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Submission under the Convention on Long-range Transboundary Air Pollution (CLRTAP)
and National Emission Ceilings Directive (NECD 2016/2284/EU)

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INFORMATIVE INVENTORY REPORT

(1990 – 2017)

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Content

Executive summary ... - 7 -
ES1 Introduction ... - 7 -
ES2 Emission trends 1990–2017 and projections for 2020, 2025 and 2030 ... - 8 -
ES3 Sectoral emissions in 2017 ... - 10 -
ES4 Recalculations and other changes ... - 15 -
ES5 Improvements and other activity ... - 19 -
ES6 Planned improvements ... - 21 -
1. Introduction ... - 24 -
1.1. Background information for inventory preparation ... - 25 -
1.2. Institutional and organizational arrangements for inventory preparation ... - 28 -
1.3. The process of inventory preparation ... - 30 -
1.4. Description of methodologies and data sources used ... - 31 -
1.4.1. Official data sources ... - 31 -
1.4.2. Methodology ... - 33 -
1.5. Key sources categories ... - 36 -
1.6. QA/QC and verification methods ... - 37 -
1.6.1. Quality Control (QC) ... - 37 -
1.6.2. Quality Assurance (QA) and Verification ... - 38 -
1.7. General uncertainty evaluation ... - 39 -
1.7.1. Overview of the uncertainty evaluation method ... - 39 -
1.7.2. Documentation of uncertainties ... - 40 -
1.7.3. Results of Tier 1 uncertainty evaluation ... - 42 -
1.8. General assessment of completeness ... - 43 -
1.8.1. Sources reported as “NE“ ... - 44 -
1.8.2. Explanation of the notation key “IE“ ... - 45 -
1.8.3. An account of sub-sources included in reporting codes “OTHER“ ... - 46 -
2. Analysis of key trends by pollutant ... - 48 -
2.1. The methodology for key source analysis ... - 48 -
2.2. Key source analysis ... - 48 -
2.3. Emissions of large point sources (LPS) in 2017 ... - 52 -
3. Emission trends by pollutant ... - 54 -
3.1. Sulphur dioxide (SO_2) ... - 54 -
3.2. Nitrogen oxides (NO_X) ... - 56 -

3.3. Ammonia (NH_3) - 58 -
3.4. Acid equivalent (AEQ) - 60 -
3.5. Carbon monoxide emission (CO) - 62 -
3.6. Non-methane volatile organic compounds (NMVOC) - 64 -
3.7. Particles (TSP, PM_{10} AND $PM_{2.5}$) and black carbon (BC) - 66 -
3.7.1. Total suspended particles (TSP) - 66 -
3.7.2. Particulate matter (PM_{10}) - 68 -
3.7.3. Particulate matter ($PM_{2.5}$) - 70 -
3.7.4. Black carbon (BC) - 72 -
3.8. Priority heavy metal emissions (Pb, Cd and Hg) - 74 -
3.8.1. Lead (Pb) - 74 -
3.8.2. Cadmium (Cd) - 76 -
3.8.3. Mercury (Hg) - 78 -
3.9. Other heavy metals (As, Cr, Cu, Ni, Se, Zn) - 79 -
3.9.1. Arsenic (As) - 80 -
3.9.2. Chromium (Cr) - 81 -
3.9.3. Copper (Cu) - 83 -
3.9.4. Nickel (Ni) - 84 -
3.9.5. Selenium (Se) - 86 -
3.9.6. Zinc (Zn) - 87 -
3.10. Persistent organic pollutants (POPs) - 89 -
3.10.1. Dioxin and furans (PCDD/PCDF) - 90 -
3.10.2. Polycyclic aromatic hydrocarbons (PAHs) - 91 -
3.10.3. Hexachlorobenzene (HCB) - 93 -
3.10.4. Polychlorinated biphenyls (PCBs) - 95 -
4. Energy (NFR 1) - 97 -
4.1. Fuel combustion (NFR 1.A) - 98 -
4.2. Energy industries (NFR 1.A.1) - 101 -
4.3. Manufacturing industries and construction (NFR 1.A.2) - 106 -
4.4. Transport (NFR 1.A.3) - 108 -
4.5. Small combustion (NFR 1.A.4.i) - 118 -
4.6. Non-road mobile sources and machinery (NFR 1.A.4.ii, 1.A.2.g.vii) - 122 -
4.7. Other sectors (NFR 1.A.5.a, 1.A.5.b) - 124 -
4.8. Fugitive emissions form fossil fuel (NFR 1.B) - 125 -
5. Industrial processes and product use (NFR 2) - 137 -
5.1. Mineral products (NFR 2.A) - 138 -

5.2. Chemical industry (NFR 2.B) - 143 -
5.3. Metal production (NFR 2.C) - 147 -
5.4. Other solvent and product use (NFR 2.D – 2.L) - 149 -
6. Agriculture (NFR 3) - 162 -
6.1. Manure management (NFR 3.B) - 163 -
6.2. Crop production and agricultural soils (NFR 3.D) - 167 -
7. Waste (NFR 5) - 173 -
7.1. Biological treatment of waste – solid waste disposal on land (NFR 5.A) - 174 -
7.2. Biological treatment of waste- composting (NFR 5.B.1) - 177 -
7.3. Waste incineration(NFR 5.C) - 178 -
7.4. Wastewater handling (NFR 5.D) - 180 -
7.5. Other waste (NFR 5.E) - 181 -
8. Natural sources (NFR 11) - 183 -
8.1. Forest fires (NFR 11.B) - 183 -
9. Recalculations and improvements - 184 -
9.1. Recalculations and other changes - 184 -
9.2. Planned improvements - 185 -
10. Projections - 189 -
10.1. Methodology - 189 -
10.2. Parameters - 195 -
10.3. Sectoral methodologies - 195 -
10.4. Results - 201 -
10.5. Sensitivity - 203 -
11. IIR References - 206 -
12. IIR Appendices - 210 -
12.1. Appendix 1. QA/QC activities - 211 -
12.2. Appendix 2. Description of SNAP97 sectors - 213 -
12.3. Appendix 3. NFR and correspond SNAP codes - 215 -
12.4. Appendix 4. Emission factors – 2017 - 218 -
12.5. Appendix 5. The energy balance for the Republic of Croatia - 2017 - 270 -
12.6. Appendix 6. NFR 2017 - 281 -
12.7. Apendix 7. Uncertainty analysis - 297 -
12.8. Appendix 8. Influence of recalculations 1990 – 2016 in respect to pollutant and SNAP97 sector - 320 -
12.9. Appendix 9. Inclusion/exclusion of the condensable component from PM10 and PM2.5 emission factors - 342 -
13. List of abbrevations - 352 -

14. List of tables - 354 -
15. List od figures - 358 -

Executive summary

ES1 Introduction

The Republic of Croatia 2019 Informative Inventory Report (1990 – 2017) provides a detail description of the methodologies used for the compilation of the Croatian air emission inventory submission under the Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe (UNECE/CLRTAP) and Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC (OJ L 344, 17/12/2016 (hereinafter new NEC Directive).

As a party to the UNECE/LRTAP Convention and the EU MS, Croatia is obligated to annually report data on emissions of air pollutants covered in the LRTAP Convention, its seven Protocols and new NEC Directive. Pollutants whose emissions the Republic of Croatia reports are: main pollutants (SO_2, NOx, CO, NMVOC and NH_3), particles (TSP, PM_{10} and $PM_{2.5}$), black carbon (BC), heavy metals (Cd, Pb, Hg, As, Cr, Cu, Ni, Se and Zn) and persistent organic compounds (PCDD/PCDF, PAHs, HCB and PCBs).

Ministry of Environment and Energy (MEE)[1] is a competent authority for Informative Inventory Report.

Executive institution with care of preparing the air pollution emission inventory, NFR formats, and IIR, including maintenance of databases (CollectER and COPERT) is EKONERG Ltd. from Zagreb.

Data on air pollution emissions, presented in this report are prepared on the standard methods and procedures according to the EMEP/EEA Air Pollutant Emission Inventory Guidebook "Technical Guidance to Prepare National Emission Inventories" (2013 and 2016), the EMEP/CORINAIR Good Practice Guidance, Good practice for CLRTAP emission inventories and other available technical guidance.

This report follows recommended structure for the Informative Inventory Report (IIR) set in Annex II of the 2014 Reporting Guidelines for Estimating and Reporting Emission Data under LRTAP Convention. Reported emissions and projections follow latest version of the template "NFR14[2]".

The Croatian IIR 2019 covers all year in the period from 1990 to 2017. The complete set of tables in the NFR format, are submitted separately in digital form only, and the NFR for 2017 is presented in the Appendix 4 of this report.

The key information on the activities required to create the Croatian inventory are national energy balance, statistical yearbooks and annual statistical reports, the national database for road vehicles, the Environmental Pollution Registry (EPR) database, the Database on Volatile Organic Compound (VOC) emissions and the data of individual plants of large polluters of the environment, EUROSTAT database and EUROCONTROL datasets. For large point sources emissions are taken from EPR base at MEE.

A key category analysis is carried out for the year 2017 showing the relevant sources for air pollution in Croatia along with the overview of large point sources emissions in 2017 (Chapter 2).

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[1] Ministry of Environment and Energy (MEE) is a legal successor of The Croatian Agency for Environment and Nature (CAEN)

[2] the Nomenclature for Reporting (NFR) format which should ensure the transparency of the inventories among Parties

With the purpose of inventory, a schedule of activities for data quality control and quality assurance that covers the basic procedures and steps in preparing the inventory and IIR is prepared and presented in Appendix 1.

The report provides an assessment of the uncertainty of the pollutant emission calculations using Tier 1 EMEP / EEA methodology. Emission uncertainty evaluation for 2017 and uncertainty of the emission trend 1990-2017 per pollutant are provided in Chapter 1.7 and Annex 7.

Details on projections are presented in Chapter 6.

In section ES2, the trends of all pollutants in the scope for 1990-2017 are presented along with emission projections for 2020, 2025 and 2030. Section ES3 gives an overview of sectoral emissions in 2017. Overview of performed recalculations and other changes is given in section ES4, improvements in ES5 and planned improvements in ES6.

ES2 Emission trends 1990–2017 and projections for 2020, 2025 and 2030

Emissions of almost all relevant air pollutants show a general downward trend in the period from 1990 to 2017. The NOx emissions were reduced by 50,0%, SO_2 za 92,6%, NH_3 by 32.9%, NMHOS by 63.2%, CO by 64.7%, $PM_{2,5}$ by 56,2%, PM_{10} by 49.6%%, TSP by 35.9%%, BC by 47.8%, teški metali: Pb by 98.5%, Cd by 276.8%, Hg by 62.3%, As by 94.0%, Cr by 59.7%, Cu by 0%, Ni by 74.9%, Se by 20.6% i Zn by 11.4%. The PCDD/PCDF emission was reduced by 66.6%, PCBs by 14% and PAHs by 74.9% (Table 1.1-5). The HCB emission increased by 3.4% since 1990 (see details in Chapter IV).

Emission of three main pollutants SO_2, NOx and NMVOC show that emissions in 2017 are below the emission ceilings laid down in the Gothenburg Protocol and new NEC Directive (Table 1.1-2). It is expected that this status will be maintained by 2020 when new reduction commitments come into force, including for $PM_{2.5}$ emissions. Details on projections are presented in Chapter 6.

Following figure ES2-1 shows trends of relative emissions of main pollutants, their projections in the with measures scenario (WM) and in the with additional measure (WAM) scenario, their emission quotas and the reduction commitments from 2020 to 2029 and for the period after 2030 that are prescribed in the revised Gothenburg Protocol and the new NEC Directives and which have also been transposed into Croatian legislation by the Regulation on the national obligations to reduce emissions of certain pollutants into air in the Republic of Croatia (OG 78/2018).

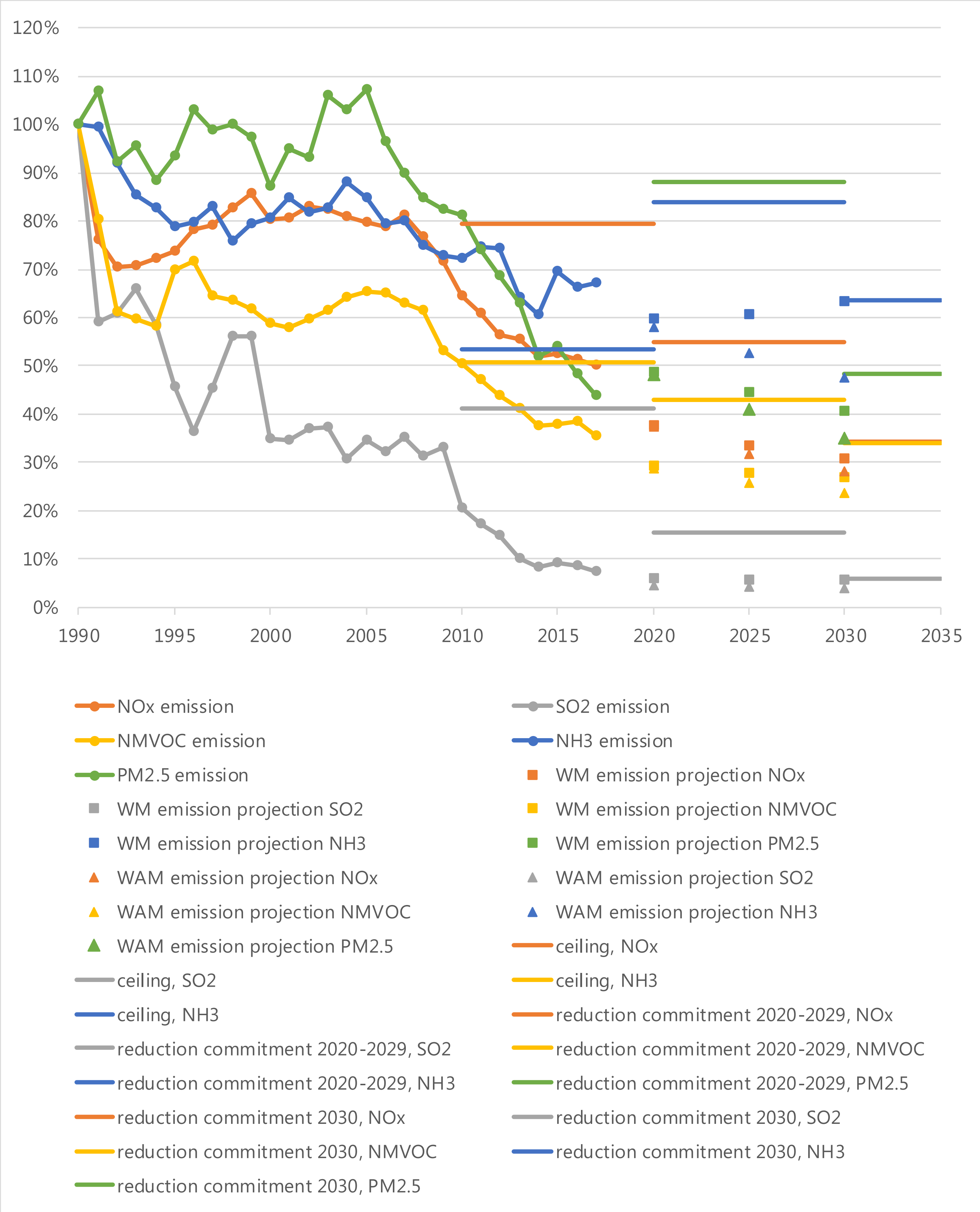

Figure ES2-1 Relative total emission for main pollutants in the Republic of Croatia for 1990 - 2017 and projections for 2020, 2025 and 2030 for with measure scenario (WM) and for with additional measure scenario (WAM), prescribed quotas and the reduction commitment from 2020 to 2029 and for the period of 2030

ES3 Sectoral emissions in 2017

Energy (fuel combustion and fugitive emissions) is the main source of air pollution in Croatia. The energy sector contributes the most to the following substances: to the total SO_2 emission with 98.6%, NOx with 85.4%, NMVOC with 42.4%, NH_3 with 7.3%, TSP with 42.5%, $PM_{2,5}$ with 87.2%, PM_{10} with 62.2%, BC with 94.9%, CO with 99.7%, Pb with 79.8%, Cd with 88.6%, Hg with 82.5%, As with 89%, Cr with 95.8%, Cu with 92.7%, Ni with 97.6%, Se with 44.4%, Zn with 99.6%, PCDD / PCDF with 89.3%, PAU with 99.7% i HCB with 99.7%.

Industrial processes and product use are the main sources of PCBs, NMVOC, Pb, Cd, Hg, TSP, PM_{10}, $PM_{2.5}$, As and Se emissions. To the total PCBs emissions industrial processes and product use contributes with 99.3%, to NMVOC emission with 39.5%, TSP with 41.5%, PM_{10} with 20.9%, Pb with 20.2%, Cd with 11.3%, Hg with 15.4%, Se with 55.6%, $PM_{2,5}$ with 9% As with 10.7%, Cu with 7.3%, NH_3 with 6.6% i BC with 5.1%.

Agriculture is the main source of emissions of NH_3 (84.6%), NOx (12.4%), NMVOC (14%) PM_{10} (16.3%) and TSP (12.9%).

Waste: the main source of PCDD/PCDF (10.1%), Hg (2.1%), NMVOC (4.2%) and NH_3 (1.6%) emissions.

Natural emissions; the emissions originating from forest fires is reported and they are not included in national total emissions. They are therefore observing under memo items.

Tables from ES3-1 to ES3-4 present total national emissions by source of discharges, and total (specific) emissions expressed in dependence of population, area and gross domestic product of Croatia in 2017. The share of each SNAP sector in total national emissions of certain pollutants is also representing in tables. Table ES3-1 shows an overview of national emissions of pollutants that cause acidification, eutrophication and photochemical pollution (SO_2, NOx, NMVOC, CO and NH_3). Table ES3-2 shows particulate matter emissions (TSP, PM_{10}, $PM_{2.5}$ and BC), table ES3-3 shows heavy metal emissions (Pb, Cd, Hg, As, Cr, Cu, Ni, Se and Zn). Table ES3-4 shows emission of persistent organic pollutants (PAHs, PCDD / PCDF, PCBs and HCB) for Croatia in 2017.

Table ES3-1 Emissions of the substances which cause acidification, eutrophication and photochemical pollution in the Republic of Croatia, 2017.

Emissions 2017, t/yr	SO_2	NOx	NMVOC	CO	NH_3
Combustion in energy transformation industry	4,317.2	5,447.2	415.1	1,409.3	9.1
Non-industrial combustion plants	1,045.1	6,691.5	15,035.0	113,993.7	2,067.5
Combustion in manufacturing industry	2,207.9	4,154.1	994.8	8,156.9	49.9
Production processes	4,605.4	1,344.1	6,655.5	29,122.5	2,560.6
Extraction and distribution of fossil fuels and geothermal energy	0	0	2,425.4	0	0
Solvent and other product use	4	17	19,493.8	510.9	38
Road transport	34.4	23,520.1	5,484.3	30,610.0	484.2
Other mobile source and machinery	22.9	6,839.1	1,247.6	12,590.4	2.7
Waste treatment and disposal	319.7	41.2	2,654.8	190.5	603.9
Agriculture	0	6,798.1	8,835	0	31,826.6
TOTAL	12,556.6	54,852.1	63,241.1	196,584.3	37,642.2
Other source and sinks (not included in national total)	1,066.8	6,731.8	14,633.1	145,800.6	970.9
Emissions in relation to population, kg/citizen	3.0	13.1	15.2	47.1	9.0
Emissions in relation to area, kg/km^2	0.2	1.0	1.1	3.5	0.7
Emissions in relation to GDP, g/EUR	0.3	1.2	1.4	4.2	0.8
Share, %	**SO2**	**NOx**	**NMVOC**	**CO**	**NH3**
Combustion in energy transformation industry	34.4	9.9	0.7	0.7	2.4E-02
Non-industrial combustion plants	8.3	12.2	23.8	58.0	5.5
Combustion in manufacturing industry	17.6	7.6	1.6	4.1	0.1
Production processes	36.7	2.5	10.5	14.8	6.8
Extraction and distribution of fossil fuels and geothermal energy	0	0	3.8	0	0
Solvent and other product use	0	3.0E-02	30.8	2.6E-01	0
Road transport	0.3	42.9	8.7	15.6	1.3
Other mobile source and machinery	0.2	12.5	2.0	6.4	7.1E-03
Waste treatment and disposal	2.5E+00	7.5E-02	4.2	9.69E-02	1.6
Agriculture	0	12.4	14	0	84.6
TOTAL	100.0	100.0	100.0	100.0	100.0
Other source and sinks (not included in national total)	8.5	12.3	23.1	74.2	2.6

Table ES3-2 Particulate matter emissions in the Republic of Croatia, 2017

Emissions 2017, t/yr	TSP	$PM_{2.5}$	PM_{10}	BC
Combustion in energy transformation industry	1,228.5	758.3	959.1	30.8
Non-industrial combustion plants	12,210.4	11,344.2	11,625.7	1,702.4
Combustion in manufacturing industry	460.3	375.8	410.7	70.1
Production processes	15,959.1	1,369.4	5,351.1	36.1
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0
Solvent and other product use	461.8	352.8	436.1	110.5
Road transport	2,112.1	1,460.3	1,859.6	770.7
Other mobile source and machinery	417.7	415.0	416.3	119.8
Waste treatment and disposal	186.6	185.9	186.2	5.4
Agriculture	4,898.6	464.1	4,133.2	0.0
TOTAL	37,935.1	16,725.7	25,378.0	2,845.9
Other source and sinks (not included in national total)	30.7	30.3	30.7	12.0
Emissions in relation to population, kg/citizen	9.1	4.0	6.1	0.7
Emissions in relation to area, kg/km^2	0.7	0.3	0.4	0.1
Emissions in relation to GDP, g/EUR	0.8	0.4	0.5	0.1
Share, %	**TSP**	**$PM_{2.5}$**	**PM_{10}**	**BC**
Combustion in energy transformation industry	3.2	4.5	3.8	1.1
Non-industrial combustion plants	32.2	67.8	45.8	59.8
Combustion in manufacturing industry	1.2	2.2	1.6	2.5
Production processes	42.1	8.2	21.1	1.3
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0
Solvent and other product use	1.2	2.1	1.7	3.9
Road transport	5.6	8.7	7.3	27.1
Other mobile source and machinery	1.1	2.5	1.6	4.2
Waste treatment and disposal	0.492	1.111	0.734	0.189
Agriculture	12.9	2.8	16.3	0.0
TOTAL	100.0	100.0	100.0	100.0
Other source and sinks (not included in national total)	0.1	0.2	0.1	0.4

Table ES3-3 Heavy metals emissions in the Republic of Croatia, 2017

Emissions 2017, t/yr	Pb	Hg	Cd	As	Cr	Cu	Ni	Se	Zn
Combustion in energy transformation industry	267.1	114.3	23.2	121.4	177.3	224.9	2,868.7	25.7	1,597.2
Non-industrial combustion plants	1,279.8	43.2	598.9	14.0	1,085.0	286.8	395.1	24.3	23,644.7
Combustion in manufacturing industry	367.3	132.6	39.6	73.4	152.5	190.7	142.6	64.8	2,062.6
Production processes	803.1	57.8	89.8	301.2	313.0	108.4	675.3	236.3	317.4
Extraction and distribution of fossil fuels and geothermal	0	0	0	0	0	0	0	0	0
Solvent and other product use	1057.62	64.4	51.1	1.8	21.0	648.1	65.0	0	375.3
Road transport	4,044.6	12.0	22.7	0.3	366.6	6,944.1	69.6	6.7	6,334.6
Other mobile source and machinery	184.8	1.5	3.3	1.8	16.8	529.0	61.8	7.2	372.9
Waste treatment and disposal	2.2	9.3	1.7	1.8	3.8	5.0	3.5	0.1	25.3
Agriculture	0	0	0	0	0	0	0	0	0
TOTAL	8,006.5	435.2	830.2	515.8	2,136.0	8,937.1	4,281.7	365.2	34,730.0
Other source and sinks (not included in national total)	0.93	0.77	0.07	0.32	1.29	4.55	3.84	0.98	163.59
Emissions in relation to population, kg/citizen	1.9	0.1	0.2	0.1	0.5	2.1	1.0	0.1	8.3
Emissions in relation to area, kg/km^2	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.6
Emissions in relation to GDP, g/EUR	0.2	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.7
Share, %	**Pb**	**Hg**	**Cd**	**As**	**Cr**	**Cu**	**Ni**	**Se**	**Zn**
Combustion in energy transformation industry	3.3	26.3	2.8	23.5	8.3	2.5	67.0	7.0	4.6
Non-industrial combustion plants	16.0	9.9	72.1	2.7	50.8	3.2	9.2	6.7	68.1
Combustion in manufacturing industry	4.6	30.5	4.8	14.2	7.1	2.1	3.3	17.7	5.9
Production processes	10.0	13.3	10.8	58.4	14.7	1.2	15.8	64.7	0.9
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0	0	0	0	0	0
Solvent and other product use	13.2095	14.8	6.2	0.3479	0.98523	7.3	1.5	0	1.1
Road transport	50.5	2.76382	2.7	0.0572	17.2	77.7	1.6	1.8	18.2
Other mobile source and machinery	2.3	0.4	0.4	0.3558	0.8	5.9	1.4	2.0	1.1
Waste treatment and disposal	0.0	2.1	0.2	0.36	0.18	0.06	0.08	0.03	0.07
Agriculture	0	0	0	0	0	0	0	0	0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Other source and sinks (not included in national total)	0	0	0	0	0	0	0	0	0

Table ES3-4 Persistent organic pollutants emissions in the Republic of Croatia, 2017

Emissions 2017, kg/yr for PAH, HCB, PCB; g I-TEQ/yr for PCDD/PCDF	PAH	PCDD/ PCDF	HCB	PCB
Combustion in energy transformation industry	6.4	0.4	2.9E-02	2.3
Non-industrial combustion plants	5292.4	12.2	0.23	0.0
Combustion in manufacturing industry	397.1	0.5	1.9E-02	0.5
Production processes	18.53088	0.1	0	0.1
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0
Solvent and other product use	3.9	0.001	0	412.5
Road transport	166.1	1.1	NA	NE
Other mobile source and machinery	45.8	0.4	0.004	0.003
Waste treatment and disposal	0.0025	1.6	0.000824	0.002
Agriculture	0	0	0	0
TOTAL	5930.2	16.2	0.28	415.4
Other source and sinks (not included in national total)	110.5	0.0082	0.000303	0.0001444
Emissions in relation to population, kg/citizen	1.4	0.004	6.79E-05	0.1
Emissions in relation to area, kg/km^2	0.1	0.0003	5.01E-06	0.007
Emissions in relation to GDP, g/EUR	0.1	0.000	6.12E-06	0.009
Share, %	**PAH**	**PCDD/ PCDF**	**HCB**	**PCB**
Combustion in energy transformation industry	1.1E-01	2.3	10.4	0.5
Non-industrial combustion plants	89.2	75.0	81.4	0.0
Combustion in manufacturing industry	6.7	3.2	6.7	0.1
Production processes	0.3	0.7	0.0	0.0
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0
Solvent and other product use	0.1	0.006	0	99.3
Road transport	2.8	6.5	-	-
Other mobile source and machinery	0.8	2.2	1.2	0.001
Waste treatment and disposal	0	10.1	0	0.001
Agriculture	0	0	0	0
TOTAL	100.0	100.0	100.0	100.0
Other source and sinks (not included in national total)	1.9	0.05	0	0

ES4 Recalculations and other changes

The recalculations had to be carried out due to the availability of new information, improvements in sectors, implementation of higher tier (e.g. Tier 2), changing methodology, due to identification of time series inconsistency, increase the accuracy of the estimates and reduce the uncertainty.

The emissions of almost all pollutants were recalculated for the full time series 1990–2016, for the present submission. In Appendix 8. The influence of emission recalculations made 1990 - 2016 in respect to each of pollutant and by SNAP97 sector are presented. In addition, the overview of changes between total pollutants emissions for 2016 submitted in 2018 and in this year submission with explanations for existing differences, and comparison with national total pollutants emissions in 2017 are presented in table ES4-1.

Table ES4-1 Recalculations and explanations for changes between submitted total pollutants emissions for year 2016 in IIR 2018 and in IIR 2019

Pollutant	2017 submission IIR 2017	2018 submission IIR 2018		Unit	Explanations for changes between the 2018 and 2019 submissions
	2016	2016	2017		
NOx	52.4	56.2	54.9	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.3.b Road transport: Correction of vehicles number. 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used. 1.B.2.a.iv Refining / Storage: Correction of the amount of raw material for the FCC process. 3.B laying hens, other poultry, turkey, geese and for 1990-2016 period due to corrections in calculations and AD (2016 year only) 3.D.a.2.b Sewage sludge applied to soils: The whole period was recalculated due to the TERT recommendation. AD was changed from the population number to applied N from sewage sludge. The EF used was 0.04 kg NO2 (2016 EMEP/EEA Guidebook, Annex 2) 3.D.a.2.a Livestock manure applied to soils: emissions wwere recalculated and reported in the appropriate category instead of IE reporting within 3.B.
NMVOC	69.9	68.1	63.2	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.3.b Road transport: Correction of vehicles number. 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used. 1.B.2.a.iv Refining / Storage: Correction of the amount of raw material for the FCC process. 2.B.1 Ammonia production: New EF included for the entire 1990-2017 period. 2.D.3.e Degreasing: New methodology used for emissions calculations for the entire 1990-2017 period.

Pollutant	2017 submission IIR 2017	2018 submission IIR 2018		Unit	Explanations for changes between the 2018 and 2019 submissions
	2016	2016	2017		
					2.D.3.h Printing: Small changes due to the correction of calculation for the year 2016. 5.A.1 Solid waste disposal on land: correction of AD for entire time series 1990 - 2016 according new data for industrial waste and sludge. 5.D.1 Domestic wastewater handling: correction of AD for 2016.
SO_2	14.7	14.8	12.6	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.3.b(i-iv) Road transport: Correction of Sulphur contant in fuels. 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used 1.B.2.a.iv Refining / Storage: Correction of the amount of raw material for the FCC process.
NH_3	35.0	37.1	37.6	kt	Changes stems from methodology improvement and recalculations made in: 2.B.1 Ammonia production: New EF (Tier 2) included for the entire 1990-2017 period. 3.B laying hens, other poultry, turkey, geese and for 1990-2016 period due to corrections in calculations and AD (2016 year only) 3.D.1.a Synthetic N fertizliers N gnojiva – 1990-2016 recalculations due to the correction of error where emissions were reported as NH3-N instead od NH_3. In addiition, correction was made in the ratio of soil areas with pH > 7.0. 3.D.1.a. Inorganic N fertilizers (including urea) – the whole time period was recalculated due to a mistake where emissions were reported as NH3-N instead of NH3. 3.D.a.2.b Sewage sludge applied to soils: The whole period was recalculated due to the TERT recommendation. AD was changed from the population number to applied N from sewage sludge. The EF used was 0.13 kg NH3 (2016 EMEP/EEA Guidebook, Annex 1)
$PM_{2.5}$	18.4	18.5	16.7	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.3.b Road transport: Correction of vehicles number. 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used 1.B.2.a.iv Refining / Storage: Correction of the amount of raw material for the FCC process. 2.A.1 Cement production: harmonization of activity data with NIR2019. 2.A.2 Lime production: harmonization of activity data

Pollutant	2017 submission IIR 2017	2018 submission IIR 2018		Unit	Explanations for changes between the 2018 and 2019 submissions
	2016	2016	2017		
					with NIR2019. 5.A.1 Solid waste disposal on land: correction of AD for entire time series 1990 - 2016 according new data for industrial waste and sludge
PM_{10}	25.6	26.9	25.4	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.3.b Road transport: Correction of vehicles number. 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used 1.B.2.a.iv Refining / Storage: Correction of the amount of raw material for the FCC process. 2.A.1 Cement production: harmonization of activity data with NIR2019. 2.A.2 Lime production: harmonization of activity data with NIR2019. 5.A.1 Solid waste disposal on land: correction of AD for entire time series 1990 - 2016 according new data for industrial waste and sludge
TSP	37.5	38.9	37.9	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.3.b Road transport: Correction of vehicles number. 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used 1.B.2.a.iv Refining / Storage: Correction of the amount of raw material for the FCC process. 2.A.1 Cement production: harmonization of activity data with NIR2019. 2.A.2 Lime production: harmonization of activity data with NIR2019. 5.A.1 Solid waste disposal on land: correction of AD for entire time series 1990 - 2016 according new data for industrial waste and sludge
BC	3.0	3.0	2.8	kt	There was no change.
CO	202.4	205.4	196.6	kt	The change is negligible.
Pb	8.0	8.0	8.0	t	There was no change.
Cd	0.8	0.8	0.8	t	There was no change.
Hg	0.5	0.5	0.4	t	There was no change.
As	0.4	0.4	0.5	t	There was no change.
Cr	2.0	2.0	2.1	t	There was no change.
Cu	8.4	8.3	8.9	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used

Pollutant	2017 submission IIR 2017	2018 submission IIR 2018		Unit	Explanations for changes between the 2018 and 2019 submissions
	2016	2016	2017		
					1.B.2.a.iv Refining / Storage: Correction of the amount of raw material for the FCC process.
Ni	7.8	4.2	4.3	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used 1.B.2.a.iv Refining / Storage: Correction of the amount of raw material for the FCC process.
Se	0.4	0.4	0.4	t	There was no change.
Zn	34.4	34.6	34.7	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used 1.B.2.a.iv Refining / Storage: Correction of the amount of raw material for the FCC process.
PCDD / PCDF	20.5	20.5	16.2	g I-Teq	There was no change.
Total 4 PAHs	6.9	6.9	5.9	t	There was no change.
benzo (a) pyrene	2.3	2.3	1.9	t	There was no change.
benzo (b) fluoranthene	2.4	2.4	2.1	t	There was no change.
benzo (k) fluoranthene	0.9	0.9	0.8	t	There was no change.
indeno (1,2,3-cd) pyrene	1.3	1.3	1.1	t	There was no change.
HCB	0.30	0.30	0.28	kg	There was no change.
PCBs	422.3	422.1	415.4	kg	1.A.1.c emission factors from 2016 EMEP/EEA Guidelines were used. 1.A.1.c. for the period from 2013 till 2016 consumption of biogass was added 1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used

ES5 Improvements and other activity

The Croatian IIR 2019 includes improvements and other activity that will lead to future improvements of inventory are present in table ES5-1.

Table ES5-1 Improvements and other activity made in IIR 2019

NFR sector, Name	NFR sub-sector, Name	Description of improvements and other activity made
1.A Energy – fuel combustion	1.A.1.b Rafinery	The correction of the SO_2 emission factor for fuels was made in 2015 and 2016.
1.A Energy – fuel combustion	1.A.1.c Production of electricity and heat	Emission factors from 2016 EMEP/EEA Guidelines were used. For the period from 2013 till 2016 consumption of biogass was added
1.A Energy – fuel combustion	1.A.3.b Road transport	The following corrections were made: the number of vehicles for 2016, the content of sulfur in fuels for the years 2014 - 2016, the volume of liquefied petroleum gas (CNG).
1.A Energy – fuel combustion	1.A.3.a Aviation (civil)	Revision of activity data for the period 2005 -2016. g. Template of new data from EUROCONTROL base.
1.A Energy – fuel combustion	1.A.4.a Comm./institut.	1.A.4.a emission factors from 2016 EMEP/EEA Guidelines were used
1.B Fugitive emissions from fuels	1.B.2.a.iv Refining/storage	Correction of activity data for the FCC process for the years 2013 - 2016.
	1.B.2.a.v Distribution of oil products	Correction of activity data for refinery dispatcher for 2015 and 2016 and for gas stations for 2014, 2015 and 2016 based on received corrected values from data providers.
	B.2.b.2 Natural gas – transport	Correction of FE NMVOC for 2016
	1.B.2.c Venting and flaring	Correction of activity data for 2015 and 2016 obtained from data providers.
2 Industrial processes and product use	2.A.1 Cement production	Recalculation was performed for the period 1990-1997, 2012 and 2014-2016, due to harmonization of activity data with NIR2019.
2 Industrial processes and product use	2.A.2 Lime production	Recalculation was performed for 1990-1991, 2008-2010 and 2013-2015, due to harmonization of activity data with NIR2019.
2 Industrial processes and product use	2.B.1 Ammonia production	NH_3 emission recalculation was performed for the whole time series due to incorrect use of EF (Tier 1 EF was used instead of Tier 2, GB2016). Furthermore, NMVOC EF (Tier 2, GB2016) was included in emissions calculations for this activity and NMVOC emissions were calculated for the whole time series.
2 Industrial processes and product use	2.D.3.e Degreasing	Recalculation for the trend was performed taking into account the amount of solvent used, and by removing the previously used cold cleaning sub-category from the calculation.
2 Industrial processes and product use	2.D.3.h Printing	Recalculation for 2016 was performed due to the error in calculation.
3 Agriculture	3.B Manure management	Emissions from livestock manure applied to soils were recalculated and reported in the appropriate category (3.D.a.2.a) instead of IE reporting within 3.B.
3 Agriculture	3.D.1.a. Inorganic N fertilizers (including urea)	The whole time period was recalculated due to a mistake where emissions were reported as NH3-N instead of NH3.
3 Agriculture	3.D.a.2.b Sewage sludge applied to soils	The whole period was recalculated due to the TERT recommendation. AD was changed from the population number to applied N from sewage sludge. The EF used were 0.04 kg NO2 (2016 EMEP/EEA Guidebook, Annex 2) 0.13 kg

NFR sector, Name	NFR sub-sector, Name	Description of improvements and other activity made
		NH3 (2016 EMEP/EEA Guidebook, Annex 1)
3 Agriculture	3.D.a.2.a Livestock manure applied to soils	Emissions from livestock manure applied to soils were recalculated and reported in the appropriate category (3.D.a.2.a) instead of IE reporting within 3.B.
3 Agriculture	3.D.c Farm-level agricultural operations including storage, handling and transport of agricultural products	PM emissions are now reported in this category instead of IE in 3.D.a.1.
3 Agriculture	3.D.e Cultivated crops	NMVOC emissions are now reported in this category instead of IE in 3.D.a.1.
5 Waste	5.A.1 Solid waste disposal on land	New data for industrial waste and sludge are included for entire time series 1990 – 2016.
5 Waste	5.D Wastewater handling 5.D.1 Domestic wastewater handling	Correction of AD has been made for 2016.

ES6 Planned improvements

Planned improvements for the next or one of the next inventories are present in table ES6-1.

Table ES6-1 Improvements planned for the next or one of the next inventory

NFR sector, Name	NFR sub-sector, Name	Improvements planned
1.A Energy – fuel combustion	1.A.1.a Public electricity and Heat production	As long term goal Croatia will take certain steps to justify the use of direct emissions for large point sources in the inventory For 2016 collect dat on continuous measurements in thermal power plants
1.A Energy – fuel combustion	1.A.2 Stationary combustion in manufacturing industries and construction	On short term basis it is planned to divide total consumption of fuel to appropriate branches for the whole period from 1990 to 2000
1.A Energy – fuel combustion	1.A.2 Stationary combustion in Manufacturing industries and construction	For NOx emission calculation Croatia uses methodology disaggregated by fuel types (gas oil, fuel oil, natural gas, etc.) but not disaggregated by technology. As long term goal Croatia will estimate NOx emission by technology type.
1.A Energy – fuel combustion	1.A.3.a Aviation (civil)	For the harmonization of the calculation methodology with the GB2016 for the aviation, it is necessary to estimate the representative aircraft. For that it is necessary to collect more detailed data on aircrafts and their movements in all airports in Croatia.
1.A Energy – fuel combustion	1.A.3.b Road transport	The application of COPERT 5 software programme is planned for next submission. Also, during the processing of "raw" data (Ministry of interior vehicle data base in text form), it was noted that some vehicles are missing, so clarification of data was requested from the Ministry of Interior. Interior Ministry drew attention to the different categorization of vehicles in 2014. Consequently the model for the processing of "raw" vehicle data was amended and it was found that the model should be applied to the whole historical trend, because some vehicles due to insufficiently described categorization were not counting. The above improvement will be carried out in one of the following submissions. Include the national values for gasoline pressure in accordance with regulations in the Republic of Croatia instead of using the defoult COPERT 5 model values. In 2014 Croatia reported annual mileage of each vehicle type to Odyssee database. It is planned to incorporate those data in COPERT 5 model. Croatia calculates emissions from all lubricants in the scope of 2.D.3.i Other Solvent Use, 2G. As long term goal Croatia will divide lubricant used for solvent purposes and lubricant used for road transportation purposes according to EMEP / EEA Guidebook and TERT recommendation.
1.A Energy – fuel combustion	1.A.4.b.i Small combustion - Residential	Revision of the share of installed biomass combustion technologies based on the results of the survey conducted in the framework of the project "Creation of a Register of Pollutant Emissions Inventories with Spatial Distribution of Emissions in EMEP High Resolution Network" (source: HAOP) in one of the following inventories when financial resources are provided.
2 Industrial processes and product use	2.A.3 Glass production	Currently, both glass which is nationally produced and glass which is imported and then processed in Croatia, is being included in calculations as nationally produced glass products,

NFR sector, Name	NFR sub-sector, Name	Improvements planned
		due to unavailability of disaggregated statistical data. Revision of applied method for emission calculation in line with specific national circumstances should be made to avoid overestimation of emissions for this category. At the moment, this matter is categorised as a long term plan for improvement, provided the required financial resources are made available.
2 Industrial processes and product use	2.A.5.b Construction and demolition	The plan is to recalculate the trend (entire reporting period) for this category after collecting the required activity data according to Tier 1 EMEP/EEA GB2016 methodology, which would include: Construction of houses, Construction of apartments, Non-residential construction and Road construction. In order to achieve this, efforts will be made to collect these data for one of the next submissions.
2 Industrial processes and product use	2.C.1 Iron and steel production	Additional and revised data regarding iron and steel production category have been obtained within the scope of the 2018 in-country review of the NIR. Due to insufficient time to process these data, it was not possible to include revised emissions calculations in this submission. All data regarding this category will be harmonized with NIR and included in IIR in the next submission.
2 Industrial processes and product use	2.D.3.d Coating applications	The plan is to recalculate the trend (entire reporting period) for this category after further investigation of available data which would enable transition to Tier 2 EMEP/EEA GB2016 methodology. Since trend analysis should be carried out, the recalculations will be included in one of the next submissions.
2 Industrial processes and product use	2.D.3.g Chemical products	A new inventory improvement project, which will be led by MEE, is planned for the upcoming period. This project will, inter alia, include updating EFs for this source category according to the GB2016. This improvement and revised emissions will be included in one of the next submissions. In addition, following the recommendation for inventory improvement given by the ERT during the 2018 review, it was found that the asphalt blowing activity (SNAP 060310) is present in Croatia, and emissions from this activity will be calculated after collecting all the activity data, which is expected for one of the next submissions.
2 Industrial processes and product use	2.D.3.h Printing	The plan is to recalculate the trend (entire reporting period) for this category after further investigation of available data which would enable transition to Tier 2 EMEP/EEA GB2016 methodology. Since trend analysis should be carried out, the recalculations will be included in one of the next submissions.
3 Agriculture	3.B Manure management	The plan is to improve emission calculation of NH3 (Nex and other parameters used in the emission estimates are taken from the „Improvement of NH3, CH4 i N2O emission calculation from manure management and development of national factors“, developed by the experts from the Faculty of Agriculture, 2015). Factors and parameters in question will undergo a revision during a new project that is planned due to issues raised by the ERT in the NIR reviews in 2016. As a part of this revised project, updated national emission factors and parameters are expected. The above mentioned improvement will be carried out in one of the following submissions.
3 Agriculture	3.D.a.2.c Other organic fertilizers applied to soils (including composts)	It is necessary to check on availability of AD on other organic fertilizers. This improvement will be made in one of the upcoming reports.
5 Waste	5.B.1 Biological treatment	Activity data on types of composted waste (dry weight)

NFR sector, Name	NFR sub-sector, Name	Improvements planned
	of waste - Composting	presented in the GHG emissions report have been used for NH_3 emission calculation for the period 2007 – 2017. Activity data for the previous period are not available, so notation key 'NE' is used, which should be investigated. Future improvements are related primarily to aggregation of accurate data for NH_3 emission calculations for the entire reporting period, which is included in the Annual Data Collection Plan. When the competent authority provides all necessary information and data that will be included in the inventory.

1. Introduction

Obligations of the Croatian Agency for Environment and Nature in accordance with the Law on Air Protection (OG 130/11, 47/14, 61/17, 118/18) and the Regulation on National Emission Ceiling of Certain Pollutants in Air in the Republic of Croatia (OG 76/18) [3] (hereinafter: text: Regulation on NEC) are: the preparation of the annual activity data collection program for each sector as set out in Annex II of the NEC Regulation, the establishment and management of pollutants emission calculation in the air and preparation of nformative inventory report from Article 7 of the NEC Regulation, in accordance with the quality assurance and control plan for the emission calculation, arhivation of sectoral activity data for calculation of emissions, emission factors and documents used for the planning, production, quality control and quality assurance of the emissions calculation and preparation of emission inventory.

The NEC Regulation lays down certain pollutants in the air that cause adverse effects of acidification, eutrophication and photochemical pollution, their emission quota or national reduction obligation for a given period in the Republic of Croatia. With this Regulation, the following EU directives were transposed into the legal order of the Republic of Croatia:

- Articles 1 and 4 of Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on the national emissions ceilings for certain atmospheric pollutants (OJ L 309, 27.11.2001), as supplemented by the Council Directive 2013/17/EU of 13 May 2013 on the adaptation of certain directives in the field of environment for the accession of the Republic of Croatia (OJ L 158, 10.6.2013)
- European Parliament and Council Directive (EU) 2016/2284 of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35 / EC and repealing Directive 2001/81 / EC (OJ L 344, 17. 12. 2016.).

The NEC Regulation fully transposes the Republic of Croatia's obligations under the UNECE Convention on Transboundary Air Pollution (hereinafter: the LRTAP Convention) as well as the obligations laid down in the Gothenburg Protocol (see Chapter 1.1.).

The LRTAP Convention and the NEC Directives prescribe the use of the EMEP / EEA Air Pollutant Emission Inventory Guidebook 2016 and the revised Guidelines for Reporting Emissions and Projections of the Convention on Long-Range Transboundary Air Pollution 2016 (ECE/EB.AIR.125).

The Republic of Croatia as a party to the LRTAP Convention, the Protocol on Long-term Financing of the Cooperative Programme for Monitoring and evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP Protocol) and the remaining seven protocols and as a full member of the EU, is required to submit to the relevant body of the LRTAP Convention and to the European Environment Agency (EEA/EIONET) national emissions, informative inventory report, emission projections, spatial distribution of emission, emission of large point sources in terms and formats prescribed by the guidelines of the Executive Body for the LRTAP Convention.

Calculations are carried out emissions of five major pollutants into the air (SO_2, NOx, CO, NMVOC, NH_3), particles (TSP, PM_{10}, $PM_{2.5}$ and BC), nine heavy metals (Cd, Pb, Hg, Ni, Se, Zn) and for persistent organic pollutants (polycyclic aromatic hydrocarbons (PAU), polychlorinated biphenyls (PCBs), hexachlorobenzenes (HCBs) and dioxins and furans (PCDD / PCDF)).

One of the obligations of the Parties to the LRTAP Convention is also the annual verification of submitted reports (estimates / inventories) and emission projections by the Parties to the LRTAP Convention in parallel with the verification of the report in accordance with the new NEC Directive. The annual review of the emissions in accordance with the LRTAP Convention is carried out by appointed experts of the parties (the so-called ROSTER list of all appointed experts who can participate in the

[3] Replaces the earlier regulation: Regulation on emission quotas for certain non-detergents in the Republic of Croatia (OG 108/13, 19/17)

review). The review team is established by the EMEP Center for Inventory Inventories and Projections for Every Annual Review (ERT). The annual review by the European Commission is carried out by a Technical Expert Review Team (TERT) pursuant to the new NEC Directive.

1.1. Background information for inventory preparation

The 1979 UNECE Convention on Long-range Transboundary Air Pollution (hereinafter the LRTAP Convention) is the framework agreement and was the first international legal binding instrument to deal with air pollution on regional bases. The aim of the LRTAP Convention is that Parties shall endeavor to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution by developing policies and strategies to combat the discharge of air pollutants through exchanges of information, consultation, research and monitoring. The LRTAP Convention entered into force in 1983 and currently has a 51 Party.

The LRTAP Convention has been extended by eight protocols (1985 – 1999) that are the key assets/legal instruments for reducing air pollution. Protocols identify specific measures to be taken by Parties to cut their emissions of air pollutants - sulfur dioxide (SO_2), nitrogen oxides (NOx), volatile organic compounds (VOC), heavy metals (HMs) and persistent organic pollutants (POPs).

The Republic of Croatia is a party to the UNECE LRTAP Convention and its 7 related protocols (Table 1.1-1). Pursuant to the above, the Republic of Croatia is internationally obliged to observe the obligations stipulated by the LRTAP Convention and its protocols.

Table 1.1-1 Status of ratification of international treaties under the CLRTAP

Treaty	Signed by the Parties	In force since	Number of Parties	Ratified[4] by Croatia	Official gazette, No.
Convention on Long-range Transboundary Air Pollution	1979	1983	51	1992	OG-IT 12/93
Protocol on Long-term Financing of the Cooperative Programme for Monitoring and evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)	1984	1988	45	1992	OG-IT 12/93
Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent	1985	1987	25	-	OG-IT 17/98
Oslo Protocol on Further Reduction of Sulphur Emissions	1994	1998	28	1998	OG-IT 3/99
Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes	1988	1991	35	2007	OG-IT 10/07
Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes	1991	1997	24	2007	OG-IT 10/07
Aarhus Protocol on Persistent Organic Pollutants/revised in 2009	1998	2003	33	2007	OG-IT 05/07
Protocol on Heavy Metals/revised in 2012	1998	2003	33	2007	OG-IT 05/07
Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone	1999	2005	25	2008	OG-IT 07/08

The Protocol to abate acidification, eutrophication and ground-level ozone in the context of the LRTAP Convention (hereinafter: Gothenburg Protocol) promotes an approach that takes into account the

[4] Ratification, Acceptance (A), Approval (AA), Accession (a)

multiple effects of certain pollutants in order to prevent or to minimize exceedances of critical loads of acidification, nitrogen loads and critical levels of ozone for human health and vegetation. For this purpose, national emission quotas must be set, which each Party shall keep below the defined value until 2010 and in the following years, for the following pollutants: SO_2, NOx, NH_3 and VOC. For the Republic of Croatia the prescribed quotas are shown in Table 1.1-2.

In the legislation of the European Union (EU) and then in the national legislation, the Gothenburg Protocol was largely transposed by Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on large combustion plants and Directive 2001/81 / EC of the European Parliament and Council of 23 October 2001 on the national emission ceilings for certain pollutants (old NEC Directive).

With Amendments to the Gothenburg Protocol, new emission reduction commitments have been adopted for 2020, including, and in addition to the above-mentioned pollutants, fine particles ($PM_{2.5}$) which are listed for the Republic of Croatia in the tables 1.1-2 and 1.1.

At the EU level, an existing policy on air protection has been improved with a view to achiev an air quality level that does not lead to significant adverse effects and risks to human health and the environment and was adopted by Directive 2016/2284/EU of the European Parliament and of the Council of 14 December 2016 on the reduction on national emission of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/ EC (OJ L 433, 17.12.2016) (hereinafter: the new NEC Directive).

The new NEC Directive foresees new obligations for the reduction of certain pollutants in the air for NMOC, NH_3, SO_2, $PM_{2.5}$ and NOx for the period 2020 to 2029 and after 2030 at a certain percentage (%) reduction compared with 2005[5] (tables 1.1-2 and 1.1-3). The new NEC Directive also assumes the commitments proposed in the revised Gothenburg Protocol, which were defined for achievement in 2010 and in the following years. The new NEC Directive came into force on 31 December 2016.

Table 1.1-2 Emission quotas for certain pollutants for Croatia and deadlines achieving them

Emission quotas *	Deadline	SO_2	NOx	NH_3	NMVOC
Gothenburg Protocol	by 2010	70 kt	87 kt	30 kt	90 kt
Revised Gothenburg Protocol	after 2010 up to 2020				
NEC Directive/Directive 2001/81/EC	1. July 2013				

Table 1.1-3 Emission reduction commitments for SO_2, NOx, NH_3, NMVOC and $PM_{2.5}$ in accordance to NEC Directive for Croatia

Pollutant	Reduction commitments for Croatia compared to 2005	
	For any year from 2020 to 2029	For any year from 2030
SO_2	55 %	83 %
NOx	31 %	57 %
NH_3	1 %	25 %
NMVOC	34 %	48 %
$PM_{2.5}$	18 %	55 %

The Republic of Croatia is obliged to fulfill the prescribed obligations both for SO_2, NOx, NMVOC, NH_3, $PM_{2.5}$, in accordance with the Gothenburg Protocol and the new NEC Directive, and for persistent organic pollutants: PAU, HCB, PCB and PCDD / PCDF in accordance with the Protocol on Persistent Organic Pollutants (hereinafter referred to as the POPs Protocol).

The POO Protocol entered into force for the Republic of Croatia on 6 December 2008. In accordance with paragraph 5 (a) of Article 3 (Principal Obligations) "[Beach Party Shall] ie each Party shall reduce its total emissions of each of the substances listed in Annex III to the POPs Protocol to the emission level in the reference year determined in accordance with the same Annex, by taking effective measures, appropriate for each of the above mentioned substances." The reference year for the

[5] 2005 is a base year in respect of which the compliance with Gothenburg Protocols and the new NEC Directive is checked

Republic of Croatia for all POPs is 1990. Accordingly, in Table 1.1-4 there is an overview of emission levels for individual POPs, which need to reduce emissions if they are currently exceeding that level.

Table 1.1-4 Emission levels for certain POPs according to Protocol on POPs

Pollutant	Emission level in 1990*
Polycyclic aromatic hydrocarbons (PAHs)**	23.6 t
Dioxins and furans (PCDD/PCDF)	48.6 g I-Teq
Hexachlorobenzene (HCB)	0.27 kg
Polychlorinated biphenyls (PCBs)	483.1 kg

*according to Annex III, Protocol on POPs

*"For the purposes of emission inventories, the following four indicator compounds shall be used: Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene i Indeno(1,2,3-cd)pyrene

In accordance with CLRTAP Executive Body's Decision 2002/10[6], on emission data reporting under the LRTAP Convention and the Protocols in force, Croatia is obliged to report on air emissions in line with Emission Reporting Guidelines[7] and methodology described in EMEP/EEA Emission Inventory Guidebook 2016. Specifically, the application of annual emissions under the CLRTAP consists of the preparation of NFR formats (emission inventor) and Informative Inventory Report (IIR). Croatia, as a Party to the UNECE LRTAP Convention and its Protocols, in 1998, submitted its first national emission calculation and IIR for emissions in 1996.

The NFR nomenclature (CLRTAP) is fully consistent with the CRF nomenclature under the UN Framework Convention on Climate Change (UNFCCC), with the overall aim of harmonization reporting formats.

Taking into account the above mentioned, this IIR follows the proposed content; the introductory chapter describes the national inventory background, the institutional and organizational arrangements, and the inventory preparation process, and methodologies and data sources used. It also gives an overview of the key categories, QA/QC procedures, the uncertainty evaluation and the general assessment of completeness. The Chapter 2 provides explanation of key trends by pollutants following NFR nomenclature. The Chapter 3 provides emission trends by pollutant. Chapters 4 to 8 present on source category descriptions, methodologies used for emission estimation, activity statistics, emission factors, main recalculations and planned improvements. The Chapter 9 gives a summary of recalculations (by sector, year and pollutant) and planned improvements. In Chapter 10 an overview of Croatia projections for the following pollutants are presented NOx, SO_2, NMVOC, NH_3 and $PM_{2.5}$.

The national inventory is updated annually in order to reflect the availability of new information, sectoral improvements, implementation of higher Tier (e.g. Tier 2), change in methodology used, identification of time series inconsistency, the accuracy of the estimates, inclusion of technical corrections by teams for revision under the LRTAP Convention and the NEC Directive and the reduction of the uncertainty.

Recalculations are applied retrospectively to earlier years, which accounts for any difference in previously published data. Conducted recalculations are described in detail in Chapters from 4 to 8, and in the Chapter 9 with a summary of them.

The total emissions of Croatian from 1990 to 2017 reported by pollutant are presented in the Table 1.1-5, along with the share of change in periods from 1990 – 2017 and 2016 - 2017 by pollutant.

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[6] Decision 2002/10 on emission data reporting under the Convention and the Protocols in force, ECE.EB.AIR/77/Add.1, 2002

[7] Emission Reporting Guidelines, ECE/EB.AIR/80, 2003

Table 1.1-5 Time series of total emissions in the Republic of Croatia by pollutant

Pollutant	Unit	1990	1995	2000	2005	2010	2015	2016	2017	Share of change from 1990-2017	Share of change fron 2016-2017	Emission ceiling in 2010 and up to 2020
NOx	kt	109.6	80.8	87.9	87.5	70.5	57.4	56.2	54.9	-50.0%	-2.4%	87
NMVOC	kt	177.6	124.0	104.3	115.9	89.5	67.5	68.1	63.2	-64.4%	-7.1%	90
SO2	kt	170.4	77.8	59.4	58.7	35.2	15.8	14.8	12.6	-92.6%	-15.2%	70
NH3	kt	56.1	44.3	45.3	47.6	40.6	39.0	37.1	37.6	-32.9%	1.3%	30
PM2.5	kt	38.2	35.7	33.3	41.0	31.1	20.7	18.5	16.7	-56.2%	-9.4%	-
PM10	kt	50.3	44.8	41.3	52.0	40.5	29.3	26.9	25.4	-49.6%	-5.8%	-
TSP	kt	59.2	53.0	51.3	71.2	55.4	41.9	38.9	37.9	-35.9%	-2.4%	-
BC	kt	5.5	4.9	4.8	5.9	4.7	3.3	3.0	2.8	-47.8%	-5.7%	-
CO	kt	557.2	444.7	451.2	418.8	300.0	219.2	205.4	196.6	-64.7%	-4.3%	-
Pb	t	539.6	329.9	277.3	55.7	8.2	8.0	8.0	8.0	-98.5%	-0.1%	-
Cd	t	1.1	0.8	0.8	1.0	0.9	0.9	0.8	0.8	-26.8%	0.4%	-
Hg	t	1.2	0.3	0.5	0.6	0.5	0.5	0.5	0.4	-62.3%	-13.5%	-
As	t	8.6	1.2	1.0	1.1	0.8	0.5	0.4	0.5	-94.0%	28.9%	-
Cr	t	5.3	3.7	3.1	3.7	2.6	2.2	2.0	2.1	-59.7%	5.1%	-
Cu	t	8.9	6.0	7.1	8.9	7.8	8.1	8.3	8.9	0.0%	7.2%	-
Ni	t	17.1	13.8	10.9	13.7	7.7	4.5	4.2	4.3	-74.9%	2.3%	-
Se	t	0.5	0.3	0.3	0.4	0.4	0.3	0.4	0.4	-20.6%	2.6%	-
Zn	t	39.2	32.3	30.8	37.7	36.9	35.6	34.6	34.7	-11.4%	0.5%	-
PCDD/ PCDF	g I-Teq	48.6	42.8	41.1	48.6	34.0	23.1	20.5	16.2	-66.6%	-20.8%	-
PAHs	t	23.6	16.7	14.9	18.4	13.5	8.2	6.9	5.9	-74.9%	-14.6%	-
HCB	kg	0.27	0.27	0.26	0.31	0.30	0.30	0.30	0.28	3.4%	-4.2%	-
PCBs	kg	483.1	468.3	441.4	435.7	433.7	425.0	422.1	415.4	-14.0%	-1.6%	-

1.2. Institutional and organizational arrangements for inventory preparation

An important pre-condition for efficient data management system and development of the inventory is a clearly defined organization, competences and responsibilities of institutions involved in the process of developing the inventory. Previous includes a number of steps to be taken in the collection and processing of data, calculation, control and verification of emission inventories and documentation and communication to competent international bodies.

In terms of organizational arrangements, a decentralized model was applied in Croatia in which particular tasks of inventory preparation is delegated to domestic public and professional institutions. From institutional point of view, the Ministry of Environment and Energy (MEE) is a National Focal Point for LRTAP Convention, and also responsible for inventory preparation.

The Ministry of Environment and Energy selects executive institution for annual inventory preparation according to the requirements of LRTAP Convention by public tendering, EKONERG – Energy Research and Environmental Protection Institute Ltd, Zagreb, has been selected as executive institution for preparation of this IIR.

The main official sources of activity data for the inventory of pollutant emissions are:

- The Ministry of Environment and Energy[8] with assistance of Energy Institute Hrvoje Požar that prepares the national annual energy balance;
- The Central Bureau of Statistics (Business Statistics Sector) that, on the basis of the statistic survey programme, collects data on the amounts of raw materials and products relating to activities defined by the National Classification of Business Activities;
- The Ministry of Interior keeps data on number of registered road vehicles and off-road vehicles.
- The Ministry of Environment and Energy that collects data from emission point sources in the Environmental Pollution Register (EPR) [9])
- The Ministry of Agriculture[10]
- The EUROCONTROL data
- The EUROSTAT data.

Activity data provided through questionnaires completed directly by individual emission sources or other specialized institutions are used in the development of the inventory to calculate and check data provided by official publications.

The Figure 1.2-1 shows structure and components of Croatia emission inventory system.

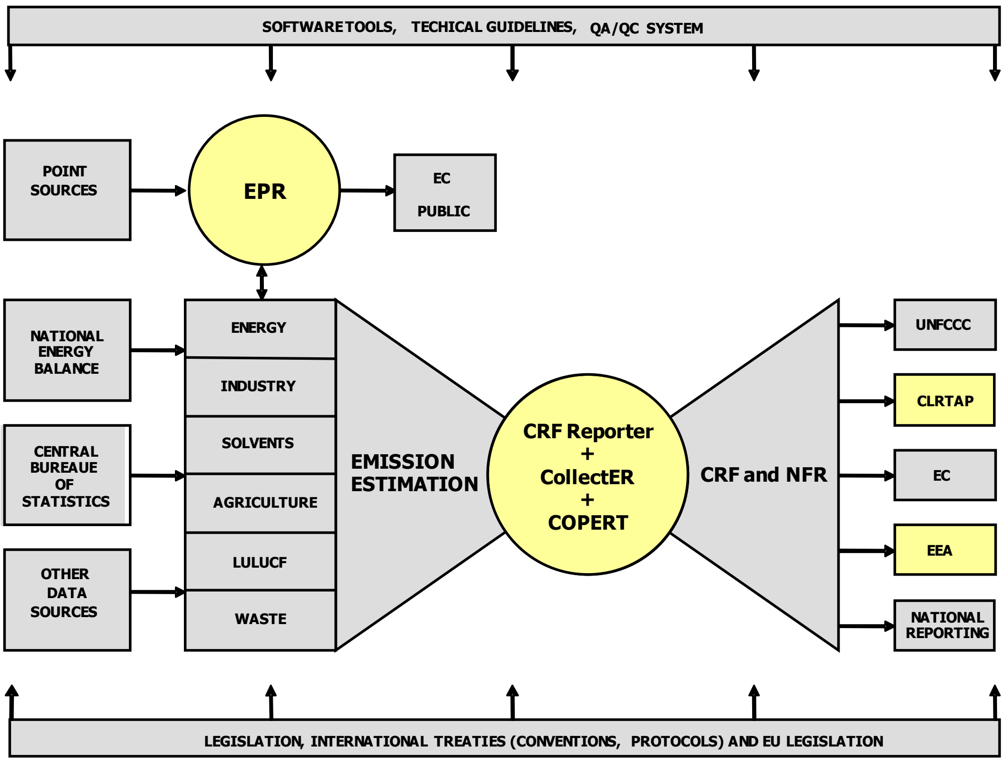

Figure 1.2-1 National emission inventory system

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[8] Since December 2011 Ministry of Economy, since 19 October 2016 Ministry of Environment and Energy

[9] EPR – Environmental Pollution Register: a: a set of data of sources, type, amount, manner and place of discharge, transfer and disposal of pollutants and waste into the environment based on the *Ordinance on the Environmental Pollution Register (OG 87/15)*

[10] Ministry of Regional Development, Forestry and Water Management - since December 2011 Ministry of Agriculture

1.3. The process of inventory preparation

The process of inventory preparation has three main phases:

1. planning,
2. preparation and
3. reporting and archiving.

Planning

Planning phase includes activities related to organizational and technical aspects of inventory preparation such as: selection of executive institution, preparation of timetable according to EMEP reporting programme, preparation a schedule of activities for data quality control and quality assurance (see Appendix 1), review of existing/updated reporting guidelines and guidebooks, updating of emission factors and analysis of recommendations for inventory improvement from previous submissions or gave by expert review teams if such exists.

In accordance with Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution[11], the Parties to the LRTAP Convention are obliged to submit the data to the Secretariat of the Convention within the following deadlines and scope:

- *Reporting deadlines*: The deadline for submitting annual emission inventory reports is 15 February. The deadline for submitting four-yearly projection reports is 15 March. The deadline for submitting the IIR is 15 March. Parties are, however, encouraged to submit their IIRs at the same time they submit their emission reports. The deadline for submitting gridded data and LPS data is 1 May. The EU may deliver its emission and projections reports by 30 April, its IIR by 30 May and its gridded data and LPS data by 15 June;
- *Four-yearly reporting*: Parties to the Gothenburg Protocol within the geographical scope of EMEP shall regularly update their projections and report every four years from 2015 onward their updated projections, for the years 2020, 2025 and 2030 and, where available, also for 2040 and 2050.
- *Four-yearly reporting*: Every four years from 2017 onward, Parties shall report for the year x-2 updated aggregated sectoral (GNFR) gridded emissions and LPS emissions. Gridded emissions in a grid of 0.1 x 0.1 degrees shall be reported for all substances referred to in paragraph 7 of these Guidelines. As an alternative, a Party may report gridded emissions in a grid of approximately 50 x 50 km^2 until it is technically and economically feasible to switch to a grid of 0.1 x 0.1 degrees.

Detailed and updated information related to deadlines and scope of reporting are available on official EMEP[12] /CEIP[13] web page – www.ceip.at/.

Reporting under the new NEC Directive should be fully consistent with reporting under the LRTAP Convention.

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[11] ECE/EB.AIR/125, Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution, TFEIP, March 2014.

[12] EMEP European Monitoring and Evaluation Programmeis a scientifically based and policy driven programme under the CLRTAP for international co-operation to solve transboundary air pollution problems.

[13] CEIP: The EMEP Centre on Emission Inventories and Projections

Inventory preparation

Inventory preparation phase is a central phase in the process, which includes identification and updating of emission sources according to Nomenclature for Reporting, collection and processing of activity data, emission calculation and recalculations if necessary according to EMEP/EEA and EMEP/CORINAIR methodology, filling the database and preparation of report and tables.

Reporting and archiving

After inventory preparation phase, activity data and emission factors should be properly archived, emission inventory report and NFR tables should be submitted and QA/QC procedures and activities should be documented. In addition, the Ministry of Environment and Energy (MEE) should start with initial activities related to inventory review process and facilitate public access to inventory data.

1.4. Description of methodologies and data sources used

1.4.1. Official data sources

Activity data needed for emissions calculation are extracted from regular publications and databases of Central Bureau of Statistics and other relevant governmental organizations and ministries. For particular sub-sectors and source categories, data that are more detailed are required then those published in official statistical reports, such as disaggregated energy balance, vehicle fleet etc.). Beside official publications, the MEE sends questionnaires directly to the Large Point Sources asking for activity data, which they use for emissions calculations in order to check consistency of data provided by different sources (see chapter on quality control). The Table 1.4-2 gives the overview of the official and other activity data sources in relation to the NFR sectors.

Table 1.4-2 Official and other activity data sources for NFR sectors

<table>
<tr><th>NFR Sector</th><th>Activity data</th><th>Source</th></tr>
<tr><td rowspan="4">1 Energy
1 A 1 Energy Industries</td><td rowspan="3">Fuel sold, fuel consumption and fuel characteristic data for thermal power plants
Fuel characteristic in power plants</td><td>Energy balance - The Ministry of Environment and Energy with assistance of Energy Institute Hrvoje Požar (1990 – 2017)</td></tr>
<tr><td>Environmental Pollution Register - Ministry of Environment and Energy</td></tr>
<tr><td>National electricity producer</td></tr>
<tr><td>Sulphur content in fuel</td><td>Major national fuel producer</td></tr>
<tr><td rowspan="4">1 A 2 Manufacturing Industries and Construction</td><td rowspan="3">Fuel sold
Fuel consumption</td><td>Energy balance - The Ministry of Environment and Energy with assistance of Energy Institute Hrvoje Požar (1990 – 2017)
Industry analysis balance - Energy Institute Hrvoje Požar (2000 – 2017)</td></tr>
<tr><td>Environmental Pollution Register - Ministry of Environment and Energy</td></tr>
<tr><td>Major national industry companies</td></tr>
<tr><td>Sulphur content in fuel</td><td>Major national fuel producer</td></tr>
<tr><td rowspan="5">1 A 3 Transport</td><td>Fuel sold</td><td>Energy balance - The Ministry of Environment and Energy with assistance of Energy Institute Hrvoje Požar (1990 – 2016)</td></tr>
<tr><td>Number of vehicles</td><td>Vehicle data base – the Ministry of Interior</td></tr>
<tr><td>Annual mileage</td><td>Statistical yearbook – the Central Bureau of Statistics
Odyssee database</td></tr>
<tr><td>Min. and max temperature for big towns</td><td>Statistical yearbook – the Central Bureau of Statistics</td></tr>
<tr><td>Sulphur content in fuel</td><td>Major national fuel producer</td></tr>
</table>

NFR Sector	Activity data	Source
	Number of flights and fuel amount by cycle and routes	EUROCONTROL data (2005 – 2017)
	Annual take-off and landing number by aircraft type and at airports	Croatian Civil Aviation Agency
	Average flight time by type of aircraft for domestic aviation and international air traffic. In respect of international air traffic by category of flights shorter than 1,000 nm and for flights longer than 1,000 nm (km or nm of airline)	Croatian Civil Aviation Agency
1 A 4 Residential – public – commercial sector – agriculture / forestry / fishing	Fuel sold	Energy balance - The Ministry of Environment and Energy with assistance of Energy Institute Hrvoje Požar (1990 – 2017)
	Sulphur content in fuel	Major national fuel producer
1 B Fugitive Emissions from fuel	Amount of fuel treated, stored, distributed	Energy balance - The Ministry of Environment and Energy with assistance of Energy Institute Hrvoje Požar (1990 – 2017)
	Production and processed data	Ministry of Environment and Energy (survey request: oil refineries)
	Emission data	Environmental Pollution Register (EPR) - MEE
2 Industrial Processes and Product Use	Production/consumption data	Annual Report on Industrial Production – PRODCOM - the Central Bureau of Statistics
		Environmental Pollution Register (EPR) - MEE
		Ministry of Environment and Energy (survey requests: steel producers, fertilizers producers)
		Database on Volatile Organic Compound emissions (VOC database) – Ministry of Environment and Energy
	Import and export data	EUROSTAT database (2001 – 2017)
	Fuel sold for non-energy consumption	Energy balance - The Ministry of Environment and Energy with assistance of Energy Institute Hrvoje Požar (1990 – 2017)
	Population data	Statistical yearbook – the Central Bureau of Statistics
3 Agriculture	Number of animals	Statistical yearbook - the Central Bureau of Statistics Croatian Agricultural Agency
	Amount of N-fertilizers sold	Report on fertilizer production - the International Fertilizer Association - IFA data bank MEE (survey requests: fertilizers producers)
	Nitrogen from a sewage sludge when used in agriculture	MEE
5 Waste	Amount of waste	Environmental Pollution Register, Waste Management Information System- Ministry of Environment and Energy
	Statistical data related to living conditions in households	Censuses for 1981, 1991, 2001, 2011 - the Central Bureau of Statistics
	The amount of treated wastewater	Statistical Reports and Releases - Central Bureau of Statistics
	Number of car and house fires	Ministry of Interior
11 Natural sources (11B Forest fires)	Area of land burned and amount of wood burned	Statistical yearbook - the Central Bureau of Statistics
		Ministry of Agriculture

1.4.3. Methodology

After activity data are collected, they are distributed to NFR and SNAP sectors, sub-sectors and source categories database with corresponding update emission factors entered into central database CollectER. Croatia is using CollectER III (Version 3 of October 2010) for annual inventory preparation. The CollectER III was conducted in accordance with the recommendations TFEIP/EIONET and ETC/ACC European Environment Agency (EEA). Emissions from road transport are calculated by means of program application COPERT 4 (v11.3) that contains activity data on vehicle fleet and procedures for emissions calculation from road transport.

Pollutant emissions are reporting in defined NFR14 format (Excel spreadsheet), which discusses the sources of emissions of the following sectors: Energy (NFR 1); Industrial Processes and product use (NFR 2); Agriculture (NFR 3); Waste (NFR 5); and Natural sources (NFR 11). The NFR format under the CLRTAP is in full compliance with the CRF format under the UNFCCC. In Appendix 2, the distribution of sectors according to SNAP nomenclature with explanations is presented.

In combination with software tools, EMEP/EEA methodology aims to obtain consistency, completeness, comparability and transparency of the emissions estimates utilizing two basic methodological approaches:

- "Bottom-up" where total emissions from defined territory are determined by summing the measured/estimated emissions from all individual sources on defined territory. In case when one or more sources are missed out inventory is incomplete which leads to lower level of emissions.
- "Top-down" where total emissions from defined territory are determined from aggregate statistical data (for instance total fuel consumption or cement production) and average emission factors that give the best estimation of activities (sectors) under consideration.

Due to evident advantages and shortcomings of both approaches inventory agency in practice, utilize both of them with emphasis on achieving a balance between resources available and quality of estimations. For Large point sources emissions calculation, "bottom up" approach is used, and emissions from all other sources by "top down". That combination is reasonable because data for LPS are considered more reliable than other smaller sources.

Emissions are calculated on the base of the standard methods and procedures of:

- EMEP/EEA[14] Air Pollutant Emission Inventory Guidebook "Technical Guidance to Prepare National Emission Inventories" (2009, 2013, 2016)
- EMEP/CORINAIR Atmospheric Emission Inventory Guidebook 2007 (EMEP 2007)
- EMEP/CORINAIR Good Practice Guidance. Good practice for CLRTAP emission inventories (Tinus Pulles, John van Aardenne, 24 June 2004)
- EMEP/CORINAIR Atmospheric emission inventory guidebook, Second edition (September, 1999)
- Emission factor manual PARCOM-ATMOS, Emission factor for air pollution (1992)
- Bundesamt für Umwelt, Wald und Landschaft (BUWAL): Emissionsfaktoren für stationäre Quallen – HANDBUCH (1995)

[14] Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) of the Convention on Long-range Transboundary Air Pollution provides scientific support to theConvention

- US EPA Compilation of Air Pollutant Emission Factors, Vol. 1: Stationary Point and Area Sources (1995)
- Corinair; Technical annexes, Volume 2, Default emission factors handbook (CORINE, 1992)

Emission factors not recommended in GB2016 are mainly taken from the sectoral guidelines for determining the emission of pollutants produced in the framework of the project *Reconstruction of the National Inventory System and enforcement of its implementation* (LIFE/TCY/CRO/00086).

The methodology used for calculation of emissions includes product of activity data (e.g. fuel consumption, the production statistics, number of animals, waste treated, etc.) and corresponding emission factor.

Emission factors used are default, plant specific emission factors (calculated from direct emissions observed plants reported in Croatian EPR base) and country specific emission factors. Croatia uses country specific emission factor for SO_2 emission calculation. Details on methodologa and emission factors used are described in sectoral chapters from 4 to 8.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

A detailed description of the methodology used is shown in sector-specific chapters of IIR in chapters from 4 to 8 and their abstract follows below.

The methods used for the NFR sectors are as follows:

1 ENERGY

- 1.A.1.a (Electricity production and Combined heat and power generation), 1.A.1.b, 1.A.2.f.i, 1.B.2.b.i: Tier 2 method. Emission factors: plant specific (DE – direct emissions from EPR) and emission factors from GB2016.
- 1.A.1.a (Heat plants), 1.A.1.c, 1.A.2.a, 1.A.2, 1.A.3.b.vii, 1.A.4.a, 1.A.4.c.i: Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2016.
- 1.A.3.a (Aviation (civil)), 1.A.3.a.i (i), 1A.3.a.ii (i), 1.A.3.a.i (ii), 1.A.3.a.ii (ii): Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2013.
- 1.A.3.b (Road transport), 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: COPERT 4 (v11.3) model
- 1.A.3.b.vii Road transport: Road abrasion: Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2016.
- 1.A.3.c: Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2016
- 1.A.3.d.ii, 1.A.3.d.i(i): Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2016
- 1.A.4.b.i, 1.A.2.g.vii, 1.A.4.b.ii, 1.A.4.c.ii: Tier 2 EMEP/EEA methodology, along with the recommended Tier 2 emission factors from GB2016
- 1.B.1.a, 1.B.2.a.i, 1.B.2.a.v, 1.B.2.c: Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2016.
- 1.B.2.a.iv, 1.B.2.b: Tier 2 EMEP/EEA methodology, along with the recommended Tier 2 emission factors from GB2016.

2 INDUSTRIAL PROCESSES AND PRODUCT USE

- 2.A.1, 2.A.2.: Tier 2 EMEP/EEA methodology, along with abated Tier 2 emission factors from GB2016.
- 2.A.3 (glass production only), 2.D.3.d, 2.D.3.f, 2.D.3.h, 2.K: Tier 1 EMEP/EEA methodology, along with Tier 1 emission factors from GB2016; for mineral wool production from the category 2.A.3: Tier 3 EMEP/EEA methodology and emission factors.
- 2.A.5.a, 2.A.5.b, 2.D.3.b, 2.D.3.c, 2.I : Tier 1 EMEP/EEA methodology, along with Tier 1 emission factors from GB2016 (except 2.A.5.b - emission factor from GB2013).
- 2.B.1, 2.B.2, 2.B.10.a (sulphuric acid, NPK fertilizers and urea), 2.D.3.a, 2.D.3.i (except for application of glues), 2.G: Tier 2 method. Emission factors: plant specific (DE – direct emissions from EPR), and/or EMEP/EEA emission factors from GB2016.
- 2.D.3.i (application of glues): IIASA GAINS model
- 2.C, 2.D.3.e, 2.D.3.g (activities: polyester processing and polystyrene foam processing), 2.H: Tier 2 EMEP/EEA methodology, along with Tier 2 emission factors from GB2016.
- 2.D.3.g (all activities exept polyester processing and polystyrene foam processing): recommended emission factors from CORINAIR Technical Annexes. Vol. 2 Default emission factors handbook (1994).

3 AGRICULTURE

- 3.B: Tier 2 EMEP/EEA methodology and Tier 2 emission factors from GB2016 with national specifics.
- 3.D.1.a: Tier 1 EMEP/EEA methodology and Tier 1 emission factors from GB2016 for NOx, NMVOC, and PMs emission calculation, and Tier 2 EMEP/EEA methodology, along with Tier 2 emission factors from GB2016 for NH_3 emission calculation.
- 3.D.a.2.a: Tier 2 EMEP/EEA methodology and Tier 2 emission factors from GB2016 with national specifics.
- 3.D.a.2.b: Tier 1 EMEP/EEA methodology and Tier 1 emission factors from GB2016
- 3.D.a.3: Tier 2 EMEP/EEA methodology and Tier 2 emission factors from GB2016 with national specifics.

5 WASTE

- 5.A, 5.C.1.b.iii, 5.C.1.b.v: Tier 1 EMEP/EEA methodology, along with Tier 1 emission factors from GB2016.
- 5.B.1: Tier 2 EMEP/EEA methodology for NH_3 from GB2016.
- 5.C.1.b.i: Tier 1 EMEP/EEA methodology, along with Tier 1 emission factors from GB2016 and GB2009 (for emission factors not estimated in GB2016).
- 5.D.1, 5.D.2: Tier 2 EMEP/EEA methodology for NMVOC from GB2016.
- 5.D.3: Tier 2 EMEP/EEA methodology for NH_3 from GB2016.
- 5.E: Tier 2 EMEP/EEA methodology, along with Tier 2 emission factors from GB2016.

11 NATURAL SOURCES

11.B Forest fires: MEP/EEA methodology, along with Tier 1 emission factors from GB2016.

1.6. Key sources categories

Table 1.5-1 Key source categories in 2017 for the Croatian Emission Inventory

Pollutant	Key categories (Sorted from high to low from left to right)												Total (%)
SOx	1B2aiv	1A1b	1A1a	1A2f	1A2e								86.2
	(35.3%)	(20.5%)	(13.8%)	(9.0%)	(7.6%)								
NOx	1A3bi	1A3biii	1A4bi	1A1a	1A3bii	1A2f	3Da1	1A4cii	3Da3	3Da2a			80.7
	(20.8%)	(16.4%)	(9.5%)	(6.4%)	(5.4%)	(5.3%)	(4.8%)	(4.7%)	(4.2%)	(3.2%)			
NH3	3Da1	3Da2a	3B3	3B1a	2B10a	3B1b							82.7
	(30.4%)	(21.9%)	(11.7%)	(6.4%)	(6.2%)	(6.0%)							
NMVOC	1A4bi	2D3d	2H2	2D3i	5A	3B1a	2D3h	1A3bi	3B1b	1B2av	2D3a	1A3biv	80.4
	(23.2%)	(14.5%)	(8.5%)	(5.9%)	(4.2%)	(4.1%)	(3.7%)	(3.7%)	(3.6%)	(3.5%)	(3.2%)	(2.3%)	
CO	1A4bi	1B2aiv	1A3bi										84.0
	(57.6%)	(14.8%)	(11.6%)										
TSP	1A4bi	2D3b	2A5a	3Dc	1A1a	3B3	2B10a						81.7
	(31.9%)	(30.0%)	(6.4%)	(6.2%)	(2.7%)	(2.5%)	(2.0%)						
PM10	1A4bi	2D3b	3Dc	2A5a	1A1a	1A3bvi	1A3bi	2B10a	1B2aiv				81.0
	(45.4%)	(9.6%)	(9.2%)	(4.7%)	(3.2%)	(2.4%)	(2.3%)	(2.2%)	(1.9%)				
PM2.5	1A4bi	1A1a	1A3bi	2B10a	2D3b	1A3bvi							81.0
	(67.2%)	(3.9%)	(3.5%)	(2.5%)	(1.9%)	(1.9%)							
Pb	1A3bi	1A4bi	2G	1A3bvi	2A3								83.1
	(37.8%)	(15.6%)	(13.2%)	(10.6%)	(5.9%)								
Hg	1A2f	1A1a	1B2aiv	1A4bi	2K								85.5
	(28.3%)	(25.5%)	(12.7%)	(9.6%)	(9.5%)								
Cd	1A4bi	2G	1B2aiv										83.4
	(71.6%)	(6.2%)	(5.6%)										
PCDD/ PCDF	1A4bi	5E											84.8
	(74.7%)	(10.1%)											
PAH	1A4bi												89.0
	(89.0%)												
HCB	1A4bi												80.6
	(80.6%)												

Data source: RepDab Report, http://www.ceip.at/repdab-check-your-inventory/

Table 1.5-1 (cont.) Key source categories in 2017 for the Croatian Emission Inventory

Pollutant	Key categories (Sorted from high to low from left to right)												Total (%)
As	1B2aiv	1A1a	1A2f	2A3									89.7
	48.1%	18.4%	13.0%	10.3%									
Cr	1A4bi	1A3bvi	1B2aiv	1A2f									81.8
	49.3%	14.7%	11.5%	6.3%									
Cu	1A3bvi	2G											84.3
	77.1%	7.3%											
Ni	1A1b	1B2aiv	1A1a	1A4ai									84.6
	56.2%	12.0%	10.8%	5.5%									
Se	2A3	1A2f	1A4bi										84.3
	61.0%	16.9%	6.4%										
Zn	1A4bi	1A3bi	1A3bvi										82.3
	67.4%	7.4%	7.4%										
benzo(a) pyrene	1A4bi												91.6
	91.6%												
benzo(b) fluoranthe	1A4bi												87.6
	87.6%												
benzo(k) fluoranthe	1A4bi												85.7
	85.7%												
Indeno (1,2,3-cd)	1A4bi												91.2
	91.2%												
PCBs	2K												99.3
	99.3%												
BC	1A4bi	1A3bi	1A3bii	1A3biii									81.6
	58.5%	15.0%	4.2%	4.0%									

Data source: EKONERG Ltd

1.7. QA/QC and verification methods

Quality assurance and quality control procedures for inventory compilation and reporting are part of defined QA/QC plan. In 2009, EKONERG Ltd. for the MEE has prepared an internal document (the QA/QC plan) to organise and implement activities across all of the emissions inventory activities including involved stakeholders (e.g. suppliers of data, recipients, inventory compiling institution), data collection, data manipulation, inventory compilation, consolidating the inventory estimates (e.g. into a single national database) and reporting. QA/QC activities performed for this inventory compilation is presented in Appendix 1 and these include checks in: data collection activities, activity data entry into databases, emission calculation, databases items, Emission reporting template - NFR tables for all years from 1990 to 2016 (for 2016 in Appendix I), preparation of IIR (Informative Inventory Report) and archiving.

Before submitting reporting tables, the RepDab tool is run. If needed, data is revised. When all tables passed all RepDab tests, then tables are submitted.

Following sub-chapters give a clarification of the terms 'quality control' and 'quality assurance' used for the purpose of the inventory management.

1.7.1. Quality Control (QC)

Quality Control (QC) is a system of routine technical activities to measure and control the quality of the inventory as it is being developed. The QC system is designed to:

- Provide routine and consistent checks to ensure data integrity, correctness, and completeness;
- Identify and address errors and omissions;
- Document and archive inventory material and record all QC activities.

QC activities include general methods such as accuracy checks on data acquisition and calculations and the use of approved standardized procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. Higher tier of QC activities include technical reviews of source categories, activity and emission factor data and methods. For example, control of bottom-up data for industry and energy sector from the Croatia Environmental Pollution Register (EPR) is performed. The EPR is based on the Ordinance on the Environmental Pollution Register (Official Gazette No. 87/15). According to that Ordinance the competent authorities (CA), which are 21 counties, with in cooperation with the competent inspectorate, are responsible to assess the completeness, consistency and credibility of the data submitted by the operators, and they verified forms. Data from EPR (direct pollutants emissions, fuel consumptions and productivity) by each individual plant are checking on consistency, transparency and completeness in the process of inventory preparation. If, by comparing previously reported data, there are significant decreases (dips) or significant increases (peak) in the reported emissions and/or fuel consumption and/or realized productivity, then it is checked whether the plant has introduced a new emission reduction technology (also part of the ROO system), new fuel or incorrect entry of certain data in the database occurred (the most common error is entering the data in another metering unit). In the next step, the inventory compiler informs the person in MEE responsible for air pollutant emission inventory work, who then informs the person responsible for EPR database. Further, person responsible for EPR database notifies the competent authority in the county, who then informs the responsible person at operator about data inconsistency. The responsible person at operator then corrects or explains the inconsistency. For the energy sector particularly for the sector of electricity and heat production, the total amount of fuel reported in the ROO database is compared with fuel sold amount by fuel type from the National Energy Balance. Last notation is also the part of yearly process of data collection.

1.7.2. Quality Assurance (QA) and Verification

Quality Assurance (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process. Reviews, preferably by independent third parties, should be performed upon a finalized inventory following the implementation of QC procedures. Reviews verify that data quality objectives were met, ensure that the inventory represents the best possible estimates of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the QC programme.

Ministry of Environment and Energy (MEE) is responsible for inventory preparation and final approval according Regulation on emission quotas for certain pollutants in the air in the Republic of Croatia (OG 108/13 and 19/17) and pursuant to the aforesaid, the MEE responsibility is also to carry out verification and peer reviews of: activity data quality, calculated emissions, and prepared report before the submission to the LRTAP Convention.

In the inventory preparation process, general quality control procedures have been applied (see Appendix 1). In addition, some specific quality control procedures related to check of activity data and emission factors were applied in previous submissions with new or updated emission factors and activity data from other sources (Environmental Pollution Register, direct communication with operators). Application of quality control procedures have resulted in recalculations of emissions which is presented in Chapter 10. For now, the system of quality assurance at the national level has not been established yet i.e. the institutions that will examine the inventory have not yet been determined.

In the framework of the UNECE LRTAP Convention and EU National Emissions Ceilings Directive by the year, 2008 began with a review and check in detail the inventories of each Party (so-called Stage 3 in depth reviews) in accordance with the model established under the UN Framework Convention on Climate Change (UNFCCC). The Republic of Croatia was reviewed in 2011 and in 2014 (Table 1.6-1). The annual review is concentrated on SO_2, NOx, NMVOC, NH_3, plus PM_{10} and $PM_{2.5}$ for the time series which are reflecting current priorities from EMEP Steering Body and the Task Force on Emission Inventories and Projections (TFEIP). HMs and POPs have reviewed to the extent possible.

Approved plan of Stage 3 (in depth) review in the 2018 -2020 period - of Emission inventories under CLRTAP by Parties to be reviewed is presented in Table 1.6-1.

Table 1.6-1 Approved plan of Stage 3 (in depth) reviews of Emission inventories under CLRTAP (2018 -2020)

2018	Armenia, Azerbaijan, Belarus, Finland, Moldova and Ukraine
2019	Albania, Bosnia and Herzegovina, Georgia, Montenegro, Norway, Russian Federatio, Serbia and Turkey
2020	European Union, FRY of Macedonia, Island, Kazakhstan, Kyrgyzstan, Liechtenstein, Monaco and Switzerland

Data source: http://www.ceip.at/review-of-inventories/in-depth-review-of-ae-inventories

The first comprehensive technical review of National Emission Inventories for EU member states, pursuant to the Directive on the Reduction of National Emissions of Certain Atmospheric Pollutants (Directive (EU) 2016/2284), was first implemented in June 2017. A technical review is conducted on the basis of officially submitted emissions in NFR tables for the period 1990 - 2015 (submission on 15. February 2017) and the Informative Inventory Report (IIR) (submission on 15. March 2017). Comprehensive technical review of inventories under NEC Directive was carried out for 2005, 2010 and 2015 and for the following pollutants: NOx, NMVOC, SO_2, NH_3 and $PM_{2.5}$.

The Comprehensive Technical Review of Member State Inventories aims to ensure accurate, reliable and verified emission inventories, in particular for 2005 and 2015, to ensure that the Commission has accurate, reliable and verified information on annual NECD emissions to determine compliance with the NECD targets. A secondary objective of the review was to strengthen Member States' capacity in managing NECD inventories efficiently and in delivering high quality inventory data and Informative Inventory Reports (IIRs) to the European Commission in due time. The review also sought to harmonise approaches used in monitoring inventories reported under the NECD with reviews undertaken by other organisations that have similar interests such as the reviews under the LRTAP Convention and the EU Greenhouse Gas Monitoring Mechanism (MMR)/United Nations Framework Convention on Climate Change (UNFCCC).

1.8. General uncertainty evaluation

Emissions uncertainty analysis are calculated on the basis of the standard methods and procedures of:

- UNECE: Guidelines for Estimating and Reporting Emission Data under the Convention on Long Range Transboundary Air Pollution, Edition 2009 (UNECE 2009)
- EMEP/EEA air pollutant emission inventory guidebook (EMEP/EEA Guidebook).

The uncertainty estimations of total national emissions reporting to the CLRTAP for Croatia are developed to be in accordance with the Tier 1 methodology described in the EMEP/EEA Guidebook. The uncertainty estimates are based on emission data for the base year (1990) and 2017, and on uncertainties for activity rates and emission factors for NFR sectors. Estimated emissions for 1990 and 2017, the uncertainty introduced into the trend 1990-2017, and the uncertainty in total national emissions 2017 for all pollutants are shown in the Table 1.7-1. The uncertainty estimates include all NFR sectors on aggregated level Detail calculation sheets and results of Croatia uncertainty analyses are provided in Appendix 7.

1.8.1. Overview of the uncertainty evaluation method

The uncertainty in an emission can be propagated from uncertainties in the activity data and the emission factor through the error propagation equation (Mandel 1984, Bevington and Robinson 1992)[15]. This method is present in the EMEP/EEA Guidebook, where the conditions imposed for use of the method are:

- Input parameters (emission factor, activity data) have Gaussian (normal) distributions. Uncertainty is symmetric with respect to the mean value. The length of the range from mean to upper larger value (97.5% percentile) is equal to the length of the range from mean to lower, smaller value (2.5% percentile).
- The correlation between the input data in model does not exist. That is the main reason why is appropriate aggregation of data needed for the uncertainty analysis.
- Calculation of trend uncertainty using Tier 1 method is based on the essential assumption that the input uncertainty of emission factors and activity data for 1990 and 2017 are equal.

Under these conditions, the uncertainty calculated for the emission rate is appropriate.

[15] http://cxdd.broceliande.kerbabel.fr/?q=node/398/200

The Guidebook recommends that inputs (direct emissions[16], activity data and emission factors) are as far as possible statistically independent, e.g. that emission factors used in several source categories yield one uncertainty estimate on an aggregated level rather than using the same Figure for each source category.

Appropriate aggregation of data for the uncertainty analysis is important to avoid over- or underestimation of uncertainty due to correlations.

Assumptions used in NFR sectors aggregation are following:

- Emission factors are considered independent across the different sectors, technologies and fuel.
- Emission estimates of different pollutants are considered to be independent.
- Activity data are considered to be independent.

Assumptions used in uncertainty calculation are following:

- Emission factor uncertainties were in lower end of default range for all sources and pollutants (EMEP/EEA Guidebook, Part A - general guidance chapters, 5-Uncertainties, Table 3-2 and 3-3).
- Emission factor uncertainties have Type A sensitivities and activity data uncertainties have Type B sensitivities, as suggested in EMEP/EEA Guidebook.

1.8.2. Documentation of uncertainties

The uncertainty estimates for emission factors derive from expert judgments based on information on 95% confidence intervals in the EMEP/EEA Guidebook. The default uncertainties for emission factors are given in letter codes (Table 3-2, General guidance chapter 5 - Uncertainties EMEP/EEA Guidebook) representing an uncertainty range (Table 3-3, General guidance chapter 5 - Uncertainties EMEP/EEA Guidebook). In uncertainty analysis, the lower value of the default uncertainty range for emission factors was used for all sources and pollutants. For some pollutants and source categories, no information on default uncertainty ranges is available in the EMEP/EEA Guidebook and thus the uncertainty ranges from Switzerland´s IIR 2011 are applied when appropriate.

The uncertainty estimates for activity data derive from Croatia's greenhouse gas inventory (Croatian NIR), from expert judgment based on comparisons with available datasets of other countries and from EMEP/EEA Guidebook (Table 3-1, General guidance chapter 5 – Uncertainties) where appropriate (Table 1.7.2-1). For source categories where activity data uncertainty was taken from Croatian NIR, default uncertainty from IPCC guidance was used and average value from range of given uncertainty was set. For source categories, where activity data uncertainty was taken from other countries with available activity data uncertainty sheets, available data was compared and expert judgment was made to choose the most acceptable activity data uncertainty.

Sources of data used:

- uncertainty analysis of Croatia's greenhouse gas inventory – NIR (activity data),
- uncertainties from France's, Finland's, Switzerland's and Danish's Informative Inventory Reports (emission factors and activity data),
- default values of EMEP/EEA Guidebook (activity data and emission factors).

[16] In this context direct emissions means emission data based on measurements or expert judgements reported e.g. by plants in EPRT.

Uncertainty ranges for activity data

Uncertainty rates for activity data in NFR sectors and used aggregation level are listed in Table 1.7.2-1.

Table 1.7.2-1 Applied uncertainty levels for activity data and data sources by NFR sector aggregation

NFR SECTOR AGGREGATION	%	DATA SOURCE
1A1, 1A2, 1A3b	3	National data in combination with comparisons with other datasets and other countries
1A3a Aviation	3	National data in combination with EUROCONTROL datasets
1A3c i 1A3d	5	National data in combination with comparisons with other datasets and other countries
1A4a	5	expert judgment in combination with comparisons with other datasets and other countries
1A4b, 1A4c	3	National data in combination with Tier 2 methodology from EMEP/EEA 2016 guidebook
1B1, 1B2ai	10	expert judgment in combination with comparisons with other datasets and other countries
1B2aiv, 1B2av, 1B2b,1B2c	3	Facilities data in combination with Tier 2 methodology from EMEP/EEA 2016 guidebook
2A1, 2A2, 2A3	3	Facilities data in comparison with national statistical data
2A5a, 2A5b	5	National data and comparison with other datasets and other countries
2B1, 2B2	3	Facilities data in comparison with national statistical data
2B10a, 2H, 2I	5	National data and comparisons with other datasets and other countries
2C	7.5	Facilities data in comparison with national statistical data
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	30	National statistical data and comparisons with other datasets and other countries
2K	50	National population statistical data and comparisons with other datasets and other countries
2D3a, 2D3i, 2G, 2D3d, 2D3e, 2D3f	10	National statistical data in combination with Tier 2 methodology from EMEP/EEA 2016 guidebook
3B1, 3B2, 3B4d, 3B4e, 3B4f	10	National statistical data in comparisons to National Central Register of Livestock under Croatian Agricultural Agency
3B3, 3B4g	50	National statistical data in comparisons to National Central Register of Livestock under Croatian Agricultural Agency
3D	5	Facilities data in combination with Tier 2 methodology from EMEP/EEA 2016 guidebook
5A, 5B1, 5C	5	National data from the Environmental Pollution Register and Waste Management Information System under the Ministry of Environment and Energy
5D1, 5D2	30	National statistical data
5D3	30	National statistical data from 1991, 2001 and 2011 Census under Croatian bureau of Statistic in combination with extrapolation method
5E	5	National base of accidental fire under Ministry of Interior

Uncertainty ranges for emission factors

The applied uncertainties are for most emission factors, default values referring to EMEP/EEA Guidebook. Guidebook doesn´t propose uncertainty for pollutants TSP, PM_{10}, $PM_{2.5}$, BC and NH_3 (regard some sectors) so in comparison with datasets of other countries, expert judgment is applied for TSP, PM_{10}, $PM_{2.5}$ and BC, or in the case of NH_3 the emission factors uncertainty from Danish IIR was applied (Table 1.7.2-3). Furthermore, for 1.A.4 subsectors the TSP, PM_{10} and $PM_{2.5}$ emission factors uncertainty from Switzerland´s IIR 2011 was applied (Table 1.7.2-4). The applied uncertainties for emission factors are listed in Tables from 1.7.2-2 to 1.7.2-4.

Table 1.7.2-2 Applied uncertainty levels for SO_2, NO_2, NMVOC, CO, TSP, PM_{10}, $PM_{2.5}$, PAH, HCB, PCDD/PCDF emission factors by NFR sectors

NFR SECTORS	EMISSION FACTORS UNCERTAINTY RATES, %										
	SO_2	NO_2	NMVOC	CO	TSP	PM_{10}	$PM_{2.5}$	BC	PAH	HCB	PCDD/PCDF
1.A.1, 1.A.2	10	20	50	20	50	50	50	50	100	100	100
1.A.3.b Road transport	20	20	20	20	100	100	100	100	400	400	400
1.A.3 Other transport	20	100	100	100	500	500	500	500	400	400	400
1.A.4	20	50	50	50	x	x	x	x	400	400	400
1.B	50	50	50	50	50	50	50	50	400	400	400
2	20	50	50	50	50	50	50	50	400	400	400
2.A	20	50	20	50	50	50	50	50	400	400	400
2.D.3.i	20	31	50	50	50	50	50	50	400	400	400
3.B	-	100	-	-	100	100	100	x	400	400	400
3.D	-	100	100	-	50	50	50	x	400	400	400
5.A, 5.D	20	-	50	-	100	100	100	100	400	400	400
5.C	20	20	50	50	50	50	50	50	100	100	100

Data source: EMEP/EEA guidebook, Part A - general guidance chapters, 5-uncertainties, Table 3-2 and 3-3, with exception for TSP, PM_{10}, $PM_{2.5}$ – expert judgment

Table 1.7.2-3 Applied uncertainty levels for heavy metals, HCH and PCBs emission factors by NFR sectors

NFR SECTORS	EMISSION FACTORS UNCERTAINTY RATES, %									
	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	NH_3	PCBs
1.A.1, 1.A.2	100	100	100	100	100	100	100	100	100	1000	100
1.A.3.b Road transport	400	400	400	400	400	400	400	400	400	400	400
1.A.3 Other transport	400	400	400	400	400	400	400	400	400	1000	400
1.A.4	400	400	400	400	400	400	400	400	400	1000	400
1.B	400	400	400	400	400	400	400	400	400	1000	400
2 A, 2 B, 2 C, 2 D, 2 F	400	400	400	400	400	400	400	400	400	400	400
3.B	400	400	400	400	400	400	400	400	400	100	400
3.D	400	400	400	400	400	400	400	400	400	100	400
5.D.1	400	400	400	400	400	400	400	400	400	400	400
5.D.3	100	100	100	100	100	100	100	100	100	1000	100

Data source: EMEP/EEA guidebook, Part A - general guidance chapters, 5-uncertaintie, Table 3-2 and 3-3

Table 1.7.2-4 Applied uncertainty levels for $PM_{2.5}$, PM_{10} and TSP emission factors for NFR 1.A.4

NFR SECTORS	EMISSION FACTORS UNCERTAINTY RATES, %			
	$PM_{2.5}$	BC	PM_{10}	TSP
1.A.4.a Commercial / institutional	78.0	78.0	78.0	78.0
1.A.4.b.i Residential	76.0	76.0	76.0	76.0
1.A.4.b.ii Residential: Household and gardening (mobile)	50.0*	50.0*	50.0*	50.0
1.A.4.c.i Agriculture/Forestry/Fishing: Stationary	39.0	39.0	39.0	39.0
1.A.4.c.ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	80.0*	80.0*	80.0*	80.0

Data source: Switzerland´s IIR 2011 with exception for (*) PM_{10}, $PM_{2.5}$, BC– expert judgment

1.8.3. Results of Tier 1 uncertainty evaluation

Table 1.7.3-1 shows a summary of the uncertainty evaluation of Croatia total emissions 2017 and the trend uncertainties 1990-2017 by pollutant. Detail calculation sheets and results of Croatia uncertainty analyses are provided in Appendix 7.

Table 1.7.3-1 The summary of the uncertainty evaluation for Croatia and total emissions by pollutant in 2017

Pollutant	Total emission in 2017	Unit	Emission uncertainty	Trend	Trend uncertainty
			%	%	%
SO_2	12.56	kt	18.23	-92.63	1.29
NOx	54.85	kt	17.83	-49.95	2.76
NMVOC	63.24	kt	19.02	-64.39	3.40
CO	196.58	kt	31.75	-64.72	5.19
TSP	37.94	kt	32.08	-35.90	15.88
PM_{10}	25.38	kt	37.85	-49.59	7.07
$PM_{2.5}$	16.73	kt	53.49	-56.20	4.54
BC	2.85	kt	53.92	-47.84	9.54
PAH	5.93	kt	357.33	-74.92	15.32
HCB	0.28	kg	322.77	3.42	16.48
PCDD/PCDF	16.23	g I-TEQ	300.37	-66.60	13.23
NH_3	37.64	kt	86.37	-32.94	11.08
As	0.52	kt	194.71	-94.00	23.95
Cd	0.83	kt	289.71	-26.76	87.81
Cr	2.14	kt	208.56	-59.66	60.79
Cu	8.94	kt	160.39	0.02	29.08
Hg	0.44	kt	87.44	-62.28	93.68
Ni	4.28	kt	88.32	-74.93	17.12
Pb	8.01	kt	131.76	-98.52	1.76
Se	0.37	kt	246.75	-20.60	42.63
Zn	34.73	kt	274.45	-11.37	44.33
PCBs	415.36	kg	400.29	-14.03	60.39

The results of uncertainty analysis are interpreted in the manner provided below. For example, in Table 1.7.3-1 row with evaluated NO_2 emission uncertainty tells us that with certainty of 95% total NO_2 emission for the year 2017 varies between [54.85*(1-p/100), 54.85*(1+p/100)], where "p" is emission uncertainty (17,83%). With the same approach the 95% probability range for trend is between [-49.95%-t, -49.95%+t], where "t" is trend uncertainty (2.76%).

High emission uncertainty for pollutants: PAH, PCDD/PCDF, Cu, Pb, Se, PCBs, Zn, Hg is expected. The main reason is high default uncertainty of emission factors (400%) that is given in Table 3.2 from EMEP/EEA guidebook. These are categories that have been classified at level E, which is an estimate of uncertainty based on assumptions and has unlimited range of uncertainty. For pollutants: PM_{10}, $PM_{2.5}$, BC and TSP uncertainty ranges in Table 3.3 from EMEP/EEA guidebook are not defined. For pollutant, NH_3 range of uncertainty is classified in category D or E, where estimate of the uncertainty is based on assumption, so the range is not specified. As the total uncertainty would not be overestimated, for PM_{10}, $PM_{2.5}$, BC and TSP, the source category NFR 1.A.4 is divided into lower subcategories.

1.9. General assessment of completeness

According to reporting guidelines, in cases when methodological and data gaps exist in the inventory, parties to the Convention are required to inform and explain in a transparent manner the reason of their appearance, also the emission of certain emission sources from the inventory. To accomplish this, Parties have to use designated notation keys, Explanation of the meaning and the purpose of notation keys are presented in the following sub-chapter.

Notation keys are used in NFR emission tables for sub-sectors, from which emissions has not been quantitatively estimated. In Table 1.8-1 definition for each notation key used in NFR format is presented.

Table 1.8-1 Definition of Notation keys

Notation key	Meaning	Purpose
NO	Not occurring	For activities or processes which do not exist in Republic of Croatia / for emissions by sources of compounds that do not occur for a particular compound or source category;
NE	Not estimated	Where emission occur, but have not been estimated or reported
NA	Not applicable	When activity or process exist, but it is assumed that they do not result with emission / Is used for activities which are believed to result in emission which are insignificant to national totals;
IE	Included elsewhere	Where emissions for mentioned activity or process are calculated and included in inventory, but did not separately presented for this source category / For emissions of pollutants which are calculated, but included elsewhere from expected source category in the inventory;
C	Confidential	For emissions by sources of compounds which could lead to the disclosure of confidential information
NR	Not relevant	According to paragraph 9 in the Emission Guidelines, Emission inventory reporting should cover all years from 1980, Onwards, if data are available, Where emissions are not strictly required by the different Protocols, e.g. for some parties emissions of NMVOC prior to 1988

1.9.1. Sources reported as "NE"

Table 1.8.1-1 Explanation to the Notation key NE

NFR14 code	Substance(s)	Reason for not estimation
1.A.1.b	NH_3, PCB, HCB	FEs are not available in EMEP/EEA GB
1.A.1.c	PCB, HCB	FEs are not available in EMEP/EEA GB
1.A.2.g.vii	PCB, HCB, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, PCDD/F, Hg, As	FEs are not available in EMEP/EEA GB
1.A.3.b.i 1.A.3.b.ii 1.A.3.b.iii 1.A.3.b.iv	HCB, PCBs	FEs are not available in EMEP/EEA GB neither in COPER 4 model
1.A.3.b.vi	Hg, As, PCDD/F, PAHs, HCB, PCBs	FEs are not available in EMEP/EEA GB
1.A.3.b.vii	BC, PCDD/F, PAHs, HCB, PCBs	FEs are not available in EMEP/EEA GB
1.A.3.d.ii	benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene	FEs are not available in EMEP/EEA GB
1.A.4.b.ii, 1.A.4.c.ii	Hg, As, PCDD/PCDF, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, HCB, PCBs	FEs are not available in EMEP/EEA GB
1.A.4.c.i	HCB, PCBs	FEs are not available in EMEP/EEA GB
1.B.2.a.i	SO_2, PCDD/F	FEs are not available in EMEP/EEA GB
1.B.2.c	NH3, PCDD/PCDF	FEs are not available in EMEP/EEA GB
2.B.1	NMVOC, SO_2, $PM_{2.5}$	FEs are not available in EMEP/EEA GB
2.B.2	NH_3, $PM_{2.5}$	FEs are not available in EMEP/EEA GB
2.C.3	HCB	FEs are not available in EMEP/EEA GB
3.D.a.2.b	NH_3, NOx (1990 – 2004)	AD are not available
3.D.a.2.c	NH_3, NOx	AD are not available
3.D.a.4	NH_3, NOx	FEs are not available in EMEP/EEA GB
3.D.b	All relevant	There is no methodology.
3.D.d	All relevant	There is no methodology.
3.F	NH_3, NOx, NMVOC, SO_2, CO, PM	AD are not available
5.A	NH_3, CO, Hg	FEs are not available in EMEP/EEA GB 2016

NFR14 code	Substance(s)	Reason for not estimation
5.B.1	NH_3 (1990 - 2006)	AD are not available
	NOx, CO, NMVOC, SO_2, TSP, PM_{10}, $PM_{2.5}$, BC	FEs are not available in EMEP/EEA GB 2016
5.C.1.b.i	NH_3, Se	FEs are not available in EMEP/EEA GB2016 and EMEP/EEA GB 2009
5.C.1.b.iii	NH_3, PM_{10}, $PM_{2.5}$, Se, Zn	FEs are not available in EMEP/EEA GB 2016
5.C.1.b.v	BC	FEs are not available in EMEP/EEA GB 2016
5.D.1	NH_3, TSP, PM_{10}, $PM_{2.5}$, BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	FEs are not available in EMEP/EEA GB 2016
5.D.2	NH_3, TSP, PM_{10}, $PM_{2.5}$, BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	FEs are not available in EMEP/EEA GB 2016
5.D.3	NMVOC, TSP, PM_{10}, $PM_{2.5}$, BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	FEs are not available in EMEP/EEA GB 2016
5.E	NOx, CO, NMVOC, SO_2, NH_3, BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PAHs, HCB, PCBs	FEs are not available in EMEP/EEA GB 2016

1.9.2. Explanation of the notation key "IE"

Table 1.8.2-1 Explanation to the Notation key IE

NFR14 code	Substance(s)	Included in NFR code	
1A.2.a	All relevant	1.A.2.f	(1990 - 2000)
1.A.2.b	All relevant	1.A.2.f	(1990 - 2000)
1.A.2.c	All relevant	1.A.2.f	(1990 - 2000)
1.A.2.d	All relevant	1.A.2.f	(1990 - 2000)
1.A.2.e	All relevant	1.A.2.f	(1990 - 2000)
1A2gviii	All relevant	1.A.2.f	(1990 - 2017)
1.A.3.d.i.(ii)	All relevant	1.A.3.d.i(i)	(1990 - 2017)
1.A.4.a.ii	All relevant	1.A.4.b.ii and 1.A.4.c.ii	(1990 - 2017)
1.A.4.c.iii	All relevant	1.A.3.d.ii (based on total amount of exhausted fuel for national navigation, maritime and river traffic)	(1990 - 2017)
1.A.5.a	All relevant	1.A.4.a.i	(1990 - 2017)
1.A.5.b	All relevant	1.A.3.a, 1.A.3.b (i-iv), 1.A.3.d	(1990 - 2017)
2.A.1	All relevant for fuel combustion except for PMs	1.A.2.f	(1990 - 2017)
2.A.2	All relevant for fuel combustion except for PMs	1.A.2.f	(1990 - 2017)
2.A.3	All relevant for fuel combustion except for PMs	1.A.2.f	(1990 - 2017)
2.A.5.c	TSP, PM_{10}, $PM_{2.5}$	2.A.1, 2.A.2, 2.A.3, 2.A.5.a, 2.A.5.b	(1990 - 2017)
2.B.10.b	TSP, PM_{10}, $PM_{2.5}$	2.B.10.a	(1990 - 2017)
2.C.1	NH_3	1.A.2.f	(1990 - 2000)
		1.A.2.a	(2001 - 2017)
2.C.2	All relevant for fuel combustion	1.A.2.b	(1990 - 2003)
2.C.3	All relevant for fuel combustion	1.A.2.b	(1990 - 1991)
2.G	All relevant	2.D.3.a	(1990 - 2017)
3.D.a	NOx, NH_3, and other relevant	3.B source categories	(1990 – 2017)
3.D.b	PMs	3.D.a.1	(1990 – 2017)
3.D.c	PMs	3.B source categories, 3.D.a.1	(1990 – 2017)
3.D.e	PMs	3.D.a.1	(1990 – 2017)
5.C.1.b.i	All relevant for fuel combustion	1.A.2.f	(2009 – 2017)
5.C.1.b.ii	All relevant	5.C.1.b.i	(1997 – 2002)

1.9.3. An account of sub-sources included in reporting codes "OTHER"

Table 1.8.3-1 Sub-sources accounted for in reporting codes "Other"

NFR14 code	Substance(s) reported	Sub-source description	
1.A.2.f	All relevant	Stationary combustion in manufacturing industries and construction: Iron and steel (1 A 2 a), Non-ferrous metals (1 A 2 b), Chemicals (1 A 2 c), Pulp, Paper and Print (1 A 2 d), Food processing, beverages and tobacco (1 A 2 e)	(1990 - 2000)
1.A.5.a	All relevant	(C) - military, (IE) Combustion in commercial and institutional plants (NFR 1 A 4 a and SNAP 020100)	(1990 - 2017)
1.A.5.b	All relevant	(C) - military, (IE) - Combustion in vehicles (sub-sectors 1 A 3 b (i-iv)), other mobile combustion in NFR code 1 A 4 a i	(1990 - 2017)
1.B.1.c	NO	-	(1990 - 2017)
1.B.3	NO	-	(1990 - 2017)
2.B.10.a	NOx, CO, NMVOC, SO_2, NH_3, PM_{10}, TSP, $PM_{2.5}$	Processes in inorganic chemical industry - production of: sulfuric acid (SNAP 040401), NPK fertilizers (SNAP 040407), urea (SNAP 040408), Ammonium phosphate SNAP 040406), carbon black (SNAP 040409), and processes in organic chemical industry - production of: Ethylene (SNAP 040501), Propylene (SNAP 040502), Vinyl chloride (SNAP 040504), Polyethylene LD (SNAP 040506), Polyvinylchloride (SNAP 040508), Styrene (SNAP 040510), Polystyrene (SNAP 040511) and Ethyl benzene (SNAP 040518)	1990
		Processes in inorganic chemical industry - production of: sulfuric acid (SNAP 040401), NPK fertilizers (SNAP 040407), urea (SNAP 040408), Ammonium phosphate SNAP 040406), carbon black (SNAP 040409), and processes in organic chemical industry - production of: Ethylene (SNAP 040501), Propylene (SNAP 040502), Vinyl chloride (SNAP 040504), Polyethylene LD (SNAP 040506), Polyvinylchloride (SNAP 040508), Polystyrene (SNAP 040511) and Ethyl benzene (SNAP 040518)	1991
		Processes in inorganic chemical industry - production of: sulfuric acid (SNAP 040401), NPK fertilizers (SNAP 040407), urea (SNAP 040408), Ammonium phosphate SNAP 040406), carbon black (SNAP 040409), and processes in organic chemical industry - production of: Ethylene (SNAP 040501), Propylene (SNAP 040502), Vinyl chloride (SNAP 040504), Polyethylene LD (SNAP 040506), Polyvinylchloride (SNAP 040508), Polystyrene (SNAP 040511)	1992 and 1993
		Processes in inorganic chemical industry - production of: sulfuric acid (SNAP 040401), NPK fertilizers (SNAP 040407), urea (SNAP 040408), Ammonium phosphate SNAP 040406), carbon black (SNAP 040409), and processes in organic chemical industry - production of: Ethylene (SNAP 040501), Propylene (SNAP 040502), Vinyl chloride (SNAP 040504), Polyethylene LD (SNAP 040506), Polyvinylchloride (SNAP 040508), Polystyrene (SNAP 040511), Formaldehyde (SNAP 040517) and Ethyl benzene (SNAP 040518)	1995 and 1996
		Processes in inorganic chemical industry - production of:	1994 and

NFR14 code	Substance(s) reported	Sub-source description	
		sulfuric acid (SNAP 040401), NPK fertilizers (SNAP 040407), urea (SNAP 040408), Ammonium phosphate SNAP 040406), carbon black (SNAP 040409), and processes in organic chemical industry - production of: Ethylene (SNAP 040501), Propylene (SNAP 040502), Vinyl chloride (SNAP 040504), Polyethylene LD (SNAP 040506), Polyvinylchloride (SNAP 040508), Polystyrene (SNAP 040511) and Formaldehyde (SNAP 040517)	1997 - 2000
		Processes in inorganic chemical industry - production of: sulfuric acid (SNAP 040401), NPK fertilizers (SNAP 040407), urea (SNAP 040408), Ammonium phosphate SNAP 040406), carbon black (SNAP 040409), and processes in organic chemical industry - production of: Ethylene (SNAP 040501), Propylene (SNAP 040502), Vinyl chloride (SNAP 040504), Polyethylene LD (SNAP 040506), Polystyrene (SNAP 040511) and Formaldehyde (SNAP 040517)	2001 and 2002
		Processes in inorganic chemical industry - production of: sulfuric acid (SNAP 040401), NPK fertilizers (SNAP 040407), urea (SNAP 040408), Ammonium phosphate SNAP 040406), carbon black (SNAP 040409), and processes in organic chemical industry - production of: Ethylene (SNAP 040501), Propylene (SNAP 040502), Polyethylene LD (SNAP 040506), Polystyrene (SNAP 040511) and Formaldehyde (SNAP 040517)	2003 - 2009
		Processes in inorganic chemical industry - production of: NPK fertilizers (SNAP 040407), urea (SNAP 040408), and processes in organic chemical industry - production of: Ethylene (SNAP 040501), Propylene (SNAP 040502), Polyethylene LD (SNAP 040506), Polystyrene (SNAP 040511) and Formaldehyde (SNAP 040517)	2010 - 2011
		Processes in inorganic chemical industry - production of: sulfuric acid (SNAP 040401), NPK fertilizers (SNAP 040407), urea (SNAP 040408), and processes in organic chemical industry - production of: Formaldehyde (SNAP 040517)	2012 – 2017
2.C.7.c	NO	-	(1990 - 2017)
2.D.3.i	VOC, NOx, CO, SO_2, NH_3, $PM_{2.5}$, PM_{10}, TSP, As, Cd, Cr, Cu, Hg, Pb, PCDD/PCDF, Total 4 PAH, benzo(a), benzo(b), benzo(k), Indeno	Fat, edible and non-edible oil extraction (SNAP 060404), Tobacco combustion (SNAP 060602), Preservation of wood with creosote preservative type / organic solvent borne preservative (SNAP 060406), Application of glues and adhesives (SNAP 060405) and conservation of vehicles (SNAP 060407)	(1990 - 2017)
2.H.3	NO	-	(1990 - 2017)
2.G	NMVOC	Use of pesticide, including fungicide	(1990 – 2017)
3.D.a.2.c	NO	-	(1990 - 2017)
5.E	All relevant	Detached house fire (SNAP 091010), undetached house fire (SNAP 091011), apartment building fire (SNAP 091012), industrial building fire (SNAP 091013) and car fire (SNAP 091009)	(1990 - 2017)

2. Analysis of key trends by pollutant

This chapter gives an overview of the methodology for the key source analysis by observed pollutants, the results of key sources analysis with an overview of the change in share from 1990 to 2017, then overview of direct emissions of large point sources in Croatia (from EPR base) and in the end overview and analysis of pollutants time series.

2.1. The methodology for key source analysis

The methodology used to identify key source categories of individual pollutant follows the quantitative Approach 1 described in the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Sensitivity analysis - a simplified approach, suggested in the assessment of key sources, if uncertainties are not known. In Approach 1, key categories are identified using a predetermined cumulative emissions threshold. Key categories are those which, when summed together in descending order of magnitude, cumulatively add up to 80 % of the total level[17]

2.2. Key source analysis

The analysis of key sources in Republic of Croatia includes all pollutants under CLRTAP and associated protocols: pollutants which causes acidification, eutrophication and ground-level ozone (SO_2, NO_X, CO, NMVOC and NH_3), particles (TSP, PM_{10} and $PM_{2.5}$), black carbon (BC), heavy metals (Pb, Cd and Hg), other heavy metals (As, Cr, Cu, Ni, Se and Zn) and persistent organic pollutants: total 4 PAHs (benzo(a)-pyrene, benzo(b)-fluoranthene, benzo(k)-fluoranthene, Indeno(1,2,3-cd)-pyrene), PCDD/PCDF, HCB and PCBs). National emissions have been disaggregated into the categories according to required reporting format (NFR). A summary of all key and main sources and their contributions to overall pollutant emissions and percentage of emission change ("-"decrease and "+"increase) from 1990 to 2017 is provided in Table 2.2-1 below. As a note, each of pollutant totals in Table 2.2-1 represents pollutant total only for emission of key sources, not a national total.

Table 2.2-1 Summary of key and main sources and their contributions to overall pollutants emission and percentage of emission change ("-" decrease and "+" increase) from 1990 to 2017

Pollutant	NFR Code	Key source during 2017 NFR name	Emission in 2017	% of total emission in 2017	% change from 1990 to 2017
NO_x	1A3biii	Road transport: Heavy duty vehicles and buses	8.99	16.39%	-10.37%
	1A3bi	Road transport: Passenger cars	11.39	20.77%	-53.33%
	1A1a	Public electricity and heat production	3.49	6.35%	-69.67%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	2.91	5.31%	-84.58%
	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	2.57	4.68%	-66.98%

[17] *Guidebook 2009 (Key category analysis and methodological choice)*: The predetermined threshold is based on an evaluation of several inventories and is aimed at establishing a general level where a significant percentage of inventory uncertainty will be covered by key categories. The final category that should be defined as key is that category for which the cumulative total is exactly equal to, or exceeds the 80 % threshold. This approach is consistent with that recommended by IPCC for the determination of key sources.

Pollutant	NFR Code	Key source during 2017 NFR name	Emission in 2017	% of total emission in 2017	% change from 1990 to 2017
	3Da3	Urine and dung deposited by grazing animals	2.31	4.21%	-48.28%
	3Da1	Inorganic N-fertilizers (includes also urea application)	2.65	4.84%	-4.97%
	1A3bii	Road transport: Light duty vehicles	2.98	5.44%	11.71%
	1A4bi	Residential: Stationary	5.21	9.49%	18.62%
	3Da2a	Animal manure applied to soils	1.76	3.21%	-31.54%
		Total for key sources	44.26	80.7%	
NMVOC	1A4bi	Residential: Stationary	14.66	23.18%	-36.18%
	2H2	Food and beverages industry	5.38	8.51%	-75.93%
	2D3i	Other solvent use	3.73	5.90%	-67.64%
	1A3biv	Road transport: Mopeds & motorcycles	1.48	2.34%	-8.29%
	1A3bi	Road transport: Passenger cars	2.32	3.67%	-90.51%
	2D3d	Coating applications	9.16	14.48%	-57.64%
	1B2av	Distribution of oil products	2.19	3.47%	-39.12%
	3B1a	Manure management - Dairy cattle	2.59	4.10%	-46.92%
	5A	Biological treatment of waste - Solid waste disposal on land	2.63	4.15%	60.28%
	3B1b	Manure management - Non-dairy cattle	2.29	3.62%	52.55%
	2D3a	Domestic solvent use including fungicides	2.05	3.24%	-81.49%
	2D3h	Printing	2.36	3.73%	-27.76%
		Total for key sources	44.14	80.4%	
SO_2	1A1a	Public electricity and heat production	1.74	13.8%	-97.7%
	1B2aiv	Fugitive emissions oil: Refining / storage	4.43	35.3%	146.0%
	1A1b	Petroleum refining	2.58	20.5%	-88.5%
	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	0.95	7.6%	#VALUE!
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	1.13	9.0%	-96.8%
		Total for key sources	10.82	86.2%	
NH_3	3B3	Manure management - Swine	4.40	11.70%	-36.74%
	3Da1	Inorganic N-fertilizers (includes also urea application)	11.44	30.40%	11.51%
	3B1a	Manure management - Dairy cattle	2.40	6.39%	-63.80%
	3B1b	Manure management - Non-dairy cattle	2.27	6.03%	-11.20%
	2B10a	Chemical industry: Other	2.34	6.22%	-32.81%
	3Da2a	Animal manure applied to soils	8.26	21.94%	-44.08%
		Total for key sources	31.12	82.7%	
$PM_{2.5}$	1A4bi	Residential: Stationary	11.24	67.23%	-60.40%
	1A3bi	Road transport: Passenger cars	0.59	3.54%	237.60%
	1A1a	Public electricity and heat production	0.65	3.86%	-6.48%
	2B10a	Chemical industry: Other	0.42	2.50%	51.63%
	2D3b	Road paving with asphalt	0.33	1.95%	306.20%
	1A3bvi	Road transport: Automobile tyre and brake	0.32	1.94%	81.14%

Pollutant	NFR Code	Key source during 2017 NFR name	Emission in 2017	% of total emission in 2017	% change from 1990 to 2017
		wear			
		Total for key sources	13.55	81.0%	
PM_{10}	1A4bi	Residential: Stationary	11.52	45.38%	-60.45%
	2D3b	Road paving with asphalt	2.44	9.62%	306.20%
	2A5a	Quarrying and mining of minerals other than coal	1.19	4.68%	-12.13%
	1B2aiv	Fugitive emissions oil: Refining / storage	0.49	1.94%	-30.13%
	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	2.33	9.20%	-51.09%
	1A3bi	Road transport: Passenger cars	0.59	2.33%	237.60%
	1A3bvi	Road transport: Automobile tyre and brake wear	0.61	2.40%	79.26%
	1A1a	Public electricity and heat production	0.81	3.20%	-31.32%
	2B10a	Chemical industry: Other	0.56	2.20%	48.31%
		Total for key sources	20.54	81.0%	
TSP	1A4bi	Residential: Stationary	12.10	31.90%	-60.54%
	2D3b	Road paving with asphalt	11.40	30.04%	306.20%
	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	2.33	6.15%	-51.09%
	3B3	Manure management - Swine	0.94	2.48%	-30.85%
	2A5a	Quarrying and mining of minerals other than coal	2.42	6.38%	-12.13%
	1A1a	Public electricity and heat production	1.03	2.71%	-51.78%
	2B10a	Chemical industry: Other	0.76	1.99%	3.84%
		Total for key sources	30.98	81.7%	
CO	1A4bi	Residential: Stationary	113.29	57.6%	-40.8%
	1A3bi	Road transport: Passenger cars	22.80	11.6%	-89.7%
	1B2aiv	Fugitive emissions oil: Refining / storage	29.06	14.8%	-41.9%
		Total for key sources	165.15	84.0%	
Pb	1A3bi	Road transport: Passenger cars	3.02	37.8%	-99.3%
	1A4bi	Residential: Stationary	1.25	15.6%	-29.9%
	1A3bvi	Road transport: Automobile tyre and brake wear	0.85	10.6%	74.0%
	2A3	Glass production	0.47	5.9%	1.0%
	2G	Other product use	1.06	13.2%	90.3%
		Total for key sources	6.65	83.1%	
Cd	1A4bi	Residential: Stationary	0.59	71.6%	6.3%
	2G	Other product use	0.05	6.2%	-22.9%
	1B2aiv	Fugitive emissions oil: Refining / storage	0.05	5.6%	-41.9%
		Total for key sources	0.69	0.83	
Hg	1A1a	Public electricity and heat production	0.11	25.5%	102.3%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.12	28.3%	1.8%
	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	0.04	9.5%	-13.7%
	1B2aiv	Fugitive emissions oil: Refining / storage	0.06	12.7%	-38.3%

Pollutant	NFR Code	Key source during 2017 NFR name	Emission in 2017	% of total emission in 2017	% change from 1990 to 2017
	1A4bi	Residential: Stationary	0.04	9.6%	-27.7%
		Total for key sources	0.37	85.5%	
PCDD / PCDF	1A4bi	Residential: Stationary	12.1	74.7%	-63.3%
	5E	Other waste	1.6	10.1%	-40.3%
		Total for key sources	13.8	84.8%	
PAH	1A4bi	Residential: Stationary	5.28	89.0%	-71.0%
		Total for key sources	5.28	89.0%	
As	1B2aiv	Fugitive emissions oil: Refining / storage	0.25	48.1%	1281.6%
	1A1a	Public electricity and heat production	0.09	18.4%	-86.6%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.07	13.0%	-37.5%
	2A3	Glass production	0.05	10.3%	1.0%
		Total for key sources	0.46	89.7%	
Cr	1A4bi	Residential: Stationary	1.05	49.28%	2.54%
	1A3bvi	Road transport: Automobile tyre and brake wear	0.31	14.73%	73.68%
	1B2aiv	Fugitive emissions oil: Refining / storage	0.25	11.50%	-41.92%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.13	6.26%	-61.13%
		Total for key sources	1.75	81.8%	
Cu	1A3bvi	Road transport: Automobile tyre and brake wear	6.89	77.1%	73.6%
	2G	Other product use	0.65	7.3%	70.5%
		Total for key sources	7.54	84.3%	
Ni	1A1b	Petroleum refining	2.41	56.2%	-54.8%
	1B2aiv	Fugitive emissions oil: Refining / storage	0.52	12.0%	-34.0%
	1A1a	Public electricity and heat production	0.46	10.8%	-92.4%
	1A4ai	Commercial/institutional: Stationary	0.24	5.5%	-72.7%
		Total for key sources	3.62	0.85	
Se	2A3	Glass production	0.22	61.0%	1.0%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.06	16.9%	-20.1%
	1A4bi	Residential: Stationary	0.02	6.4%	-22.5%
		Total for key sources	0.31	84.3%	
Zn	1A4bi	Residential: Stationary	23.42	67.4%	3.2%
	1A3bi	Road transport: Passenger cars	2.58	7.4%	58.6%
	1A3bvi	Road transport: Automobile tyre and brake wear	2.58	7.4%	80.6%
		Total for key sources	28.57	82.3%	
benzo(a) pyrene	1A4bi	Residential: Stationary	1.76	91.6%	-71.9%
		Total for key sources	1.76	91.6%	
benzo(b) fluoranthene	1A4bi	Residential: Stationary	1.87	87.6%	-69.7%
		Total for key sources	1.87	87.6%	
benzo(k) fluoranthene	1A4bi	Residential: Stationary	0.68	85.7%	7.2%
		Total for key sources	0.68	85.7%	
Indeno	1A4bi	Residential: Stationary	0.97	91.2%	-72.0%

Pollutant	NFR Code	Key source during 2017 NFR name	Emission in 2017	% of total emission in 2017	% change from 1990 to 2017
(1,2,3-cd) pyrene		Total for key sources	0.97	91.2%	
PCBs	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	412.45	99.3%	-13.7%
		Total for key sources	412.45	99.3%	
HCB	1A4bi	Residential: Stationary	0.23	80.6%	6.9%
		Total for key sources	0.23	80.6%	
BC	1A4bi	Residential: Stationary	1.66	58.48%	-48.11%
	1A3bi	Road transport: Passenger cars	0.43	14.95%	402.43%
	1A3bii	Road transport: Light duty vehicles	0.12	4.17%	-43.84%
	1A3biii	Road transport: Heavy duty vehicles and buses	0.11	3.97%	-47.22%
		Total for key sources	2.32	81.57%	

2.3. Emissions of large point sources (LPS) in 2017

Overview of the total emissions of large point sources (LPSs) is shown in table 2.3-1. Emissions of LPSs reported in the EPR were used. All other pollutant emissions required under the LRTAP Convention were calculated according to EMEP/EEA methodology. Emissions from two refineries in Croatia is presented in a way that the total emissions from both refineries are allocated in 65:35 shares in favour of the refinery with higher emissions in accordance with the EPR. The table also shows total emissions of LCPs, total national emissions and the share of LCPs in total national emissions in 2017.

Table 2.3-1 Pollutant emissions from large point source (LPS) and LPS share in the Republic of Croatia national total emissions, 2017

Pollutant	NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	TSP	CO	Pb	Cd	Hg	PCDD/ PCDF (dioxins/ furans)	PAHs	HCB	PCBs
LCP	kt	kt	kt	kt	kt	kt	kt	kt	t	t	t	g I-Teq	t	kg	kg
HEP, TPP PLOMIN 1	0.67552	0.00986	0.88254	0.001018	0.04745	0.0949	0.1898	0.01117	0.02988	0.000734	0.02621	0.0328333	6.545E-06	0.0020353	0.55806562
HEP, TPP PLOMIN 2	0	0.0452116	0	0.004664	0	0	0	0	0	0	0	0.1504726	3.801E-05	0.00932676	2.55733655
HEP, TPP RIJEKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HEP, TPP SISAK	0	0.0254479	0	0.000954	0	0	0	0	0	0	0	0.003181	1.909E-05	0	0
HEP, CHP ZAGREB (EL-TO)	0.543405	0.016471	0.11142	0.000618	0.00217	0.00434	0.008681	0.26816	0.000004	0	0.000611	0.0020594	1.258E-05	0	0
HEP, CHP ZAGREB (TE-TO)	0.52885	0.0534884	0.43848	0.001899	0.00734	0.01468	0.02936	0.08711	0.015453	0.000164	0.001957	0.0089021	0.0009857	0	0
HEP, CHP OSIJEK	0.11263	0.0063805	0.03259	0.000239	0.001655	0.00331	0.00662	0.00325	0.001489	0.000016	0.000229	0.0007976	4.785E-06	0	0
HEP, KTPP Jertovec	0.04153	0.000793	0	2.97E-05	0	0	0	0.00157	0	0	0.000028	9.912E-05	5.947E-07	0	0
PETROKEMIJA	1.425386	0.0747037	0.174484	2.257915	0.418855	0.194531	0.817185	0.002813	0	0	0.0028332	0.0001393	0	0	0
INA D.D. SISAK OIL REFINERY	0	0	0	0	0	0	0	0	0	0	0	0	0.0002578	0	0
INA D.D. RIJEKA OIL REFINERY	0	0	0	0	0	0	0	0	0	0	0	0	0.0004787	0	0
NAŠICECEMENT	0.37611	0.0732093	0.241604	0	0.046069	0.091217	0.010749	0.695596	0.057882	0.004725	0.0289409	0.0024216	0.0002746	0.0027169	0.06083499
CEMEX HRVATSKA (DALMACIJACEMENT)	1.498457	0.0221512	0.028144	0	0.095988	0.190057	0.022397	4.579571	0.120601	0.009845	0.0603004	0.0050455	0.0005722	0.00566085	0.12675386
HOLCIM HRVATSKA Ltd	0.152278	0.0208165	0.018728	0	0.029902	0.059206	0.006977	0.236753	0.037569	0.003067	0.0187847	0.0015718	0.0001783	0.00176346	0.03948618
ISTRACEMENT, CALUCEM Group	0.033144	0.0021187	0.020674	0	0.009544	0.018898	0.002227	0.230233	0.011535	0.000942	0.0057676	0.0004826	5.473E-05	0.00054145	0.01212368
ROCKWOOL ADRIATIC	0.06029	0.01525	0.314974	0.09195	0.02962	0.03361	0.03818	0.026407	0.05285	0.00078	0.0031424	0.0803037	0.0582129	0.0002444	0.06701228
BELIŠĆE	0.12938	0	0	0	0	0	0	0.016727	0	0	0	0	0	0	0
Vetropack Straža d.d.	0.432486	0	0.212605	0	0	0.002638	0	0.004958	0	0	0	0	0	0	0
SLADORANA D.D. ŽUPANJA	0.034389	0.361103	0	0	0	0.000336	0	0.045807	0	0	0	0	0	0	0
SUGAR FACTORY OSIJEK	0.172958	0	0.877164	0	0	0.100295	0	0.018959	0	0	0	0	0	0	0
VIRO SUGAR FACTORY Ltd.	0.037624	0	0.026911	0	0	0.004398	0	0.026911	0	0	0	0	0	0	0
LCP TOTAL	6.087433	0.7270047	3.353408	2.359286	0.688594	0.808019	1.132177	6.212357	0.327263	0.020273	0.1488042	0.2883096	0.0610965	0.02228911	3.42161316
NATIONAL TOTAL	54.85208	63.241075	12.55658	37.6422	16.72571	25.37796	37.93513	196.5843	8.006476	0.830223	0.4351908	16.225819	5.9302092	0.28	415.359658
SHARE LCP IN NATIONAL TOTAL	11.10%	1.15%	26.71%	6.27%	4.12%	3.18%	2.98%	3.16%	4.09%	2.44%	34.19%	1.78%	1.03%	7.86%	0.82%

3. Emission trends by pollutant

This chapter gives a description and graphical overview of pollutant emissions, as well, the overview of emissions by SNAP nomenclature, for the period 1990 - 2017. In addition, the acidification index was considered.

Methodology improvement (move to higher tier), harmonization of so far used EFs with new propose ones in EMEP/EEA guidebook, activity data harmonization with NIR and other activities led to differences in national emission total of pollutants submitted in previous year and those submitted this year, and are aggregated in tables in Appendix 8 and in detail described in chapters from 4 to 9 in the part *Recalculations and other changes* and in the Chapter 10.

3.1. Sulphur dioxide (SO_2)

The total sulphur dioxide (SO_2) emission in 2017 was amounted to 12.6 kt that is 15.2 % lower than in 2016 (Table 3.1-1). Moreover, the SO_2 emission in 2017 was decrease by 92,6 % compared with 1990 (Figure 3.1-1).

Of the total SO_2 emission in 2017, 60.7% is generated from Energy sector; 34.4 % from the public electricity and heat production, 17.6% from fuel combustion in manufacturing industry and construction, 37.8% from fugitive emissions - activities in the Refining/storage sector and 8.3 % from small combustion (stationary and mobile).

Since 1990, emissions from the public electricity and heat production sector have declined by 95.3 %, from the manufacturing industry and construction by 94.9 %, from transport sector by 97.8 %, from small combustion by 95.7 %. Sulphur emissions from industrial processes and product use sector, have also decreased, by 85 % compared to 1990, due to a stopping of the aluminium production, pulp and paper production (Kraft process) and carbon black production and also due to great reduction in production of sulphuric acid. Increasing trend in SO_2 emissions (by 68.3 % since 1990) has sector Refining/storage (NFR 1.B.2.a.iv) due to the installation of sulphur recovery plants, the first one in 1997 and second in 2008 within the refineries.

The great reduction is mainly occurs due to a transfer from fuels with high sulphur content to low-sulphur fuels, for both road transport and stationary combustion. Also, the war for Croatian independence in the period 1991 – 1995 was the reason for the decline in fuel consumption and overall production in almost all sectors and as consequence the decline in emissions. Great decline in SO_2 emission trend can be observed in 2000 due to second coal thermal power plant (TPP) entering into operation in Croatia. Second TPP has a technique for reducing SO_2 emission (SO_2 scrubbing process) with efficiency higher than 95%. The second TPP on coal has approximately double capacity in comparison to first one. Since 2000, first TPP with no technique for the SO_2 emission reduction is in operation only when the electricity needs are higher (mainly in the summer).

It can be seen that the SO_2 emissions in 2017 was lower than the reduction commitment quota of 70 kt.

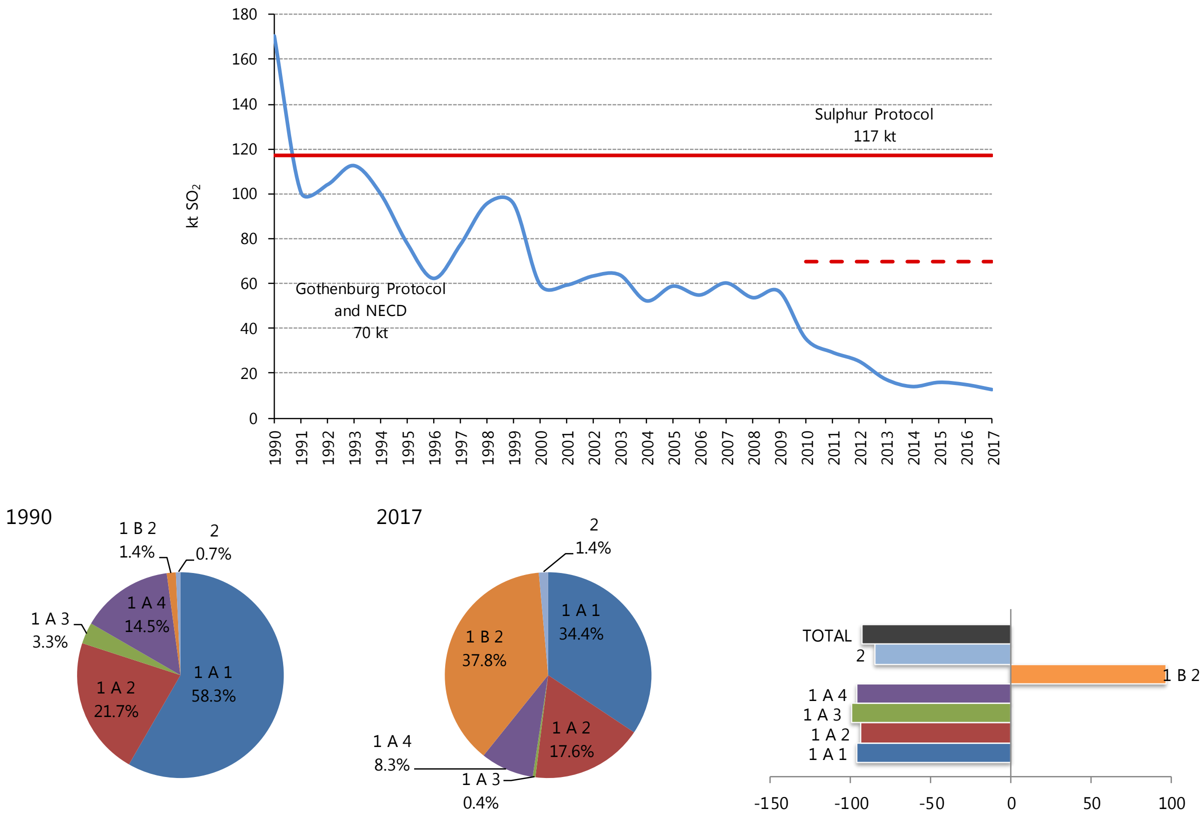


Figure 3.1-1 The SO_2 emissions (kt/yr.) and percentage share by sector and variation in SO_2 emissions

Table 3.1-1 The SO_2 emissions by SNAP nomenclature in the period 1990-2017

SO_2											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	99.3	22.7	35.6	3.0	NA	NA	4.4	4.7	0.61	NA	170.4
1991	59.9	13.3	18.9	2.1	NA	NA	3.0	3.1	0.40	NA	100.6
1992	73.3	7.7	14.4	1.6	NA	NA	4.4	2.1	0.35	NA	104.0
1993	75.1	10.1	17.8	1.8	NA	NA	4.8	2.5	0.44	NA	112.5
1994	66.4	7.4	18.4	1.8	NA	NA	3.5	2.0	0.45	NA	99.9
1995	53.2	4.6	13.1	1.9	NA	NA	2.9	1.6	0.48	NA	77.8
1996	39.2	4.3	9.1	1.6	NA	NA	4.9	2.6	0.46	NA	62.2
1997	52.9	6.1	10.2	1.9	NA	NA	4.0	1.8	0.46	NA	77.2
1998	69.2	4.9	12.9	2.5	NA	NA	4.2	2.0	0.45	NA	96.2
1999	69.5	6.5	10.2	2.8	NA	NA	4.6	2.0	0.49	NA	96.2
2000	32.9	6.2	9.6	3.9	NA	NA	5.2	2.7	0.46	NA	60.9
2001	33.6	5.2	10.5	3.4	NA	NA	3.9	2.2	0.43	NA	59.2
2002	33.5	7.0	11.7	3.6	NA	NA	4.4	2.7	0.43	NA	63.3
2003	35.3	6.5	9.5	3.4	NA	NA	5.7	2.9	0.44	NA	63.7
2004	25.3	5.9	9.0	3.8	NA	NA	5.2	2.6	0.46	NA	52.2
2005	32.5	5.7	9.5	3.8	NA	NA	4.3	2.5	0.44	NA	58.7
2006	29.3	4.9	9.8	3.4	NA	NA	4.2	2.7	0.42	NA	54.7
2007	38.3	3.7	8.5	4.0	NA	NA	3.1	2.0	0.46	NA	60.1
2008	32.0	3.4	8.1	3.6	NA	NA	2.9	3.3	0.39	NA	53.6
2009	36.7	3.8	6.5	3.5	NA	NA	2.4	3.0	0.43	NA	56.4
2010	19.7	3.6	5.6	2.3	NA	NA	1.9	1.7	0.38	NA	35.2
2011	17.2	3.1	3.8	3.5	NA	NA	0.5	0.8	0.31	NA	29.2
2012	14.5	2.9	3.4	3.7	NA	NA	0.0	0.4	0.26	NA	25.2

SO_2											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2013	8.9	1.5	3.0	3.3	NA	NA	0.0	0.2	0.27	NA	17.2
2014	6.1	1.1	2.8	3.6	NA	NA	0.0	0.1	0.22	NA	13.9
2015	7.8	1.1	3.0	3.5	NA	NA	0.0	0.1	0.27	NA	15.8
2016	6.2	1.1	3.0	4.2	NA	NA	0.0	0.1	0.29	NA	14.8
2017	4.3	1.0	2.2	4.6	NA	NA	0.0	0.0	0.32	NA	12.6
2017 vs 1990	-95.7%	-95.4%	-93.8%	53.4%	NA	NA	-99.2%	-99.5%	-48.0%	NA	-92.6%
2017 vs 2016	-30.4%	-1.3%	-26.0%	10.4%	NA	NA	19.8%	-61.4%	9.6%	NA	-15.2%

3.2. Nitrogen oxides (NO_X)

The nitrogen oxides (NO_x) emission encompasses nitrogen monoxide and nitrogen dioxide emissions. The emissions are expressed as equivalents of NO_2. The NO_x is a pollutant that causes acidification and eutrophication. Together with volatile organic compounds and other reactive gases in atmosphere, and in presence of solar radiation, the NO_x takes part in ground ozone formation. Nitrogen oxides are formed in all combustion in the energy and transport sectors, and the largest emission sources are road traffic, off-road vehicles and machinery, production of electricity and heating and manufacturing industry and construction.

The NOx emission in 2017 amounted to 54.9 kt, which is a decline by 50 % since 1990 and by 2.4 % compare to 2016 (Table 3.2-1). Emissions from the energy sector in 2017 were about 46.8 kt and account for about 85.4 % of the total NOx emission. Transport sector (NFR 1.A.3) was the main contributor in energy sector in 2017, with contribution of 47.4 % to the total of NOx emission, and with domination of road transport.

In relation to the 1990 the NOx emission in transport sector has declined by 35.7%, due to the introduction of catalytic converters in cars and the subsequent successively more strict emission standards. Energy stationary combustion sectors (including off-road mobile sources) also have recorded a great decrease since 1990, mostly due to lower fuel consumption. The industrial processes and product use sector also record a decline of historic emissions by 55.7 %, mostly due to stopping the production of aluminium, paper and pulp (Kraft process) and carbon black production and also due to decline in productions. The Agriculture Sector recorded a decrease of 31.6% in the 1990s mainly due to the decrease in the use of N-fertilizers in crop production. Also, the war for Croatian independence in the period 1991 – 1995 was the reason for the decline in fuel consumption and overall production in almost all sectors and as consequence the decline in emissions. Since 2007 the trend of NOx emission has recorded decline due to the economic crisis which still exists in Croatia (Figure 3.2-1).

The NOx emission in 2017 was lower than the reduction commitment quota of 87 kt.

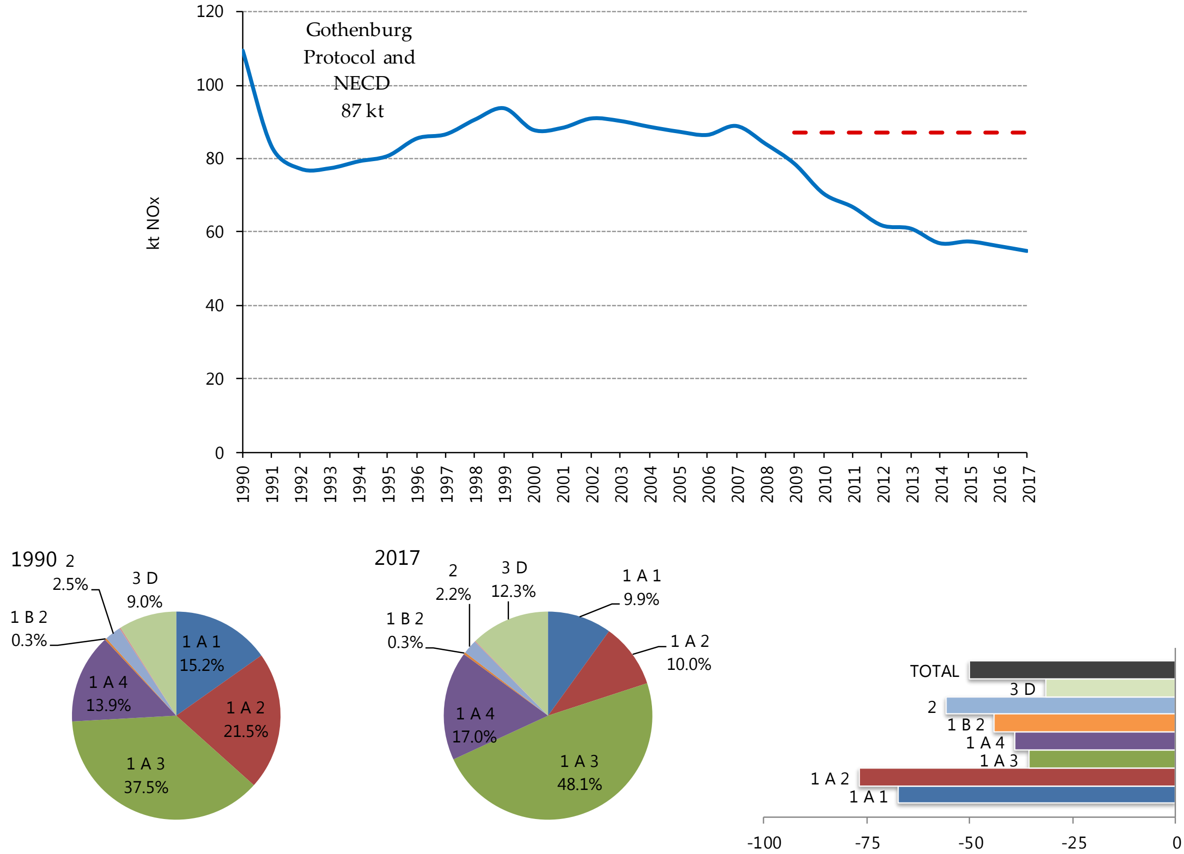


Figure 3.2-1 The NO_X emissions (kt/yr.) and percentage share by sector and variation in NO_X emissions

Table 3.2-1 The NO_X emissions by SNAP nomenclature in the period 1990-2017

NOx											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	16.6	7.5	18.9	3.0	NA	2.19E-02	37.1	16.4	7.7E-02	10.1	109.6
1991	12.1	6.7	13.1	2.6	NA	2.04E-02	26.6	12.4	5.9E-02	9.8	83.3
1992	14.4	6.6	11.1	2.9	NA	2.26E-02	25.4	7.8	5.1E-02	8.9	77.3
1993	14.9	7.1	11.0	2.5	NA	2.05E-02	26.7	7.1	6.1E-02	8.1	77.5
1994	12.9	6.2	11.5	2.6	NA	8.93E-03	28.6	9.6	5.7E-02	7.9	79.4
1995	15.0	6.7	10.9	2.8	NA	2.16E-02	28.6	9.2	6.4E-02	7.5	80.8
1996	14.7	8.0	11.2	2.6	NA	2.09E-02	30.8	10.6	5.8E-02	7.5	85.6
1997	14.4	7.6	10.9	2.7	NA	2.06E-02	32.9	10.0	6.0E-02	8.1	86.8
1998	17.0	6.8	12.4	2.4	NA	2.18E-02	33.4	11.7	6.1E-02	7.2	91.0
1999	18.2	7.6	11.5	2.7	NA	2.52E-02	34.7	11.6	6.7E-02	7.7	94.1
2000	13.1	6.8	11.3	2.9	NA	2.45E-02	32.6	13.6	6.6E-02	7.8	88.2
2001	12.7	6.9	12.2	2.3	NA	3.22E-02	31.7	14.5	6.6E-02	8.1	88.5
2002	14.3	7.0	12.0	2.4	NA	3.52E-02	33.4	13.9	6.2E-02	8.0	91.1
2003	13.2	7.7	11.1	2.6	NA	3.73E-02	33.5	14.3	6.3E-02	7.9	90.4
2004	10.8	7.4	12.5	3.0	NA	2.73E-02	33.3	13.2	6.1E-02	8.4	88.8
2005	11.4	7.5	12.5	2.6	NA	2.71E-02	31.6	13.6	6.1E-02	8.2	87.5
2006	10.5	6.9	13.1	2.5	NA	2.65E-02	31.6	13.8	6.4E-02	8.0	86.6
2007	12.6	6.4	14.1	2.7	NA	2.67E-02	31.5	13.6	6.9E-02	8.0	89.0
2008	10.8	6.6	13.0	2.6	NA	2.80E-02	28.7	14.8	6.4E-02	7.6	84.1
2009	10.5	6.8	11.8	1.6	NA	2.05E-02	27.9	12.6	6.6E-02	7.4	78.7
2010	8.5	7.2	8.2	1.8	NA	2.39E-02	26.5	11.2	3.7E-02	7.2	70.5
2011	9.0	6.9	6.8	1.3	NA	2.10E-02	24.9	10.5	4.5E-02	7.4	66.9

NOx											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2012	7.9	6.6	6.9	1.2	NA	2.01E-02	22.6	9.3	4.6E-02	7.3	61.9
2013	7.9	6.4	5.9	1.1	NA	1.77E-02	24.2	8.8	4.4E-02	6.5	61.0
2014	7.3	5.7	5.6	1.2	NA	1.53E-02	22.5	8.2	5.0E-02	6.3	57.0
2015	7.2	6.6	5.2	1.2	NA	1.49E-02	22.9	7.5	5.5E-02	6.7	57.4
2016	7.2	6.7	5.1	1.1	NA	1.50E-02	22.2	7.1	6.1E-02	6.7	56.2
2017	5.4	6.7	4.2	1.3	NA	1.67E-02	23.5	6.8	4.1E-02	6.8	54.9
2017 vs 1990	-67.3%	-10.2%	-78.0%	-54.8%	NA	-23.8%	-36.7%	-58.2%	-46.4%	-32.4%	-50.0%
2017 vs 2016	-24.5%	0.1%	-18.8%	24.7%	NA	11.3%	5.8%	-3.9%	-31.9%	1.3%	-2.4%

3.3. Ammonia (NH_3)

Ammonia contributes to acid deposition and eutrophication. It also reacts rapidly with atmospherically-formed sulphuric and nitric acids to contribute to ambient levels of fine particles. Agriculture represents the largest source of ammonia emissions. Ammonia is a common by-product of animal excreta due to the often inefficient conversion of feed nitrogen into animal product.

The NH_3 emission in 2017 amounted to 37.6 kt. Emission has decrease by 32.9 % since 1990 and by 1.3 % since year before (Table 3.3-1). About 84.6 % of NH_3 emissions in Croatia in 2017 originate from the Agriculture sector, in which source category manure management account for about 29.2 % and the Production of crops and agricultural soils with 55.3%. Sectors with a smaller share in NH_3 total emissions in 2017 were the industrial processes sector (about 6.6 %) with emission domination from production of ammonia, nitric acid and mineral N-fertilizers; the Small combustion sector and mobile machinery (5.5 %) with dominance of emission from Residential; Waste sector with dominace of emissions from Latrines (1.6%) and Transport sector (1.3%) with dominance of emissions from passenger cars.

Since 1990, NH_3 emissions has decreased considerably and this is due to emission reductions in the sectors Agriculture, Industrial processes and product use, Small combastion and Waste. The decrease in the Agricultural sector is 71.8% as a result of the continuous decrease in the number of animals for most types (see Tables 6.1-4 and 6.1-5). Decrease in the sector Industrial processes and product use is 30.2% and is the result of reduced production. The decline of NH_3 emissions by sectors in the period from 1991 to 1995 is the result of the war for Croatian independence, while the reason for decline in the years after 2008 is due to economic recession. The increase in NH_3 emissions by 15.5 times compared to 1990 was recorded in the Transport sector with road traffic domination and as a result of the introduction of catalysts into vehicles. The catalysts contain urea that is converted into NH_3.

The ammonia emission in 2017 (Figure 3.3-1) was above the quota value of 30 kt.

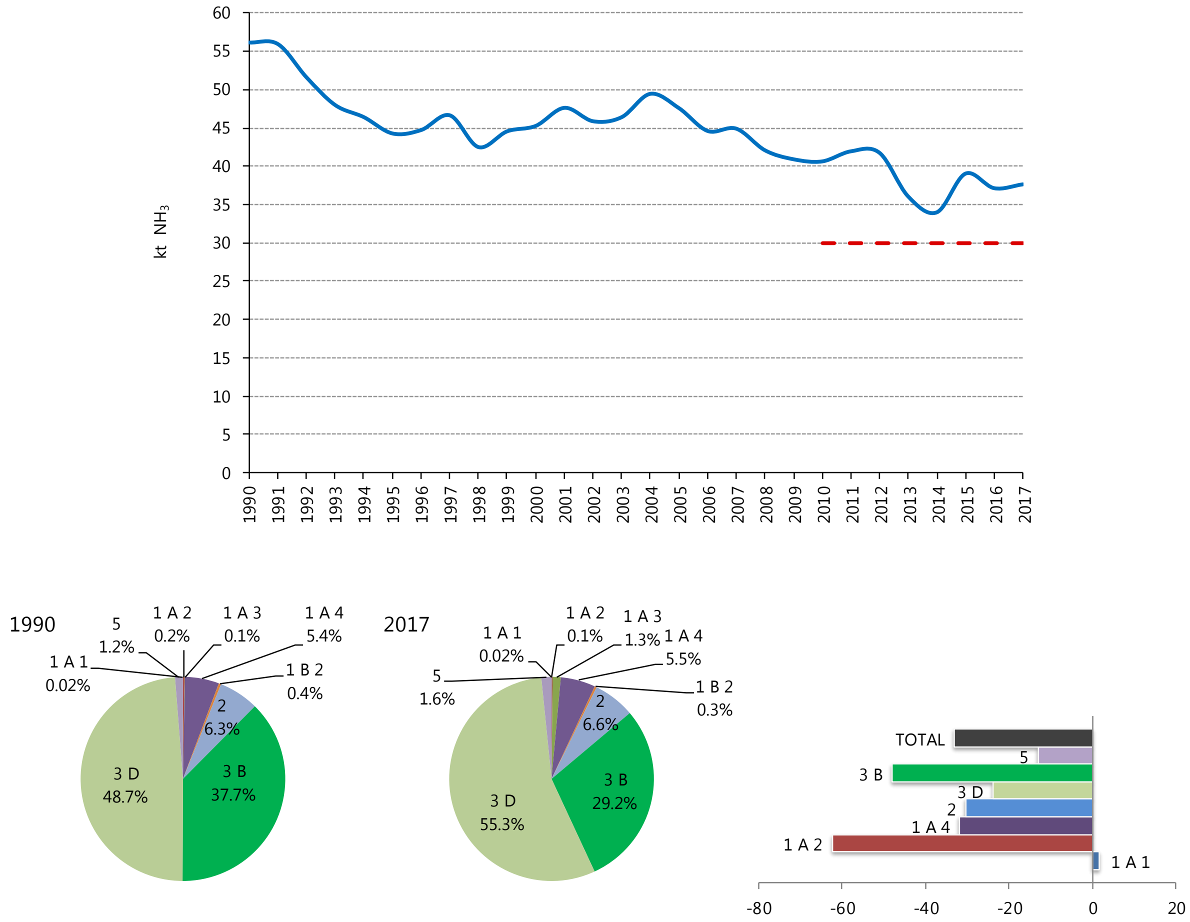


Figure 3.3-1 The NH_3 emissions (kt/yr.) and percentage share by sector and variation in NH_3 emissions

Table 3.3-1 The NH_3 emission by SNAP nomenclature in the period 1990-2017

NH_3											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	8.9E-03	3.03	0.13	3.71	NA	5.0E-02	0.03	3.5E-03	0.69	48.5	56.1
1991	5.4E-03	3.58	0.13	3.63	NA	4.7E-02	0.02	2.5E-03	0.69	47.8	55.9
1992	6.3E-03	3.13	0.11	4.61	NA	5.2E-02	0.02	1.4E-03	0.69	43.0	51.6
1993	9.0E-03	3.30	0.11	3.26	NA	4.7E-02	0.04	1.7E-03	0.69	40.5	48.0
1994	5.5E-03	2.99	0.08	3.62	NA	2.0E-02	0.04	1.8E-03	0.68	39.0	46.4
1995	4.0E-03	3.16	0.09	3.68	NA	4.9E-02	0.06	1.7E-03	0.68	36.6	44.3
1996	4.8E-03	3.53	0.09	3.65	NA	4.7E-02	0.09	1.8E-03	0.67	36.6	44.7
1997	7.0E-03	3.24	0.12	3.71	NA	4.6E-02	0.15	1.7E-03	0.67	38.7	46.6
1998	6.6E-03	3.25	0.11	4.16	NA	5.0E-02	0.23	2.0E-03	0.66	34.0	42.5
1999	6.4E-03	3.19	0.08	3.03	NA	5.7E-02	0.29	2.4E-03	0.66	37.2	44.6
2000	1.0E-02	2.84	0.08	3.57	NA	5.6E-02	0.36	2.4E-03	0.66	37.7	45.3
2001	9.4E-03	3.13	0.07	2.77	NA	7.3E-02	0.34	2.6E-03	0.65	40.6	47.6
2002	1.2E-02	2.99	0.08	2.92	NA	7.6E-02	0.37	2.5E-03	0.65	38.8	45.9
2003	1.1E-02	3.44	0.09	3.61	NA	7.9E-02	0.39	3.0E-03	0.65	38.1	46.4
2004	1.1E-02	3.36	0.10	4.60	NA	5.9E-02	0.39	2.9E-03	0.64	40.3	49.4
2005	1.1E-02	3.56	0.08	3.79	NA	6.1E-02	0.41	3.1E-03	0.64	39.0	47.6
2006	1.0E-02	3.17	0.10	2.57	NA	6.0E-02	0.45	3.3E-03	0.64	37.6	44.6
2007	1.2E-02	2.97	0.09	2.74	NA	6.1E-02	0.63	3.4E-03	0.64	37.8	44.9
2008	1.2E-02	2.88	0.07	2.18	NA	6.4E-02	0.61	3.8E-03	0.63	35.6	42.1
2009	9.5E-03	2.91	0.08	1.70	NA	4.7E-02	0.62	3.4E-03	0.63	34.9	40.9

NH_3											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2010	1.2E-02	3.02	0.09	2.63	NA	5.5E-02	0.58	3.1E-03	0.62	33.6	40.6
2011	1.3E-02	2.84	0.08	2.63	NA	4.8E-02	0.56	3.0E-03	0.62	35.1	42.0
2012	1.1E-02	2.73	0.09	2.82	NA	4.6E-02	0.57	2.8E-03	0.62	34.9	41.8
2013	1.1E-02	2.61	0.08	1.95	NA	4.0E-02	0.55	2.7E-03	0.62	30.2	36.1
2014	1.0E-02	2.19	0.06	1.58	NA	3.5E-02	0.52	2.7E-03	0.61	29.0	34.0
2015	1.0E-02	2.43	0.05	2.58	NA	3.4E-02	0.51	2.6E-03	0.62	32.8	39.0
2016	1.1E-02	2.24	0.03	2.27	NA	3.4E-02	0.51	2.6E-03	0.61	31.4	37.1
2017	9.1E-03	2.07	0.05	2.56	NA	3.8E-02	0.48	2.7E-03	0.60	31.8	37.6
2017 vs 1990	1.7%	-31.7%	-62.6%	-30.9%	NA	-24.8%	1500.7%	-24.0%	-12.9%	-34.3%	-32.9%
2016 vs 2017	-18.7%	-7.7%	63.9%	12.9%	NA	11.5%	-4.8%	0.7%	-0.6%	1.2%	1.3%

At the time when the quota was allocated, the Republic of Croatia had a basic inventory, partly incomplete because of the (non) availability of emission data, due to the (non) availability of methodologies for the calculation of emissions from particular sectors. Specifically, it was a manure management sector in which the number of animals was incomplete and the FE NH_3 used were, for each animal category, lower than those in GB1999, which were valid at the time the emission quotas of the LRTAP Convention members were allocated. The methodology for the calculation of ammonia emissions from agriculture firstly was improved and applied for the year 2001 and reported in December 2004 under the LIFE project and it was recommended that the improved methodology should be applied to the historical trend until 1990, which was done two years later (in 2006). Improved methodology implied the use of recommended emission factors for ammonia for each of the animal categories, instead of the ones used by Croatia. In 2006, two reports were submitted to the LRTAP Convention, including the emissions inventory report for the period 1990-2003 and 1990-2004, as well as NFR tables for 2003 and 2004. That emission reports have indicated the need for implementation of measures for NH_3 emission reduction from agriculture to achieve a reduction in NH_3 emissions and to meet the requirements of the Gothenburg Protocol under the LRTAP Convention. In the inventory of NH_3 emission, the Republic of Croatia currently does not include any measure. However, by reviewing the part of the environmental permits for pig and poultry farms, it has been found that some measures, such as partially or completely slatted floors in pig and poultry housing systems, are installed and in use. Also, for example, the measure for reducing ammonia emissions from urea-based fertilisers: incorporation of fertilizer into the soil, is a measure that, besides reducing emissions, is recommended to farmers and because of higher crop yields, and that farmers are likely to apply. What measures and in what scope do they appplied in Agricultur sector, is necessary to investigated and include these findings in one of the future inventories.

3.4. Acid equivalent (AEQ)

Acid equivalent is a parameter for assessing the overall amount of acidifying substances emitted into the atmosphere. At different spatial and time scales, these substances contribute to the acidification of soil, air and the aquatic environment. The acid equivalent is based on the potential fixation of H^+ ion. The calculation only takes into account SO_2, NOx and NH_3, because it is quite obvious that other acidifying substances such as HCl, only have a negligible effect, regarding their low emission level compared to the other three substances. The acid equivalent is calculated using weight coefficients: 0.0313 for SO_2, 0.0217 for NOx and 0.0588 for NH_3.

Due to the respective weight of each of three substances, the proportion of NH_3 and NO_x emissions have increased: for NOx from 21.6% in 1990 to 31.4% in 2017 and for NH_3 from 30% in 1990 to 58.3 % in 2017 (Table 3.4-1). In addition, their absolute emissions are slightly decreased during the observed period (Figure 3.4-1). This is mainly due to the significant decrease of SO_2 emission during the same period (from 48.4 % in 1990 to 10.4 % in 2017). It can be noticed that the acid equivalent has an overall decreasing trend, as a result of downward trends of all three substance emissions. This acid equivalent should follow a downward trend in coming years, as a result of the expected continuous decrease of $SO_{2,}$ and with no significant change in NO_x and NH_3 emissions.

Table 3.4-1 Emission of acidifying substances that contribute to the acidification expressed in Aeq (*)

Year	SO_2 % Aeq	NO_x % Aeq	NH_3 % Aeq	Aeq(**) kt
1990	48.4	21.6	30.0	11.0
1991	38.2	21.9	39.9	8.2
1992	40.9	21.1	38.1	8.0
1993	43.9	21.0	35.2	8.0
1994	41.3	22.7	36.0	7.6
1995	35.8	25.8	38.3	6.8
1996	30.2	28.9	40.9	6.4
1997	34.3	26.7	39.0	7.0
1998	40.1	26.4	33.5	7.5
1999	39.1	26.6	34.3	7.6
2000	28.9	29.7	41.4	6.4
2001	28.2	29.2	42.6	6.6
2002	29.8	29.7	40.5	6.7
2003	29.8	29.3	40.8	6.7
2004	25.2	29.8	45.0	6.5
2005	28.1	29.1	42.8	6.5
2006	27.6	30.2	42.2	6.2
2007	29.2	29.9	40.9	6.5
2008	28.1	30.5	41.4	6.0
2009	30.0	29.1	40.9	5.9
2010	22.0	30.5	47.6	5.0
2011	18.9	30.0	51.1	4.8
2012	17.2	29.3	53.5	4.6
2013	13.5	33.2	53.3	4.0
2014	11.9	33.7	54.5	3.7
2015	12.2	30.9	56.9	4.0
2016	12.0	31.5	56.5	3.9
2017	10.4	31.4	58.3	3.8

(*) Emissions concern only anthropogenic one (without nature)

(**) Acid equivalent: indicator of acid equivalent calculate on the base of potential fixation of H+ ion: 0.0313 for SO_2, 0.0217 for NOx and 0.0588 for NH_3

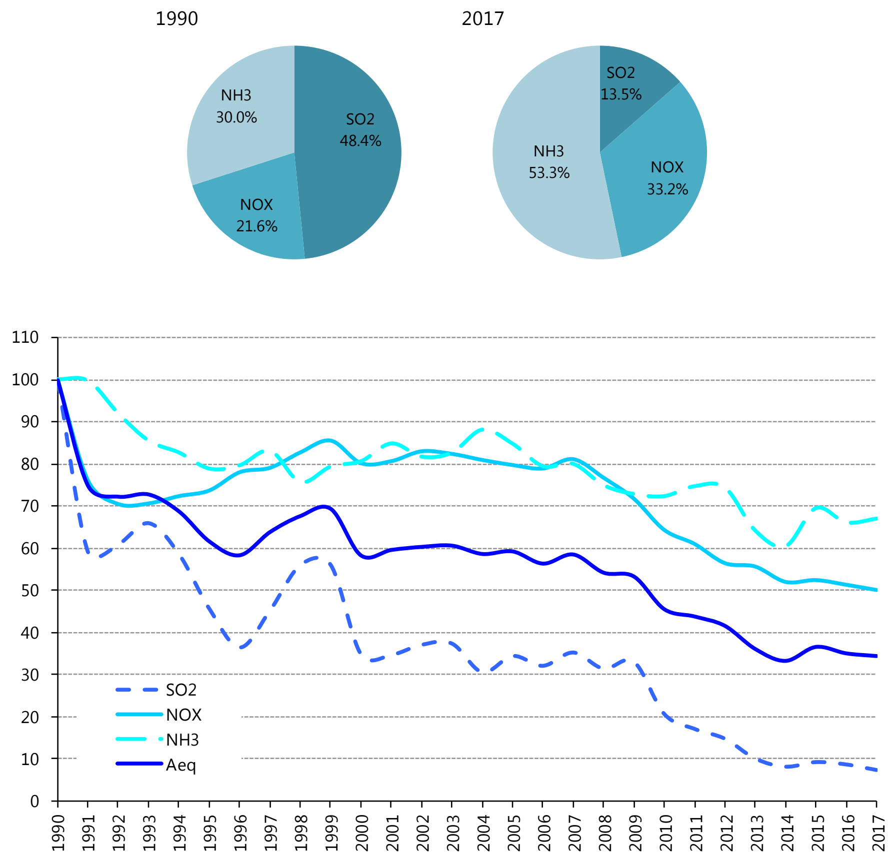


Figure 3.4-1 Relative emission of substances (without nature) that contribute to acidification and eutrophication for 1990-2017 (1990 = 100%)

3.5. Carbon monoxide emission (CO)

Main source in carbon monoxide emission is the incomplete fossil fuel combustion in energy sectors both, stationary and mobile.

The CO emission in 2017 amounted to 196.6 kt and decreased by 47.8% compared to 1990 and remained roughly at the same level as in the previous year (Figure 3.5-1 and Table 3.5-1). The Energy Sector is 99.7% of the total CO emission in 2017, of which 61.5% comes from small combustion sources (with domination of residential), 16.6% from the Transport sector (with the dominance of road transport), 14.9% from the Refining / storage sector, and 6% from fuel combustion in industry and construction.

The war for Croatian independence in the period 1991 – 1995 was the reason for the decline in fuel consumption and overall production in almost all sectors and as consequence the decline in emissions. Road transport was a main reason for CO emission reduction since 1990 (by 86.4 %) due to the introduction of catalytic converters and renewing of the vehicle fleet. Other energy sectors also note the downward trend of CO emission since 1990 mainly due to changes in the structure of fossil fuel combustion by reducing the use of low quality coal and fuel wood and increasing use of natural gas. Other sectors also have a significant reduction trend since 1990. The Industrial processes and product use sector has recorded a great reduction (by 98.6 % since 1990), due to stopping the production of aluminium, paper and pulp (Kraft process) and carbon black production and also due to the overall decline of production. CO emissions from Refining /storage sector have also decrease by 42 % since 1990, mostly due to decline in catalytic cracking activity (partial burn without CO boiler). Since 2000 the trend of CO emissions has declining due to previously mentioned reasons and since 2007 the economic crisis has contributed to further reduction of CO emissions (Figure 3.2-1). Also, reduction since 2008 is a partly result of gradual replacement of certain percentage of traditional domestic stoves and manual single house boilers with advanced/ecolabelled stoves and boilers and pellet stoves and boilers (see Table 4.5-1 and Figure 4.5-2).

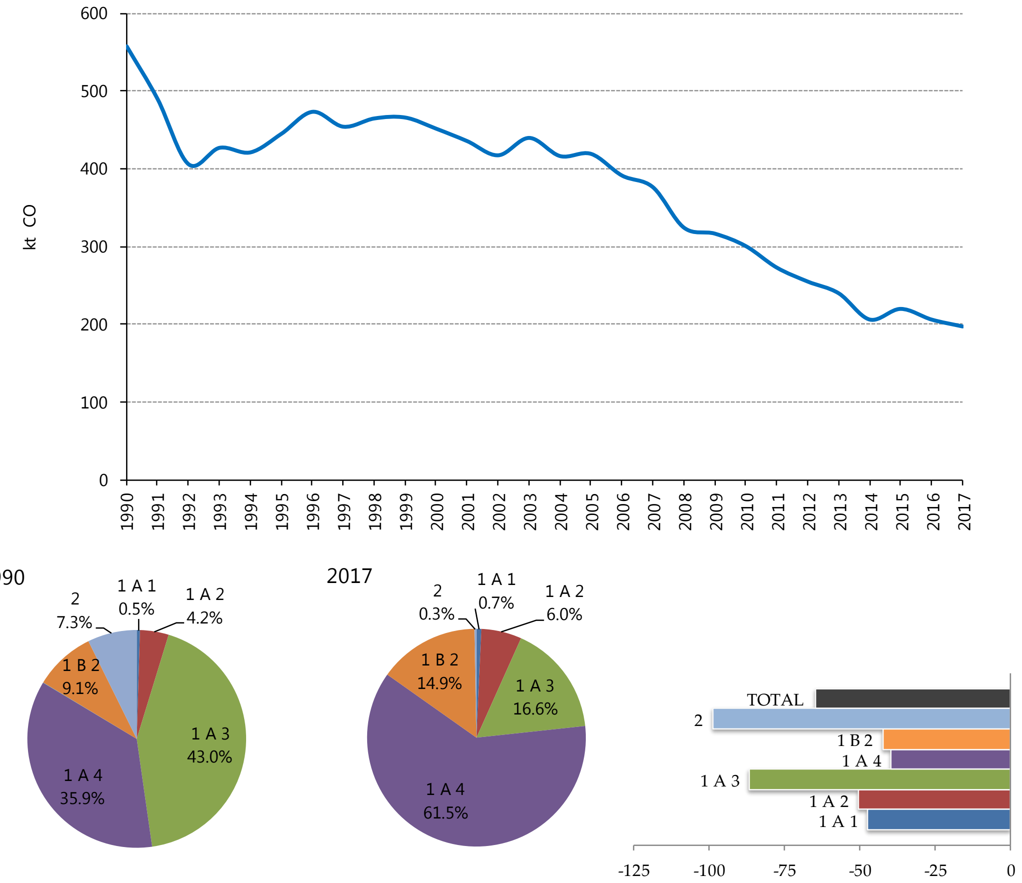


Figure 3.5-1 The CO emissions (kt/yr.) and percentage share by sector and variation in CO emissions

Table 3.5-1 The CO emissions by SNAP nomenclature in the period 1990-2017

CO											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	2.67	193.1	20.8	90.2	NA	0.67	236.6	12.9	0.39	NA	557.2
1991	2.09	213.4	14.3	60.3	NA	0.62	179.0	19.2	0.29	NA	489.2
1992	2.30	180.1	10.8	41.1	NA	0.69	156.2	14.0	0.25	NA	405.4
1993	2.57	189.6	9.8	54.4	NA	0.63	153.8	15.7	0.30	NA	426.7
1994	2.62	170.6	10.0	54.6	NA	0.27	166.7	15.8	0.28	NA	420.7
1995	2.75	179.8	9.7	61.8	NA	0.66	173.3	16.4	0.32	NA	444.7
1996	2.56	201.3	9.5	54.3	NA	0.64	186.0	18.4	0.29	NA	473.0
1997	2.34	185.0	10.3	51.7	NA	0.63	186.6	17.0	0.29	NA	453.8
1998	2.51	186.1	10.2	59.4	NA	0.67	188.8	16.5	0.30	NA	464.4
1999	2.60	183.3	9.8	61.3	NA	0.77	186.5	20.9	0.33	NA	465.5
2000	1.97	162.8	9.8	84.2	NA	0.75	171.7	19.5	0.32	NA	451.2
2001	1.48	178.2	10.4	71.6	NA	0.99	153.3	18.8	0.31	NA	435.2
2002	1.39	171.0	9.9	75.6	NA	1.07	141.3	16.5	0.30	NA	417.0

CO											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2003	1.68	197.1	9.4	77.0	NA	1.13	133.8	18.9	0.31	NA	439.3
2004	1.58	191.7	10.7	70.6	NA	0.83	121.8	18.5	0.30	NA	415.9
2005	1.22	203.4	10.9	71.8	NA	0.83	113.5	16.9	0.30	NA	418.8
2006	1.59	180.7	11.4	83.7	NA	0.81	94.9	17.5	0.31	NA	390.8
2007	2.15	168.1	12.2	88.5	NA	0.81	86.1	17.7	0.34	NA	375.8
2008	1.50	163.2	11.6	50.9	NA	0.86	76.7	18.7	0.31	NA	323.8
2009	1.22	164.2	9.9	52.0	NA	0.63	70.3	17.4	0.33	NA	316.1
2010	1.18	170.7	10.2	40.3	NA	0.73	62.0	14.8	0.17	NA	300.0
2011	1.21	160.0	8.7	32.8	NA	0.64	54.3	14.4	0.21	NA	272.3
2012	1.04	153.3	9.0	35.4	NA	0.61	41.6	13.2	0.22	NA	254.4
2013	1.11	146.0	9.1	29.5	NA	0.54	39.9	12.9	0.21	NA	239.3
2014	0.90	121.8	9.0	25.0	NA	0.47	34.8	13.3	0.24	NA	205.5
2015	1.04	135.0	9.5	26.2	NA	0.46	33.9	12.8	0.26	NA	219.2
2016	1.15	124.1	8.2	26.0	NA	0.46	32.4	12.8	0.30	NA	205.4
2017	1.41	114.0	8.2	29.1	NA	0.51	30.6	12.6	0.19	NA	196.6
2017 vs 1990	-47.2%	-41.0%	-60.7%	-67.7%	NA	-23.9%	-87.1%	-2.1%	-51.2%	NA	-64.7%
2016 vs 2017	22.2%	-8.2%	-0.9%	11.9%	NA	11.3%	-5.4%	-1.4%	-35.8%	NA	-4.3%

3.6. Non-methane volatile organic compounds (NMVOC)

The VOCs play a significant role in the formation of ozone and fine particulates in the atmosphere. Under sunlight, VOCs react with NOx emitted mainly from vehicles, power plants and industrial activities to form ozone, which in turn helps the formation of fine particulates. The accumulation of ozone, fine particulates and other gaseous pollutants results in smog. Some of NMVOCs may have undesirable ecotoxicological properties, for example benzene and xylene.

In 2017, NMVOC emissions amounted to 63.2 kt, compared to the previous year by 7.1% and 64.4% in comparison with 1990 (Figure 3.6-1). Sectors Industrial processes and product use, Small combustion and mobil machinery, Agriculture, Transport and Refining are dominant in NMVOC emissions, and in 2017 these sectors contribute to NMVOC total emissions as follows: 39.5%, 24.6%, 14% and 5.7% respectively.

The NMVOC emission reduction in the historical trend since 1990 has been recorded in all sectors. In the Industrial processes and product use, 72 % decrease was recorded as a result of the introduction of environmental protection requirements for the reduction of NMVOC emissions from organic solvent containing products ie. the implementation of best available techniques (BAT) and partly as a result of reduced production of solvent and solvent based products and stopping the production of certain chemicals. In the NMVOC emission, Transport sector has decreased by 83.2% since 1990, due to the increased use of energy-efficient vehicles and the introduction of new exhaust emission requirements. Fugitive emissions of NMVOC from petroleum products (gasoline) and natural gas have also decreased by 42.3% since 1990. Also, the war for Croatian independence in the period 1991 – 1995 was the reason for the decline due to lower fuel consumption and overall reduction of production activities in almost all sectors. The economic crisis has contributed to further reduction of NMVOC emissions since 2007 (Figure 3.6-1). Also, reduction since 2005 is a partly result of gradual replacement of certain percentage of traditional domestic stoves and manual single house boilers with advanced/ecolabelled stoves and boilers and pellet stoves and boilers (see Table 4.5-1 and Figure 4.5-2). The Waste sector is the only sector with a increasing trend in NMVOC emissions since 1990 (by 60.1%) due to increased activities related to the solid waste disposal on land.

The NMVOC emission in 2017 (Figure 3.6-1) was below the quota value of 90 kt.

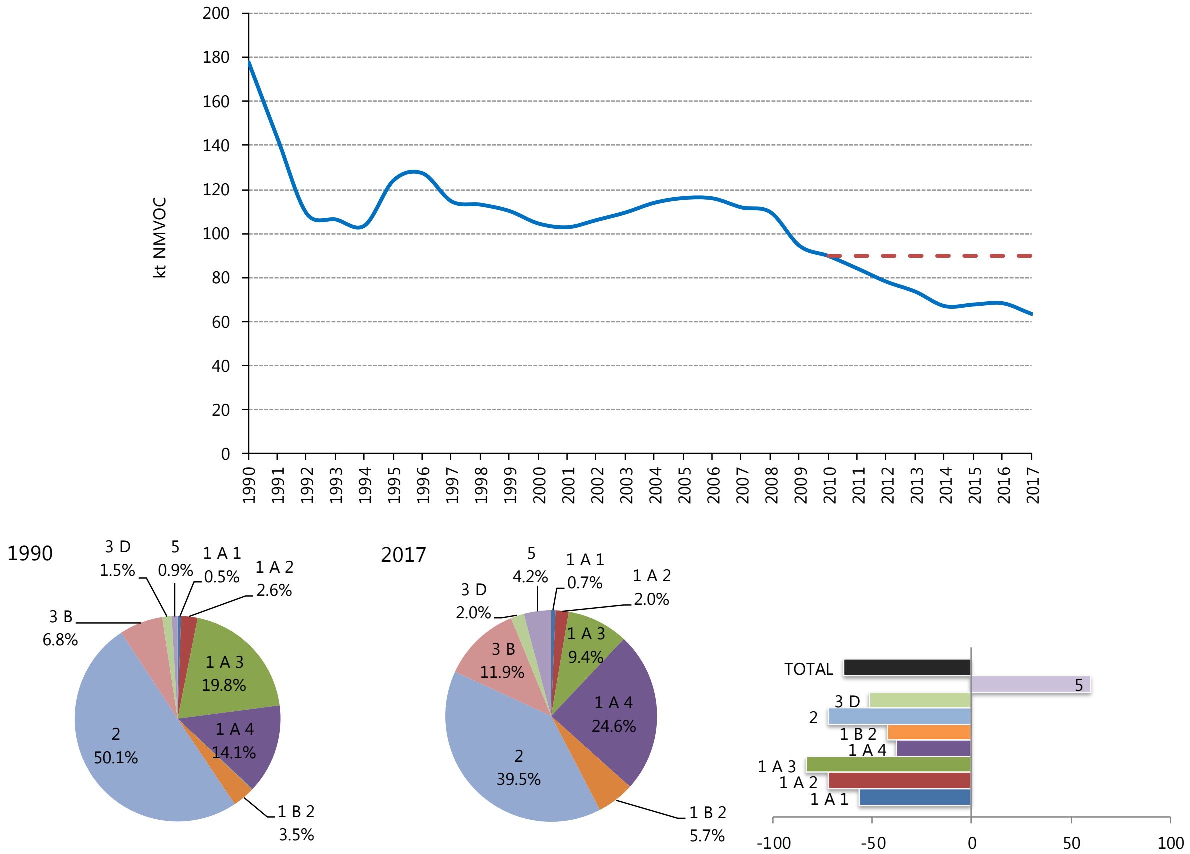


Figure 3.6-1 The NMVOCs emissions (kt/yr.) and percentage share by sector and variation in NMVOCs

Table 3.6-1 The NMVOC emissions by SNAP nomenclature in the period 1990-2017

NMVOC											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	1.0	23.3	3.6	25.6	4.2	65.6	34.6	3.2	1.69	14.7	177.6
1991	0.7	26.9	2.8	21.8	2.3	41.6	27.0	3.4	1.70	14.4	142.8
1992	0.8	23.1	2.2	13.8	2.8	25.5	23.9	3.2	1.71	11.7	108.8
1993	0.9	24.4	2.2	13.0	2.8	24.5	22.6	2.1	1.77	11.9	106.2
1994	0.8	22.0	2.0	9.9	3.1	25.0	24.7	2.5	1.83	11.5	103.4
1995	0.8	23.3	2.0	10.4	3.4	43.0	25.7	2.5	1.92	11.0	124.0
1996	0.8	26.1	2.0	11.7	3.4	39.4	28.0	2.8	2.00	10.9	127.1
1997	0.8	24.0	2.2	10.1	3.5	28.5	29.6	2.6	2.11	11.0	114.3
1998	0.8	24.1	2.2	9.7	3.6	27.2	29.7	2.7	2.22	10.7	112.9
1999	0.8	23.8	1.8	9.8	3.9	23.6	29.8	3.0	2.33	11.2	110.0
2000	0.8	21.2	1.7	9.3	3.7	24.1	28.5	3.1	2.28	9.6	104.3
2001	0.5	23.3	1.7	8.6	3.7	24.5	25.0	3.1	2.40	9.9	102.7
2002	0.5	22.4	1.7	9.1	3.7	30.4	23.3	2.7	2.50	9.6	105.9
2003	0.5	25.8	1.7	8.8	3.7	31.4	22.3	2.9	2.60	9.8	109.4
2004	0.5	25.1	1.9	9.5	3.7	37.2	20.3	2.7	2.71	10.1	113.8
2005	0.5	26.7	1.8	10.4	3.5	39.2	18.7	2.6	2.83	9.7	115.9
2006	0.5	23.8	1.9	9.8	3.5	44.1	16.6	2.6	3.09	9.9	115.8
2007	0.5	22.2	2.0	8.0	3.8	44.5	15.2	2.6	3.35	9.6	111.6

NMVOC											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2008	0.4	21.6	1.7	7.4	3.4	45.5	13.8	2.7	3.54	9.3	109.4
2009	0.5	21.7	1.6	6.9	3.6	31.9	12.5	2.3	3.61	9.4	94.2
2010	0.5	22.6	1.7	6.8	3.3	29.6	10.9	1.9	3.15	9.2	89.5
2011	0.5	21.2	1.5	7.1	3.0	27.0	9.8	1.7	3.20	8.9	83.8
2012	0.4	20.3	1.6	6.3	2.7	25.6	7.6	1.5	3.07	9.0	77.9
2013	0.4	19.3	1.4	6.1	2.6	23.2	7.1	1.4	3.13	8.7	73.3
2014	0.3	16.1	1.2	6.6	2.4	20.8	6.3	1.4	2.89	8.7	66.8
2015	0.4	17.9	1.0	5.5	2.5	20.5	6.2	1.3	3.02	9.1	67.5
2016	0.4	16.4	1.0	6.5	2.5	22.3	5.8	1.3	2.79	9.1	68.1
2017	0.4	15.0	1.0	6.7	2.4	19.5	5.5	1.2	2.65	8.8	63.2
2016 vs 1990	-56.8%	-35.5%	-72.5%	-74.0%	-42.5%	-70.3%	-84.2%	-60.9%	57.2%	-40.0%	-64.4%
2016 vs 2015	5.3%	-8.2%	4.1%	1.7%	-3.0%	-12.8%	-6.1%	-2.3%	-4.8%	-2.6%	-7.1%

3.7. Particles (TSP, PM_{10} AND $PM_{2.5}$) and black carbon (BC)

"Particulate matter" (PM), is an air pollutant consisting of a mixture of particles suspended in the air. These particles differ in their physical properties (such as size and shape) and chemical composition[18]. Calculation of particulate matter emissions and its fractions (PM_{10} and $PM_{2.5}$) is the obligation of the Parties to CLRTAP since 2002.

The TSP and BC is the substances for which emission reporting is encouraged in the LRTAP Convention by Executive Body. The BC emission calculation is introduced in the reporting Guidelines as a component of $PM_{2.5}$. The Republic of Croatia voluntarily reports the emissions of these two pollutants. Calculation of BC emission has been introduced in the Reporting Guidelines as a $PM_{2.5}$ component. BC emissions are in IIR 2016 calculated for all NFR emission sources with available FE in accordance with GB2016.

The TSP emission trend for source category 2.A.1 cement production is lower than PM_{10}, and $PM_{2.5}$ trends. The reason for that is abatement technologies installed in all four cement production facilities in Croatia. Abatement technologies are ESP on main stacks and smaller fabric filters for moderate control of fugitive sources with default efficiency of 93% for TSP emission reduction, 40% for PM_{10} emission reduction and 34% for $PM_{2.5}$ emission reduction.

3.7.1. Total suspended particles (TSP)

Emission of TSP is voluntary reported as an additional air pollutant.

In 2017, total TSP emissions were 37.9 kt, which is 2.4% higher than in the previous year and a decrease of 35.9% compared to 1990 (Figure 3.7.1-1 and Table 3.7 .1-1). In 2017, the key sectors of the TSP emissions were: Energy with 45.2%, Industrial processes and product use with 41.5% and Agriculture with 12.9%.

Since 1990, the TSP emission has a downward trend, the largest contributing factor to the energy sector with the reduction of TSP emissions by 62% due to the reduction of the consumption of solid

[18] ece.eb.125, Advance version of Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution, TFEIP, March 2014

fuels and at the same time the increase in the consumption of gaseous and liquid fuels and the Agriculture sector, with a reduction of 50% due to decreise in number of animals and in crop production. Sectors that have a trend of increasing TSP emission since 1990 are: the Transport sector (increase by 17.8%) due to a larger number of vehicles and Industrial processes and product use sector (by 89.6%) due to increased the use and productivity of some products.

The TSP emission trend has several dips and peaks in the historical trend. Great decline in the period from 1991 to 1994 was a result of the war for Croatian independence (1991 – 1995), due to lower fuel consumption and overall reduction of production activities in almost all sectors. In 1994 began the reconstruction of areas devastated by war so the emissions from the sectors of mineral products increased, and increasing trend lasted until 1999. Second increasing trend started in 2002 mostly due to increase in road paving with asphalt, and with small influence due to increasing of quarrying and mining, construction and demolition, cement production, and inorganic chemicals production (such as carbon black, ammonium phosphate, urea and NPK fertilizers). Road paving with asphalt has recorded great increase in 2002 mainly due to the longest highway in Croatia "A1" (Dalmatians) was started to build from Zagreb to Dubrovnik (total length 456 km). The economic crisis which most hit construction sector in Croatia has contributed to reduction of TSP emissions since 2008 (Figure 3.7.1-1). A significant reduction since 2005 is a result of gradual replacement of certain percentage of traditional domestic stoves and manual single house boilers with advanced/ecolabelled stoves and boilers and pellet stoves and boilers (see Table 4.5-1 and Figure 4.5-2).

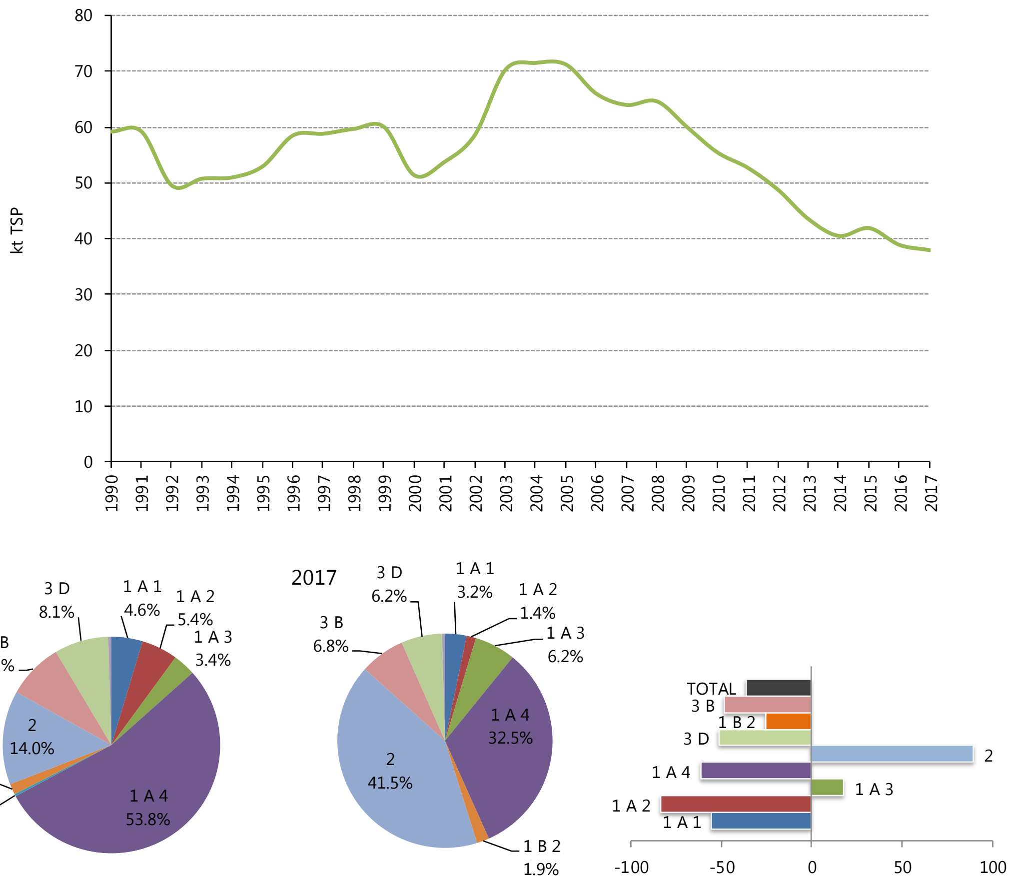


Figure 3.7.1-1: The TSP emissions (kt/yr.) and percentage share by sector and variation in TSP emissions

Table 3.7.1-1 The TSP emissions by SNAP nomenclature in the period 1990-2017

TSP

SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	2.7	31.0	2.6	8.9	1.5E-02	0.5	1.7	1.7	3.2E-01	9.7	59.2
1991	1.9	36.1	1.8	6.5	1.4E-02	0.4	1.4	1.2	2.3E-01	9.6	59.2
1992	2.4	31.1	1.3	4.5	1.1E-02	0.5	1.5	0.8	3.7E-01	7.1	49.5
1993	2.7	32.9	1.2	4.0	1.0E-02	0.4	1.6	0.6	2.3E-01	7.1	50.7
1994	2.3	29.7	1.1	7.7	9.2E-03	0.3	1.7	0.8	2.7E-01	7.1	51.0
1995	2.1	31.4	1.1	8.0	7.3E-03	0.5	1.9	0.7	3.1E-01	6.8	53.0
1996	2.0	35.2	1.0	9.3	5.9E-03	0.6	2.0	0.8	3.1E-01	7.3	58.5
1997	2.9	32.4	1.1	11.1	4.3E-03	0.6	2.2	0.8	3.0E-01	7.4	58.8
1998	3.5	32.6	1.0	11.1	4.5E-03	0.6	2.3	0.9	3.1E-01	7.4	59.7
1999	3.3	32.1	0.8	12.0	1.4E-03	0.6	2.4	0.8	3.3E-01	7.7	60.0
2000	1.4	28.6	0.8	11.4	NA	0.5	2.4	0.9	3.2E-01	5.0	51.4
2001	1.8	31.4	0.8	10.2	NA	0.7	2.5	1.0	3.1E-01	5.2	53.8
2002	1.6	30.2	0.8	15.6	NA	1.6	2.6	0.9	2.9E-01	5.1	58.6
2003	1.6	34.8	0.7	21.9	NA	1.9	2.8	0.9	3.3E-01	5.2	70.2
2004	0.9	33.9	0.8	25.3	NA	1.2	2.9	0.8	2.8E-01	5.3	71.5
2005	1.2	36.0	0.7	23.2	NA	0.8	3.0	0.8	2.9E-01	5.0	71.2
2006	1.1	31.4	0.7	22.4	NA	0.8	3.2	0.8	3.0E-01	5.3	66.0
2007	1.9	28.6	0.8	22.8	NA	0.7	3.1	0.8	2.9E-01	5.1	64.0
2008	1.0	27.1	0.6	26.3	NA	0.6	2.9	0.9	2.8E-01	5.0	64.6
2009	1.6	26.5	0.6	21.9	NA	0.4	2.8	0.8	2.6E-01	5.1	60.0
2010	1.0	26.7	0.7	18.1	NA	0.5	2.5	0.6	2.3E-01	5.0	55.4
2011	0.9	24.2	0.6	18.6	NA	0.4	2.3	0.6	2.6E-01	4.8	52.7
2012	0.9	22.3	0.6	16.9	NA	0.3	2.1	0.5	2.4E-01	4.8	48.7
2013	0.6	20.3	0.6	13.9	NA	0.5	2.0	0.5	2.2E-01	4.9	43.5
2014	0.7	16.1	0.4	15.3	NA	0.4	2.0	0.5	1.7E-01	4.9	40.5
2015	1.0	16.9	0.5	15.5	NA	0.4	2.0	0.5	1.7E-01	5.1	41.9
2016	1.2	14.4	0.4	14.7	NA	0.4	2.0	0.4	1.8E-01	5.1	38.9
2017	1.2	12.2	0.5	16.0	NA	0.5	2.1	0.4	1.9E-01	4.9	37.9
2017 vs 1990	-55.1%	-60.6%	-82.3%	80.3%	NA	-14.1%	23.3%	-76.0%	-41.7%	-49.6%	-35.9%
2017 vs 2016	0.5%	-15.5%	18.8%	8.2%	NA	11.9%	5.4%	-2.6%	5.1%	-3.0%	-2.4%

3.7.2. Particulate matter (PM_{10})

The total PM_{10} emission in 2017 was 25.4 kt. The emission decreased by 49.6% compared to 1990 and by 5.8% compared to the previous year (Figure 3.7.2-1). Energy Sector is the largest source of PM_{10} emissions and contributes 62.2% of the total emissions in 2017 (Table 3.7.2-1). Small combustion dominated by biomass combustion in residential are the key sources of PM_{10} emissions and contribute to 46.3% of total emissions in 2017. Sector Industrial processes and product use are the second largest source of PM_{10} emissions (20.9% in 2017). The third key sector in the PM_{10} emission is Agriculture, which contributes to the overall emissions in 2017 with 16.3%.

Since 1990, PM_{10} emissions have a downward trend, which was the most contributed by the Energy sector with the reduction of the PM_{10} emissions by 62% due to the reduction of the consumption of solid fuels and at the same time increasing the consumption of gaseous and liquid fuels and the Agriculture sector with a reduction of 51% due to decreasing number of animals and crop production. Sectors that note the PM_{10} emission growth trend since 1990 is the Transport sector (15.5% increase) due to the greater number of vehicles and sectors Industrial processes and product use (by 32.5%) due to increased the use and productivity of some products.

The trend of PM_{10} emissions has several dips and peak between 1990 and 2017. Great decline in the period from 1991 to 1994 was a result of the war for Croatian independence (1991 – 1995), due to lower fuel consumption and overall reduction of production activities in almost all sectors. In 1994 began the reconstruction of areas devastated by war so the emissions from the sectors of mineral products increased, and increasing trend lasted until 1999. Second increasing trend started in 2002 mostly due to increase in road paving with asphalt, and with small influence due to increasing of quarrying and mining, construction and demolition, cement production, and inorganic chemicals production (such as carbon black, ammonium phosphate, urea and NPK fertilizers). Road paving with asphalt has recorded great increase in 2002 mainly due to the longest highway in Croatia "A1" (Dalmatians) was started to build from Zagreb to Dubrovnik (total length 456 km). The economic crisis which most hit construction sector in Croatia has contributed to reduction of PM_{10} emissions since 2008 (Table 3.7.2-1). A significant reduction since 2005 is a result of gradual replacement of certain percentage of traditional domestic stoves and manual single house boilers with advanced/ecolabelled stoves and boilers and pellet stoves and boilers (see Table 4.5-1 and Figure 4.5-2).

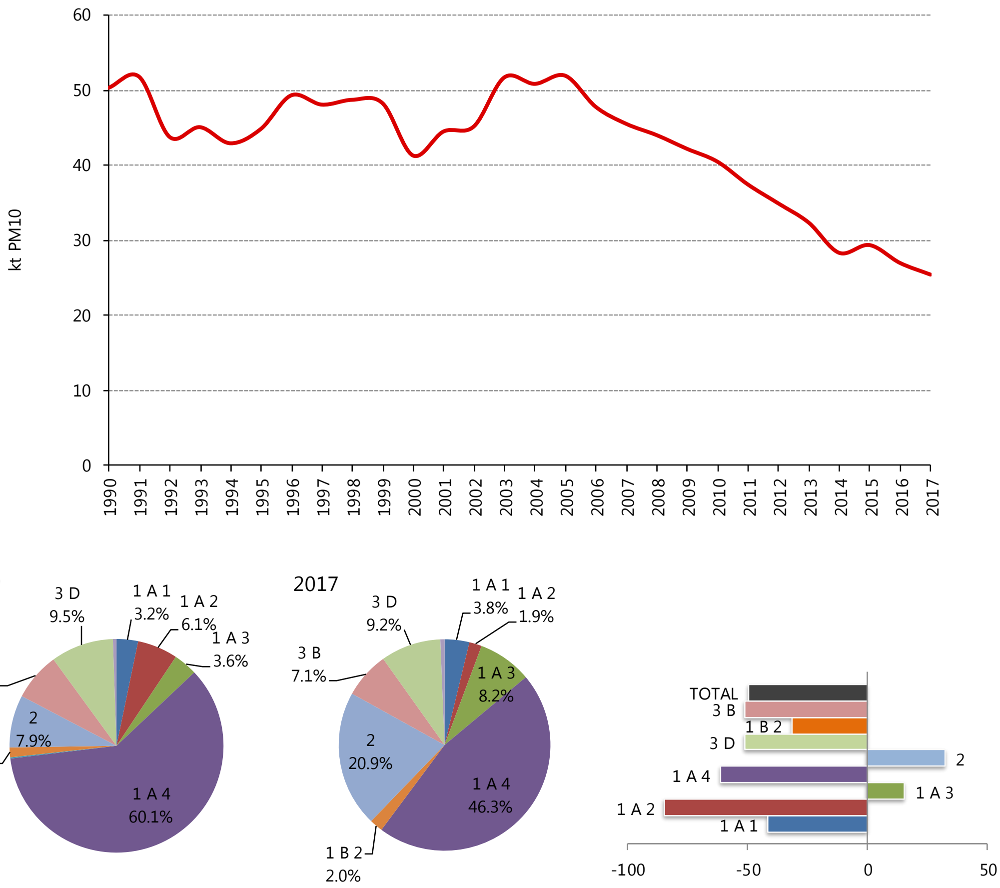


Figure 3.7.2-1 The PM_{10} emissions (kt/yr.) and percentage share by sector and variation in PM_{10} emissions

Table 3.7.2-1 The PM_{10} emissions by SNAP nomenclature in the period 1990-2017

PM_{10}											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	1.6	29.4	2.5	4.3	7.3E-03	0.5	1.5	1.7	0.32	8.4	50.3
1991	1.2	34.4	1.8	3.1	6.5E-03	0.4	1.3	1.2	0.23	8.3	51.8
1992	1.4	29.7	1.2	2.4	5.1E-03	0.5	1.3	0.8	0.37	6.1	43.8
1993	1.6	31.3	1.1	2.3	4.8E-03	0.4	1.5	0.6	0.22	6.1	45.1

PM_{10}											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1994	1.4	28.3	1.0	3.2	4.3E-03	0.3	1.5	0.8	0.27	6.1	42.9
1995	1.4	29.9	1.0	3.3	3.5E-03	0.5	1.7	0.7	0.31	5.9	44.8
1996	1.3	33.6	1.0	3.6	2.8E-03	0.5	1.8	0.8	0.31	6.3	49.3
1997	2.1	30.9	1.0	3.9	2.0E-03	0.6	2.1	0.8	0.30	6.4	48.1
1998	2.4	31.1	1.0	4.0	2.1E-03	0.6	2.1	0.9	0.31	6.5	48.8
1999	1.9	30.6	0.8	4.4	6.4E-04	0.6	2.2	0.8	0.32	6.7	48.3
2000	0.9	27.2	0.8	4.4	NA	0.5	2.2	0.9	0.32	4.1	41.4
2001	1.2	30.0	0.7	4.2	NA	0.7	2.3	1.0	0.30	4.3	44.5
2002	1.0	28.7	0.7	5.5	NA	1.5	2.4	0.9	0.29	4.2	45.2
2003	1.0	33.1	0.7	7.0	NA	1.8	2.6	0.9	0.33	4.2	51.7
2004	0.7	32.3	0.8	7.9	NA	1.1	2.7	0.8	0.28	4.3	50.9
2005	0.7	34.3	0.6	7.5	NA	0.8	2.8	0.8	0.29	4.1	52.0
2006	0.8	29.9	0.7	7.4	NA	0.7	3.0	0.8	0.29	4.3	47.8
2007	1.1	27.3	0.7	7.7	NA	0.6	2.9	0.8	0.29	4.2	45.5
2008	0.7	25.8	0.5	8.4	NA	0.6	2.7	0.9	0.28	4.2	44.0
2009	0.9	25.3	0.6	7.2	NA	0.4	2.5	0.8	0.26	4.3	42.2
2010	0.6	25.4	0.7	6.0	NA	0.5	2.3	0.6	0.23	4.1	40.5
2011	0.6	23.0	0.5	5.9	NA	0.4	2.1	0.6	0.26	3.9	37.4
2012	0.6	21.2	0.6	5.5	NA	0.3	1.9	0.5	0.24	4.0	34.9
2013	0.4	19.3	0.6	4.8	NA	0.4	1.8	0.5	0.22	4.2	32.3
2014	0.5	15.4	0.4	5.1	NA	0.4	1.8	0.5	0.16	4.2	28.3
2015	0.7	16.1	0.4	5.1	NA	0.4	1.8	0.4	0.17	4.3	29.3
2016	0.9	13.8	0.3	4.9	NA	0.4	1.8	0.4	0.18	4.2	26.9
2017	1.0	11.6	0.4	5.4	NA	0.4	1.9	0.4	0.19	4.1	25.4
2017 vs 1990	-41.4%	-60.5%	-83.4%	25.1%	NA	-13.9%	21.0%	-76.0%	-41.4%	-51.0%	-49.6%
2016 vs 2017	3.7%	-15.5%	20.3%	8.8%	NA	11.7%	5.5%	-2.6%	5.7%	-2.5%	-5.8%

3.7.3. Particulate matter ($PM_{2.5}$)

The $PM_{2.5}$ emission in the year 2017 was 16.7 kt. Emissions decreased by 56.2% compared to 1990 and increased by 9.4% compared to the previous year (Figure 3.7.3-1). Energy Sector is the largest source of $PM_{2.5}$ emissions and contributes with 87.2% of total emissions in 2017 (Table 3.7.3-1). Key sources of emissions in this sector are Small combustion and residential biomass combustion, which account for 68.5% of the total emissions in 2017. Transport sector contributes to a less extent (from 10.1% in 2017), as well as Industrial processes and solvent use (9% in 2017).

The trend of $PM_{2.5}$ emissions has several dips and peak between 1990 and 2017. Great decline in the period from 1991 to 1994 was a result of the war for Croatian independence (1991 – 1995), due to lower fuel consumption and overall reduction of production activities in almost all sectors. In 1994 began the reconstruction of areas devastated by war so the emissions from the sectors of mineral products increased, and increasing trend lasted until 1999. Second increasing trend started in 2002 mostly due to increase in road paving with asphalt, and with small influence due to increasing of quarrying and mining, construction and demolition, cement production, and inorganic chemicals production (such as carbon black, ammonium phosphate, urea and NPK fertilizers). Road paving with asphalt has recorded great increase in 2002 mainly due to the longest highway in Croatia "A1" (Dalmatians) was started to build from Zagreb to Dubrovnik (total length 456 km). The economic crisis which most hit construction sector in Croatia has contributed to reduction of $PM_{2.5}$ emissions since 2008 (Table 3.7.3-1). A significant reduction since 2005 is a result of gradual replacement of certain percentage of traditional domestic stoves and manual single house boilers with advanced/ecolabelled stoves and boilers and pellet stoves and boilers (see Table 4.5-1 and Figure 4.5-2).

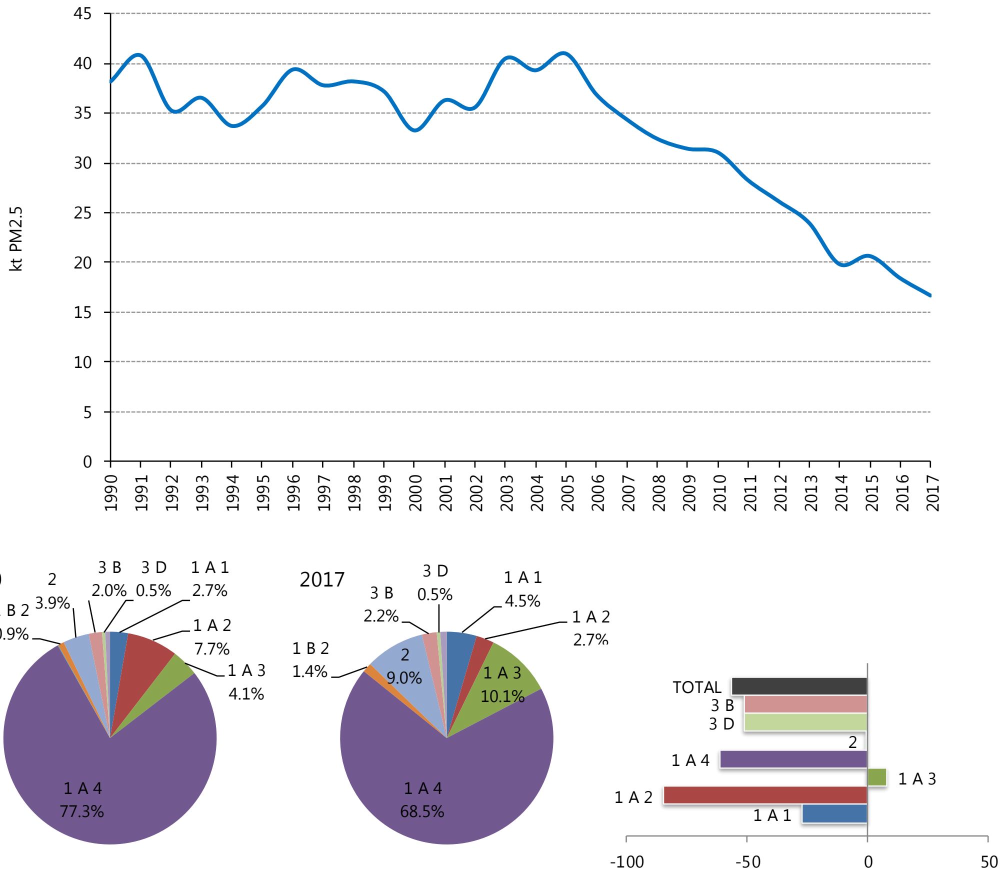


Figure 3.7.3-1 The $PM_{2.5}$ emissions (kt/yr.) and percentage share by sector and variation in $PM_{2.5}$ emissions

Table 3.7.3-1 The $PM_{2.5}$ emissions by SNAP nomenclature in the period 1990-2017

$PM_{2.5}$											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	1.0	28.6	2.4	1.4	8.7E-04	0.4	1.3	1.7	0.32	1.0	38.2
1991	0.8	33.5	1.7	1.1	7.7E-04	0.4	1.1	1.2	0.23	0.9	40.8
1992	0.9	28.9	1.2	0.9	6.0E-04	0.4	1.2	0.8	0.37	0.7	35.3
1993	1.0	30.5	1.1	0.8	5.8E-04	0.4	1.3	0.6	0.22	0.7	36.5
1994	0.9	27.6	1.0	1.0	5.2E-04	0.2	1.3	0.8	0.27	0.7	33.7
1995	0.9	29.2	1.0	1.0	4.1E-04	0.4	1.5	0.7	0.31	0.7	35.7
1996	0.9	32.7	1.0	1.0	3.3E-04	0.4	1.6	0.8	0.31	0.7	39.4
1997	1.7	30.1	1.0	1.0	2.4E-04	0.5	1.8	0.8	0.30	0.7	37.8
1998	1.8	30.3	1.0	1.0	2.5E-04	0.5	1.9	0.9	0.31	0.6	38.2
1999	1.2	29.8	0.7	1.2	7.7E-05	0.5	1.9	0.8	0.32	0.7	37.2
2000	0.6	26.5	0.8	1.3	NA	0.4	1.9	0.9	0.32	0.6	33.4
2001	0.8	29.2	0.7	1.2	NA	0.6	2.0	1.0	0.30	0.6	36.3
2002	0.7	28.0	0.7	1.3	NA	1.0	2.1	0.9	0.29	0.6	35.6
2003	0.7	32.3	0.7	1.6	NA	1.2	2.3	0.9	0.33	0.6	40.5
2004	0.5	31.5	0.8	1.8	NA	0.8	2.4	0.8	0.28	0.6	39.3
2005	0.5	33.4	0.6	1.7	NA	0.6	2.5	0.8	0.29	0.5	41.0
2006	0.5	29.1	0.7	1.7	NA	0.6	2.6	0.8	0.29	0.6	36.9
2007	0.7	26.6	0.7	1.8	NA	0.5	2.5	0.8	0.29	0.5	34.4
2008	0.5	25.1	0.5	1.8	NA	0.5	2.3	0.9	0.28	0.5	32.4
2009	0.5	24.6	0.6	1.6	NA	0.4	2.1	0.7	0.26	0.5	31.4

$PM_{2.5}$											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2010	0.4	24.8	0.7	1.5	NA	0.4	2.0	0.6	0.23	0.5	31.1
2011	0.4	22.5	0.5	1.4	NA	0.4	1.7	0.6	0.26	0.5	28.3
2012	0.4	20.7	0.6	1.4	NA	0.3	1.6	0.5	0.24	0.5	26.2
2013	0.3	18.9	0.5	1.3	NA	0.4	1.5	0.5	0.22	0.5	24.0
2014	0.3	15.0	0.4	1.3	NA	0.3	1.4	0.5	0.16	0.5	19.9
2015	0.5	15.7	0.4	1.3	NA	0.3	1.4	0.4	0.17	0.5	20.7
2016	0.7	13.4	0.3	1.2	NA	0.3	1.4	0.4	0.18	0.5	18.5
2017	0.8	11.3	0.4	1.4	NA	0.4	1.5	0.4	0.19	0.5	16.7
2017 vs 1990	-27.4%	-60.4%	-84.0%	-3.1%	NA	-19.1%	12.6%	-76.0%	-41.4%	-51.2%	-56.2%
2016 vs 2017	5.9%	-15.4%	22.1%	9.6%	NA	12.0%	4.9%	-2.6%	5.7%	-1.8%	-9.4%

3.7.4. Black carbon (BC)

The Republic of Croatia voluntarily reports on the emissions of BC as an additional pollutant in the air.

In 2017, BC emission was 2.8 kt (Figure 3.7.4-1) and was down by 47.8% compared to 1990 and 5.7% higher than in the previous year. The Energy sector is the sector with the highest contribution to the total BC emission in 2017 with 94.9%. The remaining emissions in 2017 (5.1%) come from the Industrial processes and product use sector. The key category in the energy sector is Small combustion and mobile machinery that contributes to the total BC emission in 2017 with 62.2% and Transport sector with a contribution of 27.2%.

Since 1990, the BC emission has a downward trend, and the largest contributing sector was the stationar Energy with the reduction of the BC emission by 55% due to the reduction of the consumption of solid fuels and at the same time increasing the consumption of gaseous and liquid fuels. The sector that recorded the increase of BC emissions since 1990 was the Transport (22.6% increase) due to the increase number of vehicles.

Trend of BC emissions follows the trend of $PM_{2.5}$ emissions so the reasons for present peaks and dips are the same. Great decline in the period from 1991 to 1994 was a result of the war for Croatian independence (1991 – 1995), due to lower fuel consumption and overall reduction of production activities in almost all sectors. In 1994 began the reconstruction of areas devastated by war so the emissions from the sectors of mineral products increased, and increasing trend lasted until 1999. Second increasing trend started in 2002 mostly due to increase in road paving with asphalt, and with small influence due to increasing of quarrying and mining, construction and demolition, cement production, and inorganic chemicals production (such as carbon black, ammonium phosphate, urea and NPK fertilizers). Road paving with asphalt has recorded great increase in 2002 mainly due to the longest highway in Croatia "A1" (Dalmatians) was started to build from Zagreb to Dubrovnik (total length 456 km). The economic crisis has contributed to reduction of BC emissions since 2007 (Figure 3.7.4-1). The economic crisis which most hit construction sector in Croatia has contributed to reduction of BC emissions since 2008. A significant reduction since 2005 is a result of gradual replacement of certain percentage of traditional domestic stoves and manual single house boilers with advanced/ecolabelled stoves and boilers and pellet stoves and boilers (see Table 4.5-1 and Figure 4.5-2).

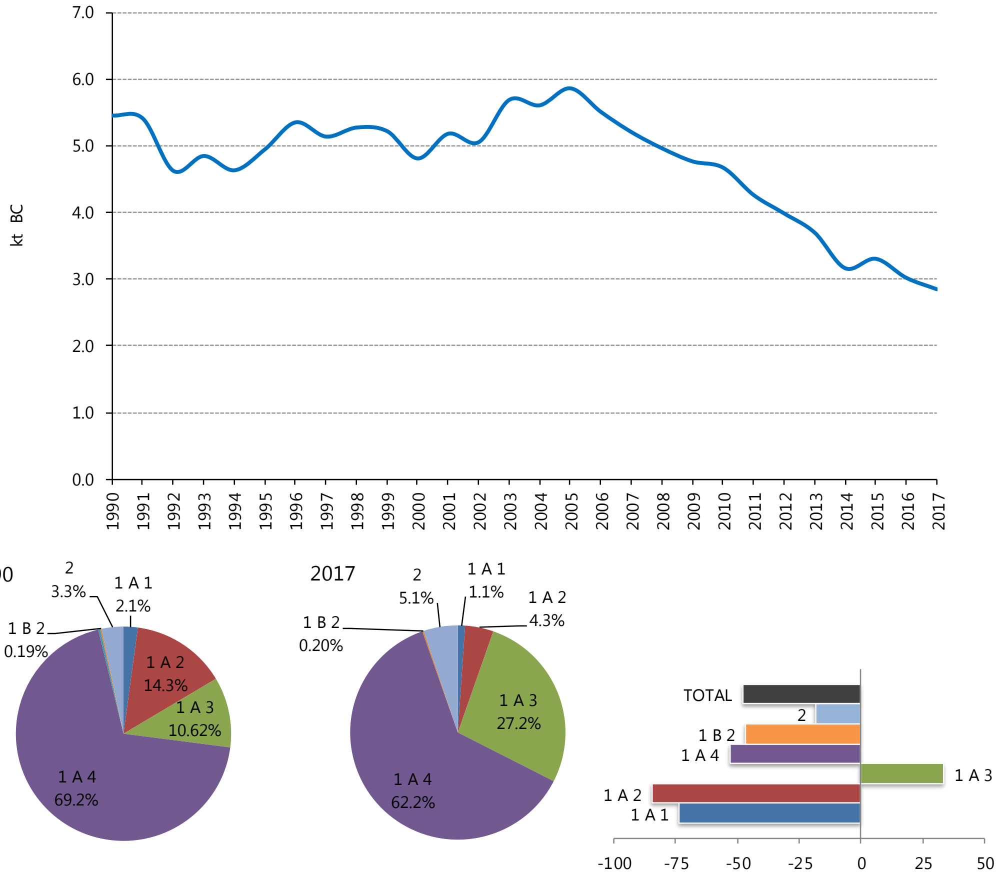


Figure 3.7.4-1 The BC emissions (kt/yr.) and percentage share by sector and variation in BC emissions

Table 3.7.4-1 The BC emissions by SNAP nomenclature in the period 1990-2017

BC											
SNAP	1	2	3	4	5	6	7	8	9	10	TOTAL
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	0.12	3.30	0.45	0.049	NA	0.15	575	0.81	1.0E-02	NA	5.46
1991	0.10	3.79	0.34	0.039	NA	0.14	468	0.52	9.1E-03	NA	5.41
1992	0.11	3.31	0.26	0.031	NA	0.15	523	0.23	6.5E-03	NA	4.63
1993	0.11	3.50	0.27	0.026	NA	0.14	613	0.19	8.3E-03	NA	4.85
1994	0.16	3.15	0.23	0.029	NA	0.06	624	0.36	6.8E-03	NA	4.63
1995	0.19	3.33	0.25	0.019	NA	0.14	728	0.29	5.6E-03	NA	4.95
1996	0.16	3.74	0.25	0.021	NA	0.14	753	0.29	5.2E-03	NA	5.35
1997	0.14	3.43	0.25	0.026	NA	0.14	857	0.29	6.2E-03	NA	5.14
1998	0.16	3.42	0.27	0.025	NA	0.15	883	0.36	5.7E-03	NA	5.27
1999	0.16	3.39	0.20	0.029	NA	0.17	916	0.35	6.9E-03	NA	5.22
2000	0.075	3.01	0.19	0.028	NA	0.16	925	0.42	6.0E-03	NA	4.81
2001	0.054	3.29	0.18	0.025	NA	0.21	983	0.42	7.3E-03	NA	5.18
2002	0.049	3.16	0.18	0.033	NA	0.22	575	0.38	7.7E-03	NA	4.61
2003	0.052	3.63	0.18	0.043	NA	0.23	1159	0.39	7.9E-03	NA	5.69
2004	0.045	3.54	0.20	0.050	NA	0.17	1232	0.36	8.0E-03	NA	5.61
2005	0.043	3.73	0.18	0.047	NA	0.18	1309	0.36	8.3E-03	NA	5.86
2006	0.040	3.29	0.19	0.045	NA	0.18	1402	0.36	9.8E-03	NA	5.51
2007	0.044	3.03	0.19	0.046	NA	0.18	1352	0.35	1.0E-02	NA	5.21
2008	0.031	2.91	0.16	0.050	NA	0.19	1239	0.38	9.9E-03	NA	4.96
2009	0.036	2.89	0.18	0.042	NA	0.14	1167	0.31	8.8E-03	NA	4.77
2010	0.029	2.95	0.15	0.038	NA	0.16	1067	0.27	5.5E-03	NA	4.67

BC											
SNAP	1	2	3	4	5	6	7	8	9	10	TOTAL
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2011	0.031	2.73	0.13	0.038	NA	0.14	939	0.25	6.8E-03	NA	4.26
2012	0.025	2.57	0.13	0.035	NA	0.14	869	0.21	5.1E-03	NA	3.98
2013	0.017	2.40	0.12	0.032	NA	0.12	822	0.19	5.0E-03	NA	3.70
2014	0.017	1.96	0.09	0.035	NA	0.10	781	0.17	6.9E-03	NA	3.16
2015	0.023	2.13	0.07	0.034	NA	0.10	796	0.15	5.7E-03	NA	3.30
2016	0.029	1.90	0.05	0.033	NA	0.10	762	0.13	5.9E-03	NA	3.02
2017	0.031	1.70	0.07	0.036	NA	0.11	771	0.12	5.4E-03	NA	2.85
2017 vs 1990	-73.4%	-48.4%	-84.5%	-26.7%	NA	-24.8%	34.0%	-85.2%	-47.4%	NA	-47.8%
2016 vs 2017	5.3%	-10.6%	35.0%	9.9%	NA	11.5%	1.1%	-9.8%	-9.0%	NA	-5.7%

3.8. Priority heavy metal emissions (Pb, Cd and Hg)

Heavy metals emissions from anthropogenic sources became of importance to UNECE/LRTAP Convention, after various studies showed that heavy metals attached to air-borne particles can be widely dispersed on very large scales. They are stable and cannot be degraded or destroyed, and therefore they tend to accumulate in soils and sediments. Because of their toxicity and other mentioned properties, heavy metals are also hazardous for living organisms. Recognized danger from heavy metals accelerated UN decision to include the Protocol on heavy metals in the framework of the LRTAP Convention. The Republic of Croatia has signed this Protocol in June 1999 at the meeting of the ministers of environmental protection in Aarhus and ratified it by Low on ratification of the Protocol to the 1979 Convention on long-range transboundary air pollution on Heavy Metals (OG-IT 05/07) in 2007.

Emissions of priority metals are mainly a result of fuel combustion. The emission depends on the type and quantity of combusted fuel, so Cd emission will be greater if in the observed year more fuel oil was used, while the Hg emission increases with higher consumption of natural gas.

3.8.1. Lead (Pb)

The lead emission (Figure 3.8.1-1 and Table 3.8.1-1) in 2017 has amounted to 8.0 t. The Pb emission has decrease by 98.5 % since 1990 and by 0.1% comparing to previous year. Key sources in Pb emission in 2017 were: Transport sector (52.3 %) with the dominance of road transport, the Industrial processes and product use sector (20.2 %) with the domination of glass production and production of steel in electric arc furnaces and Small combustion and mobile machinery sector (16.3 %). The Pb emissions from these activities originates from the lead content in the raw material of production process, respectively in the fuel.

The lead in the historical trend shows several major reductions, which are the result of decreases in the Transport sector and Industrial processes and product use sector. Transport sector notes a 99 % decrease in lead emissions since 1990 as a result of the gradual ban on the use of leaded gasoline fuels. Efforts began in 1996 when the Pb content in leaded gasoline was reduced from 0.6 g/l to 0.74 g/l, while unleaded with 0.02 g/l to 0.013 g/l, then in 2003 Pb content in leaded gasoline was reduced to 0.15 g/l, and in unleaded one at 0.005 g/l and, in 2006, leaded gasoline was completely thrown out of use. Reduction in 1992 has occurred due to stopping the process of steel production in the Siemens-Martin furnaces. Stopping the process was a result of the war for Croatian independence

(1991 - 1995). Also, the war for Croatian independence caused a reduction in fuel consumption and reduction in overall production in the industrial processes and product use sector (Figure 3.8.1-1).

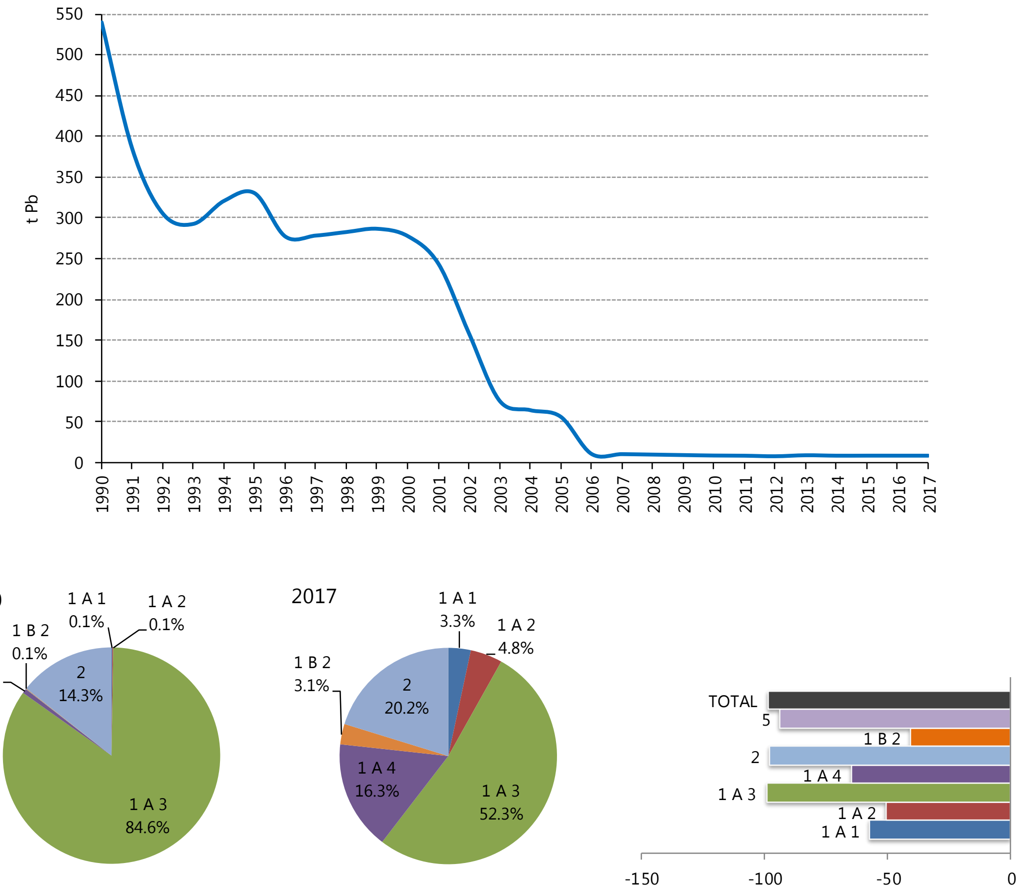


Figure 3.8.1-1 The Pb emissions (t/yr.) and percentage share by sector and variation in Pb emissions

Table 3.8.1-1 The Pb emissions by SNAP nomenclature in the period 1990-2017

Pb											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	0.62	1.97	0.64	77.48	NA	0.56	456.1	2.21	1.3E-02	NA	539.6
1991	0.53	1.79	0.43	29.45	NA	0.56	344.8	6.86	1.2E-02	NA	384.4
1992	0.67	1.36	0.35	0.89	NA	0.56	298.0	3.08	1.2E-02	NA	304.9
1993	0.54	1.48	0.30	0.88	NA	0.56	282.6	6.00	1.2E-02	NA	292.4
1994	0.46	1.27	0.32	0.82	NA	0.56	311.3	5.83	1.2E-02	NA	320.6
1995	0.51	1.33	0.29	0.69	NA	0.95	320.5	5.61	1.3E-02	NA	329.9
1996	0.51	1.49	0.28	0.61	NA	1.40	267.7	4.80	1.3E-02	NA	276.8
1997	0.59	1.37	0.32	0.63	NA	1.38	270.0	3.69	1.4E-02	NA	278.0
1998	0.72	1.39	0.33	0.82	NA	0.94	275.2	2.95	1.5E-02	NA	282.4
1999	0.75	1.38	0.35	0.77	NA	0.76	278.6	3.75	1.6E-02	NA	286.4
2000	0.48	1.22	0.41	0.87	NA	0.55	271.2	2.67	1.7E-02	NA	277.4
2001	0.52	1.28	0.43	0.80	NA	1.30	237.2	1.97	1.8E-02	NA	243.6
2002	0.57	1.26	0.41	0.76	NA	6.50	147.7	0.92	1.6E-02	NA	158.1
2003	0.74	1.45	0.42	0.83	NA	9.01	62.3	0.65	1.4E-02	NA	75.4
2004	0.51	1.38	0.46	1.02	NA	4.86	55.1	0.52	1.4E-02	NA	63.9
2005	0.58	1.47	0.47	1.03	NA	2.17	49.5	0.41	1.4E-02	NA	55.7
2006	0.55	1.34	0.54	0.97	NA	1.64	4.8	0.36	1.5E-02	NA	10.2
2007	0.59	1.26	0.45	1.04	NA	1.15	5.0	0.37	1.6E-02	NA	9.9

Pb											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
2008	0.55	1.27	0.40	1.12	NA	0.80	4.8	0.34	1.3E-02	NA	9.3
2009	0.51	1.32	0.38	0.95	NA	0.36	4.9	0.34	1.5E-02	NA	8.7
2010	0.35	1.42	0.40	1.00	NA	0.14	4.6	0.22	5.4E-03	NA	8.2
2011	0.40	1.38	0.34	0.94	NA	0.12	4.6	0.22	6.0E-03	NA	8.0
2012	0.35	1.37	0.35	0.70	NA	0.01	4.3	0.19	8.5E-03	NA	7.3
2013	0.31	1.35	0.36	0.84	NA	1.14	4.3	0.19	5.5E-03	NA	8.5
2014	0.30	1.19	0.36	1.13	NA	0.81	4.0	0.19	5.7E-03	NA	8.0
2015	0.32	1.35	0.34	1.01	NA	0.78	4.1	0.16	6.2E-03	NA	8.0
2016	0.34	1.31	0.32	0.75	NA	1.00	4.1	0.19	6.8E-03	NA	8.0
2017	0.27	1.28	0.37	0.80	NA	1.06	4.0	0.18	2.2E-03	NA	8.0
2017 vs 1990	-57.2%	-35.1%	-42.9%	-99.0%	NA	90.3%	-99.1%	-91.6%	-83.2%	NA	-98.5%
2016 vs 2017	-21.8%	-2.6%	14.9%	7.4%	NA	5.6%	-1.3%	-0.4%	-67.3%	NA	-0.1%

3.8.2. Cadmium (Cd)

The cadmium emission in 2017 was amounted to 0.83 t. The Cd emission has decrease by 26.8 % since 1990 and increased by 0.4 % in comparison to year before (Figure 3.8.2-1 and Table 3.8.2-1). Majority of Cd emission originates from the fuel combustion in Energy sector (88.6 % in 2017), with domination of Small combustion and mobile machinery sector (72.4%). The sector, second in domination of Cd emissions in 2017, was Industrial processes and products use sector with a contribution of 11.3 %. The Cd emission originates from Cd content in fuels (biomass, fuel oil, coal) and in raw materials at the entrance of the production process.

Total of Cd emissions has a decreasing trend in the period 1990 - 2017, as a result of reduced consumption of fuel oil and a simultaneous increase in natural gas consumption. Also, lower consumption of fossil fuels in the energy sector has contributed to the reduction of Cd emissions. Cd emissions has significantly decreased in the period 1991 - 1992 (about 43%), due to stopping the process of steel production in the Siemens-Martin furnaces in Sisak, 1992. Stopping the process was a result of the war for Croatian independence (1991 - 1995). Also, the war for Croatian independence caused a reduction in fuel consumption and production in production processes and product use sector. In 2015, the emissions recorded an increase in the Small combustion sector (Residential combustion), and the reason for the mentioned peak is an increase of biomass consumption in the residential sector.

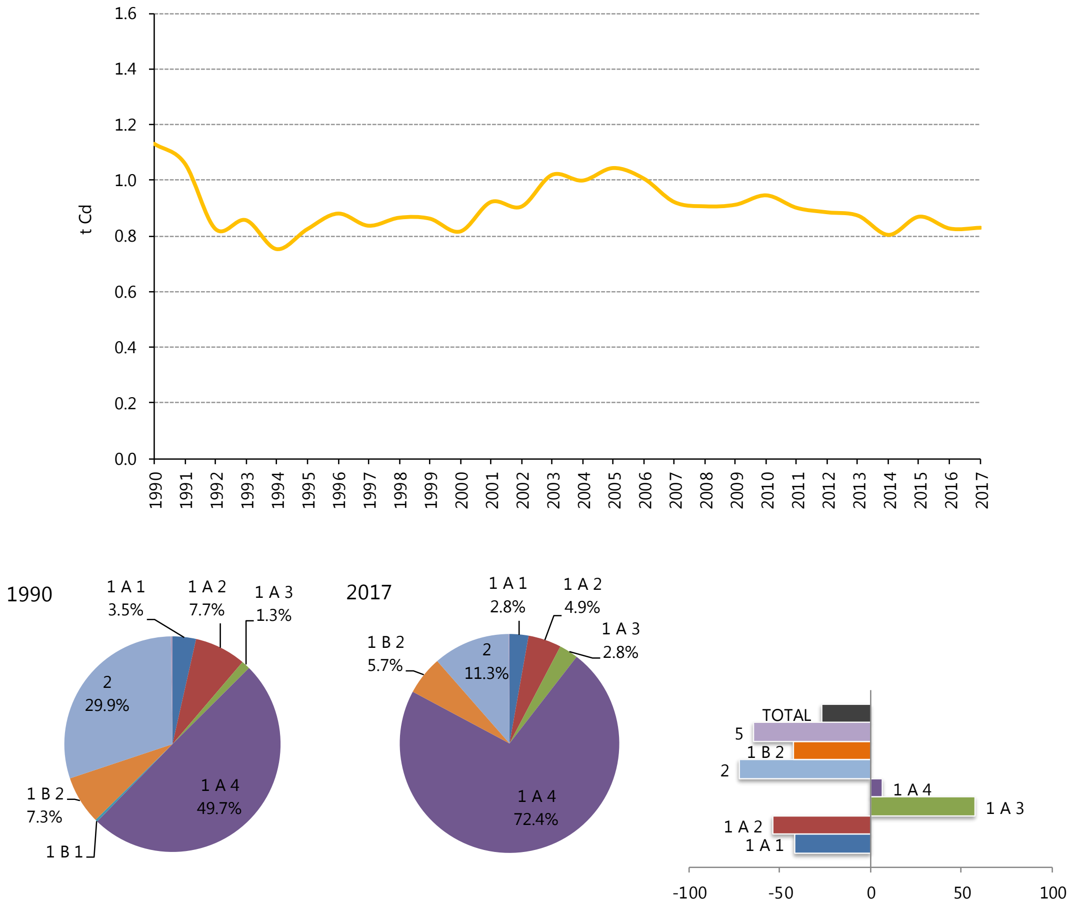


Figure 3.8.2-1 The Cd emissions (t/yr.) and percentage share by sector and variation in Cd emissions

Table 3.8.2-1 The Cd emissions by SNAP nomenclature in the period 1990-2017

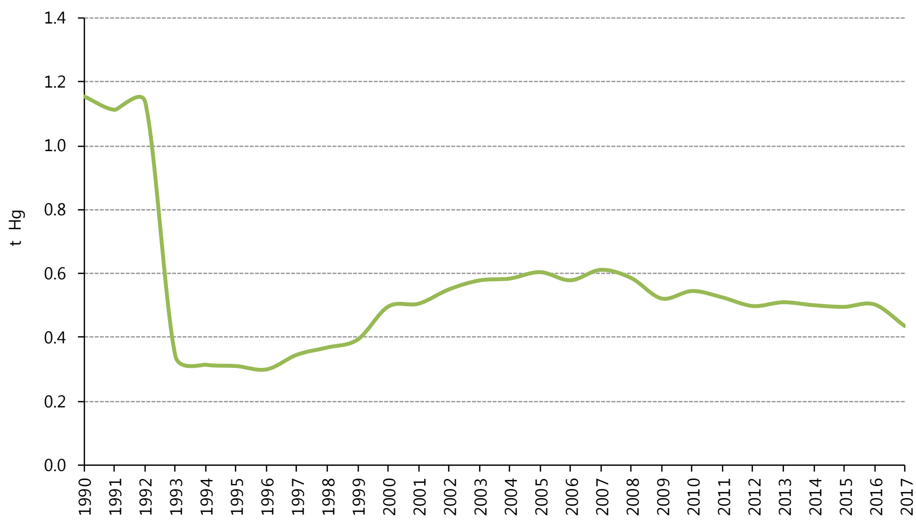
Cd											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	0.04	0.56	0.09	0.36	NA	6.6E-02	1.4E-02	4.7E-03	4.2E-03	NA	1.13
1991	0.03	0.69	0.07	0.19	NA	6.2E-02	1.0E-02	3.4E-03	3.4E-03	NA	1.06
1992	0.03	0.57	0.06	0.09	NA	6.8E-02	9.7E-03	2.0E-03	4.1E-03	NA	0.83
1993	0.03	0.60	0.05	0.09	NA	6.2E-02	1.0E-02	1.8E-03	3.4E-03	NA	0.86
1994	0.03	0.55	0.05	0.09	NA	2.7E-02	1.1E-02	2.4E-03	3.6E-03	NA	0.75
1995	0.03	0.58	0.05	0.09	NA	6.6E-02	1.2E-02	2.3E-03	4.1E-03	NA	0.82
1996	0.03	0.64	0.05	0.07	NA	6.4E-02	1.3E-02	2.6E-03	4.0E-03	NA	0.88
1997	0.03	0.59	0.06	0.07	NA	6.3E-02	1.4E-02	2.5E-03	3.9E-03	NA	0.84
1998	0.03	0.59	0.07	0.10	NA	6.6E-02	1.5E-02	2.8E-03	4.1E-03	NA	0.88
1999	0.03	0.58	0.07	0.10	NA	7.6E-02	1.6E-02	2.8E-03	4.3E-03	NA	0.88
2000	0.03	0.52	0.10	0.12	NA	7.4E-02	1.6E-02	3.3E-03	4.4E-03	NA	0.87
2001	0.03	0.57	0.10	0.11	NA	9.8E-02	1.6E-02	3.5E-03	4.4E-03	NA	0.92
2002	0.03	0.55	0.09	0.11	NA	1.1E-01	1.7E-02	3.4E-03	4.1E-03	NA	0.91
2003	0.03	0.63	0.10	0.11	NA	1.2E-01	1.8E-02	3.7E-03	4.2E-03	NA	1.02
2004	0.03	0.61	0.11	0.13	NA	8.6E-02	1.8E-02	3.5E-03	4.0E-03	NA	1.00
2005	0.03	0.65	0.12	0.13	NA	8.3E-02	1.9E-02	3.7E-03	4.0E-03	NA	1.05
2006	0.03	0.60	0.15	0.12	NA	8.1E-02	2.0E-02	4.0E-03	4.2E-03	NA	1.01
2007	0.03	0.58	0.07	0.13	NA	8.1E-02	2.2E-02	4.1E-03	4.3E-03	NA	0.92
2008	0.03	0.58	0.06	0.13	NA	8.5E-02	2.1E-02	4.7E-03	3.9E-03	NA	0.91
2009	0.03	0.60	0.07	0.12	NA	6.2E-02	2.1E-02	4.2E-03	4.0E-03	NA	0.91

Cd											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
2010	0.03	0.65	0.06	0.12	NA	7.2E-02	2.0E-02	3.8E-03	2.3E-03	NA	0.95
2011	0.03	0.63	0.05	0.10	NA	6.3E-02	2.0E-02	3.8E-03	2.6E-03	NA	0.90
2012	0.03	0.63	0.05	0.09	NA	6.0E-02	2.0E-02	3.5E-03	2.9E-03	NA	0.89
2013	0.02	0.63	0.05	0.09	NA	5.4E-02	2.0E-02	3.4E-03	2.4E-03	NA	0.87
2014	0.02	0.55	0.05	0.11	NA	4.7E-02	2.0E-02	3.4E-03	2.1E-03	NA	0.80
2015	0.02	0.64	0.04	0.10	NA	4.6E-02	2.1E-02	3.3E-03	2.3E-03	NA	0.87
2016	0.02	0.62	0.03	0.08	NA	4.6E-02	2.1E-02	3.3E-03	2.5E-03	NA	0.83
2017	0.02	0.60	0.04	0.09	NA	5.1E-02	2.3E-02	3.3E-03	1.7E-03	NA	0.83
2017 vs 1990	-41.9%	6.6%	-54.0%	-74.9%	NA	-22.9%	66.8%	-29.1%	-60.1%	NA	-26.8%
2016 vs 2017	-5.2%	-2.9%	29.7%	8.6%	NA	11.2%	7.2%	0.6%	-31.8%	NA	0.4%

3.8.3. Mercury (Hg)

The mercury emission in 2017 was amounted to 0.44 t (Figure 3.8.3-1 and Table 3.8.3-1). Emission has decreased by 62.3 % since 1990, and by 13.5% since year before. The majority of mercury emissions in 2017, resulting from fuel combustion in the Energy sector (69.8 % in 2017). The second sector in dominance in Hg emission in 2017 was the Industrial processes and products use sector with a contribution of 15.4 % and third sector fugitive emissions from fuels with 12.7%. Mercury emissions originate from its content in fuels (coal, natural gas), in raw materials at the entrance in the production processe (eg. Refining, steel and glass production) and in weste gas flows that are combusted on flares in refineries and during the exploitation of oil and gas.

In 1990, dominant source in Hg emission was fugitive emissions from fuels, in particularly, fugitive emission from production and processing of natural gas (68.6 % in 1990). In 1993, the process units for removal of mercury from natural gas were put into operation. With this measure for mercury emission reduction, the inlet average mercury concentration of 516 $\mu g/m^3$ has decreased at the outlet to 0.12 $\mu g/m^3$ of average mercury concentration (Lit. 6). The above was the reason for reducing Hg emission in observed period. Since 2000, Hg emissions have started to increase, due to entry in operation of the second of two thermal power plants on coal in Croatia. In 2017, a drop in Hg emission was recorded due to the reduced work of coal-fired power plants.



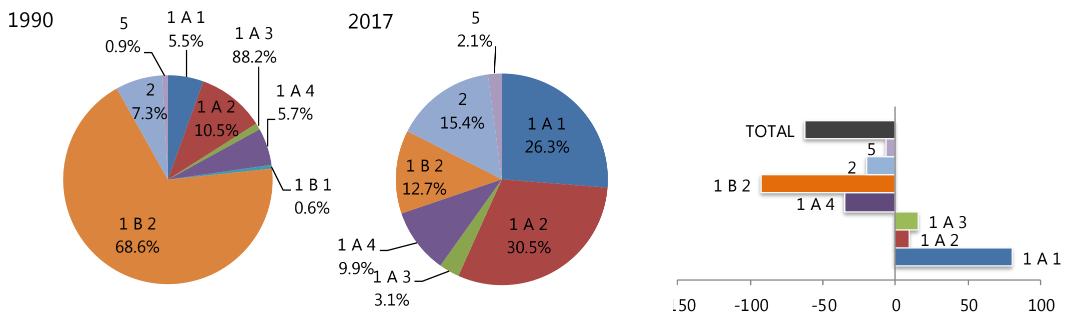


Figure 3.8.3-1 The Hg emissions (t/yr.) and percentage share by sector and variation in Hg emissions

Table 3.8.3-1 The Hg emissions by SNAP nomenclature in the period 1990-2017

Hg											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	0.06	0.07	0.12	0.11	0.70	7.5E-02	8.5E-03	3.2E-03	1.0E-02	NA	1.15
1991	0.04	0.06	0.08	0.07	0.77	7.0E-02	6.4E-03	1.8E-03	1.0E-02	NA	1.11
1992	0.06	0.04	0.09	0.06	0.80	7.0E-02	5.9E-03	1.4E-03	1.2E-02	NA	1.14
1993	0.05	0.05	0.08	0.08	2.3E-03	7.2E-02	6.1E-03	1.3E-03	1.1E-02	NA	0.34
1994	0.02	0.04	0.09	0.07	2.0E-03	7.3E-02	6.6E-03	8.0E-04	1.2E-02	NA	0.31
1995	0.03	0.04	0.07	0.07	2.4E-03	7.3E-02	7.0E-03	1.1E-03	1.3E-02	NA	0.31
1996	0.02	0.05	0.08	0.06	2.8E-03	7.0E-02	7.6E-03	1.5E-03	1.3E-02	NA	0.30
1997	0.06	0.04	0.09	0.06	2.0E-03	7.1E-02	8.4E-03	1.2E-03	1.3E-02	NA	0.35
1998	0.06	0.05	0.10	0.07	2.9E-03	7.0E-02	9.0E-03	1.1E-03	1.3E-02	NA	0.37
1999	0.05	0.05	0.12	0.08	2.0E-03	7.1E-02	9.5E-03	1.0E-03	1.3E-02	NA	0.40
2000	0.12	0.04	0.13	0.11	1.9E-03	6.8E-02	9.6E-03	1.0E-03	1.3E-02	NA	0.50
2001	0.12	0.04	0.15	0.09	2.1E-03	6.7E-02	9.6E-03	1.0E-03	1.3E-02	NA	0.51
2002	0.17	0.04	0.15	0.10	7.3E-04	6.8E-02	1.0E-02	1.2E-03	1.3E-02	NA	0.55
2003	0.19	0.05	0.15	0.10	7.5E-04	6.8E-02	1.1E-02	1.2E-03	1.4E-02	NA	0.58
2004	0.18	0.05	0.16	0.10	7.8E-04	6.8E-02	1.1E-02	1.1E-03	1.4E-02	NA	0.58
2005	0.19	0.05	0.16	0.11	7.6E-04	6.7E-02	1.1E-02	1.2E-03	1.5E-02	NA	0.60
2006	0.18	0.05	0.17	0.09	7.1E-04	6.7E-02	1.2E-02	1.2E-03	1.5E-02	NA	0.58
2007	0.19	0.04	0.17	0.11	7.1E-04	6.7E-02	1.2E-02	1.3E-03	1.6E-02	NA	0.61
2008	0.19	0.05	0.16	0.09	5.0E-05	6.7E-02	1.2E-02	1.5E-03	1.4E-02	NA	0.59
2009	0.14	0.05	0.14	0.10	4.2E-05	6.7E-02	1.2E-02	1.6E-03	1.5E-02	NA	0.52
2010	0.19	0.05	0.13	0.08	3.9E-05	6.7E-02	1.1E-02	1.3E-03	1.0E-02	NA	0.54
2011	0.20	0.05	0.12	0.07	4.1E-05	6.7E-02	1.1E-02	1.3E-03	1.0E-02	NA	0.52
2012	0.18	0.05	0.11	0.07	4.1E-05	6.7E-02	1.1E-02	1.3E-03	1.2E-02	NA	0.50
2013	0.19	0.05	0.12	0.06	4.1E-05	6.6E-02	1.1E-02	1.4E-03	1.0E-02	NA	0.51
2014	0.19	0.04	0.13	0.06	4.1E-05	6.6E-02	1.1E-02	1.5E-03	1.0E-02	NA	0.50
2015	0.18	0.04	0.12	0.06	4.1E-05	6.6E-02	1.1E-02	1.4E-03	1.1E-02	NA	0.50
2016	0.20	0.04	0.12	0.05	4.1E-05	6.5E-02	1.1E-02	1.5E-03	1.1E-02	NA	0.50
2017	0.11	0.04	0.13	0.06	4.1E-05	6.4E-02	1.2E-02	1.5E-03	9.3E-03	NA	0.44
2017 vs 1990	80.1%	-34.7%	9.7%	-45.3%	-100.0%	-13.6%	40.7%	-51.9%	-7.9%	NA	-62.3%
2016 vs 2017	-43.4%	-0.7%	12.5%	14.7%	0.0%	-1.2%	6.2%	6.3%	-16.5%	NA	-13.5%

3.9. Other heavy metals (As, Cr, Cu, Ni, Se, Zn)

Emissions of other heavy metals (As, Cr, Cu, Ni, Se and Zn) Croatia voluntary reports as an additional air pollutants.

A group of other heavy metals included Arsenic (As), Chrome (Cr), Copper (Cu), Nickel (Ni), Selenium (Se) and Zinc (Zn). Sources of their emissions are different, e.g. the emission of arsenic, chromium and nickel occur because of their presence (trace) in the solid fuel and heavy fuel oil, and partly in the composition of the individual input materials in manufacturing processes such as glass, iron and steel. Copper is mostly emitted as a result of tire and brake wear, zinc is mostly emitted as a result of biomass combustion in residential sector, while selenium is emitted due to their presence (in trace) in raw materials for e.g. glass and mineral wool production.

3.9.1. Arsenic (As)

The arsenic emission in 2017 was estimated to 0.52 t (Figure 3.9.1-1 and Table 3.9.1-1). Emission has decreased by 94 % since 1990 and increased by 28.9% since year before. The Energy sector is a significant source of arsenic in 2017 (89 %). From non-energy sectors, the Industry production and product use has dominance and contributed with 10.7 % to As emission in 2017 (glass production and steel production with less extent). Arsenic emissions originate from the As content in raw materials and in fuels.

Industrial processes and steelmaking activity in open hearth furnace steel plant was the key source in As emission in 1990. Stopping the steelmaking activity in Siemens-Marten furnace in Sisak, 1992 has resulted with great decline of As emissions. Stopping the process was a result of the war for Croatian independence (1991 – 1995). The war has also caused a decrease in fuel consumption and other production activities in industrial processes and product use sector.

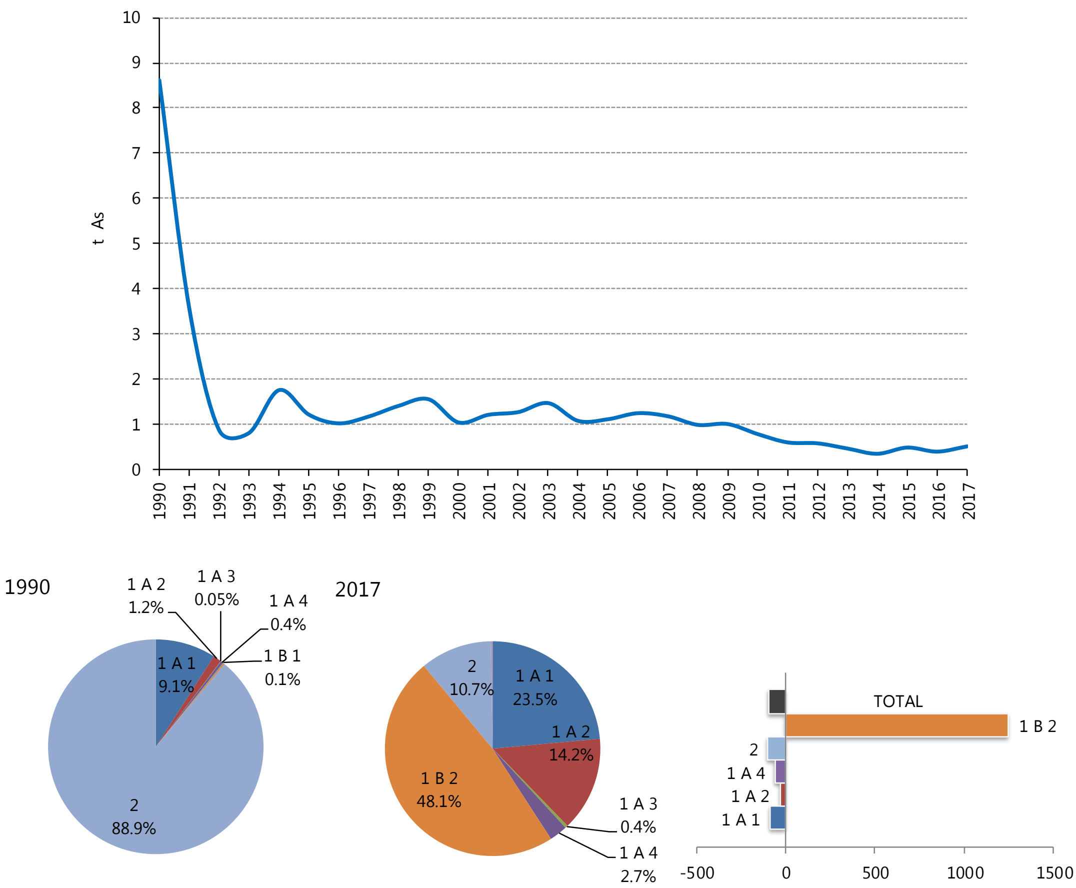


Figure 3.9.1-1 The As emissions (t/yr.) and percentage share by sector and variation in As emissions

Table 3.9.1-1 The As emissions by SNAP nomenclature in the period 1990-2017

As											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	0.78	3.2E-02	0.11	7.67	NA	9.4E-04	2.6E-04	3.9E-03	3.2E-03	NA	8.60
1991	0.58	2.3E-02	0.07	2.89	NA	9.4E-04	2.0E-04	3.4E-03	2.2E-03	NA	3.57
1992	0.74	1.7E-02	0.06	0.04	NA	9.4E-04	1.8E-04	7.6E-03	3.6E-03	NA	0.87
1993	0.69	2.0E-02	0.05	0.05	NA	9.4E-04	1.8E-04	8.5E-03	2.2E-03	NA	0.81
1994	1.28	1.6E-02	0.06	0.40	NA	9.4E-04	2.0E-04	1.3E-03	2.7E-03	NA	1.76
1995	0.74	1.7E-02	0.05	0.40	NA	1.6E-03	2.1E-04	5.2E-03	3.2E-03	NA	1.22
1996	0.61	1.9E-02	0.05	0.33	NA	2.4E-03	2.3E-04	1.2E-02	3.2E-03	NA	1.02
1997	0.75	1.8E-02	0.06	0.34	NA	2.3E-03	2.5E-04	8.7E-03	3.0E-03	NA	1.18
1998	0.94	1.8E-02	0.07	0.38	NA	1.6E-03	2.7E-04	3.3E-03	3.2E-03	NA	1.43
1999	0.99	1.9E-02	0.08	0.47	NA	1.3E-03	2.8E-04	2.6E-03	3.3E-03	NA	1.57
2000	0.48	1.6E-02	0.12	0.47	NA	9.4E-04	2.9E-04	2.0E-03	3.3E-03	NA	1.09
2001	0.60	1.6E-02	0.13	0.47	NA	2.2E-03	2.8E-04	3.4E-03	3.1E-03	NA	1.21
2002	0.60	1.7E-02	0.12	0.52	NA	1.1E-02	2.9E-04	6.1E-03	2.9E-03	NA	1.27
2003	0.83	1.9E-02	0.12	0.47	NA	1.5E-02	3.0E-04	5.8E-03	3.2E-03	NA	1.47
2004	0.46	1.7E-02	0.14	0.45	NA	8.2E-03	3.0E-04	1.2E-03	2.8E-03	NA	1.08
2005	0.54	1.8E-02	0.15	0.39	NA	3.7E-03	3.0E-04	1.3E-03	2.8E-03	NA	1.12
2006	0.56	1.7E-02	0.18	0.48	NA	2.8E-03	3.1E-04	1.4E-03	2.8E-03	NA	1.25
2007	0.59	1.5E-02	0.10	0.46	NA	2.0E-03	3.3E-04	1.4E-03	2.8E-03	NA	1.18
2008	0.55	1.5E-02	0.10	0.32	NA	1.4E-03	3.1E-04	2.7E-03	2.7E-03	NA	0.99
2009	0.57	1.6E-02	0.09	0.33	NA	6.1E-04	3.1E-04	2.2E-03	2.6E-03	NA	1.01
2010	0.22	1.7E-02	0.08	0.47	NA	2.4E-04	3.0E-04	2.8E-03	2.2E-03	NA	0.79
2011	0.26	1.6E-02	0.06	0.26	NA	2.1E-04	3.0E-04	2.7E-03	2.5E-03	NA	0.60
2012	0.20	1.5E-02	0.06	0.30	NA	1.4E-05	2.8E-04	2.7E-03	2.4E-03	NA	0.58
2013	0.13	1.5E-02	0.07	0.24	NA	1.9E-03	2.8E-04	1.6E-03	2.2E-03	NA	0.47
2014	0.11	1.3E-02	0.07	0.15	NA	1.4E-03	2.7E-04	1.7E-03	1.7E-03	NA	0.35
2015	0.15	1.4E-02	0.07	0.25	NA	1.3E-03	2.8E-04	1.7E-03	1.8E-03	NA	0.49
2016	0.12	1.4E-02	0.07	0.20	NA	1.7E-03	2.8E-04	1.7E-03	1.9E-03	NA	0.40
2017	0.12	1.4E-02	0.07	0.30	NA	1.8E-03	3.0E-04	1.8E-03	1.8E-03	NA	0.52
2017 vs 1990	-84.4%	-55.8%	-31.7%	-96.1%	NA	90.3%	11.6%	-53.2%	-41.5%	NA	-94.0%
2016 vs 2017	4.9%	-1.1%	11.3%	51.6%	NA	5.6%	3.7%	6.0%	-3.3%	NA	28.9%

3.9.2. Chromium (Cr)

The chromium emission in 2017 was amounted to 2.1 t (Figure 3.9.2-1 and Table 3.9.2-1). The Cr emission has decreased by 59.7 % since 1990 mostly due to reducing the consumption of heavy fuel oil in stationary energy sectors and simultaneously increasing consumption of natural gas.

The great reduction in Cr emission (by 92.3%) in comparison to 1990, was happened in Industrial processes and product use sector, due to stopping the process of pig iron production (blast furnace charging) in Sisak and Split in 1992 and steel production in the open hearth furnace steel plant (Siemens Martin' furnaces) in Sisak, 1992. Stopping these processes were a result of the war for the Croatian independence (1991 – 1995). About 8.3% of Cr emissions in 2017 originated from the public electricity and heat production sector whereas the impact of this sector in the nineties was significantly higher (36.2% in 1990). The annual Cr emissions from this source show long-term trend fluctuations between 1990 and 2017 which mostly depends on the type of fuel. Higher consumption of biomass, solid fuel and heavy fuel oil leads to higher Cr emissions. Small peak in 2015 is the result of an increase in biomass consumption in the residential sector.

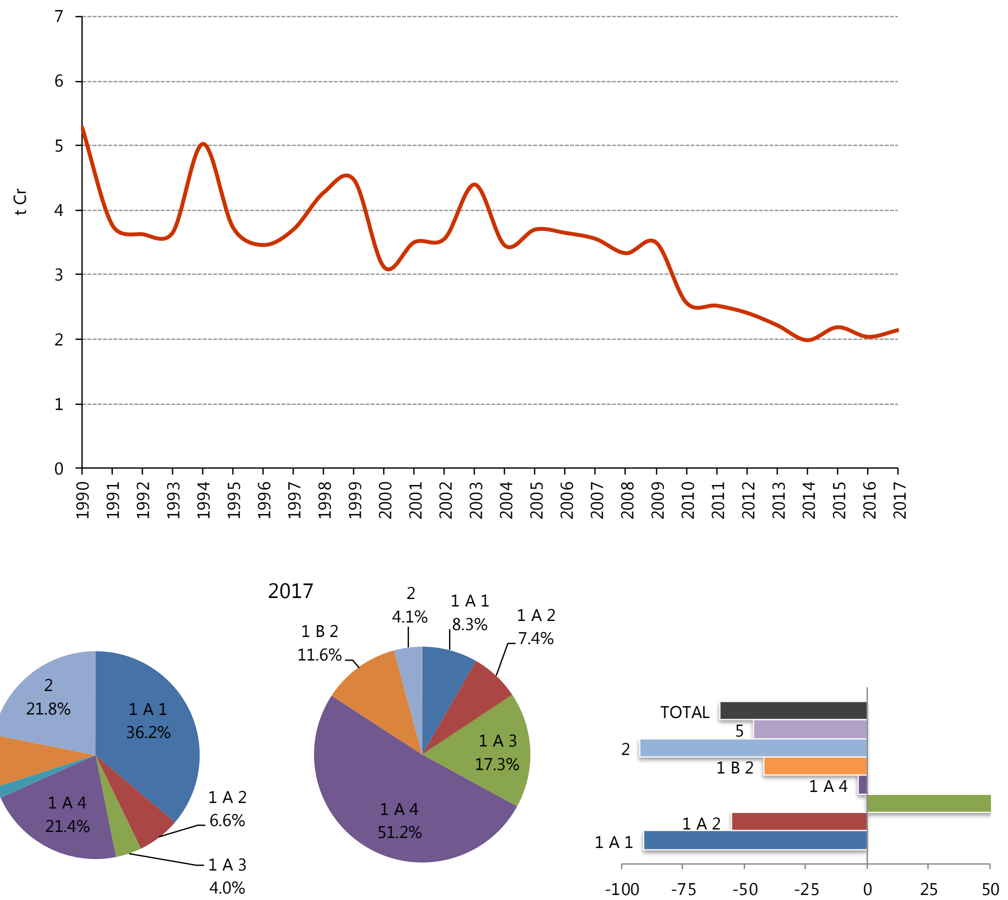


Figure 3.9.2-1 The Cr emissions (t/yr.) and percentage share by sector and variation in Cr emissions

Table 3.9.2-1 The Cr emissions by SNAP nomenclature in the period 1990-2017

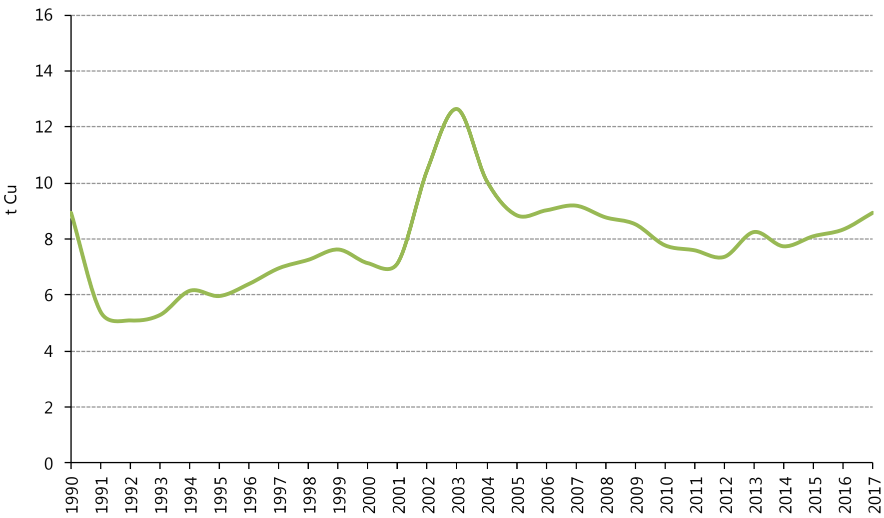
Cr											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	1.92	1.12	0.34	1.7	NA	1.1E-02	0.20	2.6E-02	7.7E-03	NA	5.3
1991	1.42	1.21	0.24	0.72	NA	1.1E-02	0.15	2.0E-02	5.5E-03	NA	3.8
1992	1.81	1.10	0.19	0.34	NA	1.1E-02	0.15	1.6E-02	6.6E-03	NA	3.6
1993	1.70	1.17	0.17	0.42	NA	1.1E-02	0.16	1.7E-02	5.8E-03	NA	3.7
1994	3.25	1.04	0.17	0.37	NA	1.1E-02	0.17	1.3E-02	6.2E-03	NA	5.0
1995	1.92	1.10	0.16	0.33	NA	1.9E-02	0.18	1.6E-02	7.5E-03	NA	3.7
1996	1.54	1.24	0.16	0.27	NA	2.8E-02	0.20	2.3E-02	7.0E-03	NA	3.5
1997	1.84	1.15	0.18	0.27	NA	2.8E-02	0.22	1.9E-02	6.9E-03	NA	3.7
1998	2.37	1.12	0.22	0.34	NA	1.9E-02	0.23	1.6E-02	7.5E-03	NA	4.3
1999	2.51	1.13	0.21	0.38	NA	1.5E-02	0.25	1.6E-02	8.0E-03	NA	4.5
2000	1.15	1.00	0.30	0.50	NA	1.1E-02	0.25	1.7E-02	8.4E-03	NA	3.2
2001	1.41	1.08	0.30	0.44	NA	2.6E-02	0.22	2.0E-02	8.0E-03	NA	3.5
2002	1.39	1.04	0.27	0.45	NA	1.3E-01	0.25	2.2E-02	7.1E-03	NA	3.6
2003	1.97	1.20	0.30	0.46	NA	1.8E-01	0.27	2.3E-02	7.0E-03	NA	4.4
2004	1.06	1.16	0.33	0.50	NA	9.7E-02	0.28	1.8E-02	6.3E-03	NA	3.5
2005	1.25	1.22	0.36	0.52	NA	4.3E-02	0.29	1.9E-02	6.3E-03	NA	3.7
2006	1.29	1.12	0.44	0.44	NA	3.3E-02	0.31	2.0E-02	6.3E-03	NA	3.6
2007	1.35	1.07	0.24	0.51	NA	2.3E-02	0.33	2.1E-02	6.6E-03	NA	3.6
2008	1.25	1.07	0.22	0.42	NA	1.6E-02	0.32	2.5E-02	6.1E-03	NA	3.3
2009	1.32	1.12	0.21	0.50	NA	7.1E-03	0.33	2.1E-02	6.4E-03	NA	3.5
2010	0.43	1.19	0.20	0.40	NA	2.8E-03	0.32	2.1E-02	3.9E-03	NA	2.6

Cr											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
2011	0.52	1.16	0.16	0.34	NA	2.4E-03	0.31	2.0E-02	4.7E-03	NA	2.5
2012	0.40	1.15	0.17	0.35	NA	1.7E-04	0.31	1.9E-02	5.0E-03	NA	2.4
2013	0.22	1.14	0.17	0.31	NA	2.3E-02	0.32	1.7E-02	4.6E-03	NA	2.2
2014	0.17	1.00	0.16	0.29	NA	1.6E-02	0.31	1.7E-02	4.2E-03	NA	2.0
2015	0.23	1.15	0.14	0.29	NA	1.6E-02	0.33	1.7E-02	5.0E-03	NA	2.2
2016	0.12	1.12	0.13	0.29	NA	2.0E-02	0.34	1.7E-02	5.5E-03	NA	2.0
2017	0.18	1.08	0.15	0.31	NA	2.1E-02	0.37	1.7E-02	3.8E-03	NA	2.1
2016 vs 1990	-90.8%	-3.5%	-55.6%	-81.2%	NA	90.3%	79.5%	-35.4%	-50.4%	NA	-59.7%
2016 vs 2015	45.1%	-2.9%	18.3%	9.6%	NA	5.6%	8.8%	0.8%	-30.9%	NA	5.1%

3.9.3. Copper (Cu)

The Cu emissions in 2017 have amounted to 8.94 t (Figure and Table 3.9.3-1). The Transport sector (mostly automobile tire and brake wear) contributes with 78.5% in 2017 and has the domination in the national copper emission in Croatia.

Emission of copper is currently at the same level as in 1990. Great decline happened in 1991, as a consequence of the war for Croatian independence (1991 – 1995). After decline period, the Cu emission has long-term increase period, mostly due to constant increase of road vehicle population and annual mileage, what leads to higher automobile tire and brake wear. The period of high emissions from 2002 to 2005 with a peak in 2003 was the result of the increasing trend of use of fireworks and signalling rockets (NFR 2.G, SNAP 060601).



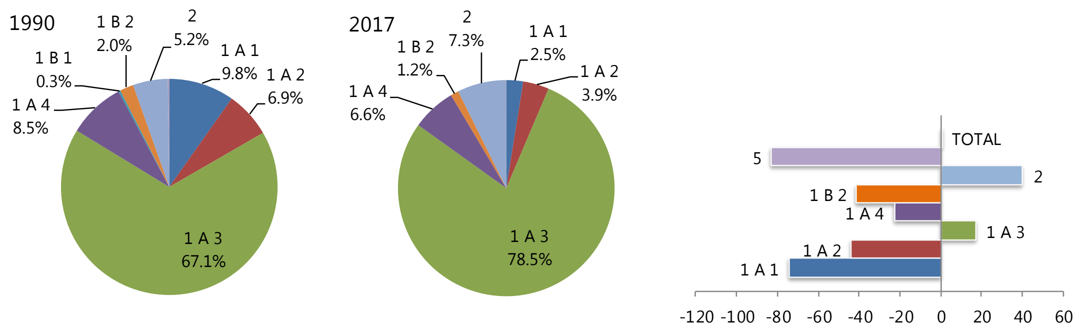


Figure 3.9.3-1 The Cu emissions (t/yr.) and percentage share by sector and variation in Cu emissions

Table 3.9.3-1 The Cu emissions by SNAP nomenclature in the period 1990-2017

Cu										
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	0.87	0.40	0.38	0.29	NA	0.38	5.88	0.70	0.02	NA	8.9
1991	0.64	0.38	0.25	0.18	NA	0.38	3.01	0.53	0.02	NA	5.4
1992	0.80	0.31	0.20	0.12	NA	0.38	2.95	0.30	0.02	NA	5.1
1993	0.75	0.33	0.17	0.16	NA	0.38	3.21	0.27	0.02	NA	5.3
1994	1.35	0.29	0.18	0.14	NA	0.34	3.43	0.40	0.02	NA	6.1
1995	0.83	0.30	0.16	0.13	NA	0.60	3.55	0.36	0.02	NA	6.0
1996	0.69	0.34	0.16	0.10	NA	0.85	3.83	0.39	0.02	NA	6.4
1997	0.81	0.31	0.17	0.10	NA	0.84	4.30	0.38	0.03	NA	7.0
1998	1.02	0.31	0.19	0.13	NA	0.60	4.55	0.45	0.03	NA	7.3
1999	1.08	0.31	0.21	0.15	NA	0.51	4.90	0.46	0.03	NA	7.6
2000	0.57	0.28	0.25	0.20	NA	0.39	4.92	0.54	0.03	NA	7.2
2001	0.68	0.29	0.27	0.18	NA	0.83	4.29	0.57	0.04	NA	7.1
2002	0.69	0.28	0.26	0.18	NA	3.78	4.71	0.55	0.03	NA	10.5
2003	0.93	0.33	0.25	0.18	NA	5.20	5.14	0.59	0.03	NA	12.7
2004	0.56	0.31	0.28	0.19	NA	2.83	5.30	0.58	0.02	NA	10.1
2005	0.64	0.33	0.29	0.20	NA	1.31	5.44	0.61	0.02	NA	8.9
2006	0.65	0.30	0.34	0.17	NA	1.00	5.89	0.65	0.03	NA	9.0
2007	0.69	0.29	0.26	0.20	NA	0.73	6.33	0.67	0.03	NA	9.2
2008	0.63	0.29	0.24	0.16	NA	0.54	6.13	0.77	0.02	NA	8.8
2009	0.65	0.30	0.21	0.19	NA	0.26	6.22	0.67	0.03	NA	8.5
2010	0.30	0.32	0.22	0.15	NA	0.15	6.00	0.62	0.01	NA	7.8
2011	0.36	0.31	0.18	0.12	NA	0.13	5.87	0.61	0.01	NA	7.6
2012	0.30	0.31	0.18	0.13	NA	0.07	5.80	0.56	0.02	NA	7.4
2013	0.22	0.30	0.19	0.11	NA	0.70	6.16	0.55	0.01	NA	8.2
2014	0.20	0.27	0.19	0.09	NA	0.51	5.92	0.54	0.01	NA	7.7
2015	0.24	0.30	0.18	0.10	NA	0.49	6.24	0.53	0.01	NA	8.1
2016	0.23	0.29	0.17	0.10	NA	0.61	6.39	0.53	0.01	NA	8.3
2017	0.22	0.29	0.19	0.11	NA	0.65	6.94	0.53	0.00	NA	8.9
2017 vs 1990	-74.3%	-29.1%	-49.9%	-62.7%	NA	70.5%	18.0%	-24.3%	-78.8%	NA	0.0%
2016 vs 2017	-2.9%	-2.7%	12.5%	12.4%	NA	6.0%	8.6%	0.3%	-56.0%	NA	7.2%

3.9.4. Nickel (Ni)

Emission of nickel in 2017 amounted to 6.2 t (Figure and Table 3.9.4-1). The Ni emission has declined by 28.9 %, since 1990. Majority of Ni emissions in historical trend originate from the public electricity and heat production sector (68.2 % in 1990 and 73.8 % in 2017). The historical trend of Ni emission from this source category shows long-term fluctuations between which mostly depend on the type of fuel. Higher consumption of solid fuel and heavy fuel oil leads to higher Ni emissions and vice versa. Decline in Ni emission in 1991 was as a consequence of the war Croatian independence (1991 – 1995). In that period of time there was a reduction in fossil fuel consumptions and stopping the production of steel in the open hearth furnace steel plant (Siemens Martin' furnaces) in Sisak, 1992. In recent years (since 2010) the trend recorded continuous reduction of Ni emission, as a result of the decreasing use of coal as a fuel in general consumption sector (mainly residential).

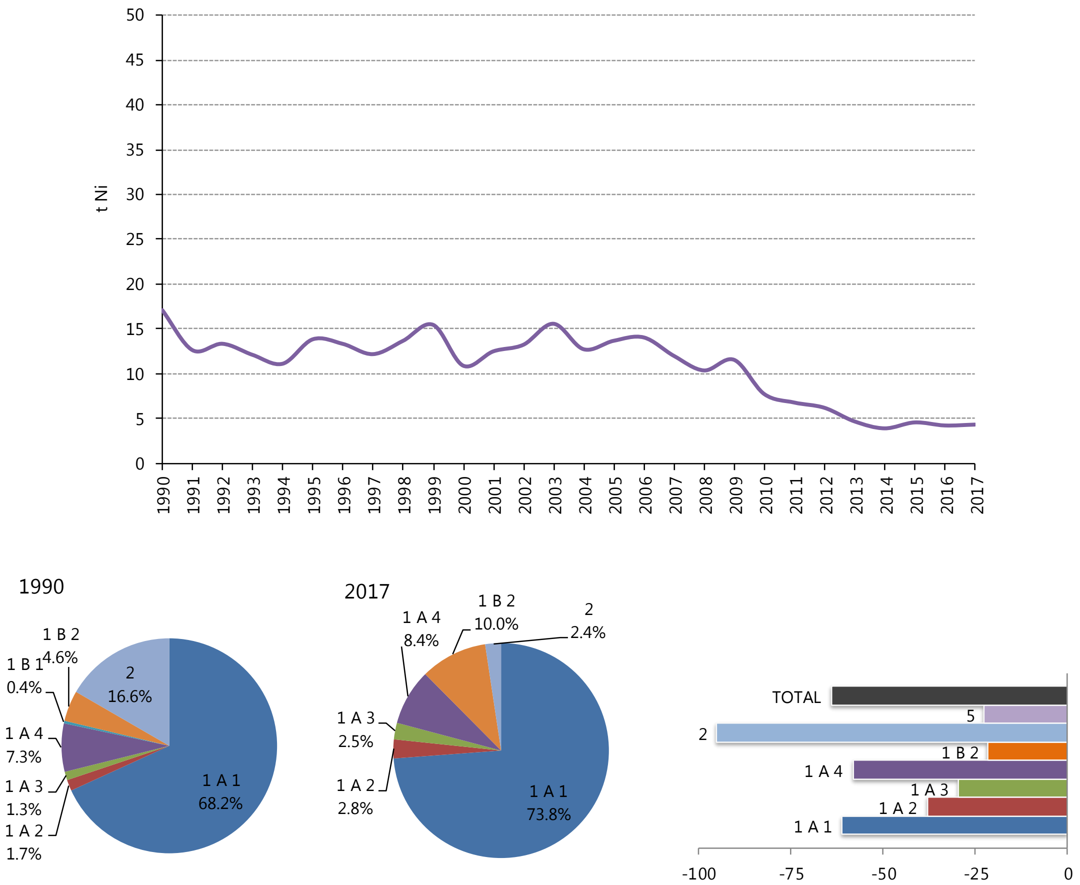


Figure 3.9.4-1The Ni emissions (t/yr.) and percentage share by sector and variation in Ni emissions

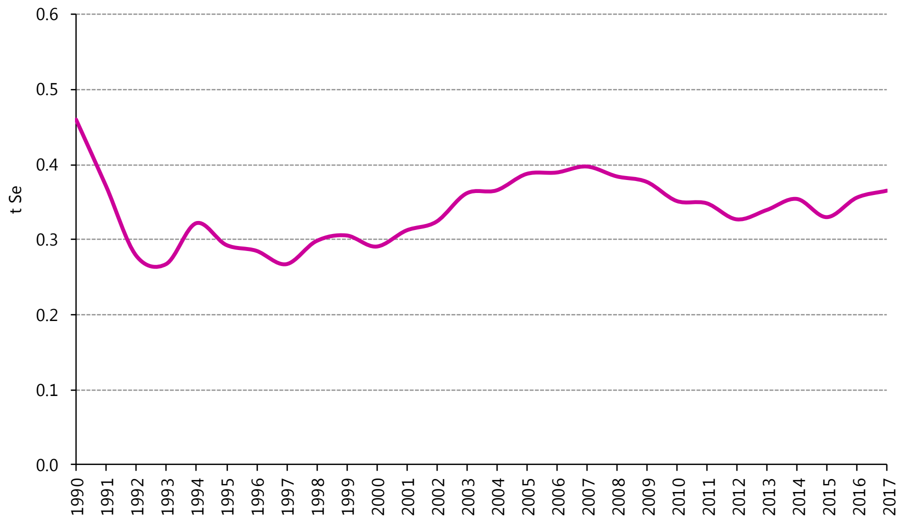
Table 3.9.4-1 The Ni emissions by SNAP nomenclature in the period 1990-2017

Ni											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	11.6	1.22	0.27	3.63	NA	0.05	0.11	0.13	7.5E-03	NA	17.1
1991	9.7	0.81	0.17	1.75	NA	0.05	0.03	0.14	5.5E-03	NA	12.6
1992	11.1	1.08	0.14	0.62	NA	0.05	0.03	0.34	5.0E-03	NA	13.3
1993	9.5	1.21	0.12	0.75	NA	0.05	0.03	0.39	5.7E-03	NA	12.1
1994	9.1	0.97	0.13	0.76	NA	0.03	0.03	0.06	5.6E-03	NA	11.1
1995	11.6	1.02	0.11	0.74	NA	0.07	0.04	0.24	6.7E-03	NA	13.8
1996	10.6	1.35	0.11	0.61	NA	0.08	0.04	0.55	6.0E-03	NA	13.3
1997	9.6	1.28	0.12	0.62	NA	0.08	0.04	0.40	6.1E-03	NA	12.2
1998	11.5	0.94	0.76	0.78	NA	0.07	0.05	0.15	6.4E-03	NA	14.3
1999	13.0	1.25	0.74	0.86	NA	0.07	0.05	0.11	6.9E-03	NA	16.0
2000	8.4	1.09	1.87	1.07	NA	0.06	0.05	0.09	7.1E-03	NA	12.6

Ni											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
2001	8.5	0.95	1.74	0.96	NA	0.10	0.05	0.16	6.7E-03	NA	12.5
2002	9.1	1.01	1.44	0.98	NA	0.30	0.05	0.28	6.1E-03	NA	13.2
2003	11.0	1.07	1.74	0.99	NA	0.40	0.05	0.26	6.1E-03	NA	15.6
2004	8.3	1.00	2.02	1.09	NA	0.22	0.05	0.05	5.8E-03	NA	12.7
2005	8.9	0.94	2.52	1.10	NA	0.12	0.06	0.05	5.8E-03	NA	13.7
2006	8.6	0.82	3.40	0.97	NA	0.10	0.06	0.06	5.8E-03	NA	14.0
2007	9.4	0.70	0.54	1.11	NA	0.08	0.07	0.06	6.4E-03	NA	12.0
2008	7.8	0.68	0.65	0.93	NA	0.07	0.06	0.12	5.8E-03	NA	10.3
2009	9.0	0.66	0.68	1.03	NA	0.04	0.06	0.08	6.3E-03	NA	11.5
2010	5.7	0.64	0.25	0.92	NA	0.04	0.06	0.12	3.1E-03	NA	7.7
2011	5.1	0.59	0.14	0.75	NA	0.04	0.06	0.11	3.9E-03	NA	6.7
2012	4.5	0.51	0.17	0.73	NA	0.03	0.06	0.11	4.3E-03	NA	6.2
2013	3.1	0.45	0.20	0.68	NA	0.07	0.06	0.06	4.0E-03	NA	4.6
2014	2.4	0.36	0.25	0.67	NA	0.05	0.06	0.06	4.4E-03	NA	3.9
2015	3.1	0.42	0.14	0.68	NA	0.05	0.06	0.06	5.2E-03	NA	4.5
2016	2.9	0.41	0.13	0.59	NA	0.06	0.06	0.06	5.9E-03	NA	4.2
2017	2.9	0.40	0.14	0.68	NA	0.07	0.07	0.06	3.5E-03	NA	4.3
2017 vs 1990	-75.4%	-67.7%	-47.8%	-81.4%	NA	20.6%	-35.0%	-54.0%	-53.3%	NA	-74.9%
2016 vs 2017	0.1%	-3.0%	11.5%	13.8%	NA	7.7%	8.0%	3.9%	-41.0%	NA	2.3%

3.9.5. Selenium (Se)

Emission of selenium was amounted to 0.33 t in 2017 (Figure and Table 3.9.5-1) and was reduced by 28.9 % since 1990. The dominant sector in the selenium emission is Industrial processes and product use sector. It has contributed with 55.6 % in 2017, and in 1990 with 47.9 % in total Se emission. The domination within that sector has glass production activity, due to the metal content in the raw material. That activity has recorded a decreasing trend in recent years, as a result of economic crisis since 2007. In 2017, about 17.5 % of Se emissions originated from fuel combustion in manufacturing industry and construction, and 10.7 % from the public electricity and heat production.



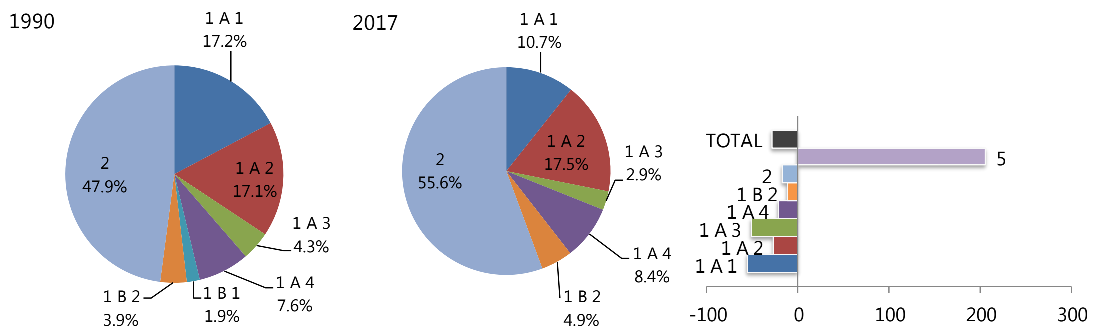


Figure 3.9.5-1 The Se emissions (t/yr.) and percentage share by sector and variation in Se emissions

Table 3.9.5-1 The Se emissions by SNAP nomenclature in the period 1990-2017

Se											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	7.9E-02	3.3E-02	7.7E-02	0.25	NA	NA	1.5E-02	8.5E-03	3.6E-05	NA	0.46
1991	5.9E-02	3.1E-02	5.0E-02	0.22	NA	NA	2.9E-03	6.4E-03	4.2E-05	NA	0.37
1992	6.5E-02	2.5E-02	4.8E-02	0.13	NA	NA	2.8E-03	6.8E-03	5.0E-05	NA	0.28
1993	6.3E-02	2.7E-02	4.1E-02	0.13	NA	NA	3.0E-03	6.3E-03	6.0E-05	NA	0.27
1994	9.1E-02	2.3E-02	5.0E-02	0.15	NA	NA	3.2E-03	4.2E-03	6.5E-05	NA	0.32
1995	6.8E-02	2.4E-02	4.1E-02	0.15	NA	NA	3.3E-03	5.5E-03	6.5E-05	NA	0.29
1996	6.7E-02	2.7E-02	4.2E-02	0.14	NA	NA	3.6E-03	8.3E-03	7.1E-05	NA	0.29
1997	6.8E-02	2.5E-02	4.8E-02	0.12	NA	NA	4.0E-03	6.8E-03	7.3E-05	NA	0.27
1998	7.7E-02	2.5E-02	5.1E-02	0.14	NA	NA	4.3E-03	5.6E-03	6.9E-05	NA	0.30
1999	8.0E-02	2.5E-02	6.2E-02	0.13	NA	NA	4.6E-03	5.4E-03	6.8E-05	NA	0.31
2000	5.5E-02	2.2E-02	6.9E-02	0.14	NA	NA	4.7E-03	5.8E-03	6.5E-05	NA	0.29
2001	5.7E-02	2.4E-02	7.8E-02	0.14	NA	NA	4.3E-03	6.4E-03	6.4E-05	NA	0.31
2002	6.2E-02	2.3E-02	7.6E-02	0.15	NA	NA	4.6E-03	7.2E-03	7.0E-05	NA	0.32
2003	7.5E-02	2.7E-02	7.5E-02	0.17	NA	NA	5.0E-03	7.4E-03	7.3E-05	NA	0.36
2004	5.6E-02	2.6E-02	8.0E-02	0.19	NA	NA	5.2E-03	6.0E-03	7.3E-05	NA	0.37
2005	5.9E-02	2.7E-02	8.3E-02	0.21	NA	NA	5.4E-03	6.5E-03	7.8E-05	NA	0.39
2006	5.8E-02	2.5E-02	8.9E-02	0.20	NA	NA	5.8E-03	6.8E-03	7.8E-05	NA	0.39
2007	6.3E-02	2.4E-02	8.7E-02	0.21	NA	NA	6.3E-03	7.1E-03	8.6E-05	NA	0.40
2008	5.2E-02	2.4E-02	8.2E-02	0.21	NA	NA	6.1E-03	8.5E-03	8.4E-05	NA	0.38
2009	5.8E-02	2.5E-02	6.8E-02	0.21	NA	NA	6.1E-03	8.2E-03	8.6E-05	NA	0.38
2010	4.0E-02	2.7E-02	6.6E-02	0.21	NA	NA	5.9E-03	7.2E-03	8.9E-05	NA	0.35
2011	4.0E-02	2.6E-02	5.8E-02	0.21	NA	NA	5.8E-03	7.2E-03	9.1E-05	NA	0.35
2012	3.5E-02	2.6E-02	5.6E-02	0.20	NA	NA	5.7E-03	6.8E-03	9.2E-05	NA	0.33
2013	2.6E-02	2.5E-02	6.1E-02	0.21	NA	NA	5.9E-03	6.8E-03	9.4E-05	NA	0.34
2014	2.4E-02	2.2E-02	6.3E-02	0.23	NA	NA	5.7E-03	7.0E-03	1.0E-04	NA	0.35
2015	2.8E-02	2.6E-02	6.1E-02	0.20	NA	NA	6.1E-03	6.9E-03	1.1E-04	NA	0.33
2016	2.7E-02	2.5E-02	5.8E-02	0.23	NA	NA	6.2E-03	6.9E-03	1.1E-04	NA	0.36
2017	2.6E-02	2.4E-02	6.5E-02	0.24	NA	NA	6.7E-03	7.2E-03	1.1E-04	NA	0.37
2017 vs 1990	-67.5%	-25.9%	-16.3%	-4.4%	NA	NA	-54.6%	-15.2%	212.5%	NA	-20.6%
2016 vs 2017	-6.4%	-2.5%	12.4%	1.6%	NA	NA	8.4%	3.6%	6.6%	NA	2.6%

3.9.6. Zinc (Zn)

The zinc emission in 2017 has amounted to 35.2 t (Figure and Table 3.9.6-1) and has decreased by 10.2 % since 1990. The major sources of Zn emission in Croatia is fuel combustion in energy sector which has contributed with 99.6 % to national total in 2017. Key sources in 2017 were: Small combustion and mobile machinery sector (71.5 %), Transport (15.8 %) and Manufacturing industry and construction (7.6 %). Zinc is mostly emitted as a result of biomass combustion in residential sector, due to its content in wood.

The historic trend of Zn emission shows a decline because of stopping the steel production in the open hearth furnace steel plant in 1992. Those emission originated from Zn content in the raw material for Siemens Martin' furnaces. Stopping that process in Sisak in 1992, was a result of the war for Croatian independence (1991-1995).

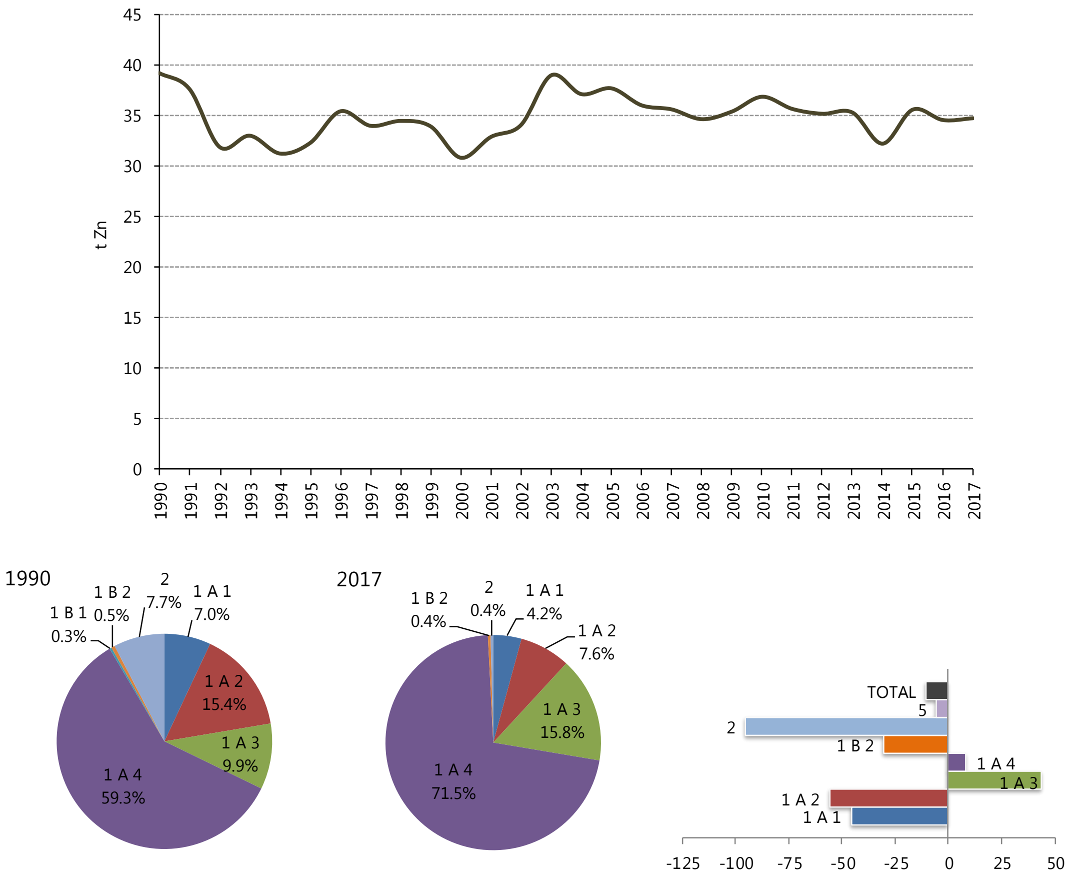


Figure 3.9.6-1 The Zn emissions (t/yr.) and percentage share by sector and variation in Zn emissions

Table 3.9.6-1 The Zn emissions by SNAP nomenclature in the period 1990-2017

Zn											
SNAP	1	2	3	4	5	6	7	8	9	10	TOTAL
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	2.7	23.0	5.9	3.1	NA	0.22	3.7	0.5	0.05	NA	39.2
1991	2.0	26.4	4.3	1.5	NA	0.21	2.8	0.4	0.04	NA	37.6
1992	2.1	22.7	3.4	0.6	NA	0.22	2.7	0.2	0.03	NA	31.9
1993	2.1	24.0	3.1	0.5	NA	0.21	2.8	0.2	0.04	NA	33.0
1994	2.7	21.6	2.9	0.5	NA	0.20	3.0	0.3	0.04	NA	31.2
1995	2.4	22.8	2.9	0.3	NA	0.35	3.2	0.2	0.04	NA	32.3
1996	2.4	25.6	2.8	0.3	NA	0.50	3.5	0.3	0.04	NA	35.4
1997	2.3	23.5	3.2	0.4	NA	0.49	3.9	0.3	0.04	NA	34.0
1998	2.4	23.6	3.1	0.5	NA	0.34	4.1	0.3	0.04	NA	34.5
1999	2.5	23.2	2.8	0.5	NA	0.29	4.4	0.3	0.05	NA	33.9
2000	1.9	20.6	2.8	0.5	NA	0.22	4.4	0.3	0.05	NA	30.9
2001	1.9	22.6	2.8	0.4	NA	0.48	4.3	0.4	0.05	NA	32.9
2002	2.1	21.7	2.8	0.3	NA	2.21	4.6	0.4	0.04	NA	34.1
2003	2.3	25.0	2.9	0.4	NA	3.04	5.0	0.4	0.04	NA	39.0

Zn											
SNAP	1	2	3	4	5	6	7	8	9	10	TOTAL
Unit	t	t	t	t	t	t	t	t	t	t	t
2004	2.0	24.3	3.1	0.6	NA	1.65	5.1	0.4	0.04	NA	37.1
2005	2.0	25.7	3.0	0.5	NA	0.76	5.3	0.4	0.04	NA	37.7
2006	1.9	23.6	3.3	0.5	NA	0.58	5.6	0.4	0.04	NA	36.0
2007	2.1	22.8	3.2	0.5	NA	0.42	6.0	0.4	0.04	NA	35.6
2008	1.7	22.9	2.7	0.7	NA	0.31	5.9	0.5	0.04	NA	34.6
2009	1.9	23.9	2.6	0.4	NA	0.15	5.9	0.4	0.04	NA	35.4
2010	1.5	25.7	2.9	0.6	NA	0.08	5.7	0.4	0.02	NA	36.9
2011	1.7	25.0	2.4	0.5	NA	0.07	5.5	0.4	0.03	NA	35.7
2012	1.5	25.0	2.6	0.2	NA	0.03	5.5	0.4	0.03	NA	35.2
2013	1.1	24.8	2.5	0.4	NA	0.40	5.6	0.4	0.03	NA	35.3
2014	1.2	21.9	2.2	0.8	NA	0.29	5.5	0.4	0.03	NA	32.2
2015	1.4	25.1	1.9	0.7	NA	0.28	5.8	0.4	0.04	NA	35.6
2016	1.6	24.3	1.7	0.3	NA	0.35	5.9	0.4	0.04	NA	34.6
2017	1.6	23.6	2.1	0.3	NA	0.38	6.3	0.4	0.03	NA	34.7
2017 vs 1990	-41.5%	2.7%	-65.0%	-89.6%	NA	73.0%	70.9%	-27.3%	-51.0%	NA	-11.4%
2016 vs 2017	-0.9%	-2.9%	23.0%	17.5%	NA	5.9%	7.6%	2.0%	-37.6%	NA	0.5%

3.10. Persistent organic pollutants (POPs)

Persistent organic pollutants (POPs) are organic substances with toxic properties, resistant to chemical, photochemical, and biochemical degradation. They can accumulate in the fatty tissues of living organisms and are toxic to humans and wildlife. They also remain stable in the environment for a long period of time and can distribute easily through air, water and across the national border and can be deposited far from their place of their release.

With the aim for POPs emissions reductions, the Executive Body adopted the Protocol on Persistent Organic Pollutants on June 1998 in Aarhus (Denmark) in the framework of LRTAP Convention for urgent global actions to control, reduce and eliminate emissions of these chemicals. Annual reduction of POPs (polycyclic aromatic hydrocarbons (PAHs), Dioxins/furans, and hexachlorocyclohexane) emissions from a specified reference year achieved by taking appropriate effective measures is one of the Protocols basic obligation for countries that are Parties to the Protocol. Each Party should develop and maintain emission inventories for these substances.

In 1996, the Republic of Croatia has started to calculate estimate the POPs emissions in accordance with EMEP/CORINAIR methodology, officially adopted by the Executive Body of the LARTAP Convention. Persistent organic pollutants are divided into three groups: industrial chemicals, polycyclic aromatic hydrocarbons and dioxins and furans (Table 3.10-1). Reporting for HCH – Hexachlorocyclohexane (lindan) emissions is excluded from the obligation to report since 2015.

Table 3.10-1 Persistent organic pollutants (POPs)

Group	POPs
Dioxins and furans (PCDD/PCDF)	PCDD – polychlorinated dibenzo-dioxins
	PCDF – polychlorinated dibenzo-furans
Polycyclic aromatic hydrocarbons (PAHs)	Benzo(a) pyrene
	Benzo(b) fluoranthene
	Benzo(k) fluoranthene
	Indeno(1,2,3-cd) pyrene
Industrial chemicals or by-product of the chemical synthesis	HCB – Hexachlorobenzene
	PCBs – Polychlorinated biphenyls

3.10.1. Dioxin and furans (PCDD/PCDF)

Dioxins and furans are persistent organic compounds that occur as a product of combustion of organic matter that contains chlorine (Cl) at temperatures between 250°C and 400°C and can occur in all sectors. The largest emission of dioxins and furans occur when burning wood in households. Other processes that contribute to these emissions are the processes of steel production in arc furnaces, fuel combustion in transport sectors, waste incineration and cremation.

In 2017, PCDD/F emission has amounted to 16.2 g I- TEQ (Figure and Table 3.10.1-1). Emission has decreased by 66.6 % since 1990. The main contributor in PCDD/F emission during historic period is fuel combustion in energy sector. A key sources in 2017 were small combustion sector with domination of combustion in residential sector (75 % of total PCDD/F emission). Fluctuations in the trend are directly dependent on the amount of biomass use in small furnaces, fuel combustion in other energy sectors and on the amount of waste incinerated. A reduction in emissions in 1991 and 1992 is the result of reduced energy consumption in these sectors in particular biomass and coal, due to the war for Croatian independence (1991 - 1995). A significant reduction since 2005 is a result of gradual replacement of certain percentage of traditional domestic stoves and manual single house boilers with advanced/ecolabelled stoves and boilers and pellet stoves and boilers (see Table 4.5-1, Figure 4.5-2).

Croatia has the obligation toward the Protocol on POPs to keep PCDD/F emissions beyond the value in base year (1990). Croatia is fulfilling an obligation towards the Protocol on POPs.

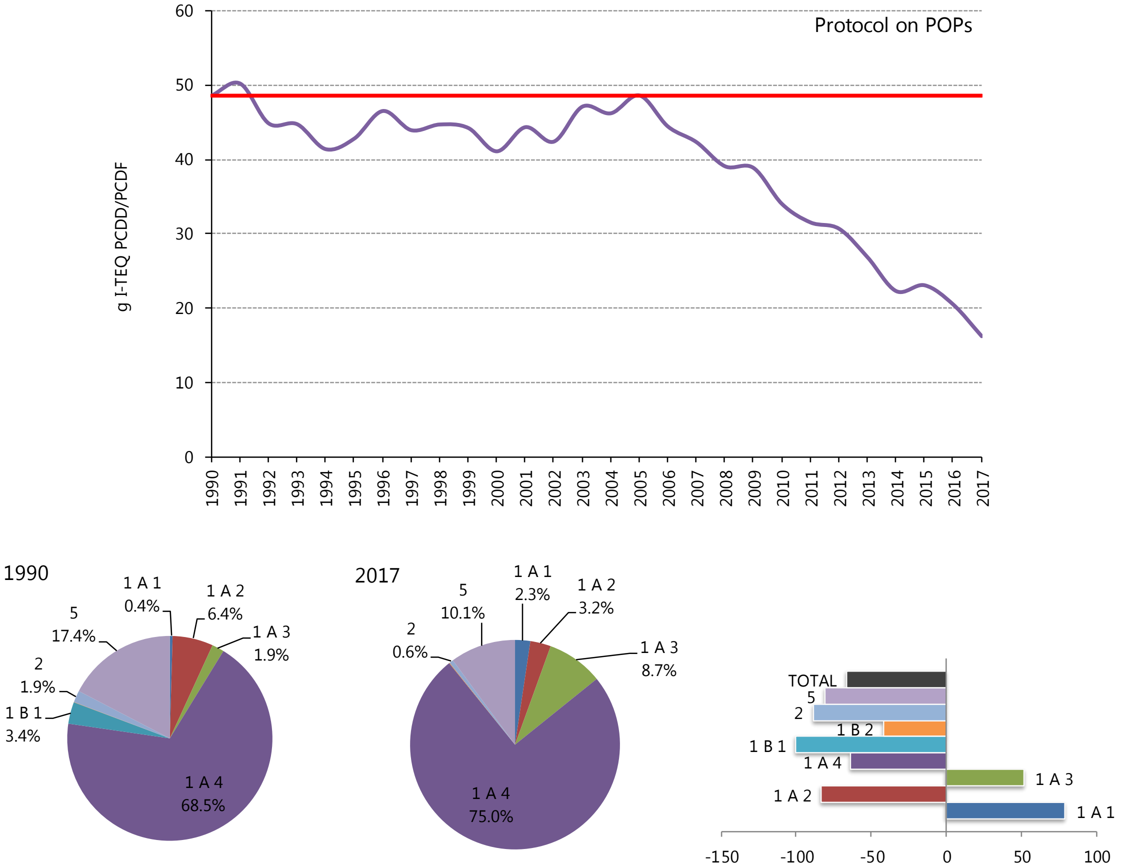


Figure 3.10.1-1 The PCDD/PCDF emissions (g I-TEQ/yr.) and percentage share by sector and variation in PCDD/PCDF emissions

Table 3.10.1-1 The PCDD/PCDF emissions by SNAP nomenclature in the period 1990-2017

PCDD/ PCDF											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ
1990	0.21	33.3	3.1	2.59	NA	NA	0.57	0.36	8.4	NA	48.6
1991	0.16	37.7	2.1	2.01	NA	NA	0.44	0.26	7.6	NA	50.2
1992	0.22	31.9	1.3	1.54	NA	NA	0.43	0.30	9.1	NA	44.8
1993	0.18	33.7	1.1	1.51	NA	NA	0.47	0.23	7.6	NA	44.7
1994	0.25	30.3	1.1	1.04	NA	NA	0.50	0.15	8.1	NA	41.4
1995	0.23	32.0	1.1	0.15	NA	NA	0.57	0.19	8.6	NA	42.8
1996	0.14	35.8	1.0	0.15	NA	NA	0.60	0.25	8.6	NA	46.5
1997	0.23	32.9	1.0	0.22	NA	NA	0.68	0.21	8.7	NA	43.9
1998	0.21	33.2	0.8	0.33	NA	NA	0.73	0.21	9.2	NA	44.7
1999	0.20	32.7	0.7	0.25	NA	NA	0.78	0.21	9.4	NA	44.2
2000	0.24	29.1	0.7	0.24	NA	NA	0.81	0.21	9.9	NA	41.1
2001	0.26	31.9	0.6	0.19	NA	NA	0.81	0.21	10.3	NA	44.3
2002	0.31	30.6	0.6	0.12	NA	NA	0.83	0.23	9.7	NA	42.4
2003	0.35	35.4	0.5	0.15	NA	NA	0.94	0.24	9.6	NA	47.1
2004	0.30	34.4	0.6	0.28	NA	NA	0.98	0.24	9.4	NA	46.2
2005	0.32	36.6	0.5	0.25	NA	NA	1.05	0.26	9.6	NA	48.6
2006	0.30	31.8	0.6	0.26	NA	NA	1.13	0.27	10.0	NA	44.4
2007	0.32	28.9	0.7	0.25	NA	NA	1.25	0.28	10.6	NA	42.3
2008	0.32	27.4	0.5	0.44	NA	NA	1.20	0.33	9.0	NA	39.1
2009	0.26	26.8	0.5	0.16	NA	NA	1.19	0.37	9.6	NA	38.8
2010	0.28	26.9	0.8	0.33	NA	NA	1.10	0.28	4.3	NA	34.0
2011	0.34	24.4	0.6	0.30	NA	NA	1.06	0.29	4.6	NA	31.5
2012	0.31	22.4	0.6	0.03	NA	NA	1.06	0.27	5.9	NA	30.7
2013	0.33	20.4	0.6	0.21	NA	NA	1.00	0.31	3.9	NA	26.8
2014	0.32	16.2	0.5	0.54	NA	NA	1.01	0.34	3.4	NA	22.3
2015	0.36	16.8	0.5	0.46	NA	NA	1.04	0.33	3.6	NA	23.1
2016	0.5	14.4	0.5	0.08	NA	NA	1.01	0.34	3.7	NA	20.5
2017	0.4	12.2	0.5	0.11	NA	NA	1.05	0.36	1.6	NA	16.2
2017 vs 1990	79.0%	-63.5%	-83.5%	-95.6%	NA	NA	83.9%	-0.3%	-80.6%	NA	-66.6%
2016 vs 2017	-16.9%	-15.6%	13.6%	37.0%	NA	NA	4.1%	6.0%	-56.2%	NA	-20.8%

3.10.2. Polycyclic aromatic hydrocarbons (PAHs)

There are more than 100 of different polycyclic aromatic hydrocarbons, and annual emission report is provided for four of them as follows: benzo (a) pyrene, benzo (b) fluoranthene, benzo (k) fluoranthene, indeno (1,2,3-cd) pyrene. The four PAHs are those defined by the Aarhus protocol. Emission of PAHs in 2016 by sectors is presented in Figure 3.10.2-1 and Table 3.10.2-1.

Emissions of PAHs were amounted to 5.9 t in 2017, and have declined by 74.9 % since 1990. The great reduction in PAHs emission in 1991 and 1992 has occurred due to decrease in coal consumption in residential sector and also because of stopping the processes of primary aluminium production (with Söderberg anodes) in Šibenik in 1992, pig iron production (blast furnace charging) in Sisak and Split in 1992, and coke production in Bakar in 1994. All previously mentioned was happened as a result of the war for Croatian independence (1991 - 1995). A significant reduction since 2005 is a result of gradual replacement of certain percentage of traditional domestic stoves and manual single house boilers with advanced/ecolabelled stoves and boilers and pellet stoves and boilers (see Table 4.5-1 and Figure 4.5-2).

Croatia has the obligation toward the Protocol on POPs to keep the overall PAHs emission beyond the value in base year (1990). Croatia fulfils the obligation towards the Protocol on POPs.

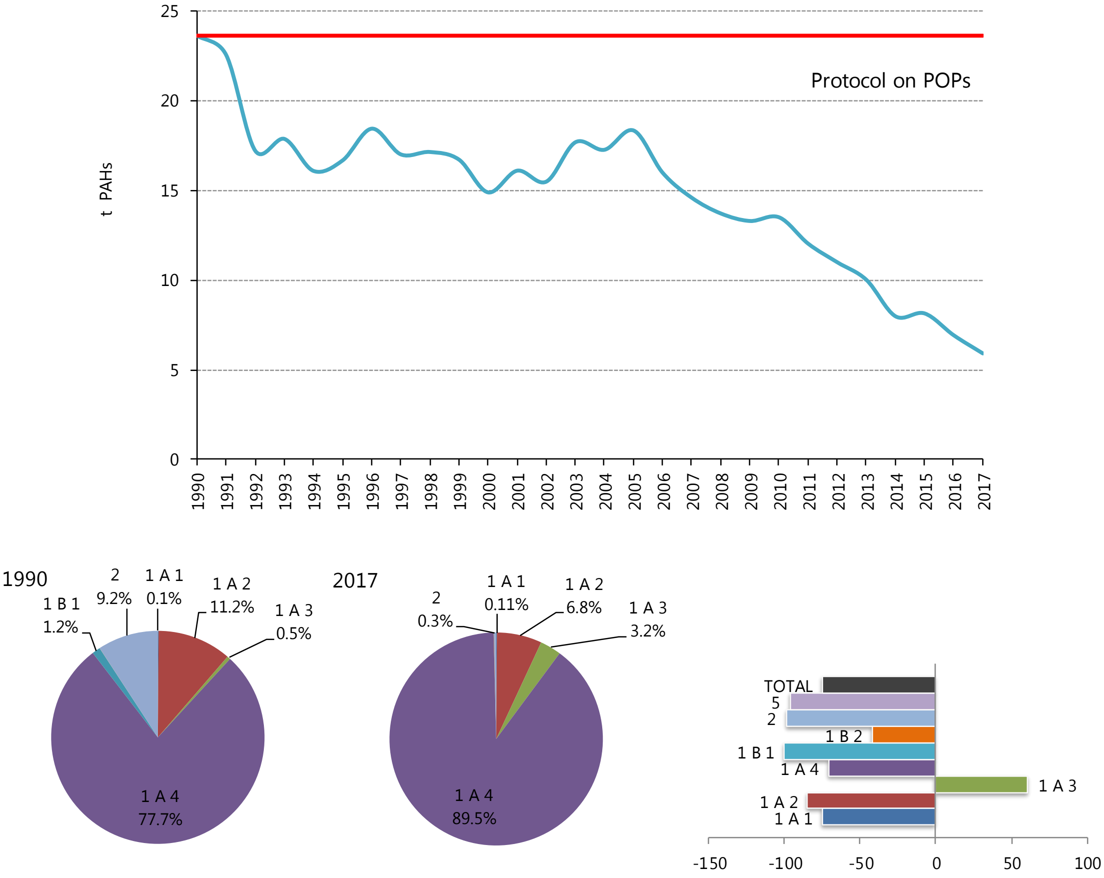


Figure 3.10.2-1 The PAHs emissions (kg/yr.), percentage share by sector and variation in PAHs emissions

Table 3.10.2-1 PAHs emissions by SNAP nomenclature in the period 1990-2017

PAH											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	2.6E-02	18.36	2.64	2.47	NA	3.9E-03	0.06	8.5E-02	1.0E-05	NA	23.65
1991	1.9E-02	19.25	1.77	1.44	NA	3.1E-03	0.05	4.0E-02	8.6E-06	NA	22.57
1992	2.5E-02	15.71	1.16	0.27	NA	3.8E-03	0.05	1.7E-02	8.3E-06	NA	17.23
1993	2.3E-02	16.51	1.02	0.26	NA	3.4E-03	0.05	2.0E-02	8.8E-06	NA	17.90
1994	4.5E-02	14.78	1.02	0.18	NA	2.5E-03	0.06	3.1E-02	8.8E-06	NA	16.11
1995	2.5E-02	15.54	1.01	NA	NA	3.9E-03	0.06	2.8E-02	9.7E-06	NA	16.69
1996	2.0E-02	17.38	0.94	NA	NA	4.0E-03	0.06	3.1E-02	9.2E-06	NA	18.46
1997	2.5E-02	15.95	0.91	NA	NA	3.8E-03	0.07	2.9E-02	2.5E-05	NA	17.03
1998	3.3E-02	16.14	0.83	NA	NA	4.0E-03	0.08	3.3E-02	4.8E-05	NA	17.16
1999	3.4E-02	15.89	0.66	NA	NA	4.6E-03	0.08	3.2E-02	5.6E-05	NA	16.74
2000	1.5E-02	14.10	0.64	NA	NA	4.0E-03	0.08	3.5E-02	7.8E-05	NA	14.91
2001	1.9E-02	15.34	0.60	NA	NA	5.0E-03	0.08	3.6E-02	8.4E-05	NA	16.12
2002	1.9E-02	14.75	0.60	NA	NA	5.4E-03	0.09	3.5E-02	4.8E-05	NA	15.51
2003	2.7E-02	17.03	0.47	NA	NA	7.7E-03	0.10	3.6E-02	1.2E-05	NA	17.70
2004	1.4E-02	16.52	0.56	NA	NA	8.2E-03	0.11	3.7E-02	6.3E-06	NA	17.29
2005	1.7E-02	17.59	0.55	NA	NA	7.2E-03	0.11	4.0E-02	3.9E-06	NA	18.36

PAH											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
2006	1.7E-02	15.21	0.56	NA	NA	6.1E-03	0.12	4.3E-02	1.1E-05	NA	16.00
2007	1.8E-02	13.72	0.64	NA	NA	7.4E-03	0.14	4.5E-02	9.9E-06	NA	14.61
2008	1.7E-02	12.94	0.52	NA	NA	7.3E-03	0.13	5.0E-02	1.0E-05	NA	13.73
2009	1.8E-02	12.57	0.52	NA	NA	7.4E-03	0.13	4.4E-02	4.3E-06	NA	13.31
2010	4.9E-03	12.62	0.66	NA	NA	8.1E-03	0.13	4.3E-02	2.1E-06	NA	13.52
2011	7.0E-03	11.33	0.49	NA	NA	6.4E-03	0.13	4.2E-02	2.7E-06	NA	12.05
2012	5.6E-03	10.35	0.48	NA	NA	7.3E-03	0.13	4.0E-02	3.0E-06	NA	11.01
2013	3.4E-03	9.35	0.46	NA	NA	9.2E-03	0.13	4.0E-02	2.9E-06	NA	10.03
2014	2.8E-03	7.33	0.41	NA	NA	3.0E-03	0.13	4.0E-02	3.1E-06	NA	8.00
2015	4.8E-03	7.52	0.37	NA	NA	3.6E-03	0.14	4.1E-02	3.7E-06	NA	8.16
2016	4.8E-03	6.36	0.37	NA	NA	2.8E-03	0.15	4.2E-02	4.3E-06	NA	6.94
2017	6.4E-03	5.29	0.40	NA	NA	3.9E-03	0.17	4.6E-02	2.5E-06	NA	5.93
2017 vs 1990	-75.2%	-71.2%	-85.0%	NA	NA	0.6%	170.8%	-46.3%	-74.8%	NA	-74.9%
2016 vs 2017	33.0%	-16.8%	7.1%	NA	NA	40.0%	11.6%	7.9%	-40.8%	NA	-14.6%

3.10.3. Hexachlorobenzene (HCB)

Hexachlorobenzene (HCB) is an industrial chemical but is also an integral part of solid fossil fuels and biomass. The HCB emission occurs mainly from biomass and solid fuel combustion and in minor extent from waste incineration, if it exists in the county.

The HCB emission in 2017 has amounted to 0.28 t (Figure and Table 3.10.3-1). In comparison to 1990, HCB emission has increased by 3.4 %, mainly due to increase in biomass combustion in Small combustion sector (mainly residential). Public electricity and heat production sector (in particularly, thermal power plants on coal) is the sector with increasing influence in HCB emission over time (10.4 % in 2017).

The Republic of Croatia has the obligation toward the Protocol on POPs to keep the overall HCB emission beyond the value in base year (1990). In 2017, this obligation was not fulfilled. Failure to comply with the obligation is the result of a recalculation of biomass consumption trend in Small combustion sector (with domination of residential), which increased by 33 PJ in the period from 1991 to 2014. In 1990 this increase was less (by 23 PJ) than the rest of the historical trend. Consequently, the trend of HCB emission has also increased in the period 1991 -2014. more than in 1990, for which HCB increase was the lowest.

Prior to the recalculation of biomass consumption data, in 1990 the Republic of Croatia had the highest consumption of biomass with respect to the whole historical trend and was consequently complying with the obligations under the Protocol of the POPs. The recalculation of the historical biomass trend has led the Republic of Croatia to non-conpliance with the POPs Protocol and in 2017 exceeds the level of HCB base year emission for 22 grams. The previously mentioned recalculation of the biomass consumption trend in the Small combustion sector (stationary) is the result of the European IPA project and is officially registered in the EUROSTAT database.

It is to be expected that in the future, due to the relatively lower cost of this energy source, compared to the other, but also, because of the global policy on the issue of greenhouse gas emissions, where biomass consumption is encouraged because there is no CO_2 emission, biomass consumption and consequently HCB emissions will increase.

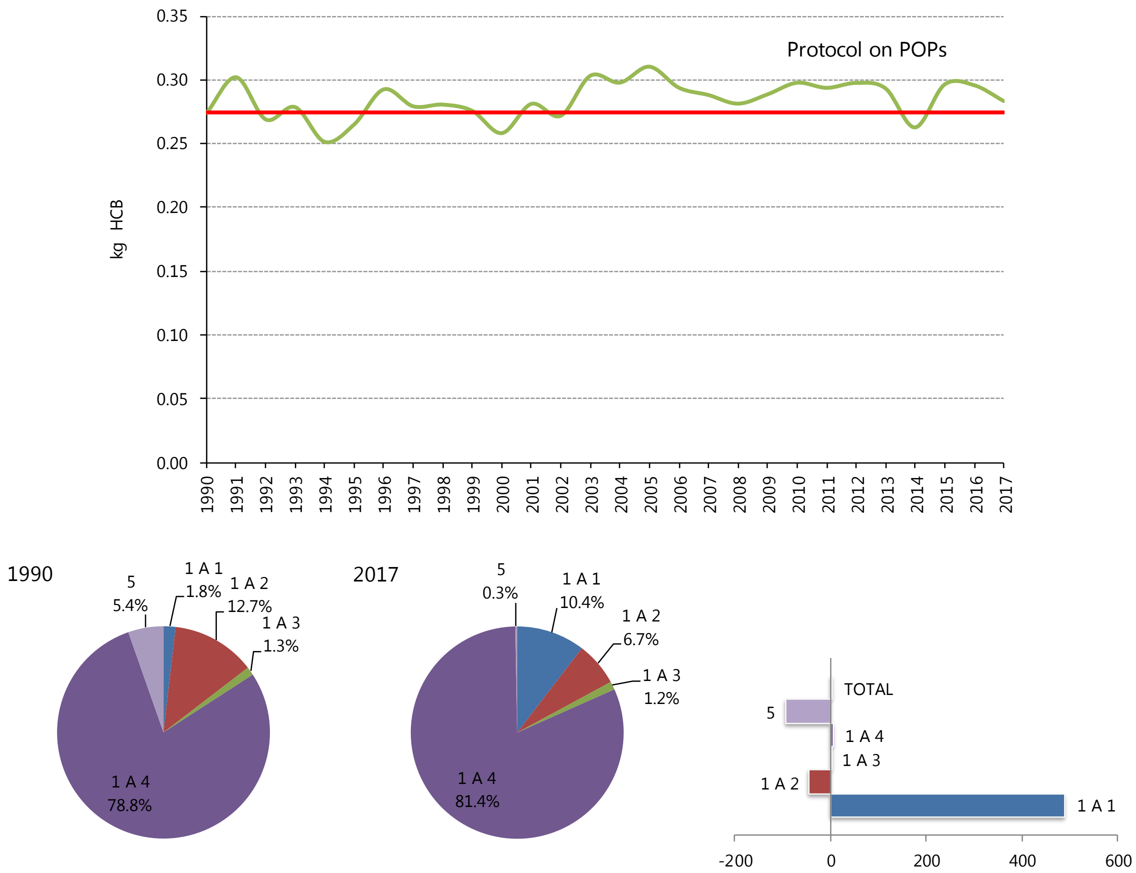


Figure 3.10.3-1 The HCB emission (kg/yr.), percentage share by sector and variation in HCB emissions

Table 3.10.3-1 The HCB emission by SNAP nomenclature in the period 1990-2017

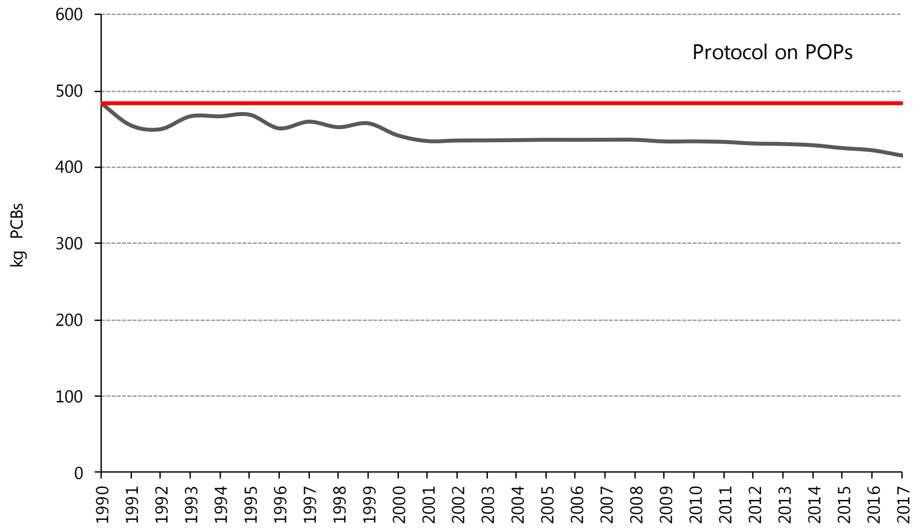
HCB											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	5.0E-03	0.22	3.5E-02	NA	NA	NA	NA	3.5E-03	1.5E-02	NA	0.27
1991	3.9E-03	0.25	2.8E-02	NA	NA	NA	NA	2.8E-03	1.5E-02	NA	0.30
1992	5.3E-03	0.22	2.4E-02	NA	NA	NA	NA	4.2E-03	1.5E-02	NA	0.27
1993	4.2E-03	0.23	2.3E-02	NA	NA	NA	NA	3.7E-03	1.5E-02	NA	0.28
1994	3.2E-03	0.21	2.1E-02	NA	NA	NA	NA	1.6E-03	1.5E-02	NA	0.25
1995	4.9E-03	0.22	2.0E-02	NA	NA	NA	NA	2.7E-03	1.5E-02	NA	0.27
1996	3.6E-03	0.25	2.0E-02	NA	NA	NA	NA	4.6E-03	1.5E-02	NA	0.29
1997	5.6E-03	0.23	2.5E-02	NA	NA	NA	NA	3.6E-03	1.7E-02	NA	0.28
1998	5.9E-03	0.23	2.4E-02	NA	NA	NA	NA	2.5E-03	1.9E-02	NA	0.28
1999	5.5E-03	0.23	2.2E-02	NA	NA	NA	NA	2.3E-03	2.0E-02	NA	0.28
2000	1.0E-02	0.20	2.3E-02	NA	NA	NA	NA	2.2E-03	2.2E-02	NA	0.26
2001	1.1E-02	0.22	2.4E-02	NA	NA	NA	NA	2.5E-03	2.4E-02	NA	0.28
2002	1.3E-02	0.21	2.4E-02	NA	NA	NA	NA	3.2E-03	2.1E-02	NA	0.27
2003	1.4E-02	0.24	2.5E-02	NA	NA	NA	NA	3.2E-03	1.8E-02	NA	0.30
2004	1.3E-02	0.24	2.7E-02	NA	NA	NA	NA	2.3E-03	1.8E-02	NA	0.30
2005	1.4E-02	0.25	2.6E-02	NA	NA	NA	NA	2.5E-03	1.8E-02	NA	0.31
2006	1.3E-02	0.23	2.9E-02	NA	NA	NA	NA	2.6E-03	1.9E-02	NA	0.29
2007	1.4E-02	0.22	2.8E-02	NA	NA	NA	NA	2.7E-03	2.1E-02	NA	0.29
2008	1.4E-02	0.22	2.4E-02	NA	NA	NA	NA	3.4E-03	1.7E-02	NA	0.28
2009	1.0E-02	0.23	2.3E-02	NA	NA	NA	NA	3.7E-03	1.9E-02	NA	0.29
2010	1.4E-02	0.25	2.5E-02	NA	NA	NA	NA	3.1E-03	6.1E-03	NA	0.30

HCB											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
2011	1.9E-02	0.24	2.1E-02	NA	NA	NA	NA	3.1E-03	6.4E-03	NA	0.29
2012	1.8E-02	0.24	2.3E-02	NA	NA	NA	NA	2.9E-03	1.0E-02	NA	0.30
2013	2.0E-02	0.24	2.3E-02	NA	NA	NA	NA	3.1E-03	5.5E-03	NA	0.29
2014	2.0E-02	0.21	2.0E-02	NA	NA	NA	NA	3.4E-03	5.8E-03	NA	0.26
2015	2.5E-02	0.24	1.8E-02	NA	NA	NA	NA	3.3E-03	6.0E-03	NA	0.30
2016	3.4E-02	0.24	1.5E-02	NA	NA	NA	NA	3.3E-03	6.3E-03	NA	0.30
2017	2.9E-02	0.23	1.9E-02	NA	NA	NA	NA	3.5E-03	8.2E-04	NA	0.28
2017 vs 1990	488.6%	6.8%	-45.7%	NA	NA	NA	NA	0.5%	-94.4%	NA	3.4%
2016 vs 2017	-12.4%	-2.9%	25.7%	NA	NA	NA	NA	6.0%	-87.0%	NA	-4.2%

3.10.4. Polychlorinated biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are industrial chemicals. The dominant source of PCBs emission is consumption of POPs and heavy metals sector (NFR 2.K), activity in the scope of industrial processes and product use sector. Other sectors steel production (2.C.1), the clinical waste incineration (6.C.a) and fuel combustion have minor contribution in total PCBs emission in Croatia.

Emission of PCBs in 2017 was estimated to about 415.4 kg (Figure and Table 3.10.4-1). A key source in overall trend, consumption of POPs and heavy metals sector includes PCBs emission from the refrigeration and air conditioning equipment using halocarbons (SNAP 060502), the foam blowing (SNAP 060504 except 060304) and the electrical equipment (SNAP 060507 except 060203). This source has contributed with 99.3 % to national PCBs emission in 2017. Changes in PCBs emission are minimal and are directly depending on the population figure in Croatia, since the emission from a key source is based on the number of inhabitants of the Republic of Croatia.



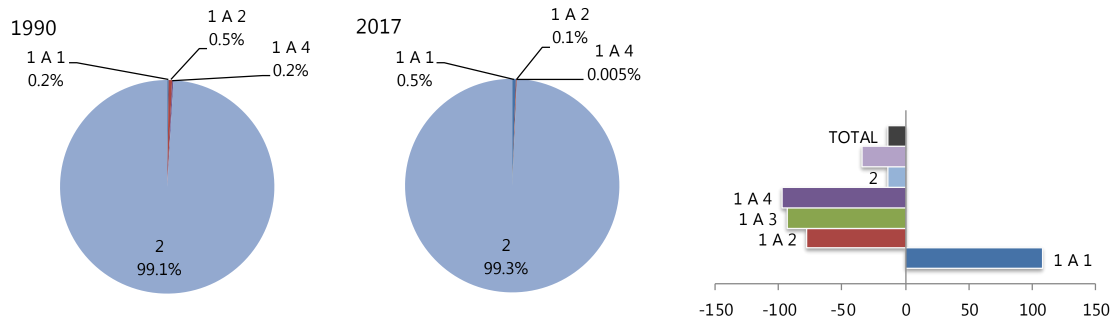


Figure 3.10.4-1 The PCBs emission (kg/yr.), percentage share by sector and variation in PCBs emissions

Table 3.10.4-1 The PCBs emissions by SNAP nomenclature in the period 1990-2017

PCBs											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	1.1	0.91	2.5	0.85	NA	477.8	NA	4.0E-02	3.4E-03	NA	483.1
1991	0.8	0.47	1.5	0.35	NA	451.3	NA	1.7E-02	3.5E-03	NA	454.5
1992	1.1	0.14	1.0	0.25	NA	447.0	NA	7.3E-03	3.7E-03	NA	449.5
1993	0.8	0.20	0.8	0.19	NA	464.1	NA	7.7E-03	3.9E-03	NA	466.1
1994	0.2	0.10	0.8	0.16	NA	464.9	NA	1.5E-03	4.0E-03	NA	466.2
1995	0.4	0.09	0.8	0.11	NA	466.9	NA	4.9E-03	4.1E-03	NA	468.3
1996	0.2	0.10	0.7	0.11	NA	449.4	NA	1.1E-02	4.2E-03	NA	450.6
1997	1.0	0.09	0.7	0.17	NA	457.3	NA	7.9E-03	4.2E-03	NA	459.2
1998	1.0	0.13	0.6	0.26	NA	450.1	NA	3.4E-03	4.2E-03	NA	452.1
1999	0.9	0.11	0.6	0.19	NA	455.4	NA	2.8E-03	4.1E-03	NA	457.1
2000	2.5	0.10	0.6	0.17	NA	438.1	NA	2.3E-03	4.1E-03	NA	441.4
2001	2.8	0.06	0.6	0.14	NA	430.5	NA	3.4E-03	4.3E-03	NA	434.1
2002	3.5	0.08	0.6	0.08	NA	430.5	NA	5.8E-03	4.5E-03	NA	434.8
2003	3.7	0.10	0.4	0.10	NA	430.6	NA	5.5E-03	4.6E-03	NA	435.0
2004	3.4	0.06	0.5	0.22	NA	431.1	NA	1.7E-03	4.9E-03	NA	435.3
2005	3.7	0.07	0.5	0.18	NA	431.2	NA	1.9E-03	5.0E-03	NA	435.7
2006	3.5	0.06	0.6	0.20	NA	431.4	NA	1.9E-03	5.2E-03	NA	435.7
2007	3.7	0.03	0.6	0.19	NA	431.2	NA	2.0E-03	5.7E-03	NA	435.8
2008	3.9	0.04	0.5	0.35	NA	431.0	NA	3.2E-03	4.9E-03	NA	435.7
2009	2.7	0.03	0.5	0.12	NA	430.3	NA	2.9E-03	5.4E-03	NA	433.6
2010	3.7	0.05	0.7	0.26	NA	429.0	NA	3.2E-03	2.9E-03	NA	433.7
2011	4.1	0.04	0.5	0.24	NA	428.1	NA	3.1E-03	2.9E-03	NA	433.0
2012	3.6	0.04	0.5	0.01	NA	426.8	NA	3.1E-03	3.7E-03	NA	430.9
2013	4.0	0.03	0.6	0.16	NA	425.6	NA	2.3E-03	2.8E-03	NA	430.3
2014	3.9	0.02	0.5	0.44	NA	423.8	NA	2.5E-03	3.0E-03	NA	428.7
2015	3.7	0.02	0.5	0.37	NA	420.4	NA	2.4E-03	3.2E-03	NA	425.0
2016	4.1	0.02	0.5	0.06	NA	417.4	NA	2.5E-03	3.2E-03	NA	422.1
2017	2.3	0.02	0.5	0.08	NA	412.5	NA	2.6E-03	2.3E-03	NA	415.4
2017 vs 1990	108.6%	-97.6%	-78.1%	-90.1%	NA	-13.7%	NA	-93.5%	-33.7%	NA	-14.0%
2016 vs 2017	-45.0%	22.7%	6.8%	41.5%	NA	-1.2%	NA	6.0%	-29.9%	NA	-1.6%

4. Energy (NFR 1)

Sector 1 Energy considers emissions originating from fuel combustion activities (NFR 1.A) and fugitive emissions from fuels (NFR 1.B). Following energy activities are reported in Croatian inventory:

- 1.A.1 Energy Industries
  - 1.A.1.a Public electricity and heat production
  - 1.A.1.b Petroleum refining
  - 1.A.1.c Manufacture of solid fuel and other energy industries
- 1.A.2 Manufacturing industries and construction
  - 1.A.2.a Iron and steel
  - 1.A.2.b Non-ferrous metals
  - 1.A.2.c Chemicals
  - 1.A.2.d Pulp, paper and print
  - 1.A.2.e Food processing, beverages and tobacco
  - 1.A.2.f Non-metallic minerals
  - 1.A.2.g.vii Mobile Combustion in manufacturing industries and construction
- 1.A.3 Transport
  - 1.A.3.a Aviation (civil)
    - 1.A.3.a.i (i) International aviation LTO (civil)
    - 1.A.3.a.ii (i) Domestic aviation LTO (civil)
    - Memo item: 1.A.3.a.i (ii) International aviation cruise (civil)
    - Memo item: 1.A.3.a.ii (ii) Domestic aviation cruise (civil)
  - 1.A.3.b Road transport
    - 1.A.3.b.i Road transport: Passenger cars
    - 1.A.3.b.ii Road transport: Light duty vehicles
    - 1.A.3.b.iii Road transport: Heavy duty vehicles
    - 1.A.3.b.iv Road transport: Mopeds & motorcycles
    - 1.A.3.b.v Road transport: Gasoline evaporation
    - 1.A.3.b.vi Road transport: Automobile tyre and brake wear
    - 1.A.3.b.vii Road transport: Automobile road abrasion
  - 1.A.3.c Railways
  - 1.A.3.d Navigation (shipping)
    - 1.A.3.d.ii National navigation (shipping)
    - 1.A.3.d.i(ii) International inland waterways
    - Memo item: 1.A.3.d.i(i) International maritime navigation
  - 1.A.3.e.i Pipeline transport
- 1.A.4 i Small combustion
  - 1.A.4.a.i Commercial / institutional

    - 1.A.4.b.i Residential
    - 1.A.4.c.i Agriculture/Forestry/Fishing
- 1.A.4 ii Non-road mobile source and machinery
    - 1.A.4.a.ii Commercial / institutional: Mobile
    - 1.A.4.b.ii Residential: Mobile
    - 1.A.4.c.ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery
    - 1.A.4.c.iiiAgriculture/Forestry/Fishing: National fishing
- 1.A.5 Other (including military)
    - 1.A.5.a Other stationary (including military)
    - 1.A.5.b Other, Mobile (including military, land based and recreational boats)
- 1.B.1 Fugitive emissions from solid fuel
    - 1.B.1.a Coal mining and handling
    - 1.B.1.b Solid fuel transformation
    - 1.B.1.c Other fugitive emissions from solid fuel
- 1.B.2 Fugitive emissions from oil and natural gas
    - 1.B.2.a.i Oil - Exploration, production, transport
    - 1.B.2.b Natural gas - Exploration, production, transport
    - 1.B.2.a.iv Refining, storage
    - 1.B.2.a.v Distribution of oil products
    - 1.B.2.c Venting and flaring
    - 1.B.2.d Other fugitive emissions from energy production

For emissions that occur in sector 1.A.3.d.i(ii) International inland waterways Croatia is using notation key "IE" and those emissions are included in the memo item: 1.A.3.d.i(i) International maritime navigation. For emissions that occur in sector 1.A.3.e i Pipeline transport Croatia is using notation key "NO". For emissions that occur in sector 1.A.4.c.iii Agriculture/Forestry/Fishing: National fishing Croatia is using notation key "IE" and those emissions are included in NFR 1.A.3.d.ii (based on total amount of exhausted fuel for national navigation, maritime and river traffic). Emissions that occur in sector 1.A.5.a are included in NFR code 1.A.4.a Combustion in commercial and institutional plants. Emissions that occur in sector 1.A.5.b Other, Mobile (including military, land based and recreational boats) are for military noted as confidential, and for land based and recreational boats are included in NFR codes 1.A.4.a.i and 1.A.3.b (i-iv).

4.1. Fuel combustion (NFR 1.A)

This chapter gives an overview of source categories included the scope of NFR code 1.A. Fuel combustion and their contributions in fuel consumption in Croatia. The overview is given for the non-transport sectors (stationary and non-road mobile sources) and for transport sectors. Non-transport sectors includes following source categories: 1.A.1 Energy Industries, 1.A.2 Manufacturing industries and construction, 1.A.4 Small combustion and Non-road mobile source and machinery. Transport sector includes following source categories: 1.A.3.a Aviation (civil), 1.A.3.b Road transport, 1.A.3.c Railways and 1.A.3.d Navigation (shipping).

In Croatia the domination regarding the fuel consumption has source category 1.A.4 Small combustion (Figure 4.1-1), which has recorded the smallest decrease of fuel consumption (-1.6 % since 1990). Categories 1.A.1 Energy Industries and 1.A.2 Manufacturing Industries and Construction have recorded significantly larger reduction in fuel consumption (as fallow: -44.9 % and 49.8 % since 1990).

Regarding 2016, categories 1.A.1 Energy Industries and 1.A.4 Small combustion have recorded a decreas in fuel consumption by 5.8 %, and 0.8 % while 1.A.2 Manufacturing Industries and Construction has recorded a increase by 10.4 %.

The greatest reduction in fuel consumption was in 1991, caused by the war for Croatian independences (1991 – 1995).

In the recent past, after 2007 fuel consumption started with continuous decreasing trend due to the economic crisis that is still continuing in Croatia.

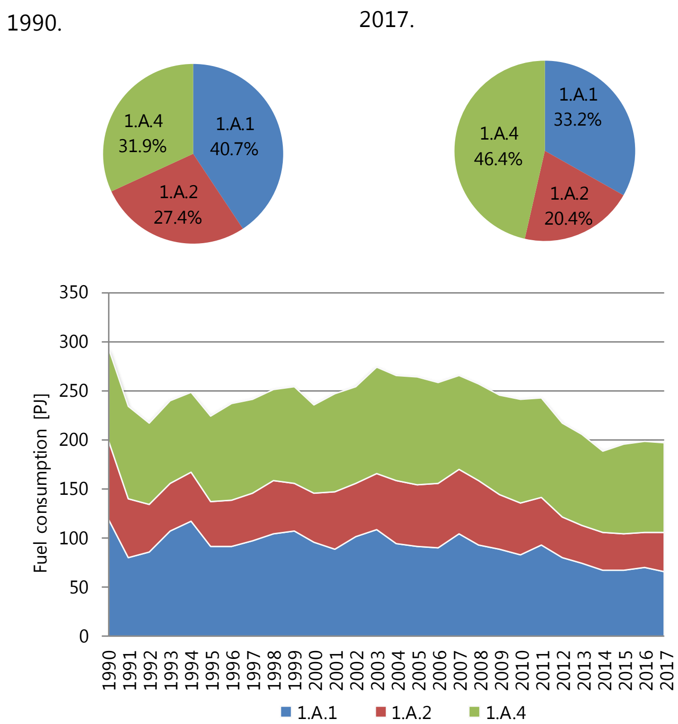


Figure 4.1-1 Activity data on fuel consumption for NFR codes 1.A.1, 1.A.2, 1.A.4

The structure of fuel consumption by type in Croatia is presented in Figure 4.1-2. Overall fuel consumption for the observed sectors in the period 1990 - 2017 has decreased by 32.4 %. The consumption of liquid fuel has reduced by 67.4 %, gaseous fuel by 2.7 %, solid fuel by 44.3 %, while the biomass consumption has increased by 9.3 % and other fuels by about 300 times (from 0.021 PJ in 1990 to 6.1 PJ in 2017).

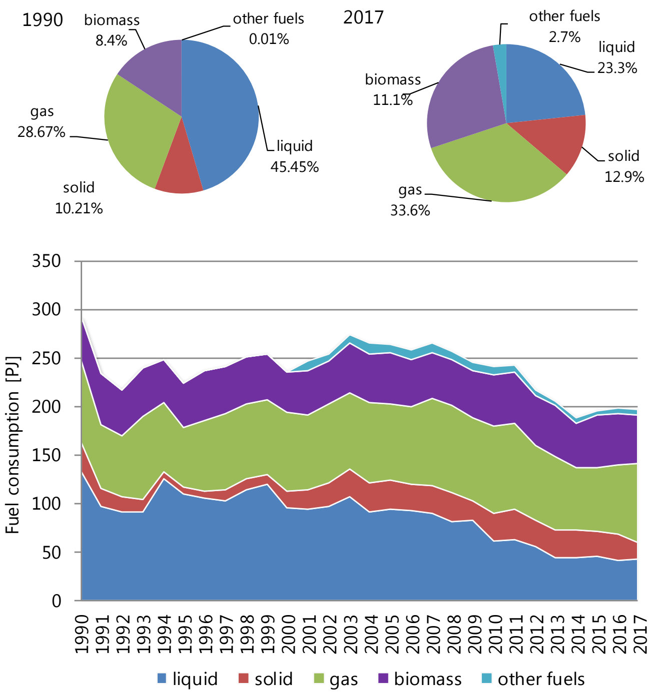


Figure 4.1-2 Activity data on fuel consumption by type for NFR codes 1.A.1, 1.A.2, 1.A.4

The source category 1.A.3 Transport includes fuel combustion in road transport, civil aviation, railways and navigation. The dominant NFR sector regarding fuel consumption in period 1990-2017 was 1.A.3.b Road transport.

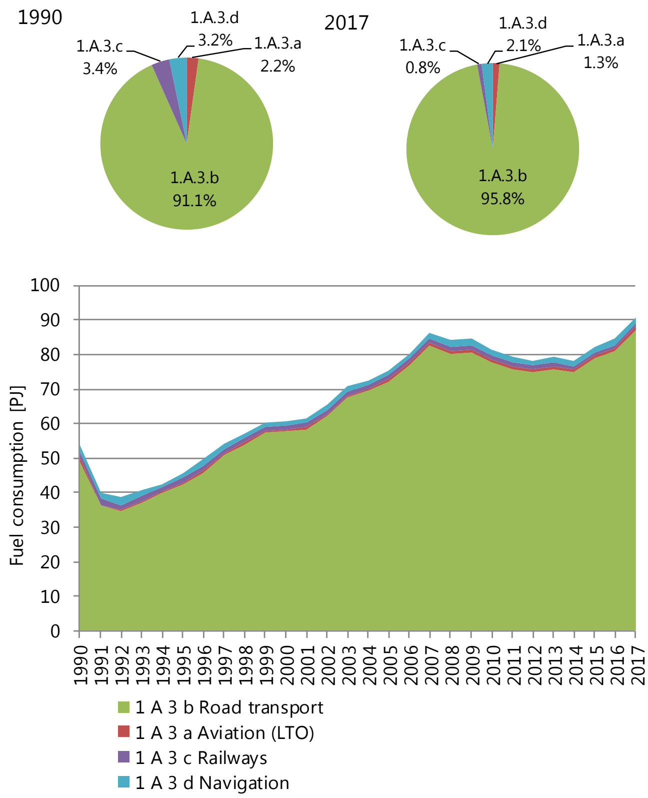


Figure 4.1-3 Consumption and percentage share for fossil fuel by types in 1.A.3 Transport

Road transport has contributed to overall transport fuel consumption in 2017 with 95.8%, and has recorded an increase in observing period by 78.3%.

The 1.A.3.a Aviation (LTO) has contributed with 1.3% to overall fuel consumption in transport sector 2017, and has recorded a decrease by 2.8%.

The 1.A.3.c Railways has contributed with 0.8% to overall transport fuel consumption in 2017, and has recorded a decrease by 58.7% in the observing period.

The 1.A.3.d Navigation has contributed with 2.1% to overall transport fuel consumption in 2017 and has recorded an increase by 8.6% in comparison to 1990 (Figure 4.1-3).

4.2. Energy industries (NFR 1.A.1)

This chapter gives an overview of source category 1.A.1 Energy industries and it includes information on methodologies, activity data, emission factors and planned improvements.

Source category description

This source category comprises emission from fuel combustion in public electricity and heat production plants (NFR 1.A.1.a), petroleum refining plants (NFR 1.A.1.b), solid transformation plants, oil and gas extraction and coal mining (NFR 1.A.1.c).

Public Electricity and Heat Production (NFR 1.A.1.a)

The source category NFR 1.A.1.a Public electricity and heat production takes into account consumption of fossil fuel from eight LPSs owned by legal entity HEP-Production Ltd, HEP Group. In public electricity and heat production sector in Croatia there are following types of plants:

- Thermal Power Plants (TPPs), which produce only electricity;
- Public Cogeneration Plants (PCPs), which produce combined heat and electricity;
- Public Heating Plants (PHPs), which produce only heat.

The installed electricity generating capacities in the Republic of Croatia include hydro and thermal power plants, increasing number of wind power plants and other power plants on renewable energy sources and certain number of industrial power plants.

By the end of 2017 electricity generation capacities in Croatia encompassed 17 locations with hydro power plants, 7 locations with thermal power plants, one half of the installed capacities of the nuclear power plant Krško (located in the territory of Slovenia) and large number of RES power plants. Thermal power plants are gas-fired, coal-fired and fuel oil-fired. The majority owner over the generation capacities in the Republic of Croatia is HEP group (State owned company), while private producers own RES generation capacities.

Total available capacities of all power plants in the Republic of Croatia by the end of 2017 amount to 5.000.6 MW. Out of this amount, 2.152 MW is placed in thermal power plants, 2.206.5 MW in hydro power plants, 576.1 in wind power plants, 60MW in solar power plants. There is also 348 MW in the nuclear unit Krško (50% of total available capacity) used for Croatian power system.

These capacities do not include generating units in other countries from which the Croatian electric power system has the right to withdraw electricity on the basis of capacity lease and share-ownership arrangements. The capacities in other countries are the following: Thermal power plant Gacko in Bosnia and Herzegovina with total installed capacity of 300 MW, coal-fired; Legal basis – shared ownership for 1/3 of capacity and power for a 25 year period and thermal power plant Obrenovac in the Republic of Serbia with installed capacity 305 MW, coal-fired; Legal basis – capacity and power lease on the basis of a credit for construction. The capacity and power from the above-mentioned facilities is not available, as the status of these facilities has not been resolved yet. The open issues regarding the agreements on investments in these facilities refer to the duration period, the way of treatment of the invested funds and what pricing methods should be applied to electricity deliveries.

Generating capacities of HPPs, TPPs and NPP Krško are presented in the Table 4.2-1.

Table 4.2-1 Generating capacities of HPPs, TPPs and NPP Krško

Facility	Available Power (MW), net output	Fuel type
HPPs	2,206.5	-
NPP Krško*	348.0	uranium oxide (UO_2)
TPP Plomin 1	105.0	coal
TPP Plomin 2**	192.0	coal
TPP Rijeka	303.0	fuel oil
CHP Sisak	631.0	fuel oil / natural gas
CHP Zagreb (east)	422.0	fuel oil / natural gas
CHP Zagreb (west)	89.0	fuel oil / natural gas / extra light oil
CPP Osijek	90.0	fuel oil / natural gas / extra light oil
KTE Jertovec	74,0	fuel oil / natural gas / extra light oil
Other biogas plants	44,6	biogas
Other biomass plants	42,0	biomass
CHP in Industry	162,1	coal / natural gas / fuel oil/ wood
Other small CHP	3,3	natural gas
Ukupno (HE+NE+TE)	4.712,5	
* 50% of NPP Krško is owned by HEP, ** TPP Plomin 2 Ltd. (HEP and RWE Power Co-ownership – share 50% : 50%)		

Source: Energija u Hrvatskoj - 2017, Annual energy report, MEE

Petroleum Refining (NFR 1.A.1.b)

The sub-sector 1.A.1.b Petroleum refining takes into account consumption of fossil fuel from two LCPs oil refineries owned by legal entity INA- Oil industry dd. in Rijeka and Sisak, while lubricants are produced in Rijeka and Zagreb. Crude oil is produced from 33 oil fields and gas condensation products from 8 gas-condensations fields, which covers about 35 percent of the total domestic demand. In the refineries, there are two types of fuel combustion – for heating and/or cogeneration and for own use of energy for production processes. Processing capacities of the Croatian refineries are presented in the Table 4.2-2 (Source: MEE).

Table 4.2-2 Processing Capacities of Oil and Lube Refineries

Processing Capacities	Installed Capacities (1000 t/year)
Oil Refinery Rijeka (Urinj)	
atmospheric distillation	5000
reforming	730
fluidized-bed catalytic cracking (FCC)	1000
visbreaking	600
isomerization	250
hydrodesulphurization (HDS)	1040
mild hydrocracking (MHC)	560
hydrocracking	2600
Oil Refinery Sisak	
atmospheric distillation	4000
reforming	680
fluidized-bed catalytic cracking (FCC)	470
coking	270
vacuum distillation	850

Processing Capacities	Installed Capacities (1000 t/year)
bitumen	350
Lube Refinery Zagreb Ltd.	
lubricants	60

Source: Croatian NIR2019; CAEN

Manufacturing of Solid Fuels and Other Energy Industries (NFR 1.A.1.c)

Sub-sector 1.A.1.c Manufacture of solid fuel and other energy industries takes into account consumption of fossil fuel in following activities: Oil and gas extraction, Coal production, Coke plant and NGL-plant. In Croatia the coal production in the period 1990-1998 was rather low. Last coal mines in Istria were closed in 1999. Coke-oven plant in Bakar, nearby Rijeka, was closed in 1994.

Natural gas is produced from 18 Pannon exploitation fields and three exploitation areas in the Adriatic meeting 49.3 % of total domestic demand. However, when gas produced in the Adriatic that actually belongs to Croatia is included in the calculation, domestic gas amounts to 39.6 % of Croatian total gas demand. The production of gas from Pannon is somewhat larger than the production from the Adriatic Sea. Most of the Pannonian gas comes from the fields Duboka Podravina and Međimurje (Molve, Kalinovac, Gola, Vučkovec and Zebanec reservoirs). The processing and preparation of gas for transportation from these fields is carried out at the Central Gas Station Molve III. Installed production capacity of Central gas stations Molve III is 5 million m^3 per day.

Methodology, emission factors and activity data

Public Electricity and Heat Production (NFR 1.A.1.a)

Emission sources such as facilities in the scope of source category public electricity and heat production plants observed as a large point source (LPS). For LPS emissions calculation a bottom-up approach is used. Double-check with the national energy balance is always performed. Bottom up approach is used in a way that available direct emission for pollutants from the national Environmental Pollution Register (EPR) entered into CollectER database for each of facilities. According to the Ordinance on the monitoring of emissions of pollutants into air from immovable sources (OG 129/2012) all large point sources for emission monitoring have installed continuous emission measurement system (CEM). Each year this system as well as emissions are subject to inspections of verified laboratories. Methods of measurements according to the requirements of the standards in the Annex I of this Ordinance are used to measure the parameters of the waste gas and the concentrations of the substance in the waste gases. For determining emissions in waste gas, the original measured weighted concentrations are used. The CEM system algorithm is designed to calculate emissions from raw (data before validation) data. The raw measured value (concentration) is multiplied by the raw amount of flue gas. In that way, determined emissions are correct and not underestimated. Validated average values are used only for the purposes of comparison with the emission limit values prescribed by the Regulation. Validated average values are not used for emission calculation.

For emission calculation for area sources (not LCPs) Tier 1 EMEP / EEA methodology was used, with a top-down approach and based on aggregated fuel consumption from the annual national Energy balance.

Emission factors are expressed as the quantity of emissions of pollutant per GJ fuel consumed. It should be noted that emission factors are changing during the observation period due to: (I) chemical composition of each type of fuel (e.g., sulphur content in the solid and liquid fuel), (II) lower heating different values for the same type of fuel and (III) introduction of technologies to reduce emissions. For 1.A.1.a (Electricity production and Combined heat and power generation) emission factors for large-scale boiler capacity> 50 MW are used, while for 1.A.1.a (Heat plants) used the recommended FE sector 1.A.4.c.i (capacity <50 MW) of GB2016. Emission factors together with the direct emissions for 2016 are given in Appendix 4 of this report.

Country specific EF for SO_2

For SO_2 emission calculation from combustion of fuel oil and gas oil for area sources (not LCPs), Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type.

Activity data for each type of fuel consumed in each of the plant along with measured direct emissions for NOx, SO_2, CO and PM_{10} were used, from the EPR database (Tier 2), i.e. the plant specific emission factors were used. For those pollutants for which the LPS doesn't have obligation to report in the EPR base, the default emission factors from GB2016 were used.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

In the case of heavy metals, for which emission factors are not available in GB2016, recommended emission factors from PARC ATMOS were used. Also, a chemical analysis were made for facilities in the scope of public electricity and heat production plants for fuel oil and different coal used in Croatia and emission factors for each of heavy metals (Pb, Cd, Hg and Ni) were determined by comparing with default emission factors for different sources.

Activity data on fuel used by type in sector 1.A.1.a are presented in Figure 4.2-1.

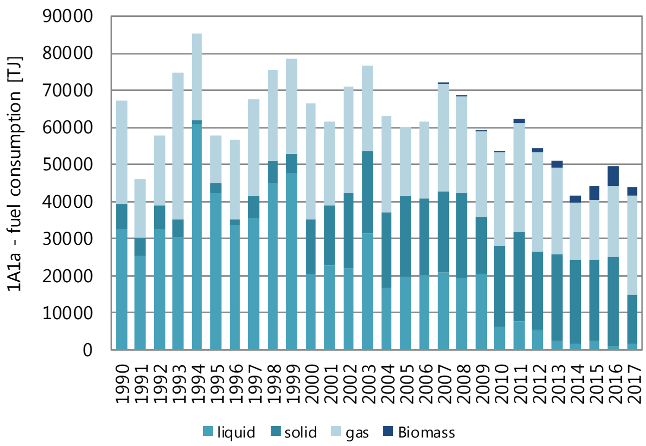


Figure 4.2-1 Activity data on fuel consumption by type for NFR 1.A.1.a

Petroleum Refining (NFR 1.A.1.b)

Methodology for emission calculation is Tier 3 EMEP/EEA, performed by multiplying total fuel sold for petroleum refining activities (disaggregated by fuel type) with emission factors.

The default Tier 2 emission factors from GB2016 are used for emission calculations. Emission factors used for emissions calculation in 2017 are given in Appendix 4 of this report.

Country specific EF for SO_2

For SO_2 emission calculation from combustion of fuel oil and gas oil, Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Activity data on fuel used by type in sector 1.A.1.b are presented in Figure 4.2-2.

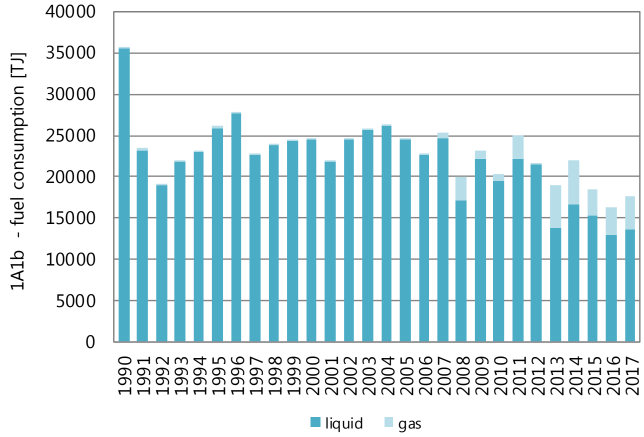


Figure 4.2-2 Activity data on fuel consumption by type for NFR 1.A.1.b

Manufacturing of Solid Fuels and Other Energy Industries (NFR 1.A.1.c)

Methodology for emission calculation is Tier 1 EMEP/EEA, performed by multiplying total fuel sold for activities in the scope of category Manufacturing of solid fuels and other energy industries (disaggregated by fuel type) with emission factors.

The default Tier 1 emission factors from GB2016 are used for emission calculations. For ammonia emission estimation Tier 1 default EMEP/CORINAIR (1999) emission factor was used by fuel type. Emission factors used for emissions calculation in 2016 are given in Appendix 4 of this report.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Activity data on fuel used by type in sector 1.A.1.c is presented in Figure 4.2-3.

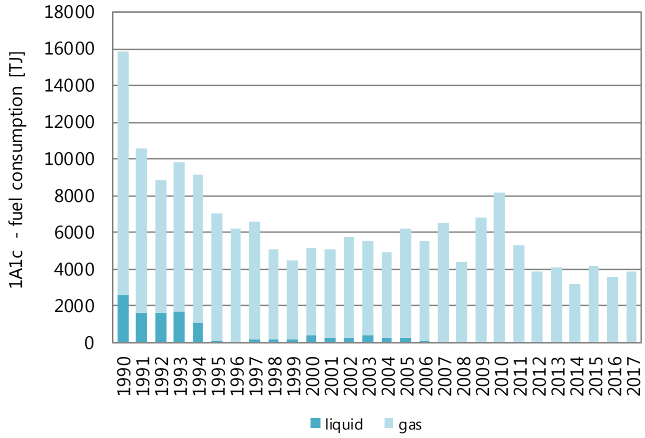


Figure 4.2-3 Activity data on fuel consumption by type for NFR 1.A.1.c

Recalculations and improvements

In the sector 1.A.1.c for the emission calculation, emission factors from the previous Guidelines were used. In IIR 2019 FE from 2016 EEA / EMEP Guidelines were used for all pollutants and for the entire period from 1990 to 2016.

For the period from 2013 to 2016 consumption of biogas was added.

4.3. Manufacturing industries and construction (NFR 1.A.2)

Source category description

Manufacturing Industries and Construction (NFR 1.A.2) includes emissions from fuel combustion in different industries in Croatia, such as Iron and steel (NFR 1.A.1.a), Non-ferrous metals (NFR 1.A.1.b), Chemicals (NFR 1.A.1.c), Pulp, paper and print (NFR 1.A.1.d), Food processing, beverages and tobacco (NFR 1.A.2.e) and Non-metallic minerals (NFR 1.A.2.f). These are all stationary sources of fuel combustion. In the scope of this source category is also one mobile source Mobile Combustion in manufacturing industries and construction (NFR 1.A.2.g.vii) which is observed within the source category NFR 1.A.4 ii Non road mobile source and machinery.

This sector also includes the emissions from fuel used for the generation of electricity and heat in industry (industrial cogeneration plants and industrial heating plants). In national energy balance fuel consumed in industrial heating plants and cogenerations were not divided by appropriate industrial branches, so in addition to national energy balance so called "Industry analysis balance" was created annually, for the period from 2001 to 2016. For the period 2001 to 2016 emissions are reported by specific NFR sector while for period 1990 -2000 all emissions are reported under NFR code 1.A.2.f.

Methodology, emission factors and activity data

Methodology for emission estimation for almost all NFR codes in the scope of source category 1.A.2 Manufacturing Industries and Construction is default Tier 1 EMEP/EEA, along with Tier 1 emission factors (GB2016). Croatia estimates all emissions for all pollutants which EF are provided in EMEP/EEA GB for 1.A.2.a, 1.A.2.b, 1..A2.c, 1.A.2.e for all fuel types specified in national energy balance.

For NFR code 1.A.2.f Non-metallic minerals for whole observed trend plant specific emission factor are used for emission calculation of SO_2, NOx, CO, and PMs. Non-metallic minerals sector include all facilities for cement production in Croatia which have domination in emissions within the 1.A.2.f Non-metallic minerals sector and within the overall source category 1.A.2.

The amount of fuel consumed and emissions in the sector 1.A.2 Manufacturing Industries and Construction (SNAP 03) is shown as aggregated value (by fuel types) in the scope of sub-sector 1.A.2.f Non-metallic minerals for period 1990 - 2000, while for period 2001 onward are reported on disaggregated value (by fuel types) for each type of industry in the sub-sector where occur.

For emissions calculation for LPSs in NFR sector 1.A.2.f Non-metallic minerals, a bottom-up approach is used. Bottom-up approach is used in cement production and the mineral wool production in a way that direct emissions available from the national Environmental Pollution Register (EPR) are entered into CollectER database. Double-check with the national energy balance is always performed. Fuel amounts related to those direct emissions are subtracted from the amount of fuel from an energy balance depending on the fuel type and activities. For facilities for cement production, since 2007 the emissions reported in the EPR are used for SO_2, NOx, CO and NMVOC, which include all the specifics related to fuel, raw materials and production technology in each of facilities. For trend 1990 - 2006 for each plant the plant-specific emission factor are defined.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Country specific EF for SO_2

For SO_2 emission calculation from combustion of fuel oil and gas oil, Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type. Furthermore, for source categories: 1.A.2.c and 1.A.2.e there is no Tier 2 SO_2 EFs provide in GB2016 (chapter 1.A.2). In respect of all mentioned above, Croatia considers that SO_2 emission calculation methodology is more detailed than Tier 1.

NOx emission factor

For NOx emission calculation Croatia uses methodology disaggregated by fuel types (gas oil, fuel oil, natural gas, etc.) but not disaggregated by technology. For now Croatia does not have plan for moving from Tier 1 to Tier 2 in respect of technology disaggregation. This recommendation is included in IIR's improvement plan as long term goal.

Activity data on fuel used by type for all activities in the scope of source category 1.A.2 are presented in Figure 4.3-1.

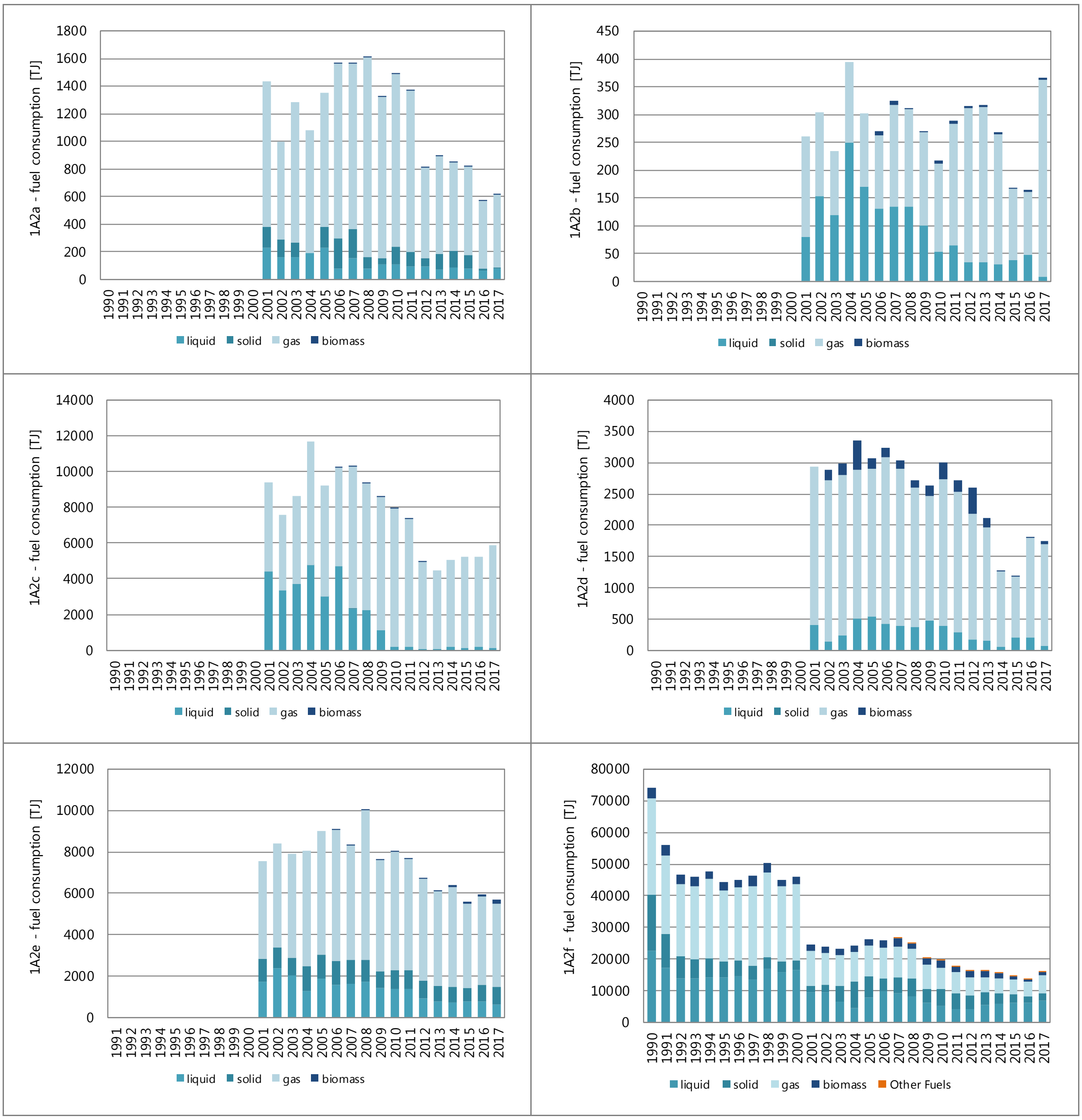


Figure 4.3-1 Activity data on fuel consumption by type for NFR codes 1.A.2.a, 1.A.2.b, 1.A.2.c, 1.A.2.d, 1.A.2.e, 1.A.2.f.

Recalculations and improvements

There was no recalculation and improvements.

4.4. Transport (NFR 1.A.3)

Source category description

Fuel consumption in sector 1.A.3 takes into account fossil fuel consumed in sub-sectors: 1.A.3.a Aviation, 1.A.3.b (i-iv) Road transport, 1.A.3.c Railways, and 1.A.3.d.ii Navigation (shipping). Fuel consumption in sub-sector 1.A.3.d.ii National navigation (Shipping) takes into account fuel consumption for sea and river transport. The sub-sector, 1.A.3.d.i (ii) International inland waterways does not take into account.

Aviation (civil) (NFR 1.A.3.a)

The Republic of Croatia has 7 international airports: Zagreb, Split, Dubrovnik, Zadar, Osijek, Rijeka and Pula and 3 national airports: Brač, Mali Lošinj and Osijek for aircraft in commercial air transport.

The scope of the emissions to be included comprises the civil aviation portion of combustion emissions from mobile sources that concerns the movement of people and/or freight by air. The activities comprise of: international airport traffic (LTO-cycles < 914 m), international cruise traffic (>914 m), domestic airport traffic (LTO-cycles < 914 m), domestic cruise traffic (>914 m). Emissions from two source categories International aviation LTO (civil) (NFR 1.A.3.a.i (i)) and Domestic aviation LTO (civil) (NFR 1.A.3.a.ii (i)) counts in national emission totals, and emissions from two other International aviation cruise (civil) (NFR 1.A.3.a.i (ii)) and Domestic aviation cruise (civil) (NFR 1.A.3.a.ii (ii)) are concerned as memo items, which are excluded from national totals. The scope of the emissions that are included comprises civil commercial use of airplanes, including scheduled and charter traffic for passengers and freight, air taxiing and general aviation. Fuel used at airports for ground transport is excluded from these NFR codes, and are reported under 1.A.3.b, Road transport. Fuel for stationary combustion at airports is also excluded and reported under the appropriate stationary combustion category.

Road transport (NFR 1.A.3.b)

Emissions from Road transport source category in Croatian inventory are reporting in following categories of road vehicles: passenger cars (NFR 1.A.3.b.i), light commercial vehicles (< 3.5 t) (NFR 1.A.3.b.ii), heavy-duty vehicles (> 3.5 t) and buses (NFR 1.A.3.b.iii), mopeds and motorcycles (NFR 1.A.3.b.iv), which are exhaust emission sources and gasoline evaporation (NFR 1.A.3.b.v), and tyre and brake wear (NFR 1.A.3.b.vi), and road abrasion (NFR 1.A.3.b.vii) which are fugitive emission sources.

Railways (NFR 1.A.3.c)

Emissions from rail transport concern the movement of goods or people by rail. Exhaust emissions from railways arise from the combustion of liquid fuels in diesel engines, and solid or liquid fuels in steam engines to provide propulsion Railway locomotives by type in Croatia are: diesel, electric and on steam (the last one in inventory years 1990 and 1991). A few coal-powered locomotives still exist nowadays but they are used for exhibition purposes only. The length of railway lines has decreased in 2014 from 2,722 km to a total of 2,604 km of which 90% are single track and the rest are double track railway. The 37% of the total railway length were electrified. Railways source category isn't a key source in Croatia.

Navigation (shipping) (NFR 1.A.3.d)

Navigation (shipping) source category covers all water-borne transport from recreational craft to large ocean-going cargo ships that are driven primarily by high-, slow- and medium-speed diesel engines and occasionally by steam or gas turbines. Exhaust emissions from navigation arise from engines used as main propulsion engines and auxiliary engines used to provide power and services within vessels.

Emissions from Navigation (shipping) source category in Croatian inventory are reporting in following NFR categories: 1.A.3.d.ii National navigation (shipping) and memo item: 1.A.3.d.i(i) International maritime navigation.

The Republic of Croatia has six ports of international economic interest in the cities: Rijeka, Zadar, Šibenik, Split, Ploče and Dubrovnik. The network of inland waterways of the Republic of Croatian is 804 km, of which 539 km are international waterways. Inland ports open to international public transport are: Osijek, Sisak, Slavonski Brod and Vukovar.

Fuels used for international inland waterways are covered in category 1.A.3.d.ii. The use of bunker fuels for international inland navigation, for example from a Croatian sea port upstream a river to a neighboured country (Hungary, Serbia) is not possible. Vessels fuelling in Croatia for a trip on the Danube river to are covered in category 1A3dii and that trips from seaport upstream a river are not possible.

Pipeline transport (NFR 1.A.3.e.i)

In Croatia all compressor stations are electric, so no emissions occurred from this source for the whole period from 1990 to 2017. As a confirmation of this claim, in IEA and EUROSTAT energy balance data on consumption of all fuel use for pipeline transport can be found for the whole historical period. In IEA and EUROSTAT energy balance for the whole period, consumption of gas and oil in pipeline transport was 0 TJ. In 2017 for Pipeline transport 3 ktoe electricity is consumed.

In Croatian NGL plant natural gas is consumed in compressor station, but according to IEA methodology only fuel used in compressor stations for oil and natural gas transport through pipelines are part of Pipeline transport sector (excluding compressors on plant location).

Data on input and output fuels from NGL plant Ivanić Grad are collected via annual questionnaire (for the whole historical period). Although according to IEA methodology only input and output of fuels in NGL plant accounts in energy balance (excluding own use), in National energy balance own use of fuels in NGL plant are accounted too. Total amount of fuel used for own use in NGL plant is specified in national energy balance in section Energy sector own use-NGL plant. For 2017 in NGL plant only natural gas was used in own use purposes (23.7*106 m^3). This amount of fuel with all other oil and gas extraction in energy industries are summed in 1.A.1.c sector.

Methodology, emission factors, activity data

Aviation (civil) (NFR 1.A.3.a)

Emissions from Aviation (civil) source category were calculated using Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2016. The methodology consists of fossil fuel distribution into domestic and international traffic, along with distribution of jet fuel into the LTO and cruise cycle. For process of jet fuel distribution the Eurocontrol data were used. The Eurocontrol (European Organisation for the Safety of Air Navigation) data are recommended by ERT and secured over the EEA (European Environment Agency). Quality of Eurocontrol data is checked by the ETC/ACM and can be used for reporting and for checking the quality of data on emissions from aviation to the UNFCCC and the LRTAP reporting. Eurocontrol data are available for the period 2005 - 2017. The Eurocontrol database contains aggregate data on the quantities of fuel, number of flights and emissions for each country as well as for the Republic of Croatia. These aggregated amount of fuel and emissions were calculated using Tier 3 methodology by applying "Advanced Emissions Model" (AEM). Quantities of fuel in the Eurocontrol database do not match completely to the amount of fuel in the energy balance of the Republic of Croatia for the period 2005 - 2017 due to estimation with model. With respect to previously mentioned, for jet fuel distribution real amounts of jet fuel from national energy balance were used and were distributed in accordance with the Eurocontrol jet fuel data distribution. Methodological issues remain a Tier 1, because aviation sector is not a key source category in Croatian inventory. Emission factors are presented in Appendix 4.

Two type of activity data are used for emission calculation from Aviation source category: fuel sold for aviation activities and data for number of LTO cycle regarding Croatia, (preferably with a destination for international LTO and general knowledge of the type of aircraft performing the aviation activity). Sources for those activity data are annual national energy balances for fuel sold, and Eurocontrol database for number of LTO cycle for national and international movements. Two types of fuels are used for aviation activities in Croatia: Jet kerosene for national and international traffic and aviation gasoline only for domestic LTO aviation. The Eurocontrol data will be used as alternative source as long as Croatia will not have available and reliable data regarding number of LTO cycle. Based on Eurocontrol data for Croatia on number of flights in the LTO cycle on domestic and international routes, the average number of flights on domestic LTO routes is established to be around 13%, and the remaining (87%) is international LTO flights. The Eurocontrol data on the amount of fuel for international long distances flights (flights outside the territory of Europe) were also take into account to get average share of fuel consumed for international LTO long distances flights in total fuel consumed for international LTO flights.

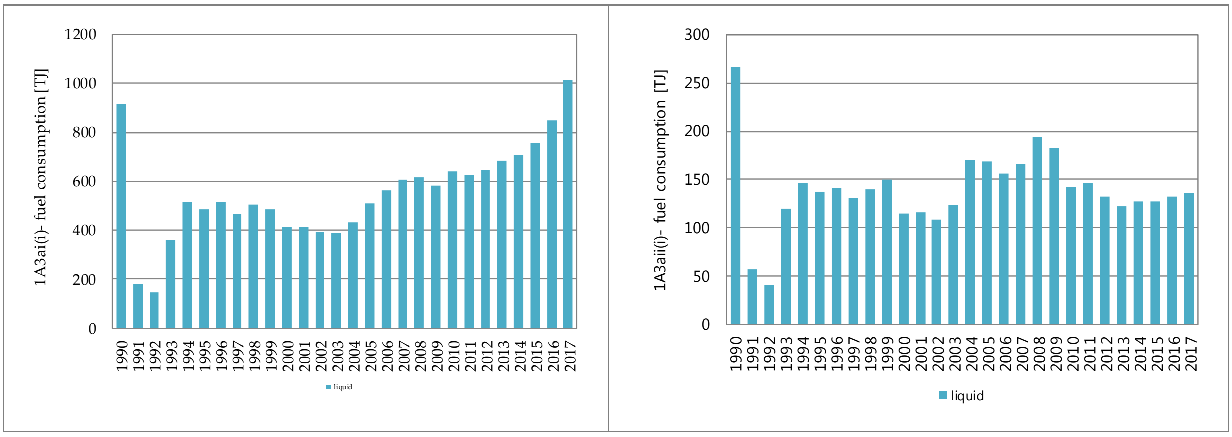
The Tier 1 emission factors from GB2013 were used for emission calculation. Default emission factors are stratified due to fuel type (jet kerosene or aviation gasoline), and additional for jet kerosene additional stratification to four different NFR codes and representative aircraft basis. For emission calculation from jet kerosene combustion proposed emission factors for average fleet were used both for LTO and cruise. Additionally for international LTO traffic the average fleet emission factors regarding short or long distance flights were used. Regarding combustion of gasoline in cars, heavy metals and ammonia emission factors from COPERT 4 were used. Regarding combustion of kerosene for stationary combustion, heavy metals, PCDD/PCDF and PAH_S emission factors for NFR 1.A.2 were used.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Country specific EF for SO_2

For SO_2 emission calculation from combustion of fuel gasoline and kerosine, Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type.

Activity data on fuel used for all activities in the scope of source category 1.A.3.a are presented in Figure 4.4-1.



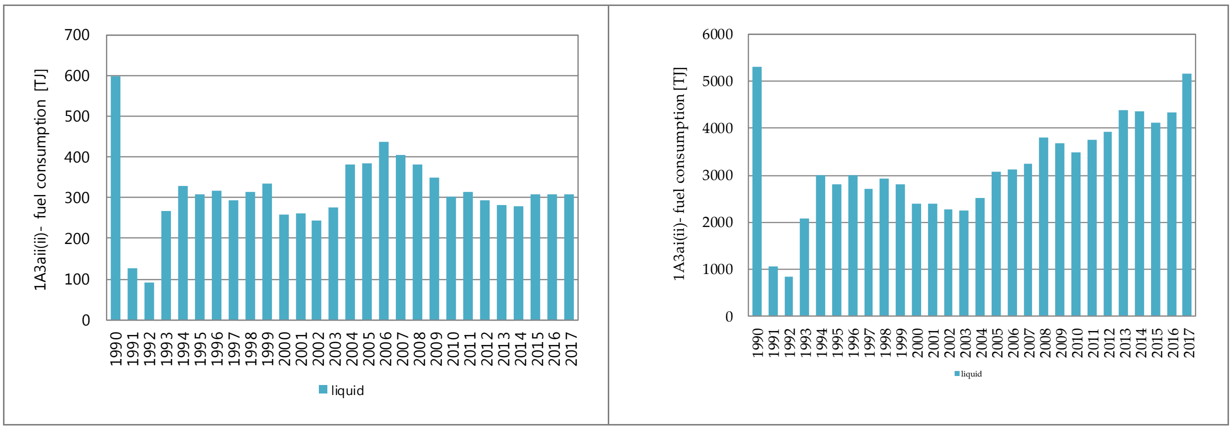


Figure 4.4-1 Activity data on fuel consumption for NFR codes 1.A.3.a.i(i), 1.A.3.a.ii(i), 1.A.3.a.i(ii), 1.A.3.a.ii(ii)

Road transport (NFR 1.A.3.b)

The COPERT 4 ver11.3 package (Tier 2/3 method) was used for air emission calculation from sub-sectors 1.A.3.b(i-vi) Road transport, which requires a detailed set of data as following: type of vehicles (passenger cars, light duty vehicles, heavy duty vehicles, buses, mopeds, motorcycles), type of motor (gasoline four-stroke, gasoline two-stroke, diesel, rotation motor and electromotor), cylinder capacity (<1.4 lit, 1.4-2.0 lit, >2.0 lit), weight class (<3.5 t, 3.5-7.5 t, 7.5-16 t, 16-32 t, >32 t) and age of vehicles (distribution of vehicles per ECE categories according to EC directives). Required detail dataset regarding vehicles characteristics are contained in the Croatian vehicle database. Besides mentioned data, data on amounts of all types of liquid and gaseous fuels consumed in road transportation are also required. The source of fuel sold for road transport is annual national energy balances. Also average monthly minimal and maximal temperature data are required by COPERT model. Required statistical data on temperature were collected yearly for ten biggest towns in Croatia. Additional data like: highway, rural and urban transport mileage, average speed of various vehicles and different road types, average daily trip distance, beta value (the fraction of the monthly mileage driven before the engine and any exhaust components have reached their nominal operation temperature) are expert judgement or COPERT default data. Two assumptions/adjustments were applied when using COPERT model:

- gasoline or diesel oil tank-filled abroad and consumed in Croatia is equal to amount of same type of fuels tank-filled in Croatia and consumed abroad (this is due to a large number of tourist destination and transit trips in Croatia), so effect of this consumption pattern in neutral to fuel balance;
- fuel consumption calculated by COPERT, taking into account number of vehicles and annual average vehicle mileage, should be to a highest possible degree equal to consumption of fuels from the national energy balance (the difference should not be greater than 1%).

For PMs (TSP, PM_{10} and $PM_{2.5}$) emission calculations from source category NFR 1.A.3.b.vii Road transport: Automobile road abrasion, the Tier 1 EMEP/EEA methodology is used, due to this source category is not a key source. The proposed Tier 1 emission factors have been estimated using the Tier 2 method and assuming some default emission values for vehicle characteristics. Emission factors are given as a function of each vehicle category alone.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Country specific EF for SO_2

For SO_2 emission calculation from combustion of fuel gasoline and kerosine, Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type.

The relevant activity statistics for Tier 1 are the number of vehicles in each defined category, and the average mileage driven per vehicle in each defined category (or their product, i.e. the total vehicle-km for each defined category) (Table 4.4-1). Defined categories are: (I) Two-wheel vehicles that correspond to mopeds and motorcycles, (II) Passenger cars that are small or larger family cars used mainly for the carriage of people, (III) Light-duty trucks that include vans for the carriage of people or goods and (IV) Heavy-duty vehicles which correspond to trucks, urban buses and coaches.

Table 4.4-1 Activity data for NFR 1.A.3.b.vii

Vehicle category	Two-wheelers	Passenger Cars	Light Duty Vehicles	Heavy Duty Vehicles
Unit	k(veh*km)	k(veh*km)	k(veh*km)	k(veh*km)
1990	121924	15680420	1184062	1273526
1991	129040	14689962	1221374	1283593
1992	134368	13704348	1245002	1282365
1993	99244	9144898	903254	914294
1994	127028	10506048	1070718	1069551
1995	149352	11440954	1339800	1210891
1996	177040	12265666	1573440	1312718
1997	210660	13518666	1837968	1401264
1998	238520	14336854	1947726	1407495
1999	264208	15206044	2023802	1400757
2000	290256	16029580	2106104	1403346
2001	320932	16945880	2231130	1436720
2002	363048	17589474	2400244	1489739
2003	416360	18289768	2726526	1569675
2004	469732	18958702	2726526	1570962
2005	530852	19524568	2856590	1578570
2006	591444	20204898	2965842	1593991
2007	654660	20647816	3039168	1596261
2008	760508	21455952	3106224	1651410
2009	766600	21230146	2990372	1573003
2010	734780	20891094	2861408	1473118
2011	706756	20721540	2765048	1410692
2012	634180	19675376	2516866	1284313
2013	602780	18778816	2397318	1213400
2014	659900	20952974	2606032	1337042
2015	647796	21294980	2688268	1373448
2016	674320	21724584	2781834	1443436

The dominant fuel consumption activity in the road transport source category in 2017 has 1.A.3.b.i Passenger cars (67.8%) and 1.A.3.b.iv Mopeds and Motorcycles has the smallest contribution (0.6%). The sub-sector 1.A.3.b.ii Light Duty Vehicles has contributed with 11.4% to overall fuel consumption within the road transportation in 2017, and 1.A.3.b.iii Heavy duty vehicles with 18.3%. The trend of fuel consumption in road transportation has growing character (by 78%) in period from 1990 to 2017. The increase in the fuel consumption was the largest in sub-sectors 1.A.3.b.iv Mopeds and Motorcycles (by 3.6 times since 1990) and 1.A.3.b.ii Light duty vehicles (2.3 times since 1990). In sub-sectors 1.A.3.b.iii Heavy duty vehicles and 1.A.3.b.i Passenger cars fuel consumption have increased by 76.5% and 52.2% respectively. The Figure 4.4-2 shows the fuel consumption by type of vehicle in road transport.

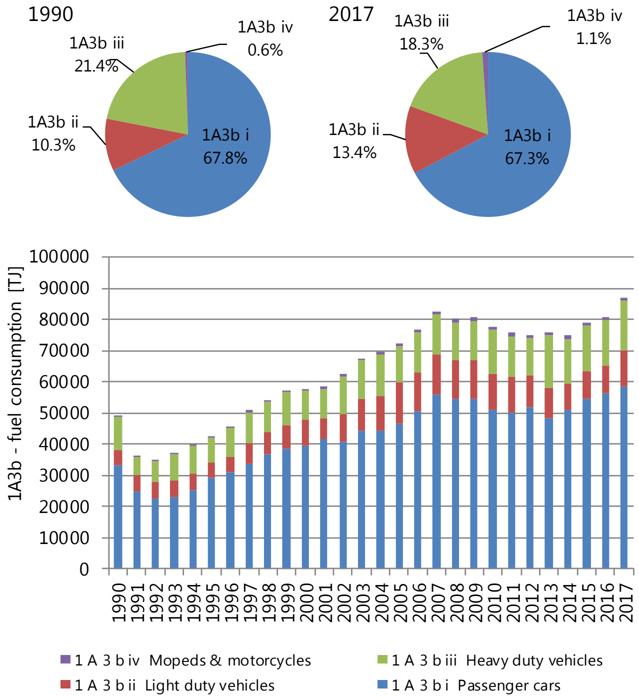


Figure 4.4-2 Fuel consumption by each type of vehicle in the road transportation

The total number of vehicles in the period 1990 - 2017 was increased by 58.1 % (Figure 4.4-3 and Table 4.4-2). The increase was largely a result of increasing number of passenger cars by 44.3 % because they presented 82.6 % of the total number of vehicles in road traffic in 2017. The number of light duty vehicles increase by 2.58 times, mopeds and motorcycles by 5.32 times and heavy duty vehicles by 20.6% in the observing period. The type and class of vehicle, their speed and driving share on each type of road are shown in Table 4.4-3.

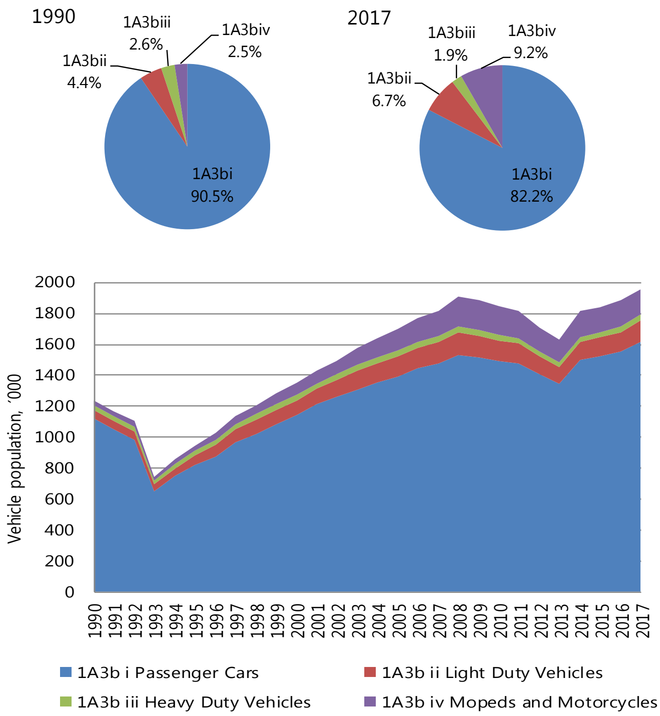


Figure 4.4-3 Number of each type of vehicle in the road transportation

Table 4.4-2 Number of road motor vehicles by type ('000)

Vehicle type, Year / unit	Passenger Cars ´000	Light Duty Vehicles ´000	Heavy Duty Vehicles ´000	Mopeds Motorcycles ´000
1990	1120.03	53.821	32.678	30.481
1991	1049.283	55.517	33.007	32.26
1992	978.882	56.591	33.038	33.592
1993	653.207	41.057	23.595	24.811
1994	750.432	48.669	27.637	31.757
1995	817.211	60.9	31.288	37.338
1996	876.119	71.52	33.938	44.26
1997	965.619	83.544	36.247	52.665
1998	1024.061	88.533	36.412	59.63
1999	1086.146	91.991	36.245	66.052
2000	1144.97	95.732	36.321	72.564
2001	1210.42	101.415	37.19	80.233
2002	1256.391	109.102	38.582	90.762
2003	1306.412	123.933	40.679	104.09
2004	1354.193	123.933	40.709	117.433
2005	1394.612	129.845	40.906	132.713
2006	1443.207	134.811	41.31	147.861
2007	1474.844	138.144	41.362	163.665
2008	1532.568	141.192	42.8	190.127
2009	1516.439	135.926	40.739	191.65
2010	1492.221	130.064	38.133	183.695
2011	1480.11	125.684	36.5	176.689
2012	1405.384	114.403	33.199	158.545
2013	1341.344	108.969	31.349	150.695
2014	1496.641	118.456	34.534	164.975
2015	1521.07	122.194	35.462	161.949
2016	1551.756	126.447	37.282	168.58
2017	1615.682	138.602	39.407	162.186

Source: MIA, Processing: Ekonerg Ltd.

Table 4.4-3 Type and class of vehicle, their speed and driving share on each type of road

Sector	Subsector	Trip speed (km/h)			Driving share, %		
		Urban	Rural	Highway	Urban	Rural	Highway
Passenger Cars	Gasoline 0,8 - 1,4 l	30	60	110	40	35	25
	Gasoline 1,4 - 2,0 l	30	60	110	40	35	25
	Gasoline >2,0 l	30	60	110	40	35	25
	Diesel 1,4 - 2,0 l	30	60	110	40	35	25
	Diesel >2,0 l	30	60	110	40	35	25
	LPG	30	60	110	40	35	25
	CNG	30	60	110	40	35	25
	2-Stroke	30	60	110	40	35	25
	Hybrid Gasoline	30	60	110	40	35	25
Light Duty Vehicles	Gasoline <3,5 t	30	60	100	30	50	20
	Diesel <3,5 t	30	60	100	30	50	20
Heavy Duty Vehicles	Gasoline >3,5 t	30	50	80	30	55	15
	Rigid <=7,5 t	30	50	80	30	55	15
	Rigid 7,5 - 12 t	30	50	80	30	55	15
	Rigid 12 - 14 t	30	50	80	30	55	15
	Rigid 14 - 20 t	30	50	80	30	55	15
	Rigid 20 - 26 t	30	50	80	30	55	15

Sector	Subsector	Trip speed (km/h)			Driving share, %		
		Urban	Rural	Highway	Urban	Rural	Highway
	Rigid 26 - 28 t	30	50	80	30	55	15
	Rigid 28 - 32 t	30	50	80	30	55	15
	Rigid >32 t	30	50	80	30	55	15
	Articulated 14 - 20 t	30	50	80	30	55	15
	Articulated 20 - 28 t	30	50	80	30	55	15
	Articulated 28 - 34 t	30	50	80	30	55	15
	Articulated 34 - 40 t	30	50	80	30	55	15
	Articulated 40 - 50 t	30	50	80	30	55	15
	Articulated 50 - 60 t	30	50	80	30	55	15
Buses	Urban Buses Midi <=15 t	30	50	0	90	10	0
	Urban Buses Standard 15 - 18 t	30	50	0	90	10	0
	Urban Buses Articulated >18 t	30	50	0	90	10	0
	Urban CNG Buses	30	50	0	90	10	0
	Coaches Standard <=18 t	30	50	90	25	65	10
	Coaches Articulated >18 t	30	50	90	25	65	10
Mopeds	2-stroke <50 cm^3	30	50	0	70	30	0
	4-stroke <50 cm^3	30	50	0	70	30	0
Motorcycles	2-stroke >50 cm^3	30	50	0	60	40	0
	4-stroke <250 cm^3	30	50	70	48	50	2
	4-stroke 250 - 750 cm^3	30	50	80	45	51	4
	4-stroke >750 cm^3	30	50	90	35	60	5

Data source: COPERT default

Railways (NFR 1.A.3.c)

Emissions from Railway source category were calculated using Tier 1 EMEP/EEA methodology, due to this sector isn't a key source. The default Tier 1 emission factors, stratified by fuel types, are from GB2016. For diesel and gas oil recommended FE for NFR 1.A.3.c are used, while for the solid fuel (coal and lignite), heavy fuel oil, kerosene and diesel recommended FE for NFR 1.A.4.a are used. Relevant activity data for Tier 1 approach is fossil fuel consumption data by fuel types from annual national energy balances (Figure 4.4-4).

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Country specific EF for SO_2

For SO_2 emission calculation from combustion of following fuels: coal, residual fuel oil, gas oil, diesel, kerosine and gasoline, Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type.

In the national energy balance there is no recorded coal consumption in rail transport since the 1991. Despite that, two coal locomotives were identified in the national register of locomotives. However, they are used only for exhibition purposes and the symbol "NO" is used for the coal consumption in rail transport, which is in accordance with the national energy balance.

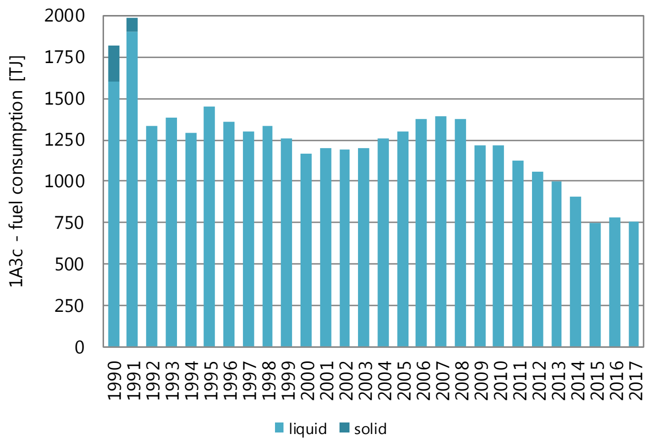


Figure 4.4-4 Activity data on fuel consumption for NFR 1.A.3.c

Navigation (shipping) (NFR 1.A.3.d)

Emissions from Navigation source category for NFR codes 1.A.3.d.ii(i) and 1.A.3.d.i(i) were calculated using Tier 1 EMEP/EEA methodology, due to this sectors aren't a key source. Emissions from 1.A.3.d.i(i) International bunkers of ships are not included in the national total emissions and are shown as memo items.

Emission factors are expressed as the quantity of pollutant emissions per GJ fuel consumed by types. Recommended Tier 1 EF from GB2016 were used for fuel: gasoline and fuel oil and for diesel the Tier 2 FE from GB2016 were used, assuming for small recreational boats that they are conventional type. For pollutants for which EF re not recommended in GB2016, EF from *The EMEP / CORINAIR Atmospheric emission inventory Guidebook - Second Edition (1999)* and *The Emission factors manual PARC ATMOS - Emission factors for air pollutants (1992)* were used.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Country specific EF for SO_2

For SO_2 emission calculation from combustion of following fuels: residual fuel oil, diesel and gasoline, Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type.

For Bunker Fuel Oil the sulphur content of fuel for pre-2006 was 2.7% wt. [source: Lloyd's Register, 1995]; For European Union as specified in the Directive 2005/33/EC 1.5 % wt. from 11th August 2006 for Baltic sea and in EU territorial seas, exclusive economic zones and pollution control zones; and 0.1 % wt. from 1 January 2010 for inland water way vessels and ships at berth in Community.

Emission factors used are presented by NFR sectors and pollutants in Appendix 4.

Relevant activity data for Tier 1 approach is fossil fuel consumption data by fuel types from annual national energy balances. International bunkers of ships are included in the national energy balance as a separate data only from 1994 onwards, while for period from 1990 to 1994 the data is based on expert judgment. Trends of fuel consumed in NFR sectors 1.A.3.d.ii(i) and 1.A.3.d.i(i) are shown in Figure 4.4-5.

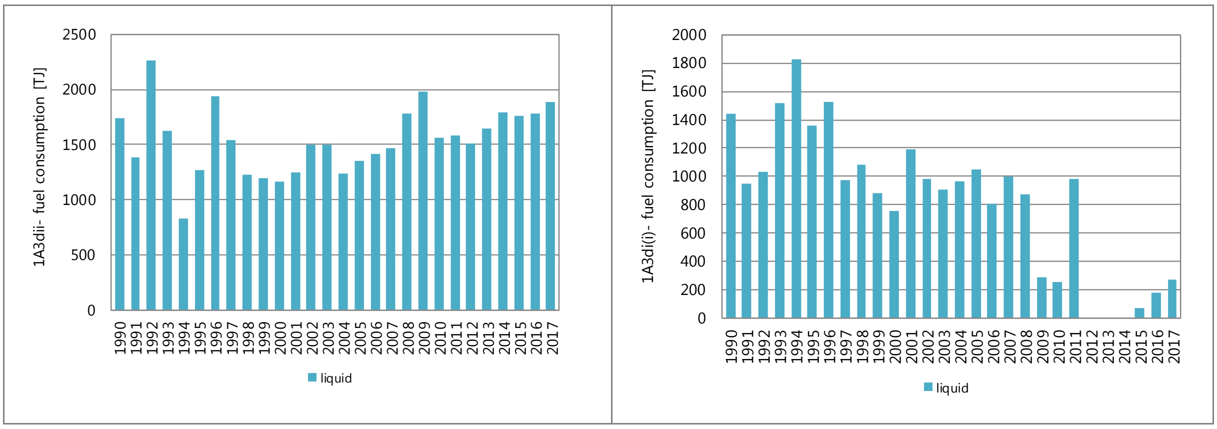


Figure 4.4-5 Activity data on fuel consumption for NFR codes 1.A.3.d.ii, and 1.A.3.d.i(i)

It has to be noted that inland navigation is strongly dependent on the navigability and that therefore fluctuations of this size are rather likely.

In accordance with the energy balance of the Republic of Croatia in the category 1.A.3.d.i(i) International navigations (bunkers) there was no fuel sold in the period 2012-2014 and notation key "NO" was used.

As the fuel consumption data for national navigation and international inland waterways are not separated in the national energy balance, emissions from Category 1.A.3.di (ii) International inland waterways are included in Category 1.A.3.d.ii National navigation (shipping), and the mark "IE" was used. International inland waterways transport can take place along the river Danube, and since international inland waterways transport with the beginning in the Croatian sea is not possible, there is no risk of underestimating national emissions by this approach.

It should be noted that in the national energy balance, all consumption of biofuels is allocated to the road transport sector. The calculations in this report are done accordingly, even though biofuels can be used in other sectors, i.e. in railways, navigation, small non-road vehicles and machinery and aviation.

Recalculations and improvements

Aviation (civil) (NFR 1.A.3.a)

All relevant emissions for the period 2005 - 2016 are recalculated due to new EUROCONTROL fuel consumption data.

Road transport (NFR 1.A.3.b)

SO_2 emissions are recalculated for the period 2014 - 2016 due to the correction of data on the amount of sulfur in diesel and gasoline.

All relevant emissions for the period from 2015 to 2016 are recalculated due to the correction of data on the number of vehicles by category.

Railways (1.A.3.c)

Navigation (shipping) (1.A.3.d)

There was no recalculation or other improvement for these source categories.

4.5. Small combustion (NFR 1.A.4.i)

Source category description

The source category 1.A.4.i Small combustion in Croatia takes into account stationary combustion under NFR sectors 1.A.4.a.i Commercial/Institutional, 1.A.4.b.i Residential, 1.A.4.c.i Agriculture/Forestry. The sectors cover combustion installations activities in the following sectors which, have a thermal capacity ≤ 50 MW_{th}. Small combustion activities are commercial and institutional heating, residential heating and cooking, agriculture/ forestry and other stationary combustion (including military). Residential heating includes fireplaces, stoves, cookers, small boilers (< 50 kW) while institutional/ commercial/ agricultural/ other heating include heating - boilers, space-heaters (> 50 kW), and smaller-scale combined heat and power generation (CHP).

Emissions from smaller combustion installations are significant due to their numbers, different type of combustion techniques employed, and range of efficiencies and emissions. Many of them have no abatement measures nor low efficiency measures. In the residential sector in particular, the installations are very diverse, strongly depending on national and regional factors including quality of fuel supply.

Methodology, emission factors, activity data

Commercial/Institutional (NFR 1.A.4.a)

Methodology for emission calculation is Tier 1 EMEP/EEA, performed by multiplying total fuel sold (disaggregated by fuel type) with emission factors. Sector NFR 1.A.4.a Commercial/Institutional is not a key source.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Country specific EF for SO_2

For SO_2 emission calculation from combustion of following fuels: coals, residual fuel oil, kerosene and gas oil, Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type.

For SO_2 emission calculation from combustion of following fuels: petroleum coke, gas works gas, ligfied petroleum gases, natural gas and wood, Coratia use default EF SO_2 from GB2016.

Emission factors are expressed as the quantity of emissions of pollutants per GJ fuel consumed.

All emission factors are default Tier 1 from GB2016, and are presented by NFR sectors in Appendix 4 of this report.

Structure of fuel combustion in Commercial/Institutional sector for period 1990 – 2017 is presented in Figure 4.5-1.

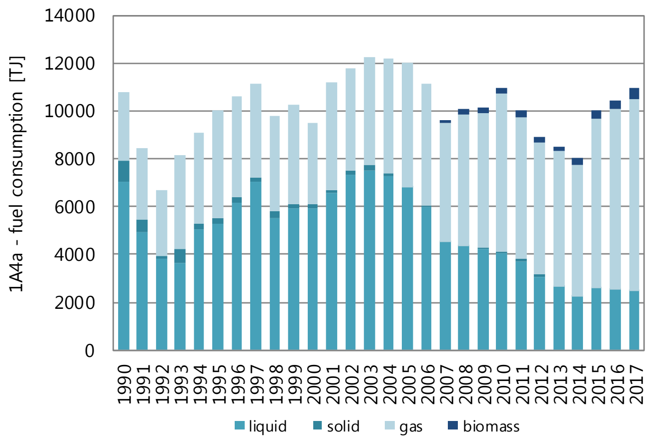


Figure 4.5-1 Activity data on fuel consumption by fuel type for NFR 1.A.4.a

Residential (NFR 1.A.4.b.i)

Within Small combustion source category only 1.A.4.b.i Residential is a key source, so Tier 2 EMEP/EEA methodology was applied for emission calculation. Tier 2 methodology was applied. The application of Tier 2 methodology implies knowledge of the structure and combustion techniques applied in residential since 1990 onwards for the territory of the Republic of Croatian. The model was created for solid and biomass fuel types on technology (furnaces) installed with assumed time of entering of certain technologies into usage. Created model on the technology regard to solid fuels and biomass, data from the GAINS model were used. The GAINS model is using those data for modelling the emission projections for Croatia (Table 4.5-1). For biomass, three basic types of technology were assumed: (I) biomass combustion in heating stoves, (II) biomass combustion in fireplaces and (III) biomass combustion in single house boilers (<50 kW), (IV) biomass combustion in advanced / ecolabelled stoves and boilers and (V) pellet stoves and boilers. For coal, two types of technology were assumed: (I) coal combustion in heating stoves and (II) coal combustion in single house boilers (<50 kW). For years in the period 1990 - 2005 the representation of each of technology are calculated by linear regression method, and for years between 2010 and 2030, the extrapolation method was used. Results of these calculations in order to obtain images and time representation of a particular type of technology regarding biomass and solid fuels combustion are shown in Figure 4.5-1.

Table 4.5-1 Technology structure for solid fuel and biomass distribution in residential sector

Fuel type	Technology	2005	2010	2030
Solid fuel	single house boilers (<50 kW)	61.5%	66.7%	1.8%
	heating stoves	38.5%	33.3%	98.2%
Biomass fuel	fireplaces	5.9%	6.0%	7.7%
	single house boilers (<50 kW)	29.4%	27.4%	15.5%
	heating stoves	64.7%	66.5%	76.8%

Source: the GAINS model

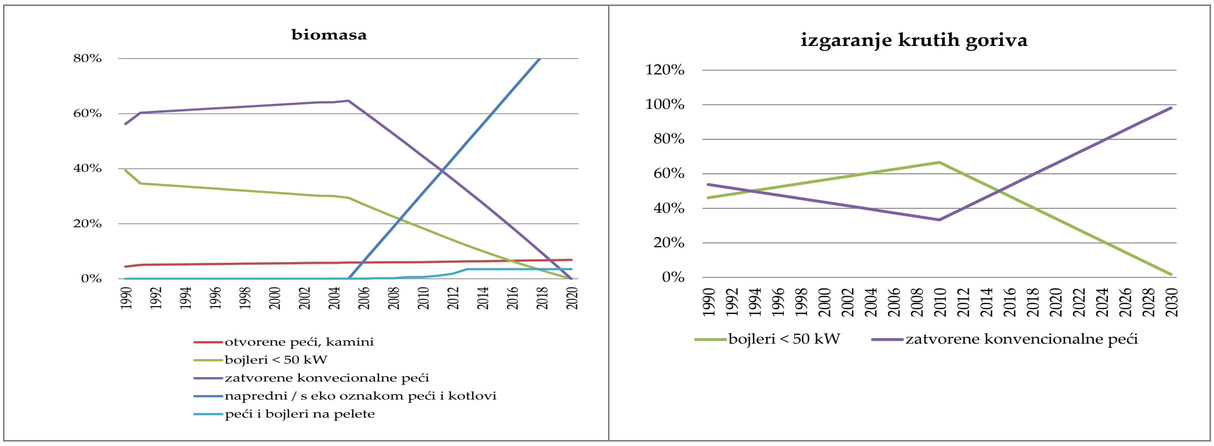


Figure 4.5-2 Model of entering of certain technologies into usage in Residential sector regarding biomass and solid fuels

For liquid and gaseous fuels, the GAINS model does not presume different technologies, so for those fuels it is assumed that correspond technologies defined by the GB2016 are represented in equal proportions for the period since 1990 (Table 4.5-2). For liquid fuels two possible technologies in accordance with GB2016 were considered: (I) liquid fuel combustion in heating stoves and (II) liquid fuel combustion in single house boilers (<50 kW). For gaseous fuels two possible technologies in accordance with GB2016 were considered: (I) gaseous fuel combustion in fireplaces and (II) gaseous fuel combustion in single house boilers (<50 kW). It is also assumed that advanced technologies such as energy efficient stoves burning wood, advanced / ecolabelled stoves and boilers burning wood and pellet stoves and boilers burning wood pellets are for now minimally represented in Croatia and as such are neglected in the calculation.

Table 4.5-2 Technology structure for liquid and gaseous fuel distribution in residential sector

Fuel type	Technology	Period since 1990
Liquid fuel	heating stoves	50%
	single house boilers (<50 kW)	50%
Gaseous fuel	fireplaces	50%
	single house boilers (<50 kW)	50%

Source: the EMEP/EEA GB2013

Two types of solid fuel were used in the residential sector in the Republic of Croatia; lignite and sub-bituminous coal, of liquid fuel: residual fuel oil, gas oil and kerosene, and of gaseous fuels: liquefied petroleum gas, natural gas and LPG gas. Structure of fuel combustion in Residential sector for period 1990 – 2017 is presented in Figure 4.5-3.

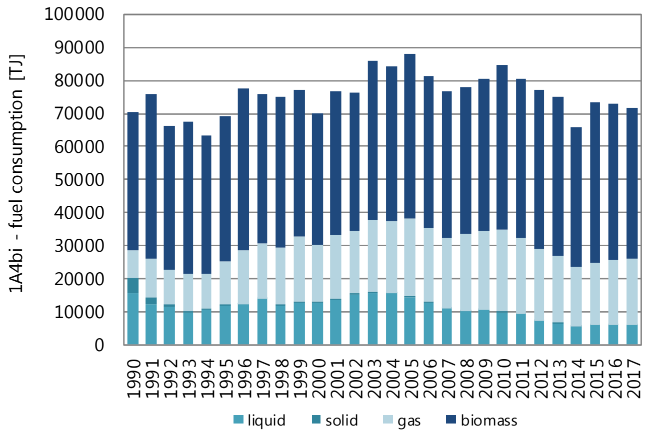


Figure 4.5-3 Activity data on fuel consumption by fuel type for NFR 1.A.4.b.i

Emission factors are expressed as the quantity of emissions of pollutants per GJ fuel consumed. Emission factors are stratified by fuel types and are default Tier 2 from GB2013 except for SO_2.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Country specific EF for SO_2

For SO_2 emission calculation from combustion of following fuels: coals, residual fuel oil, gas oil and kerosine, Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type.

National SO_2 emission factor for solid fuels assumed two type that are used in Croatia: lignite and sub-bituminous coal with net calorific value of 12.25 GJ/t and 18.2 GJ/t respectively, with their average value of sulphur content of 1.67%, and sulphur ash retention factor of 0.1.

For SO_2 emission calculation from combustion of following fuels: petroleum coke, gas works gas, ligfied petroleum gases, natural gas and wood, Coratia use default EF SO_2 from GB2016.

All factors are presented for last histroric year by NFR sectors in Appendix 4 of this report.

Agriculture/Forestry (NFR 1.A.4.c.i)

Methodology for emission calculation is Tier 1 EMEP/EEA, performed by multiplying total fuel sold (disaggregated by fuel type) with emission factors. Sector NFR 1.A.4.c.i Agriculture/Forestry is not a key source. Emission factors are expressed as the quantity of emissions of pollutants per GJ fuel consumed.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

All emission factors are default Tier 1 from GB2016, and are presented by NFR sectors in Appendix 4 of this report. Structure of fuel combustion in Agriculture/Forestry sector for period 1990 – 2017 is presented in Figure 4.5-4.

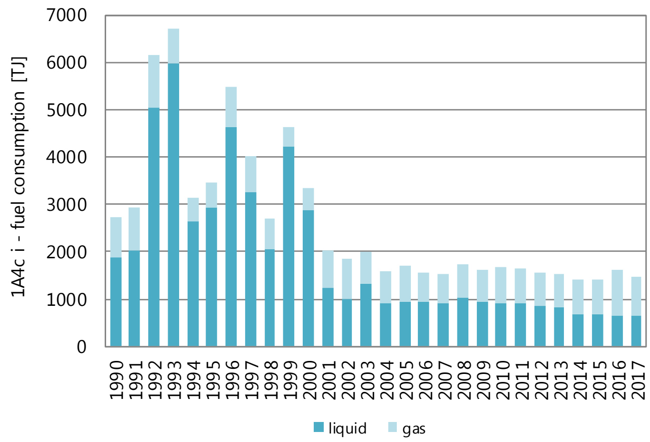


Figure 4.5-4 Activity data on fuel consumption by fuel type for NFR 1.A.4.c.i

Recalculations and improvements

Commercial/Institutional (NFR 1.A.4.a)

In the sector 1.A.4.a for the emission calculation, emission factors from the previous Guidelines were used. In IIR 2019 FE from 2016 EEA / EMEP Guidelines were used for all pollutants and for the entire period from 1990 to 2016.

Residential (NFR 1.A.4.b.i)

Agriculture/Forestry (NFR 1.A.4.c.i)

There was no recalculation or other improvement for these source categories.

4.6. Non-road mobile sources and machinery (NFR 1.A.4.ii, 1.A.2.g.vii)

Source category description

Non-road mobile sources and machinery source category covers a mixture of 'other' equipment. In Croatian inventory emissions are reported in following NFR sectors in the scope of 1.A.4.ii Non road mobile source and machinery: 1.A.4.b.ii Residential, 1.A.4.c.ii Agriculture/Forestry and 1.A.2.g.vii Mobile Combustion in manufacturing industries and construction. Types of equipment used in manufacturing industries and construction (hereafter Industry) include: Asphalt pavers/concrete pavers (SNAP 080801), Plate compactor/tampers/rammers (SNAP 080802), Rollers (SNAP 080803), Trenchers/mini excavators (SNAP 080804), Excavators (wheel / crawler type) (SNAP 080805), Cement and mortar mixers (SNAP 080806), Cranes (SNAP 080807), Graders/scrapers (SNAP 080808), Off-highway trucks (SNAP 080809), Bulldozers (SNAP 080810), Tractors / loaders/backhoes (SNAP 080811), Skid steer loaders (SNAP 080812), Dumpers/tenders (SNAP 080813), Aerial lifts (SNAP 080814), Fork lifts (SNAP 080815), Generator sets (SNAP 080816), Pumps (SNAP 080817), Air/gas compressors (SNAP 080818), Welders (SNAP 080191), Refrigerating units (SNAP 080820), Other general industrial equipment (sweepers, scrubbers, broomers, pressure washers, slope and brush cutters, swappers, piste machines, ice rink machines, blowers, vacuums, etc.) (SNAP 080821), Other material handling equipment (conveyors, tunnel locomotives, snow clearing machines, industrial tractors, pushing tractors) (SNAP 080822), and Other construction equipment (paving and surfacing equipment, bore/drill rigs, crushing equipment, peat break machines, concrete breakers/saws, pipe layers, etc.) (SNAP 080823). Types of equipment used in Agriculture/Forestry include: Two-Wheel Tractors (SNAP 080601), Agricultural tractors (SNAP 080602), Harvesters/combiners (SNAP 080603), Others (e.g. sprayers, manure distributors, mowers, balers, tillers, swatchers) (SNAP 080604), Professional chain saws/clearing saws (SNAP 080701), Professional chain saws/clearing saws (SNAP 080701), Forest tractors/harvesters/skidders (SNAP 080702), Others (tree processors, haulers, fellers, forestry cultivators, shredders and log cultivators) (SNAP 080703). Types of equipment used in Residential (Household and gardening) include: Trimmers/edgers/brush cutters (SNAP 080901), Lawn mowers (SNAP 080902), Hobby chain saws (SNAP 080903), Snow mobiles/skidoos (SNAP 080904), Other household and gardening equipment (SNAP 080905), Other household and gardening vehicles (all-terrain vehicles, off-road motor cycles, golf carts, etc.) (SNAP 080906)

For all types of equipment, the emissions originate from the combustion of fuel to power the equipment.

Methodology, emission factors and activity data

The source categories 1.A.4.b.ii, 1.a.2.g.vii and 1.A.4.c.ii form the category Non-road mobile sources and machinery is a key source in Croatian inventory and Tier 2 technology-dependent advance method proposed in EMEP/EEA GB2016 is used. In essence this advance method involves sub-dividing the fuel consumption of fuel type used by the NFR sectors into the different technology types.

Emission factors are expressed as the quantity of emissions of pollutants per tonnes of fuel consumed. All emission factors are default Tier 2 from GB2016, stratified by fuel type, NFR sector, pollutant and are grouped according to the EU emission legislation stages, and three additional layers are added to cover the emissions from engines prior to the first EU legislation stages.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

For heavy metals and POPs, GB2016 is proposing the use of emission factors for Tier 1. That is because for some pollutants (e.g. heavy metals, SO_2 and CO_2,) the emission factors are independent of the equipment technology, i.e. are simply fuel derived. The key species, which do vary with differing equipment technologies, are particulate matter, NOx, NMVOC and CO.

Country specific EF for SO_2

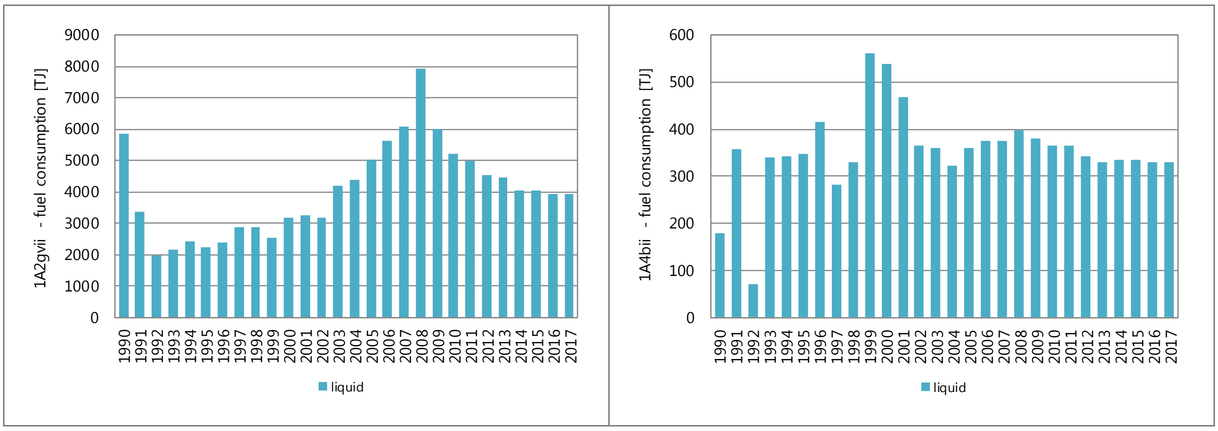
For SO_2 emission calculation from combustion of following fuels: diesel, gasoline, kerosene, gas oil and residual fuel oil, Croatia calculate national emission factors on yearly base. This SO_2 EFs are calculated on the base of annual fuel (produced and put on the market) by type and sulphur amount in fuels by type.

For SO_2 emission calculation from combustion of following fuels: gas works gas, ligfied petroleum gases and natural gas, Coratia use default EF SO_2 from GB2016.

Basic activity data is the fuel consumption data for the different NFR categories from national energy balance annually (Figure 4.6-1). These fuel consumption data are split by the relative proportion of engine technology (< 1981, 1981–1990, 1991–Stage I, Stage I, Stage II, Stage IIIA, Stage IIB, Stage IV) for each particular inventory year. Alternative approach uses data derived from Winther & Nielsen (2006) to split the total fuel consumption into engine technology layers for each inventory year. The percentage split of total fuel consumption as a function of engine age are given for diesel machinery in 1.A.2.g.vii, 1.A.4.c.ii (Agriculture) and 1.A.4.c.ii (Forestry), and for gasoline two-stroke and four-stroke machinery. The layer share of fuel consumption per engine age and inventory year for diesel-fuelled non-road machinery and gasoline fuelled non-road machinery are used. For splitting gasoline consumption between two-stroke and four-stroke gasoline machinery, the Danish fuel consumption percentage split (25/75) is used in all inventory years, having in mind that it is regarded as very uncertain.

In accordance with the distribution in the national energy balance, the consumption of fuels for off-road mobile machinery in category 1.A.4.a.ii Commercial / institutional: Mobile are included in Category 1.A.4.b.ii Residential: Mobile and 1.A.4.c.ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery, therefore the "IE" mark is used.

Also, fuel consumption in category 1.A.4.c.iii is included in category 1.A.3.d.ii National navigation (shipping) (based on the total amount of fuel intended for combustion in domestic air, sea and river transport) and the “IE” mark is used accordingly.



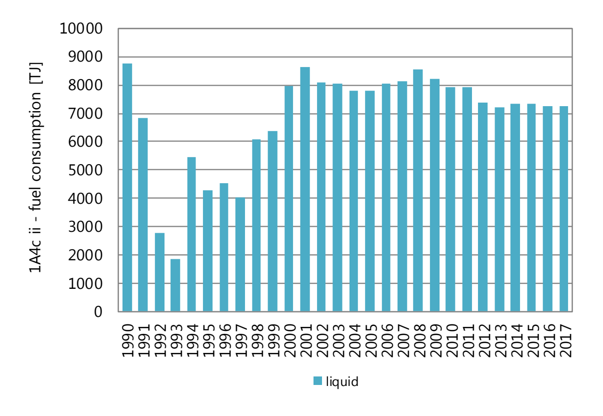


Figure 4.6-1 Activity data on fuel consumption for NFR codes 1.A.2.g.iv, 1.A.4.b.ii and 1.A.4.c.ii

Recalculations and improvements

Non-road mobile sources and machinery: Industry (NFR 1.A.2.g.vii)

Residential (NFR 1.A.4.b.ii)

Agriculture/Forestry (NFR 1.A.4.c.ii)

There was no recalculation or other improvement for these source categories.

4.7. Other sectors (NFR 1.A.5.a, 1.A.5.b)

Source category description

Category 1.A.5 is included in IIR in order to improve the transparency of inventory information on military emissions. All military emissions in sector 1.A.5 are specified as included elsewhere (IE).

In national energy balance military fuel consumed are included in 1.A.4.a.i, 1.A.3.a, 1.A.3.b and 1.A.3.d. Data on fuel sold for each category are collected via annual questionnaire by Croatian statistical office. This amount of fuel include as well fuel used for military purposes. Table 4.7-1 shows the link between the source category 1.A.5 and other source categories, where military emissions are included.

Dividing military from national specification is not possible because data for military only are not available and it is not economically justified because fuel used for military purposes is negligibly small for the whole historical period. It is most likely that contribution of military is below the threshold of significance.

Table 4.7-1 Military emissions specification

NFR code	Sector name	Notation key	NFR code where emissions are reported	Sector name where emissions are reported
1.A.5.a	Other stationary (including military)	IE	1.A.4.a.i	Commercial/Institutional: Stationary
1.A.5.b	Other, Mobile (including military)	IE	1.A.3.a.i(i), 1.A.3.a.ii(i)	Domestic and International aviation LTO (civil)
			1.A.3.b.i, 1.A.3.b.ii, 1.A.3.b.iii, 1.A.3.b.iv	Road transport
			1.A.3.d.ii	National navigation (shipping)
			1.A.3.a.i(ii), 1.A.3.a.ii(ii)	International and Domestic aviation cruise (civil)
			1.A.3.d.i(i)	International maritime navigation

4.8. Fugitive emissions form fossil fuel (NFR 1.B)

Source category description

Sector 1.B Fugitive emissions from fossil fuels are arising from the production, extraction of coal, oil and natural gas; their storage, processing and distribution. This section includes information on methodologies, activity data, emission factors, recalculations and planned improvements for the sector 1.B Fugitive emissions from fossil fuels. Information on this sector are also available in Croatian national inventory report (NIR 2016), under the UNFCCC.

Fugitive emissions from solid fuels (NFR 1.B.1)

This chapter provides an overview of the source categories 1.B.1 Fugitive emissions from solid fuels and includes information on methodologies, activity, emission factors and planned improvements. This category includes emissions from coal mining and handling (NFR 1.B.1.a), solid fuel transformation (NFR 1.B.1.b) and other fugitive emissions from solid fuels (NFR 1.B.1.c) for which Croatia does not report emissions bur used the notation key "NO".

This category includes emissions from mining and handling with coal, activity that exist in Croatia until 1999, as well as emissions during the coal transformation (fugitive emission from coke production), activity that exist in the Republic of Croatia until 1994. In the period from 1990 to 1999 coal production in Croatia has been on a steady decline. Until 1999 worked only Istrian underground coal (Tupljak, Ripenda and Koromačno) and they produced from 0.015 to 0.174 mill. tons of coal.

All underground and surface treatment of coal result mainly in fugitive emissions of methane, volatile organic compounds and particulate matter (TSP, PM_{10} and $PM_{2.5}$) during mining and post mining activity, handling with coal. Coke Plant is a major source of fugitive emissions into the air such as: sulphur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (non-methane VOC and methane (CH4), carbon dioxide (CO_2), carbon monoxide (CO) ammonia (NH_3), particulate matter and heavy metals and PAHs (polycyclic aromatic hydrocarbons).

Fugitive emissions from oil and natural gas (NFR 1.B.2)

This chapter provides an overview of the source categories 1.B.2 Fugitive emissions from oil and natural gas, and includes information on methodologies, activity, emission factors and planned improvements. This category includes emissions from oil - exploration, production and transport (NFR 1.B.2.a.i), Refining / storage (NFR 1B .2.a.iv), distribution of oil products (NFR 1.B.2.a.v), natural gas – production/processing, and transmission (NFR 1.B.2.b), Flares (NFR 1.B.2.c) and 1.B.2.d Other fugitive emissions from energy production for which Croatia do not report emissions but rather used the notation key "NO".

This category includes the fugitive emissions from exploration and production, refining, storage transportation, processing and distribution of crude oil, petroleum products (gasoline) and natural gas. Fugitive emissions also include the emissions from flared gas on oil- and gas-production installations for safety, and emissions due to degassing in the production of oil and gas. Emissions are also occurring during production and processing of natural gas and oil, transportation and use of fossil fuel. During all phases of the extraction of fossil fuel to their final use, the evaporation of highly volatile material occurs and leakage of fossil fuel is also possible.

Oil - exploration production and transport (NFR 1.B.2.a.i)

Exploration production and transport of oil in the Republic of Croatia is carried out by company INA - Oil Industry d.d in the segment activity SD Exploration & Production of oil and gas (formerly INA NAFTAPLIN). In Croatia, 34 oil fields are active, and the maximum amount of oil came from 8 most important fields, that contain 83% of the total reserves discovered in Croatia. During the war (1991 - 1995) from 34 oil fields, only 22 of them worked. All oil fields in Croatia are "on shore" fields.

Natural gas - production/processing, and transmission (NFR 1.B.2.b)

In Croatia, the production/processing, and transmission of natural gas takes place in private facilities. Extraction and production of natural gas in Croatia carried out by INA - Oil Industry d.d in the segment activity SD Exploration & Production (formerly INA NAFTAPLIN). The main gas fields with 70% of total reserves are located in the three largest gas and gas-condensate fields, namely Molve, Kalinovac and Stari Gradac in the western part of the Drava depression, along the border with Hungary. The work site "Molve" provides between 70% and 75% of gas and condensate per year in Croatia, satisfying about 50% of the needs. One of the old gas fields around the Sava Depression, turned into underground gas storage capacity of 500 mil. m^3 (Lit 27).

Transport system, carried out by transport system operator (OTS) company Plinacro Ltd. and by distribution system operators (35 company). Also, in this sector, the Hg emission that originates from process of cleaning natural gas in central gas station (CPS Molve). Natural gas produced on Croatian gas fields (Molve and Kalinovac) contains great content of Hg (516 $\mu g/m^3$), which wasn´t extracted from natural gas until 1992. In 1993 facility for Hg emission reduction started with work and Hg emission was reduced to about 0.12 $\mu g/m^3$ since then.

The transport system is managed by the transmission system operator Plinacro Ltd, it consists of international, main, regional and developable pipeline and facilities to the pipeline, measuring reduction stations (MRS) of various capacities and other facilities and systems that enable reliable and secure transport system. Basic data of the Croatian transport system are shown in Table 4.8-1.

Table 4.8-1 Basic data on the natural gas transport system of the Republic of Croatia

Natural gas transport system of the Republic of Croatia	
Number of transmission system operators	1
The total length of pipeline gas transport system	2 694 km
Interconnection / transmission system operator:	Rogatec / Plinovodi Ltd (SLO) Drávaszerdahely / FGSZ Ltd. (HU)
Underground gas storage / gas storage system operator:	Okoli / Podzemno skladište plina Ltd
Inputs from domestic production / gas producer	UMS CPS Molve / INA - d.d. UMS Etan, Ivanić Grad / INA - d.d. UMS PS Ferdinandovac / INA - d.d. UMS PS Gola / INA - d.d. UMS PS Hampovica / INA - d.d. UMS Terminal Pula / INAGIP Ltd
Number of connections for end users connection to the transmission system:	34
Number of connections to the distribution systems and the number of distribution system operators:	Number of ports: 153 Number of operators DS: 37
Number of balancing zones:	1

Source: Plinacro d.o.o. (http://www.plinacro.hr)

Refining / storage (NFR 1.B.2.a.iv)

Refining / storage in the Republic of Croatia is carried out in an oil refinery owned by a company INA - Oil Industry dd at two locations in Rijeka (INA - RNR) and Sisak (INA - RNS). Production capacities of the Croatian refineries are shown in Table 4.2-2. The calculation of emissions from these categories for INA - RNS includes emissions from FCC regenerators (without CO boiler) (from 1990), catalytic reforming unit (from 1990), coking plant (from 1994) and Claus installation (from 2007). INA - RNR includes emissions from FCC regenerators (without CO boiler) (from 1990), catalytic reforming unit (two units, from 1990) and Claus installation (from 1997). Diffuse emissions from storage and handling of petroleum products in refinery are calculated from 1990 for all refineries.

Distribution of refined petroleum products (NFR 1.B.2.a.v)

In Croatia, the distribution of petroleum products takes place through the following activities:

- Shipping and delivery of products in the refinery dispatch stations (SNAP 050501)
- transport and transfer stations oil products (SNAP 050502) and
- reloading and handling of petroleum products at service stations (retail trade) (SNAP 050503).

Distribution in Croatia is handled by company INA - Oil Industry d.d. segment activity SD Retail trade. The refinery, besides all oil products, NMVOC emissions are significant only for gasoline.

Shipping and delivery of products in the refinery dispatch stations

Shipment and delivery of oil derivatives is carried out in Croatia in two refinery dispatching stations in Sisak and Rijeka. Their specifics related to the delivery of petrol fuels are described below.

The shipment and delivery of petrol fuel to the Sisak Oil Refinery is carried out:

- By road transport, where the dispatching installation Auto-fill station PJ terminal Sisak is used, shipment of derivatives by truck tanks. The loading lines are provided with-equipment for quantity setting and overfill prevention probe.
- By rail transport, where the handling site MM1 – delivery, is used,
- Transport by barges is carried out on the Sava River south of Sisak at the port for reception and discharge of crude oil from river barges and for loading of products into river barges. The installation for oil discharge and pumping into tanks of RNS Sector is used, while the installation for loading of derivatives has not been used for a long time.

The shipment and delivery of petrol fuel to the Refinery of Rijeka and tert-butyl methyl ether (MTBT) is carried out through the terminals for ship, road and rail transport:

- Road transport: dispatch of fuel (gasoline) to the road tankers is carried out at the Šoići filling station. Charge mode:
    - Filling of road tankers: filling station newly built in 2016, closed filling system, automatic measuring system, loading on the bottom side of the tanker, built unit for the vapour recovery in 2017, issued used permit on 17.10.2017.
- Railway transport: loading and unloading of railway tanks, charging mode:
    - Rail cisterns loading: VP5 wagon filling station, built in 2016, ongoing licensing procedure (expected after technical inspection), closed filling system, automatic measuring system, built unit for the vapour recovery in 2017, the technical inspection of the unit expected soon
    - Unloading of railway tanks: the wagon-filling station VP1, built in 2017, is in the process of being tested, is under preparation for a technical inspection, the unloading of railway tanks is carried out via flexible pipes, in a partially closed system and without the possibility of returning hydrocarbon vapours, all manipulation with railway tanks is done by maneuvering locomotives on a motor drive.
- The ship's transport of gasoline takes place in the Bakar Port, charging mode:
    - Loading and unloading: The modernization of the Port of Bakar is under way, it is done by loading/unloading arms at Gat 5, and on gates that are in the phase of modernization through flexible pipes, a vapour return unit was built in 2017.

Transportation and transfer stations gasoline fuel

Emissions from the transport of gas in accordance with GB2016 was identified as negligible. This section includes emissions from gas fuel storage at terminals. According to GB2016, the methodology for calculating emissions from the storage of petrol at terminals in refineries is covered under the category 1.B.2.a.iv refinery / storage in refineries. Therefore, it is necessary to avoid double counting of emissions. The specific emissions using Tier 2 method are calculated and reported in the sector NFR 1.B.2.a.iv refinery / storage in refineries.

Gas stations

Handling and manipulation of gas fuel is carried out and at gasoline stations. Most emissions at gasoline stations are emissions from gasoline storage, and GB2016 propose only emission factors for petrol.

Flares (NFR 1.B.2.c)

The inventory included emissions from the two sub-categories: flares in refineries and flares in gas and oil extraction.

Methodology, emission factors and activity data

Coal mining and handling (NFR 1.B.1.a)

Fugitive emissions from sub-sectors 1.B.1.a Fugitive emissions from solid fuels: Coal mining and handling (SNAP 050102 Underground mining and SNAP 050103 Storage of solid fuel) are calculated with Tier 1 EMEP/EEA methodology and with „top-down“ approach by multiplying process specific activity data with the corresponding EMEP/EEA Tier 1 emission factors.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

All emission factors used for the preparation of the IIR are presented by NFR sectors and pollutants in Appendix 4.

Sources to activity data for the total mass of coal produced by underground mining for NFR 1.B.1.a are the national energy balance. Annual amounts of total mass of coal produced by underground mining are presented in Table 4.8-2.

Solid fuel transformation (NFR 1.B.1.b)

Fugitive emissions from sub-sectors 1.B.1.b Fugitive emissions from solid fuel: solid fuel transformation (SNAP 040201 Coke oven (door leakage and extinction)) are calculated with Tier 1 EMEP/EEA methodology and with „top-down“ approach by multiplying process specific activity data with the corresponding EMEP/EEA Tier 1 emission factors.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

All emission factors used for the preparation of the IIR are presented by NFR sectors and pollutants in Appendix 4.

Sources to activity data for the production of coke for the NFR 1.B.1.b are the national energy balance. Annual amounts of coke produced are presented in Table 4.8-2.

Other fugitive emissions from solid fuel (NFR 1.B.1.c)

This category refers to fugitive emissions from solid fuels that do not belong in the other categories 1.B.1. In the Republic of Croatia there is no such case and the used mark is "NO".

Oil - Exploration, production and transport (NFR 1.B.2.a.i)

Fugitive emissions from 1.B.2.a.i Extraction, 1st treatment and loading of liquid (SNAP 050200) are calculated with Tier 2 EMEP/EEA methodology by multiplying process specific activity data with the corresponding Tier 2 emission factors.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

All emission factors used for the preparation of the IIR are presented by NFR sectors and pollutants in Appendix 4.

Relevant activity data is annual mass of crude oil extracted in Croatia from the national energy balance and are presented in Table 4.8-2.

Table 4.8-2 Activity data for NFR code 1.B.1.a, 1.B.1.b, 1.B.1.c, 1.B.2.i and 1.B.3

NFR	1 B 1 a	1 B 1 b	1 B 1 c	1 B 2 a i	1 B 3
Name	Fugitive emissions from solid fuel: coal mining / handling	Fugitive emissions from solid fuel: transformation	Other fugitive emiss. from solid fuel	Fugitive emission from oil: exploration/ production/ transport	Other fugitive emissions not incl. in 1 B 2
Unit	kt	kt	-	kt	-
1990	173.7	556.0	NA	2696.2	NO
1991	154.8	456.0	NA	1930.9	NO
1992	120.3	408.0	NA	1742.9	NO
1993	115.1	422.0	NA	1727.1	NO
1994	103.2	277.0	NA	1576.6	NO
1995	82.2	NO	NA	1500.3	NO
1996	66.3	NO	NA	1469.1	NO
1997	48.5	NO	NA	1496.2	NO
1998	50.8	NO	NA	1389.4	NO
1999	15.3	NO	NA	1292.7	NO
2000	NO	NO	NA	1213.9	NO
2001	NO	NO	NA	1120.8	NO
2002	NO	NO	NA	1108.5	NO
2003	NO	NO	NA	1052.1	NO
2004	NO	NO	NA	1001.0	NO
2005	NO	NO	NA	946.0	NO
2006	NO	NO	NA	917.4	NO
2007	NO	NO	NA	879.1	NO
2008	NO	NO	NA	835.4	NO
2009	NO	NO	NA	776.2	NO
2010	NO	NO	NA	720.4	NO
2011	NO	NO	NA	664.4	NO
2012	NO	NO	NA	599.9	NO
2013	NO	NO	NA	600.7	NO
2014	NO	NO	NA	593.2	NO
2015	NO	NO	NA	670.2	NO
2016	NO	NO	NA	737.1	NO
2017	NO	NO	NA	744.5	NO

Sources: ME with assistance of EIHP, CBS; Processing: Ekonerg Ltd.

Refining / storage (NFR 1.B.2.a.iv)

Fugitive emissions during refining / storage (NFR 1.B.2.a.iv) were calculated using the Tier 2 EMEP/EEA methodology and "bottom-up" approach, multiplying relevant activity data with the recommended EMEP/EEA Tier 2 emission factors for specific process activities.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

All emission factors used for the calculation are presented by NFR sectors and pollutants in Annex 4.

Scope of process activities within the 1.B.2.a.iv Refining / storage are: SNAP 040102a – Catalytic Cracking unit regenerators, Partial burn without CO boiler, SNAP 040102b – Catalytic reforming units, SNAP 040103 - Sulphur recovery plants, SNAP 040104 - Storage and handling of petroleum products in refinery, SNAP 040103 - Other - Fluid coking units. For catalytic cracking unit regenerators, the proposed Tier 2 emission factors are for partial burn without a CO boiler, and with a primary cyclone installed, and other abatement techniques were not taking into account. Further, the existing facilities for refining haven't got abatement techniques installed within activity catalytic cracking (FCC) units in sub-sector 1.B.2.a.iv.

Data on annual throughput of each refinery of fresh feed in FCC, reforming and coking units, and sulphur annual production were obtained from CAEN (survey request). Activity data for calculating emissions from storage and handling of petroleum products in refinery, diffuse emissions is annual total throughput of crude oil in each refinery which are from annual national energy balance. Detail activity data for sub-sector 1.B.2.a.iv by SNAP, are presented in Table 4.8-3.

Table 4.8-3 Activity data for NFR code 1.B.2.a.iv, represented by the relevant SNAP codes

SNAP	040102a	040102b	040105	040103	040104
SNAP, Name	Catalytic Cracking unit regenerator	Catalytic reforming unit	Other (Fluid coking unit)	Sulphur recovery plant	Storage and handling of petroleum products in refinery
Unit	m^3	m^3	m^3	t product	kt product
1990	1281386.9	1604752.5	NO	NO	6860.7
1991	894923.1	1025834.7	NO	NO	4510.9
1992	698051.1	765189.2	NO	NO	3935.0
1993	945750.0	1089993.2	NO	NO	4914.8
1994	842190.2	965896.8	160057.6	NO	4994.3
1995	883426.3	1240143.5	160156.6	NO	5336.1
1996	702792.0	1218952.5	130610.0	NO	5112.7
1997	699881.1	1105752.4	139063.5	2182	5112.0
1998	898859.7	1035149.7	154889.9	5328	5007.5
1999	1037236.9	1136591.1	194651.3	5898	5474.8
2000	1385177.6	1208675.6	190477.4	8344	5162.8
2001	1217423.5	1159479.8	190477.4	6742	4831.6
2002	1247837.5	1028707.7	214165.0	7069	4830.0
2003	1242743.7	1204451.0	189346.3	7471	4861.7
2004	1348940.9	1184513.3	176767.0	8463	5079.3
2005	1394164.7	1048203.3	149598.6	8134	4944.7
2006	1138184.8	1033704.3	191970.8	6694	4716.4
2007	1369880.4	1067431.1	181216.5	8910	5077.4
2008	1065994.3	925676.0	116827.1	9511	4308.7
2009	1330001.8	1048720.6	122365.0	10037	4824.4
2010	1027809.8	930965.3	184824.0	6370	4256.6
2011	836242.3	743096.0	91182.9	16317	3502.7
2012	906166.8	775119.3	109368.5	17532.2	2924.9
2013	753682.5	729726.9	83736.2	15902	3062.5
2014	632786.8	661857.0	38501.3	19384	2444.4
2015	664646.0	681111.0	89984.0	17540	2998.2
2016	665394.0	718614.0	61996.0	21690	3250.5
2017	744257.0	871697.0	107924.0	24168	3562.5

Sources: CAEN (survey request: oil refineries); Processing: Ekonerg Ltd

Distribution of oil products (NFR 1.B.2.a.v)

Fugitive emissions from sub-sectors: 1.B.2.a.v Distribution of oil products (SNAP 050400 Liquid fuel distribution (except gasoline distribution), SNAP 050502 Refinery dispatch station, and SNAP 050503

Service stations (including refuelling of cars) were calculated with Tier 2 EMEP/EEA methodology and "bottom-up" approach by multiplying relevant activity data with the recommended EMEP / EEA Tier 2 emission factors, both stratified according to the different techniques in the distribution of oil products occurring in the national oil industry. According to the proposed methodology emissions from refinery, storage tanks are reported in 1.B.2.a.iv and emission from loading of mobile container in refinery are reported in 1.B.2.a.v. For source category SNAP 050502 Transport and depots (except 050503) according to GB2016 emissions from transport were identified as negligible, emissions from filling mobile containers at depots are calculated in the scope of refinery dispatch stations and emissions at depots is gasoline storage which is covered in 1.B.2.a.iv.

Detail activity country specific data are collected and this includes:

- loading facilities at refinery dispatch stations, terminals and depots — volume of volatile products loaded into different transport modes (road, rail and marine tanker); loading practices for specific modes of transport (top, bottom); type and extent of emission control measures in place (VRU), data source is national oil company;
- service stations — volume of gasoline sold; type and extent of emission control measures in place (Stage IB, Stage II), data source is national oil company, and national energy balance;
- average ambient temperature, data source is Meteorological and hydrological service;
- Reid vapour pressure (RVP) of distributed volatile products (gasoline) — is calculated from the annual average RVP value and average temperature data the true vapour pressure.

Activity data on annual amount of gasoline handled for sub-sector 1.B.2.a.v by SNAP, are presented in Table 4.8-4.

Table 4.8-4 Activity data for NFR code 1.B.2.a.v, represented by the relevant SNAP codes

Activity	Service stations, Storage tank filling	Service stations, Storage tank breathing	Service stations, Automobile refuelling	Service stations, Automobile refuelling: drips and spills	Refinery dispatch station, Road tanker	Refinery dispatch station, Rail tanker	Refinery dispatch station, Marine tanker
SNAP	50503	50503	50503	50503	50501	50501	50501
Unit	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline
1990	764.00	764.00	764.00	764.00	426.39	399.86	995.34
1991	590.50	590.50	590.50	590.50	324.52	304.33	757.55
1992	511.40	511.40	511.40	511.40	227.52	213.37	531.11
1993	497.00	497.00	497.00	497.00	298.61	280.03	697.06
1994	545.63	545.63	545.63	545.63	321.03	301.05	749.38
1995	575.10	575.10	575.10	575.10	360.69	338.25	841.97
1996	626.00	626.00	626.00	626.00	319.56	299.68	745.96
1997	678.00	678.00	678.00	678.00	325.74	305.47	760.39
1998	737.30	737.30	737.30	737.30	338.82	317.74	790.93
1999	781.70	781.70	781.70	781.70	296.25	277.81	691.54
2000	784.40	784.40	784.40	784.40	313.45	293.95	731.70
2001	753.80	753.80	753.80	753.80	293.06	274.83	684.11
2002	759.00	759.00	759.00	759.00	301.07	282.34	702.80
2003	757.30	757.30	757.30	757.30	315.93	296.28	737.49
2004	723.70	723.70	723.70	723.70	319.12	299.26	744.92
2005	709.60	709.60	709.60	709.60	333.49	312.74	778.47
2006	711.30	711.30	711.30	711.30	325.36	305.12	759.51
2007	725.30	725.30	725.30	725.30	341.14	319.92	796.34
2008	696.30	696.30	696.30	696.30	308.17	250.81	730.12

Activity	Service stations, Storage tank filling	Service stations, Storage tank breathing	Service stations, Automobile refuelling	Service stations, Automobile refuelling: drips and spills	Refinery dispatch station, Road tanker	Refinery dispatch station, Rail tanker	Refinery dispatch station, Marine tanker
SNAP	50503	50503	50503	50503	50501	50501	50501
Unit	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline
2009	692.30	692.30	692.30	692.30	269.83	286.53	871.44
2010	650.50	650.50	650.50	650.50	229.40	275.56	819.13
2011	634.90	634.90	634.90	634.90	192.05	243.26	651.59
2012	590.10	590.10	590.10	590.10	178.36	234.36	746.48
2013	576.20	576.20	576.20	576.20	170.81	198.31	657.69
2014	532.70	532.70	532.70	532.70	141.83	241.73	562.94
2015	531.50	531.50	531.50	531.50	132.28	238.02	690.00
2016	533.40	533.40	533.40	533.40	278.46	177.46	557.81
2016	513.20	513.20	513.20	513.20	354.73	133.73	676.85

Source: MIA with EIHP, CAEN INA d.d; Processing: Ekonerg Ltd

Flares (NFR 1.B.2.c)

Fugitive emissions from sub-sector 1.B.2.c Venting and Flaring are calculated for two SNAP categories: SNAP 090203 Flaring in oil refinery and SNAP 090206 Flaring in gas and oil extraction. EMEP/EEA methodology is used with Tier 2 approach. Both the activity data and the emission factors are stratified according to the different techniques that occur in Croatia. In the venting and flaring sector, these are refinery flares, flares in natural gas extraction and well testing. Well testing is not occurring in Croatia. Tier 2 approach for emission calculation is carried out by multiplying process specific activity data for the specific technology with the corresponding EMEP/EEA Tier 2 emission factor for this technology and this pollutant.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

All emission factors used for the preparation of the IIR are presented by NFR sectors and pollutants in Appendix 4.

Activity data for SNAP 090203 Flaring in oil refinery is the annual flared amount for each refinery. The data for the flared amount for each refinery were collected for the period from 2010, and used for methodology improvement, e.g. move to Tier 2. The source of data are the national oil refinery company INA Ltd. For NMVOC and SO_2 emission calculation Tier 1 approach is used, because the data on the gaseous streams composition combusted in flares were not available. Activity data used for Tier 1 approach is the annual total throughput of refineries. Besides, these data, the data on total amount of crude oil at the entrance to the refineries is use, along with amount of fuel used by type in each of refinery. Source for the total amount of crude oil is from the national energy balance. Source for the annual amount of fuels for the period 2008 – 2017 is the national EPR. Source for the annual amount of fuels for the period 1990-2004 is the basis for the preparation of the Energy Development Strategy of the Republic of Croatia (OG 130/09) collected from oil refinery company INA Ltd. For the period 2005-2007 the amount of fuels by type and refinery were calculated by using of the linear interpolation method. The data on annual fuel amount by refinery is used to determine the annual amount of crude oil at the entrance to each refinery. The data on total crude oil by each of two refineries in Croatia is confidential. Amount of gas flared at the each refinery in the period 1990 - 2009 were calculated by using weighting factors calculated as the average value of the known quantities of gas flared at the refinery for the period 2010-2014 and by multiplying with the estimated amount of crude oil at the entrance to each refinery. It is assumed that the average crude oil density in Croatia is 0.86 kg/dm^3.

Activity data for SNAP 090206 Flaring in gas and oil extraction is the annual volume of gas flared in hydrocarbons (oil and gas) extraction. The data were collected for the period from 2009 from national oil refinery company INA Ltd., and used for methodology improvement, e.g. move to Tier 2. Annual volume of gas flared in gas and oil extraction in the period 1990 - 2008 were calculated by using weighting factor calculated as the average value of the known quantities of annual gas flared in gas and oil extraction for the period 2009-2015 and by multiplying with the annual volume of total gas and crude oil extracted in Croatia. It is assumed that the average crude oil density in Croatia is 0.86 kg/dm^3 and average density of natural gas 0.73 kg/m^3.

Table 4.8-5 gives the overview of activity data for NFR 1.B.2.c Venting and Flaring, SNAP 090203 Flaring in oil refinery and SNAP 090206 Flaring in gas and oil extraction.

Table 4.8-5 Activity data for NFR 1.B.2.c Venting and Flaring, SNAP 090203 Flaring in oil refinery and SNAP 090206 Flaring in gas and oil extraction

Activity data	Gas flared in refineries		Crude oil truthput in refineries	Gas flared in gas and oil extraction
Unit	GJ	GJ	t	m^3
1990	211.317	727.761	6.860.700	22.313.460
1991	145.779	630.090	4.510.900	19.824.633
1992	64.444	337.790	3.935.000	14.236.376
1993	138.202	558.377	4.914.800	18.026.024
1994	141.458	534.205	4.994.300	14.848.538
1995	117.437	762.467	5.336.100	12.105.367
1996	144.703	705.871	5.112.700	11.294.150
1997	166.576	726.555	5.112.000	13.557.402
1998	162.667	861.277	5.007.500	12.396.234
1999	178.518	889.818	5.474.800	14.990.742
2000	150.652	1.002.606	5.162.800	12.934.101
2001	153.651	929.303	4.831.600	15.866.449
2002	181.054	834.244	4.830.000	16.733.125
2003	166.945	885.158	4.861.700	17.279.182
2004	193.983	713.208	5.079.300	17.345.753
2005	185.887	715.937	4.944.700	18.018.016
2006	179.773	742.919	4.716.400	21.409.983
2007	171.970	801.227	5.077.400	22.818.263
2008	142.593	855.865	4.308.700	21.534.636
2009	140.486	855.909	4.824.400	19.029.619
2010	125.923	512.107	4.256.600	12.015.485
2011	135.550	683.021	3.502.700	14.906.257
2012	208.873	730.163	2.924.900	11.197.569
2013	114.215	774.082	3.062.500	10.813.905
2014	54.193	893.471	2.392.000	15.176.368
2015	44.524	1.114.887	2.998.200	12.451.453
2016	160.202	1.176.112	3.250.500	12.911.506
2017	325.062	439.964	3.562.500	11.799.227

Source: MZOE with EIHP, CAEN, INA d.d.; Processing: Ekonerg Ltd.

Natural gas - production / processing and transmission (NFR 1.B.2.b)

Emissions from the production / processing and transmission of natural gas are calculated by applying the Tier 2 EMEP / EEA methodology. Company OTS Plinacro Ltd reports CH_4 emissions to the EPR. Data were available from 2011 to 2015. CH_4 emissions from natural gas transmission are estimated on the basis of the registered loss in transmission networks and emissions from natural gas consumption on measuring reduction stations for pressure regulation (MRS) (Oertenblad, 2007). In Croatian natural gas transmission system, the only loss in network is during the maintenance on specific pipeline section. According to OTS Plinacro Ltd, there is a very good maintenance of pipelines in the network, and loses are minimized because they are the expense of the system. Furthermore, the plan is to include the compressors during the maintenance of the pipeline sequence so the losses will be further reduced.

NMVOC emissions from natural gas distribution was calculated on the base of direct CH_4 emissions reported in EPR basis and are directly related on the quality of natural gas that are published by the company Plinacro Ltd. (Equation 1). Standard quality gas in Croatia is regulated by the following legal framework: The Energy Act (OG 120/12, 14/14, 95/15, 102/15), Gas Market Act (OG 28/13, 14/14, 16/17) and the General Terms of gas supply (OG 158/13, 74/17). Monitoring the quality of natural gas and reporting of the same in the legal competence of the OTS company Plinacro Ltd. and ODS which every 15 days, in accordance with the Grid Code Gas Distribution System (OG 155/14, 43/17) and Grid Code Gas Transport System (OG 3/2017), based on samples of natural gas to take measurement-reduction station (PMRS) by a certified laboratory, delivers suppliers of natural gas report on testing the quality of gas. All values refer to the volume of gas of 1 m^3 in standard condition in which the absolute pressure of the gas 101.325 Pa (1.01325 bar) and temperature of gas 288.15 K (15° C).

$$E_{NMHOS} = E_{CH4} \times (W_{NMHOS} / W_{CH4}) \qquad \text{(Equation 1)}$$

where:

W_{NMVOC} - the weight-% NMVOC

W_{CH4} - the weight-% of CH_4, according to gas quality of the current year

E_{CH4} - the annual CH_4 emission reported in RPR

For the calculation of emissions from the transmission and distribution of natural gas Tier 2 methodology was used with activity data on the quantities of natural gas transported in period from 2002 (Table 4.8-4). For the period from 1990 to 2001, data on the natural gas quantities were estimated on the basis of production data for natural gas (source: National energy balance) and the average share for gas transportation in the total amount of natural gas produced (2002 - 2013). Based on specific data for CH_4 emission available since 2010 and specific data on mass composition of natural gas available since 2010. Specific NMVOC emission factors were calculated on the yearly base and their average value was applied to the historical trend from 1990 – 2009 (Table 4.8-6). Since there was no CH_4 emission data available for 2016-2017, the factor was taken as the average for the last 5 years before 2016. The recommended Tier 2 emission factor is used to calculate NMHOS emissions from natural gas extraction (Table 4.8-7).

Table 4.8-6 Activity data for NMVOC emission estimation for sector NFR 1.B.2.b.2 Transmission of natural gas

NFR 1.B.2.b.2	Transported amount (historical data) (IMRS +PSP)		
Year	GWh	GJ	1000 m3*
1990	-	-	2507.45
1991	-	-	2355.86
1992	-	-	2233.00
1993	-	-	2537.67
1994	-	-	2219.38
1995	-	-	2476.37
1996	-	-	2336.29
1997	-	-	2215.54
1998	-	-	2026.42
1999	-	-	2017.32
2000	-	-	2117.20
2001	-	-	2610.62
2002	27900	100.440.000	2954.12

NFR 1.B.2.b.2	Transported amount (historical data) (IMRS +PSP)		
Year	GWh	GJ	1000 m3*
2003	29500	106.200.000	3123.53
2004	29100	104.760.000	3081.18
2005	29900	107.640.000	3165.88
2006	29700	106.920.000	3144.71
2007	32300	116.280.000	3420.00
2008	33100	119.160.000	3504.71
2009	30200	108.529.200	3192.04
2010	32500	116.730.000	3433.24
2011	31800	114.044.400	3354.25
2012	31300	112.532.400	3309.78
2013	28700	103.320.000	3038.82
2014	25200	90.720.000	2668.24
2015	26400	95.040.000	2795.29
2016	27648	99.531.663	2927.40
2017	32300	116.280.000	3420.00

Source: Plinacro Ltd.

Table 4.8-7 Tier 2 emission factor for NMVOC emission calculation for sector NFR 1.B.2.b

Activity	Category	Pollutant	Tier 2 emission factor	Unit
Natural gas production / processing	1.B.2.b.1	NMVOC	0.1	g/m^3

Table 4.8-8 Tier 2 emission factor for NMVOC emission calculation for sector NFR 1.B.2.b.2

Activity		Transmission of natural gas (transport + distribution)
Category		1.B.2.b.2
Pollutant		NMVOC
Tier 2 emission factor, t/m3	*1990– 2009	0.008
	2010	0.004
	2011	0.005
	2012	0.014
	2013	0.010
	2014	0.019
	2015	0.004
	2016	0.004
	2017	0.004

* FE NMVOC estimated on average value for period 2010-2015

Table 4.8-9 Activity data for NFR code 1.B.2.b, represented by the relevant SNAP codes

NFR	1 B 2 b 1	1 B 2 b 2
SNAP	050300	050600
Name	Fugitive emission from natural gas (production / processing)	Fugitive emission from natural gas: Transmission
Jed.	1000 m^3	1000 m^3
1990	1982300	2507.45
1991	1824300	2355.86
1992	1803000	2233.00
1993	2049000	2537.67
1994	1792000	2219.38
1995	1966400	2476.37
1996	1785600	2336.29
1997	1717200	2215.54

NFR	1 B 2 b 1	1 B 2 b 2
SNAP	050300	050600
Name	Fugitive emission from natural gas (production / processing)	Fugitive emission from natural gas: Transmission
Jed.	1000 m^3	1000 m^3
1998	1570100	2026.42
1999	1550550	2017.32
2000	1638500	2117.20
2001	2010400	2610.62
2002	2120300	2954.12
2003	2189600	3123.53
2004	2198100	3081.18
2005	2283400	3165.88
2006	2713500	3144.71
2007	2892100	3420.00
2008	2729400	3504.71
2009	2704800	3192.04
2010	2727200	3433.24
2011	2471400	3354.25
2012	2013100	3309.78
2013	1856100	3038.82
2014	1747000	2668.24
2015	1780500	2795.29
2016	1647200	2927.40
2017	1483500	3420.00

Source: MIA with EIHP, CAEN and Plinacro Ltd., Processing: Ekonerg Ltd.

Other fugitive emissions from energy production (NFR 1.B.2.d)

Emissions in this category are calculated based on the use of geothermal energy for electricity generation. There were not yet such activities in the Republic of Croatia and the "NO" mark was used.

Recalculations and improvements

Other fugitive emissions from solid fuel (1.B.1.c)

Oil - Exploration, production, transport (1.B.2.a.i)

Venting and flaring (NFR 1.B.2.c)

There was no recalculation or other improvement for these source categories.

Distribution of oil products (NFR 1.B.2.a.v)

Relevan emissions for FCC (SNAP 040102a - Catalytic Cracking Units, partial combustion without boiler CO) for the period 2013 - 2016 were recalculated due to correction of activity data.

Refining, storage (1.B.2.a.iv)

NMHOS emissions for SNAP 050501 Refinery dispatchers, railway tankers and ship tankers for 2016 were recalculated due to correction of activity data.

NMHOS emissions for SNAP SNAP 050503 Gas stations were recalculated for 2016 due to correction of activity data.

Natural gas - Exploration, production, transport (NFR 1.B.2.b)

The NMVOC emission for category NFR 1.B.2.b.2 for 2016 was recalculated due to FE NMHOS correction.

5. Industrial processes and product use (NFR 2)

This chapter gives an overview of the sector 2 Industrial processes and product use and contains information on methodologies, activity data, emission factors, recalculations and planned improvements. Information on this sector is also available in the Croatian NIR 2019 under the UNFCCC. Industrial process includes emissions that originate from the process (called process emissions). Emissions from fuel combustion in industry are distributed in NFR sector 1.A.2.f.i fuel combustion in industry and construction (see section 3.1). Product use is concerning solvent and solvent-based products which are the source of NMVOC emission. Solvents are chemical compounds, which are used to dissolve substances as paint, glues, ink, rubber, plastic, pesticides or for cleaning purposes (degreasing). After application of these substances or other procedures of solvent use most of the solvents are released into air. Because solvents consist mainly of NMVOC, solvent use is a major source for anthropogenic NMVOC emissions. Once released into the atmosphere NMVOCs react with reactive molecules (mainly HO-radicals) to finally form CO_2.

This source category includes the following sub-sectors from which certain pollutant emissions in the Republic of Croatia occur:

- 2.A Mineral product
  - 2.A.1 Cement production
  - 2.A.2 Lime production
  - 2.A.3 Glass production
  - 2.A.5.a Quarrying and mining of minerals other than coal
  - 2.A.5.b Construction and demolition
  - 2.A.5.c Storage, handling and transport of mineral products
  - 2.A.6 Other mineral products
- 2.B Chemical industry
  - 2.B.1 Ammonia production
  - 2.B.2 Nitric acid production
  - 2.B.10.a Other (production of carbon black, ethylene, styrene, NPK fertilizers, ammonium phosphate, formaldehyde, ethyl benzene, polystyrene, polyvinylchloride, polyethylene LD, vinyl chloride, propylene, urea and sulfuric acid)
  - 2.B.7 Soda ash production
- 2.C Metal production
  - 2.C.1 Iron and Steel production
  - 2.C.1.1 Steel production
  - 2.C.1.2 Iron production
  - 2.C.1.5 Other (Rolling mills)
  - 2.C.2 Ferro alloys production
  - 2.C.3 Aluminium production
- 2 D – 2 L Other solvent and product use
  - 2.D.3.a Domestic solvent use including fungicides
  - 2.D.3.b Road paving with asphalt

- 2.D.3.c Asphalt roofing
- 2.D.3.d Coating applications
- 2.D.3.e Degreasing
- 2.D.3.f Dry cleaning
- 2.D.3.g Chemical products
- 2.D.3.h Printing
- 2.D.3.i, 2.G Other solvent and product use
- 2.H.1 Pulp and paper industry
- 2.H.2 Food and beverages industry
- 2.H.3, 2.L Other industrial processes including production, consumption, storage etc. of bulk products
- 2.I Wood processing
- 2.J Production of POPs
- 2.K Consumption of POPs and heavy metals

Generally, method for emission calculation from industrial processes and product use includes product of observed activity data with the appropriate emission factors (Tier 1 and Tier 2). Methodology for specified activity in NFR code 2 is providing in following sub-chapters.

Emission factors are expressed as the quantity of pollutant emission per unit of production/consumption or per population. Used emission factors are from the *EMEP/EEA Guidebook – 2016 and CORINAIR Technical annexes, Vol. 2, Default emission factors handbook (1994)*. The source of emission factors used for emission calculation is noted in each of sub-sector under NFR code 2. Emission factors used for the preparation of the IIR presented by NFR sectors and pollutants are given in Appendix 4.

Generally three sources of information concerning activity and emission data for the processes and product use have been used:

- Emission data as reported annually by facilities in legally required forms under the Croatian EPR,
- National production statistics at national level from the Croatian CBS (the Annual Statistical Reports, Industrial production, Annual PRODCOM Results),
- EUROSTAT database,
- Population data from the Croatian CBS,
- Plant specific data collected by direct contacts with facilities mainly for LCPs (e.g. facilities for production of cement, lime, sugar etc.),
- National energy balance.

5.1. Mineral products (NFR 2.A)

Source category description

This source category gives overview of the production of various mineral products in the Republic of Croatia. The following processes are represented under source category 2.A Mineral products (SNAP codes are included) in Croatia: Cement production (NFR 2.A.1, SNAP 040612), Lime production (NFR 2.A.2, SNAP 040614), Glass production (NFR 2.A.3, SNAP 040613), Quarrying and mining of minerals other than coal (NFR 2.A.5.a, SNAP 040623), Construction and demolition (NFR 2.A.5.b, SNAP 040624) and Storage, handling and transport of mineral products (NFR 2.A.5.c). For source category 2.A.5.c Croatia is using notation key “IE” due to PM emissions are included in other NFR 2.A codes.

Cement production (NFR 2.A.1)

During the reporting period, there were seven factories in operation in Croatia, i.e. five clinker producers (one of the producers is the owner of three factories). Four factories were active throughout the whole reporting period. One of them produces aluminate (aluminous) cement, while all other factories in Croatia (including the ones that are inactive today) produced Portland cement. In the aforementioned aluminate cement factory, Portland cement was also produced in another production line until 1997.

One factory was closed in July 1994 and two other factories worked intermittently during the reporting period (one of them was active from 1990 to 1995 and from 1998 to 2017, and the second one from 1990 to 2009 and during 2014).

Production varied depending on the economic situation and demand on the market, thus overall production at the national level decreased in the period 1991-1995 as a result of the war. In the period 1996-2007, production increased with the escalation in construction sector activities. The trend after 2008 is a result of the economic crisis, followed by a slow recovery after 2012.

Lime production (NFR 2.A.2)

During the reporting period, five lime factories were active in Croatia; two of them were producing both quicklime and dolomitic lime and three factories were producing only quicklime. One factory ceased its operations in 2009, one in 2010 and one in 2011. Furthermore, two of the factories that were active since 1990 and are still in operation had a varying production and even periods of halted operations over the years (one did not produce lime from 1992 to 1997, as it was severely damaged during the war, and the second one during 2009 due to technical reasons). Production of dolomitic lime was stopped in the period 1991-1995.

In addition, non-marketed quicklime is being produced for the needs of sugar refining in three sugar factories. Data are available for one factory since 1991, for one since 1992 and for one since 1999. Sugar was being produced in those factories prior to these years but there are no records on lime production (factories report that those data have not been kept in their archives, and moreover, non-marketed lime is not included in national statistics)[19].

During 1990 and 1991, a certain amount of non-marketed quicklime reagent was also produced in pig iron production plant.

Apart from the abovementioned, there is no other identified non-marketed lime production in Croatia.

Production trend is very similar to trends in the cement industry due to the same dependence on the economic situation and market demands.

Glass production (NFR 2.A.3)

This source category includes production and processing of flat glass and container glass, as well as mineral wool production.

During the reporting period, two glass producing factories, were in operation in Croatia; one of them producing container glass and the other producing flat glass. In 2009, the second factory has ceased its glass production operations, and since then, together with several other factories in Croatia, it only processes imported glass (using mostly operations like cutting, grinding, paint application, laminating

[19] It should be noted that sugar factories were affected by warfare during and immediately after the war, and their production activities were discontinued or significantly reduced, with frequent interruptions. Since it was an atypical period of production, even taking aside the possibility of lime not being produced on-site, estimates of missing data, for example, by using sugar production as a surrogate data, are impaired by incomparability with typical production conditions during non-war years.

etc.). Total national quantities of final glass products (including products from glass producing and glass processing factories) are included in this category.

Quarrying and mining of minerals other than coal (NFR 2.A.5.a)

Quarrying and mining of minerals other than coal in Croatia include quarrying of ornamental and building stone, limestone, gypsum, chalk and slate, operation of gravel and sand pits; mining of clays and kaolin, mining of chemical and fertiliser minerals, extraction of salt and mining and quarrying of other minerals not elsewhere classified. Information on national production statistics, by type of minerals, is used for emission calculation.

Construction and demolition (NFR 2.A.5.b)

The basis for the calculations is national statistical data on construction and demolition activities. Specifically, data on annual floor area of the building constructed or demolished are used.

Methodology, emission factors and activity data

Cement production (NFR 2.A.1)

Methodology for emission calculation for cement production is based on Tier 2 EMEP/EEA methodology and includes multiplying annual amount of clinker produced by the appropriate emission factor. Emission factors for cement production are taken from GB2016. In direct contacts with all existing facilities for cement production, it was decided to include Tier 2 emission factors for PM, with inclusion of existing abatement technologies in all facilities: ESP on main stack and smaller fabric filters for moderate control of fugitive sources, for whole observed trend. Emissions of pollutants specific for fuel combustion are allocated to energy sector, source category 1.A.2.f.i, for the whole trend since 1990.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Besides TSP, $PM_{2.5}$ and PM_{10} emissions, BC emissions are reported for 1990 onwards and are calculated as a fraction of $PM_{2.5}$ according to GB2016.

The activity data on clinker production were collected by a survey of all cement manufacturers in Croatia and cross-checked with clinker production data from Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS) and with data from Croatian EPR. Results of comparison showed that there is no significant difference between these sets of data. The activity data on clinker production are presented in Table 5.1-1. Emission factors used for the preparation of the IIR 2019, presented by NFR sectors and pollutants, are given in Appendix 4.

Lime production (NFR 2.A.2)

Methodology for emission calculation for lime production is based on Tier 2 EMEP/EEA methodology and includes multiplying annual amount of lime produced by the appropriate emission factor. For lime production, Tier 2 controlled emission factors for PM from GB2016 are used. In all facilities, kilns are equipped with fabric filters and lime hydrators are equipped with de-dusting bag filters. Also, fabric filters for emissions control from conveyor belts are present in all facilities. Emissions of pollutants which are specific for fuel combustion are allocated to energy sector, source category 1.A.2.f, for the whole trend since 1990.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Besides TSP, $PM_{2.5}$ and PM_{10} emissions, BC emissions are reported for 1990 onwards and are calculated as a fraction of $PM_{2.5}$ according to GB2016.

Data on the amount of lime produced in Croatia includes the amount of lime produced in lime factories and sugar factories (1990 - 2017), and lime produced for the needs of pig iron production in 1990 and 1991. The activity data on lime production were collected by a survey of all lime manufacturers in Croatia and cross-checked with lime production data from Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS) and with data provide in EPR data base. Results of comparison showed that there is no significant difference between these sets of data. The activity data on lime production are presented in Table 5.1-1. Emission factors used for the preparation of the IIR 2019, presented by NFR sectors and pollutants, are given in Appendix 4.

Glass production (NFR 2.A.3)

Methodology for emission calculation for glass production is based on Tier 1 EMEP/EEA methodology, which includes multiplying annual amount of glass produced by the appropriate emission factor. Recommended Tier 1 emission factors from GB2016 were used.

Croatia recognizes the likelihood of overestimation of emissions from glass production since default emission factors include emissions from both melting and non-melting activities, while national statistics (which is a main source of activity data) does not distinguish between produced and processed glass, which results in products made from imported glass being included in activity data for this category.

Methodology for emission calculation for mineral wool production is based on Tier 3 EMEP/EEA methodology, i.e. it is based on continuously measured and verified annual emissions from one facility. Facility specific emission factors for NH_3, NMVOC and PMs were calculated based on measured emissions and annual production capacity.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

The activity data on glass and mineral wool production are taken from the Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS) and from EPR facilities reports. The activity data on glass production which include also the data for mineral wool production are presented in Table 5.1-1. Emission factors used for the preparation of the IIR 2019, presented by NFR sectors and pollutants, are given in Appendix 4.

Quarrying and mining of minerals other than coal (NFR 2.A.5.a)

Methodology for emission calculation for quarrying and mining of minerals other than coal is based on Tier 1 EMEP/EEA methodology, which includes multiplying annual amount of minerals by the appropriate emission factor. The recommended Tier 1 emission factors from GB2016 were used. The activity data on quarrying and mining of minerals other than coal are taken from the Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS) and presented in Table 5.1-1.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Emission factors used for the preparation of the IIR 2019, presented by NFR sectors and pollutants, are given in Appendix 4.

Construction and demolition (NFR 2.A.5.b)

Methodology for emission calculation for construction and demolition is based on Tier 1 EMEP/EEA methodology, which includes multiplying annual amount of floor area of the building constructed by the appropriate emission factor. The recommended Tier 1 emission factors from GB2013 were used. The plan is to recalculate emissions for the entire reporting period for this category after collecting activity data required under Tier 1 EMEP/EEA GB2016 methodology, which would include: Construction of houses, Construction of apartments, Non-residential construction and Road construction. Because of their comprehensiveness, these data could not be collected for this submission. In order to achieve this, efforts will be made to collect the specified data, if possible for the next submission.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Emission factors used for the preparation of the IIR 2019, presented by NFR sectors and pollutants, are given in Appendix 4.

The activity data are taken from the Annual Statistical Reports and presented in Table 5.1-1.

Table 5.1-1 Activity data for NFR codes 2.A.1, 2.A.2, 2.A.3, 2.A.5.a and 2.A.5.b

NFR	2.A.1	2.A.2	2.A.3	2.A.5.a	2.A.5.b
Name	Clinker	Lime production	Glass production	Quarrying and mining of minerals other than coal	Construction and demolition
Unit	kt	kt	kt	Mt	m^2
1990	2062.43	232.30	275.49	27.019	2826634
1991	1337.12	165.40	252.94	18.860	2119965
1992	1566.30	124.49	143.90	18.510	1411541
1993	1305.08	134.48	134.41	16.770	1345926
1994	1583.68	140.12	162.22	19.840	1499057
1995	1197.61	139.70	166.81	20.430	1918453
1996	1306.26	175.74	153.76	23.250	2359648
1997	1533.78	186.91	127.32	17.600	2216206
1998	1649.11	195.38	148.33	18.830	2206747
1999	2151.01	189.11	136.26	19.390	2012288
2000	2382.15	193.01	139.06	20.760	717801
2001	2739.25	239.36	150.34	23.660	2061231
2002	2698.60	269.27	158.54	26.190	2942136
2003	2692.09	249.34	186.97	31.230	3438150
2004	2852.24	284.01	210.65	33.200	3449089
2005	2926.58	309.59	227.81	30.920	4089576
2006	3104.37	366.24	228.67	35.950	4570084
2007	3160.52	376.59	237.50	37.510	5218050
2008	2995.05	367.38	255.07	43.890	4882190
2009	2439.06	251.00	280.92	35.020	3967687
2010	2320.48	222.47	295.17	24.160	3388897
2011	2071.66	182.14	320.47	25.600	2703950
2012	1996.50	139.61	300.11	24.860	2727335
2013	2198.30	126.99	327.38	23.730	1961243
2014	2318.52	135.62	364.92	23.480	1695871
2015	2155.82	134.24	334.80	24.290	1924884
2016	2055.16	125.08	378.08	22.990	1853646
2017	2411.09	145.72	394.98	23.740	2065404

Source: CBS, (with survey request: cement and lime producers and EPR data base); Processing: Ekonerg Ltd

Recalculations and improvements

Recalculation was performed for the period 1990-1997, 2012 and 2014-2016, due to harmonization of activity data with NIR2019.

Lime production (NFR 2.A.2)

Recalculation was performed for 1990-1991, 2008-2010 and 2013-2015, due to harmonization of activity data with NIR2019.

Glass production (NFR 2.A.3)

Quarrying and mining of minerals other than coal (NFR 2.A.5.a)

Construction and demolition (NFR 2.A.5.b)

There was no recalculation or other improvement for these source categories.

5.2. Chemical industry (NFR 2.B)

Source category description

This sub-chapter gives an overview of the production of various inorganic and organic chemicals in the Republic of Croatia. The following processes are represented under the sub-sector 2.B Chemical industry (SNAP codes are included) in Croatia: Ammonia production (NFR 2.B.1, SNAP 040403), Nitric acid production (NFR 2.B.2, SNAP 040402), Other chemical industry (NFR 2.B.10.a, SNAP 0404 and 0405) and Storage, handling, transport of chemical products (NFR 2.B.10.b).

Other chemical industry includes production of various chemical products: Sulphuric acid (SNAP 040401), Ammonium phosphate (SNAP 040406), NPK fertilizers (SNAP 040407), Urea (SNAP 040408), Carbon black (SNAP 040409), Ethylene (SNAP 040501), Propylene (SNAP 040502), 1,2 dichloroethane (SNAP 040503), Vinyl chloride (SNAP 040504), Polyethylene LD (SNAP 040506), Polyvinylchloride (SNAP 040508), Styrene (SNAP 040510), Polystyrene (SNAP 040511), Formaldehyde (SNAP 040517) and Ethyl benzene (SNAP 040518).

Neither Adipic acid production (2.B.3) nor Carbide production (2.B.5) occurs in Croatia.

For source category 2.A.10.b Croatia is using notation key "IE" due to PM emissions are included in other NFR 2.B codes.

Ammonia production (NFR 2.B.1, SNAP 040403)

One ammonia manufacturer has been in operation in Croatia during the whole time series. Natural gas is used as both feedstock and fuel in the production process. Ammonia is produced by catalytic steam reforming of natural gas in which hydrogen is chemically separated from natural gas and combined with nitrogen to produce ammonia. Carbon dioxide that is formed from carbon monoxide in CO shift converter is removed by using two methods: monoethanolamine scrubbing and hot potassium scrubbing.

Installation of the unit for separation of ammonia and hydrogen from a portion of synthesis gas that is incinerated in the primary reformer (installed in April 2009) made it possible to return these two components to production process (instead of incinerating them). The ammonia is extracted in a high pressure scrubber in contact with water, and the resulting ammonia water is stripped. This technology has led to an evident reduction in total NOx emissions (as NO_2) in 2009.

The same manufacturer also produces nitric acid, sulphuric acid and mineral fertilizers. Also, the same manufacturer was producing carbon black until 2009.

Nitric acid production (NFR 2.B.2, SNAP 040402)

There is one manufacturer of nitric acid in Croatia, with two units-plants, one of which has two production lines. In the production process, ammonia, which is used as a feedstock, is vaporized, mixed with air and burned over a platinum/rhodium alloy catalyst. Both plants utilize dual-pressure production processes. In July 2010, abatement technologies (Selective Catalytic Reduction-SCR) for removing NOx (as NO_2) were installed at Plant 1. This has resulted in evident reduction in NOx emissions in 2011. At Plant 2, this technology was put into trial operation in December 2017.

Nitric acid is used in the manufacture of fertilizers by the same facility.

Other chemical industry (NFR 2.B.10.a, SNAP 0404 and 0405)

Other chemical industry includes production of various chemical products such as sulphuric acid, ammonium phosphate, NPK fertilizers, urea, carbon black, ethylene, propylene, vinyl chloride, polyethylene LD, 1,2 dichloroethane, polyvinylchloride, styrene, polystyrene, formaldehyde and ethyl benzene. Production of the following chemical products was shut down: ammonium phosphate and carbon black during 2009; ethylene, propylene, polyethylene LD and polystyrene during 2011; 1,2 dichloroethane during 2001; vinyl chloride during 2002; polyvinylchloride during 2000, styrene and ethyl benzene during 1991 (with a short term reactivation of ethyl benzene production during 1995 and 1996). Production of polyethylene LD was reactivated in 2014 and 2015 and was stopped in 2016. Production of sulphuric acid has been stopped for two years in 2010 and 2011. Data on emissions have been obtained directly from production facilities for sulphuric acid, NPK fertilizers, urea, and carbon black, and from official statistics for all other activities. In 2017, there was no production of carbon black, styrene, ammonium phosphate, ethylene, propylene, 1,2 dichloroethane, vinyl chloride, polyvinylchloride, polyethylene LD, polystyrene and ethyl benzene.

Methodology, emission factors and activity data

Ammonia production (NFR 2.B.1, SNAP 040403)

Emission calculation is based on the Tier 2 EMEP/EEA methodology and includes multiplying annual amount of ammonia produced by the appropriate emission factor. Tier 2 EF from GB2016 were used for CO and NH_3 emissions, while for NOx, the facility specific annual emission factors were used since 1998. For the period 1990-1997, an average NOx emission factor was calculated and used, based on available direct emissions measurements. Data on the ammonia production and natural gas composition were collected from the survey of the manufacturer and verified by comparison with Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS). Data are presented in Table 5.2-1. Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Nitric acid production (NFR 2.B.2, SNAP 040402)

For nitric acid production, the NOx emission is estimated. Emissions calculation is based on Tier 2 EMEP/EEA methodology. Since 1998, facility specific emission factors were calculated from periodically measured NOx emissions and annual production capacity. For the period 1990-1997, an average NOx emission factor was calculated and used, based on available direct emissions measurements. Data on the production of nitric acid (100 percent HNO_3 from both plants) were collected from the survey of the manufacturer and verified by comparison with Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS). Data are presented in Table 5.2-1. Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Other chemical industry (NFR 2.B.10.a, SNAP 0404 and 0405)

Emission factors are expressed as the quantity of pollutants emission per unit of production. For Polyethylene Low Density, PVC (suspension PVC and emulsion PVC), Styrene, Polystyrene (expandable - EPS) and Ethyl benzene, Ethylene, Propylene, 1,2 dichloroethane, Vinyl chloride, Formaldehyde and Ammonium phosphate production, Tier 2 methodology with Tier 2 emission factors from GB2016 were used.

For NPK fertilizers production, since 1998 (for TSP since 2007), facility specific NOx, NH_3 and TSP emission factors were calculated from direct measurements of emissions and annual production capacity. For the period 1990-1997 (for TSP 1990-2006), an average NOx, NH_3 and TSP emission factors were calculated and used, based on available measurements.

For Sulphuric acid production, SO_2 emissions were reported. Direct SO_2 emissions are facility specific emission since 1998. For the period 1990-1997, an average SO_2 emission factor was calculated and used, based on available direct SO_2 emissions measurements and annual production capacity.

For Urea production, NH_3, TSP, $PM_{2.5}$, PM_{10} and BC emissions were reported. For TSP, $PM_{2.5}$, PM_{10} and BC emission calculation, Tier 2 emission factors from GB2016 were used. Regarding NH_3, direct facility specific emissions measurements since 1998, were used. For the period 1990 to 1997, an average NH_3 emission factor was calculated and used, based on available direct NH_3 emissions measurements and annual production capacity.

For Carbon black production, Tier 2 EMEP/EEA methodology and Tier 2 emission factors were used for SO_2, NOx, NMVOC, CO and TSP emission calculation. Those emissions were reported for the period 1990 – 2009. InFor the period 2000 – 2009, facility specific direct CO emissions were reported.

For Ammonium phosphate production Tier 2 emission factors form GB2016 were used for TSP, PMs and BC emission estimation. Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Data on the production of ammonia, nitric acid, sulfuric acid, NPK fertilizer and urea were collected from the survey of the manufacturers of these inorganic chemicals in Croatia and verified by comparison with Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS). For all other chemicals in the scope of this source category, activity data are taken from national statistic (Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS)). All activity data regarding source category other chemical industry (NFR 2.B.10.a) are presented in Tables 5.2-1 and 5.2-2. Emission factors used for the preparation of the IIR 2019, presented by NFR sectors and pollutants, are given in Appendix 4.

Table 5.2-1 Activity data for NFR codes 2.B.1, 2.B.2 and 2.B.10.a, represented by the relevant SNAP codes

NFR	2.B.1	2.B.2	2.B.10.a				
Name	Ammonia	Nitric acid	Carbon black	Sulphuric acid	Ammonium phosphate	NPK fertilisers	Urea
SNAP	040403	040402	040409	040401	040406	040407	040408
Unit	t	t	t	t	t	t	t
1990	344947	332459	30624	241759	66711	556522	280354
1991	347524	291997	18783	187009	42365	532082	328029
1992	425719	381797	13479	278434	53635	716537	356995
1993	344812	287805	17123	178269	43719	482845	273226
1994	350184	311236	21468	265550	48193	554370	278981
1995	377589	299297	27185	233122	65332	548305	314137
1996	373728	278683	26735	223201	52067	516058	383822
1997	402407	292892	24214	202191	47760	536732	361730
1998	301758	220508	24087	164011	40661	457556	279110
1999	387159	260198	20627	192587	47557	523246	360427
2000	395024	306201	20029	199585	32112	583243	352553
2001	315388	257534	21180	126284	19080	407087	279682
2002	285937	249992	19416	135224	24496	468376	265811
2003	321598	235583	21295	123248	22131	499870	336593
2004	404157	375926	20272	186318	52782	554096	396655
2005	398547	280746	18498	220625	65840	582543	372627
2006	388821	277590	26264	259014	78936	365118	370549
2007	430154	306619	23724	243149	75040	862263	407863
2008	444925	312928	16904	256988	76418	526041	405950
2009	375284	261478	3976	91486	32203	230963	389071
2010	438662	336795	NO	NO	NO	440289	439310
2011	447499	332713	NO	NO	NO	447284	445160

NFR	2.B.1	2.B.2	2.B.10.a				
Name	Ammonia	Nitric acid	Carbon black	Sulphuric acid	Ammonium phosphate	NPK fertilisers	Urea
SNAP	040403	040402	040409	040401	040406	040407	040408
Unit	t	t	t	t	t	t	t
2012	416358	288207	NO	4465	NO	373566	428931
2013	417505	297545	NO	4584	NO	223515	439062
2014	458049	307296	NO	7687	NO	208530	465373
2015	455235	344638	NO	35333	NO	344827	447934
2016	420372	293260	NO	63792	NO	238178	393544
2017	468795	322185	NO	55352	NO	276863	464367

Source: CBS, EPR, survey request: fertilizers producers; Processing: Ekonerg Ltd

Table 5.2-2 Activity data for NFR code 2.B.10.a, represented by the relevant SNAP codes

NFR	2.B.10.a									
Name	Styrene	Ethyl-ene	Propyl-ene	1,2 dichloro-ethane	Vinyl-chloride	Poly-ethylene LD	Poly-vinyl-chloride	Poly-styrene	Ethyl-benzene	Form-aldehyde
SNAP	040510	040501	040502	040503	040504	040506	040508	040511	040518	040517
Unit	t	t	t	t	t	t	t	t	t	t
1990	8923	72631	17586	72653	98976	171800	104602	46913	2725	22.0
1991	NO	66871	15272	68325	88135	136039	67934	33719	288	22.0
1992	NO	68318	13349	92089	118570	141614	70969	44389	NO	22.0
1993	NO	68634	9026	79608	103851	144415	44259	64269	NO	22.0
1994	NO	65285	7127	97528	128257	130805	79038	67498	NO	22.0
1995	NO	67547	8221	84374	112560	145235	93897	55805	4162	25.0
1996	NO	64782	7796	48631	63124	144100	45456	64121	2922	22.0
1997	NO	63554	7631	26264	35488	145439	47805	78580	NO	22.0
1998	NO	60148	6535	31308	41115	184493	73647	99960	NO	30.0
1999	NO	60295	6981	47686	62236	179745	31304	84928	NO	21.0
2000	NO	38918	6443	71364	64875	83983	2953	20172	NO	19.0
2001	NO	46632	5542	64442	14432	113146	NO	33168	NO	20.0
2002	NO	43554	5074	NO	6950	112771	NO	45439	NO	19.0
2003	NO	41252	4622	NO	NO	160944	NO	46361	NO	14.2
2004	NO	49886	5135	NO	NO	193430	NO	35331	NO	16.3
2005	NO	50263	4860	NO	NO	191958	NO	54617	NO	15.6
2006	NO	48824	4740	NO	NO	123217	NO	58721	NO	11.5
2007	NO	45438	4498	NO	NO	119015	NO	69841	NO	10.2
2008	NO	43045	4053	NO	NO	119838	NO	60471	NO	5.4
2009	NO	38797	3174	NO	NO	115646	NO	56359	NO	6.9
2010	NO	36271	2909	NO	NO	139032	NO	54194	NO	6.3
2011	NO	23323	2068	NO	NO	83920	NO	12849	NO	5.9
2012	NO	NO	NO	NO	NO	NO	NO	NO	NO	5.5
2013	NO	NO	NO	NO	NO	NO	NO	NO	NO	4.2
2014	NO	NO	NO	NO	NO	577	NO	NO	NO	3.9
2015	NO	NO	NO	NO	NO	610	NO	NO	NO	2.0
2016	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.0
2017	NO	NO	NO	NO	NO	NO	NO	NO	NO	3.0

Source: CBS, Processing: Ekonerg Ltd

Recalculations and improvements

Ammonia (NFR 2.B.1, SNAP 040403)

Recalculation was made for the whole time series to update emission factors to Tier 2, GB2016.

Nitric acid (NFR 2.B.2, SNAP 040402)

Other chemical industry (NFR 2.B.10.a, SNAP 040400 and 040500)

There was no recalculation or other improvement for these source categories.

5.3. Metal production (NFR 2.C)

Source category description

This sub-chapter gives an overview of the production of various metals in the Republic of Croatia. The following primary metal production processes are represented under sub-sector 2.C Metal production in Croatia (SNAP codes are included): Iron and steel production (NFR 2.C.1, SNAP 0402), Ferroalloys production (NFR 2.C.2, SNAP 0403) and Aluminium production (NFR 2.C.3, SNAP 0401). There is no primary production of non-ferrous metals such as magnesium, lead, zinc, copper, nickel etc. in Croatia.

Iron and steel production (NFR 2.C.1, SNAP 0402)

This category includes: Steel production (NFR 2.C.1.1, SNAP 040205 - Open hearth furnace steel plant and SNAP 040207 - Electric furnace steel plant), Iron production (NFR 2.C.1.2 SNAP 040202 - Blast furnace charging) and Other (Rolling mills) (NFR 2.C.1.5 SNAP 040208 – Rolling mills).

The production of pig iron in one plant was carried out until the end of 1991 when it was shut down due to the inability of iron ore delivery during the war, as well as a reduction and subsequently a cessation of the production of steel in open hearth furnaces (OHF) in the same year. It should be noted that sinter and pellets required for the production of iron were being imported and their production was not present in Croatia.

Emissions from lime produced for the needs of pig iron production are included in sub-sector 2.A.2.

Production of steel in electric arc furnaces (EAF), in two plants, was present during the whole time series. One plant was producing steel during the entire reporting period, with the exception of 2016. The second plant was active in the period 1990-2008 and in 2013 and 2014. Both plants used EAFs during the entire period, in which liquid steel was produced and then processed to finished products by casting and rolling. There was no production of steel in Croatia during 2016.

Since 1990, there were two rolling manufacturing processes in Croatia, hot and cold. In 2009, the cold rolling mill process was stopped.

Ferroalloys production (NFR 2.C.2, SNAP 0403)

Ferroalloys are alloys of iron and metals such as silicon, manganese and chromium. There were two factories producing ferroalloys in Croatia. One factory ceased its production in 1994, while the second factory stayed in operation until 2003. Only nationally aggregated statistical data on production quantities are available. Annual production of ferroalloys was extracted from statistical reports published by Central Bureau of Statistics. The production fluctuated over the years, mainly as a result of discontinuous operations, caused by the war in Croatia.

Aluminium production (NFR 2.C.3, SNAP 0401)

Primary aluminium is produced in two steps. First, bauxite ore is ground, purified and calcined to produce alumina (Al_2O_3). The alumina is then electrically reduced to aluminium by smelting in large pots.

Primary aluminium production in Croatia was halted in 1991, mainly due to war activities.

Two types of furnaces were used – open and closed type. Open furnaces, which are older, were mostly used in production. Total of 208 open furnaces with prebaked anodes and side feed (Alusuisse technology) were used (without computer controlled process). In September 1990, 10 new closed furnaces were put in operation (Peciney technology), with central feed and computer controlled process.

Data on primary aluminium production were collected by a survey of aluminium manufacturer.

One plant in Croatia manufactures aluminium castings by the pressure injection process. It does not deal with primary or secondary aluminium production, nor with production of aluminium from bauxite or recycled aluminium. Therefore, there are no relevant emissions from this plant.

Methodology, emission factors and activity data

Emission calculation is based on the Tier 2 of the EMEP/EEA methodology and implies multiplication of annual amount of products by the appropriate emission factor for a specific production process of metal.

Emission factors are expressed as the quantity of emissions of pollutants per unit of production.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

All emission factors are recommended ones for activities in the sub-sector 2.C Metal production and are in accordance with the GB2016. Emission factors used for the preparation of the IIR 2019, presented by NFR sectors and pollutants, are given in Appendix 4.

Information on the annual amounts of pig iron produced are taken from the Croatian NIR. Activity data for the quantities of steel produced (by both methods) and for rolling mills for period 1990 – 2008 that are presented in the published scientific article *Sofilić et all., Archives of Metallurgy and Materials, Vol. 53, 2008 Issue 2* are verified with data from the Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS). Data for the quantities of steel produced in electric furnace steel plant were taken from NIR for entire reporting period. These data refer to production of billets and ingots (data on liquid steel production are not available). Activity data for rolling mills for the period 1990 – 2008 were taken from the abovementioned scientific article, and since 2008, data were taken from the Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS). Activity data for ferroalloys production were taken from the Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS). Activity data for aluminium production were collected by a direct survey of manufacturer. Production of iron and steel, ferroalloys and aluminium are shown in Table 5.3-1.

Table 5.3-1 Activity data for NFR codes 2.C.1, 2.C.2 and 2.C.3, represented by the relevant SNAP codes

NFR	2.C.1				2.C.2	2.C.3
Name	Electric furnace steel plant	Open hearth furnace steel plant	Blast furnace charging	Rolling mills	Ferroalloys production	Aluminium production
SNAP	040207	040205	040202	040208	040302	040301
Unit	t	t	t	t	t	t
1990	171138	253161	209308	575928	129955	74248
1991	119734	94165	25713	310104	124263	50931
1992	101944	NO	NO	226086	81630	NO
1993	74082	NO	NO	190097	36605	NO
1994	63355	NO	NO	159068	54337	NO
1995	45370	NO	NO	108862	26081	NO
1996	45754	NO	NO	101965	10559	NO
1997	69895	NO	NO	110997	24694	NO
1998	103204	NO	NO	163059	12615	NO
1999	75877	NO	NO	128562	14142	NO
2000	69641	NO	NO	110266	16112	NO
2001	56169	NO	NO	98372	701	NO
2002	32789	NO	NO	55252	220	NO
2003	40942	NO	NO	111530	724	NO
2004	86105	NO	NO	115471	NO	NO

NFR	2.C.1				2.C.2	2.C.3
Name	Electric furnace steel plant	Open hearth furnace steel plant	Blast furnace charging	Rolling mills	Ferroalloys production	Aluminium production
SNAP	040207	040205	040202	040208	040302	040301
Unit	t	t	t	t	t	t
2005	73639.88	NO	NO	116393	NO	NO
2006	80516.24	NO	NO	147189	NO	NO
2007	76251.68	NO	NO	144409	NO	NO
2008	138865.5	NO	NO	188307	NO	NO
2009	54265	NO	NO	79187	NO	NO
2010	103427	NO	NO	78472	NO	NO
2011	95906.79	NO	NO	82310	NO	NO
2012	5896.2	NO	NO	28060	NO	NO
2013	65257.94	NO	NO	42248	NO	NO
2014	174620	NO	NO	35851	NO	NO
2015	148583	NO	NO	24886	NO	NO
2016	23620	NO	NO	13084	NO	NO
2017	33412	NO	NO	13151	NO	NO

Source: CBS (survey request: steel producers), Processing: Ekonerg Ltd

Recalculations and improvements

Iron and steel production (NFR 2.C.1, SNAP 040202, 400205, 040207 and 040208)

Ferroalloys production (NFR 2.C.2, SNAP 040300)

Aluminium production (NFR 2.C.3, SNAP 040100)

There was no recalculation or other improvement for these source categories.

5.4. Other solvent and product use (NFR 2.D – 2.L)

Source category description

This chapter gives an overview of the following source categories under NFR 2.D - 2L Other solvent and product use: Domestic solvent use including fungicides (NFR 2.D.3.a), Road paving with asphalt (NFR 2.D.3.b), Asphalt roofing (NFR 2.D.3.c), Coating applications (NFR 2.D.3.d), Degreasing (NFR 2.D.3.e), Dry cleaning (NFR 2.D.3.f), Chemical products (NFR 2.D.3.g), Printing (NFR 2.D.3.h), Other solvent and product use (NFR 2.D.3.i, 2.G), Pulp and paper industry (NFR 2.H.1), Food and beverages industry (NFR 2.H.2), Other industrial processes (NFR 2.H.3), Wood processing (NFR 2.I), Production of POPs (NFR 2.J) and Consumption of POPs and heavy metals (NFR 2.K). Emissions from source category 2.L Other industrial processes including production, consumption, storage etc. of bulk products are included in other NFR 2.D-2.K.

Domestic solvent use including fungicides (NFR 2.D.3.a)

Domestic solvent use including fungicides includes emissions of NMVOCs and other pollutants (e.g. Hg) arising from the domestic use of solvent-containing products. Many of these products are also used in industry and commerce. The Croatian inventory stratified the following solvent-containing products use by the public: Cosmetics and toiletries products, Car care products, DIY/buildings, Paint/varnish removers and solvents, DIY/buildings, Sealants, filling agents, Hg (fluorescent tubes), Pesticides, and Domestic use of pharmaceutical products. A further distinction between aerosol and non-aerosol products is not available in national statistics.

Road paving with asphalt (NFR 2.D.3.b)

Asphalt for road paving is commonly referred to as bitumen, asphalt cement, asphalt concrete or road oil and is produced in petroleum refineries. The annual statistical weight of asphalt produced for road paving is used to calculate emissions of NMVOCs and PM from this source category.

Asphalt roofing (NFR 2.D.3.c)

The asphalt roofing industry manufactures saturated felt, roofing and siding shingles, and roll roofing and sidings. Most of these products are used in roofing and other building applications. This source category covers emissions of NMVOC, CO and PM from all related facilities. The national production of shingles is used as activity data.

Coating applications (NFR 2.D.3.d)

Paints are used within the industrial and domestic sectors. Traditionally, the term paint has often been used to describe pigmented coating materials only, thus excluding clear coatings such as lacquers and varnishes. However, here the term paint is taken to include all materials applied as a continuous layer to a surface with the exception of glues and adhesives which are covered by NFR source category 2.D.3.i, 2.G Other solvent and product use. Inks, which are coatings applied in a non-continuous manner to a surface in order to form an image, are excluded by the definition given above.

Application of coatings during the manufacture of a number of other industrial products is covered by NFR source category 2.D.3.g Chemical products: adhesive, magnetic tapes, films and photographs manufacturing (SNAP 060311); textile finishing (SNAP 060312); leather tanning (SNAP 060313).

The use of paint is a major source of non-methane volatile organic compounds (NMVOC) emissions. The use of paints is generally not considered relevant for emissions of particulate matter, heavy metals or persistent organic pollutants (POPs).

Degreasing (NFR 2.D.3.e)

Degreasing is a process for cleaning products from water-insoluble substances, such as grease, fats, oils, waxes, carbon deposits, fluxes and tars. In most cases, the process is applied to metal products, but also plastic, fiberglass, printed circuit boards and other products are treated by the same process. The metal-working industries are the major users of solvent degreasing. Industrial metal degreasing with organic solvents takes place in specially designed cleaning equipment. Emission limits required by the Solvents Emissions Directive 1999/13/EC can only be achieved by using hermetically-sealed cleaning equipment. This leads to a significant reduction of emissions and increased workplace safety. Metal degreasing takes place in either open top or closed tanks. The open-top tanks, however, have been phased out in the European Union due to the Solvents Emissions Directive 1999/13/EC. Only small facilities, using not more than 1 or 2 tonnes of solvent per year (depending on the risk profile of the solvent) are still allowed to use open top tanks. The most common organic solvents for vapour cleaning are: methylene chloride (MC), tetrachloroethylene (PER), trichloroethylene (TRI) and xylenes (XYL).

Dry cleaning (NFR 2.D.3.f)

Dry cleaning refers to any process to remove contamination from furs, leather, down leathers, textiles or other objects made of fibres, using organic solvents.

Chemical products (NFR 2.D.3.g)

Source category Chemical products covers the emissions from the use of various chemical products in manufacturing or processing of chemical products. In Croatia, in the period since 1990, this source category includes many activities, such as: Polyester processing (SNAP 060301), Polyvinylchloride processing (SNAP 060302), Polyurethane processing (SNAP 060303), Polystyrene foam processing (SNAP 060304), Rubber processing (SNAP 060305), Pharmaceutical products manufacturing (SNAP 060306), Paints manufacturing (SNAP 060307), Inks manufacturing (SNAP 060308), Glues manufacturing (SNAP 060309) and Adhesive, magnetic tapes, films and photographs manufacturing (SNAP 060311). Almost all activities still exist in Croatia with the exception of the rubber production which was stopped during 2006, and polystyrene foam processing which was stopped during 2011. Leather tanning (SNAP 060313) is present in Croatia but ammonium salts are not used in any phase of this activity thus there are no NH_3 emissions. Emission from asphalt blowing (SNAP 060310) are included in the emission calculation within the activity 1.B.2.a.iv Refining / Storage (and also within 2.D.3.b Road paving and 2.D.3.c Asphalt roofing). Following the recommendation for inventory improvement given by the ERT during the 2018 review, it was found that the asphalt blowing activity (SNAP 060310) is present in Croatia, and emissions from this activity will be calculated after collecting all the activity data, which is expected for one of the next submissions.

Printing (NFR 2.D.3.h)

Printing includes NMVOC emissions arising from solvents used in printing industry. Printing involves the use of inks which may contain organic solvents. These inks can be diluted before use. Different inks have different portions of organic solvents and require dilution to different extents. Printing can also require the use of cleaning solvents and organic dampeners. Ink solvents, diluents, cleaners and dampeners may all make a significant contribution to emissions from industrial printing. Printing processes convert original text and pictures into an image on a carrier and the main process types are named according to how this image is carried.

Other solvent and product use (NFR 2.D.3.i, 2.G)

Other solvent and product use includes emissions of NMVOCs arising from following activities that are present in Croatia with corresponding SNAP code: Oil extraction (SNAP 060404), Application of glues and adhesives (SNAP 060405), Wood preservation - Creosote preservation type (SNAP 060406), Wood preservation - Organic solvent-borne preservative (SNAP 060406), Car dewaxing (SNAP 060409), Use of shoes (SNAP 060603), Concrete additive (SNAP 060412-2), Cooling lubricant (SNAP 060412-3), Lubricant (SNAP 060412-4), Tobacco combustion (SNAP 060602) and Use of fireworks (SNAP 060601).

Glass wool and Mineral wool enduction (SNAP 060401 and 060402) as well as Underseal treatment and conservation of vehicles (SNAP 060407) are not present in Croatia, according to available information.

Official clarifications about activity data that show time series inconsistency cannot be obtained. Based on publically available information, it can be assumed why some of dips and jumps occurred within time series. For example, from 2002, there was an increase in use of adhesives in construction due to massive increase in construction sector in Croatia, which ended in sudden drop due to the recession in 2009. In wood preservation with creosote, there is a sudden drop in 2014 due to replacement of widely-used wooden power poles with concrete poles and replacement of wooden railway ties with concrete ones. Data for vehicle dewaxing were influenced by increased use of foil wrapping of vehicles. An increasing trend of use of fireworks (mainly use of prepared explosives, other than propellent powders) was noted from 2002 to 2005 with a peak in 2003. Reasons for other inconsistencies in time series are unknown.

Pulp and paper industry (NFR 2.H.1)

There are three types of processes for pulp and paper production that were existed and still exist in Croatia: Kraft (sulphate), acid sulphite and neutral sulphite semi-chemical process. Sulphate pulping was used until 1990 and acid sulphite pulping was used until 1994, while the neutral sulphite semi-chemical process still exists.

Food and beverages industry (NFR 2.H.2)

Croatian Informative inventory reports are considering following activities in scope of NFR 2.H.2 Food and drink: production of wine (white and unspecific colour wine), spirits, beer, bread, coffee roasting, meat, fish etc. frying / curing, sugar production, animal feed, margarine and solid fats and final cakes, biscuits and breakfast cereals production.

Wood processing (NFR 2.I)

Wood processing activity includes the manufacture of plywood, reconstituted wood products and engineered wood products. This source category is only important for particulate emissions. The relevant activity statistic is the mass of wood products processed in Croatia.

Production of POPs (NFR 2.J)

According to GB2016 the production of POPs is not a key source category since the production processes are mostly highly controlled in order to manage health and environmental effects. In addition, no emission factors are available for the production of POPs.

Consumption of POPs and heavy metals (NFR 2.K)

NFR 2.K Consumption of POPs and heavy metals is considering the losses of PCBs and mercury (Hg) from electrical equipment. These substances are used in e.g. refrigerators, air conditioning equipment and electrical equipment. Electrical equipment is the largest source of PCBs emissions mainly from capacitors and transformers. The majority of capacitors used (70 %) are power capacitors and high frequency capacitors. Power capacitors are used in high and low voltage transmission lines or in high frequency transmission units. They can be used both as separate units and in the form of complex capacitor units or batteries. Mercury (Hg) emissions mainly come from the use of batteries, measurement and control instruments (including laboratory and hospital instruments), electrical equipment and light bodies (light bulbs). Other products (e.g. paints, pharmaceuticals, other medical/health problems and dental amalgams) may also be a source of Hg emissions but are unlikely to be very significant on a national level. The majority of emissions of PCBs arise from leaks from electrical transformers and capacitors which contain PCBs and which are in a poor condition and/or are poorly maintained.

Methodology, emission factors and activity data

Domestic solvent use including fungicides (NFR 2.D.3.a)

The methodology for emission estimation is based on the Tier 2b of EMEP/EEA 2016 methodology; multiplication of annual products amount by the appropriate emission factor. Emission factor is expressed as the amount of NMVOC emissions per annual production unit or per number of inhabitants and are shown in Appendix 4. Activity data for NFR code 2.D.3.a, represented by the relevant SNAP code are presented in Table 5.4-1.

Table 5.4-1 Activity data for NFR code 2.D.3.a, represented by the relevant SNAP code

NFR 2.D.3.a	Cosmetics and toiletries	House-hold products	Car care products	DIY/ build-ings, Paint/ varnish removers & solvents	DIY/ buildings, Sealants, filling agents	Pharma-ceutical products	Various products: Hg (fluorescent tubes)	Various products: pesticides
SNAP	060408-1	060408-2	060408-3	060408-4	060408-5	060411	060408-6	060408-7
Unit	kg products	kg products	kg products	kg solvent	kg products	population		t products
1990	749437	11009000	7277000	7106000	9431000	4778000		13937
1991	810098	8458000	5003000	4072000	5471000	4513000		11578
1992	755473	6974000	5574000	2525000	3285000	4470000		4982
1993	771290	6917000	4701000	2259000	2959000	4641000		6647
1994	840915	4953149	4536000	2409000	4786000	4649000		10047
1995	668622	5378897	3609000	1815000	5821000	4669000		10901
1996	380755	4190651	4764000	1909000	6608000	4494000		9994

NFR 2.D.3.a	Cosmetics and toiletries	House-hold products	Car care products	DIY/ build-ings, Paint/ varnish removers & solvents	DIY/ buildings, Sealants, filling agents	Pharma-ceutical products	Various products: Hg (fluorescent tubes)	Various products: pesticides
SNAP	060408-1	060408-2	060408-3	060408-4	060408-5	060411	060408-6	060408-7
Unit	kg products	kg products	kg products	kg solvent	kg products	population		t products
1997	380919	7007809	3692000	1716000	7912000	4572500		9194
1998	382291	6481108	2876000	1674000	9980000	4501000		7674
1999	426322	6045846	3044000	1544000	8409000	4554000		6081
2000	508522	5813441	2275000	1528000	7300000	4381000		7182
2001	497411	5956084	2505000	1474000	7383000	4305494		8570
2002	571345	7219129	3475000	1663000	9146000	4305384		7164
2003	625157	8590884	3009101	1661000	6225000	4305725		4799
2004	723313	8560240	2629826	1712000	8696000	4310861		6675
2005	483679	9004148	2764705	1693000	15084000	4312487		4423
2006	460002	9405593	1503195	1591000	12429000	4313530		4297
2007	578606	9957008	1324135	1430000	9255000	4311967		3993
2008	694125	8955890	2111528	1656000	13272000	4309796		3188
2009	581419	7663580	2136197	1405000	6968000	4302847		2372
2010	1281127	7584616	2961162	1182000	6804000	4289857		2445
2011	1544609	9098104	2616124	1112000	6686000	4280622		1923
2012	1370629	8984782	2977454	847000	5350000	4267558		1547
2013	696184	8713631	2557159	812000	4260000	4255689		939
2014	927176	8269223	2517049	711000	3529000	4238389		581
2015	498006	10871273	3850747	759000	3624000	4203604		528
2016	263372	8314330	4241600	764000	4033000	4174349		535
2017	194776	7689441	4802302	584000	4792000	4124531		462

Source: CBS, Processing: Ekonerg Ltd

Road paving with asphalt (NFR 2.D.3.b)

The methodology for emission estimation is based on the Tier 1 of EMEP/EEA 2016 methodology; multiplication of annual products amount with by the appropriate emission factor. The recommended Tier 1 emission factors from the GB2016 are used. Emission factor is expressed as the amount of NMVOC emissions per annual production unit and are shown in Appendix 4. Activity data for NFR code 2.D.3.b is represented in Table 5.4-2.

Asphalt roofing (NFR 2.D.3.c)

The methodology for emission estimation is based on the Tier 1 of EMEP/EEA 2016 methodology; multiplication of annual products amount with by the appropriate emission factor. The recommended Tier 1 emission factors from the GB2016 are used. Emission factor is expressed as the amount of NMVOC emissions per annual production unit and are shown in Appendix 4. Activity data for NFR code 2.D.3.c is represented in Table 5.4-2.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Coating applications (NFR 2.D.3.d)

The emission calculation is performed using Tier 1 EMEP/EEA 2016 methodology; multiplication of annual consumption of paint by the appropriate emission factor. There is no information on the amounts of paint used in point sources. It is assumed that all paint was used in diffuse sources. For the calculation, data from the Eurostat database (from the year 2001 onward) were used, as well as annual statistical reports on industrial production (annual PRODCOM results) (1990-2000) and expert estimates for the amounts of paint based on GDP (Source: Eurostat: June 2017, Market Survey / Feb 2016, CHP survey / June 2017, SHARES2015 from Feb 2017, ECFIN: AMECO GDP June 2017, EEA / UNFCCC June 2017). The Eurostat data on the amounts of solvent-based paint (import, export and sold production) and amounts of water-based paint (import, export and sold production) were used, whereby the total amount of water-based and solvent-based paint used was equivalent to the imported amounts reduced by the exported amounts and increased by the produced amounts (i.e. sales, product realization). In the calculation, it is assumed that the total applied paint in Croatia is equal to consumption in decorative, industrial and other applications.

Emission factor is expressed as the amount of NMVOC emissions per total paint consumption and are shown in Appendix 4. Activity data for NFR code 2.D.3.d is represented in Table 5.4-2.

Degreasing (NFR 2.D.3.e)

For the 2019 submission, calculation correction was made, taking into account recommendations of the review team with respect to the NEC Directive. The previous methodology included NMVOC emission calculations based on the amount of solvent (import/export/production) for vapour cleaning, while the EF based on the number of inhabitants was still used for cold cleaning. This submission includes methodology based solely on the amount of solvent used.

For the calculation of NMVOC emissions, the consumption of the most common organic solvents for degreasing was used (according to GB2016). Data on quantities of the most common organic solvents (import / export / production) for the years 2001 – onward, were taken from the Eurostat database. The calculation does not include the organic solvent trichlorethylene because it is assumed that this solvent is completely consumed within the activity NFR 2.D.3.f Dry cleaning. In addition to data from the Eurostat database (2001-onward), for the NMVOC emission calculation from this source for the period 1990-2000, the annual statistical reports on industrial production (annual PRODCOM results) and expert estimates for the quantities of degreasing products based on GDP were used.

NMVOC emission factor is the GB2016 Tier 2 EF, and it is expressed as the amount of NMVOC per annual unit of degreasing product. Emission factor is given in Annex 4. Activity data for NFR code 2.D.3.e is given in Table 5.4-2.

Dry cleaning (NFR 2.D.3.f)

Emission calculation for this activity includes methodology based on the amount of solvent used (import/export/production) for dry cleaning.

The EMEP/EEA GB2016 assumes that the most widespread solvent used in dry cleaning, accounting for about 90 % of the total consumption, is tetrachloroethene (also called tetrachloroethylene or perchloroethylene (PER)). Data for import / export / production are available from the Eurostat database. PER production data are available only in PRODCOM codes, where PER is linked to trichlorethylene, which is mostly used in metal degreasing processes (NFR 2.D.3.e). Given the above mentioned, the assumption that all PER (including the amount of trichlorethylene) is used only in dry cleaning sector is included in the calculation, thus minimizing the possibility of double counting. Since NMVOC EF for dry cleaning is shown in GB2016 as grams per kilogram of cleaned textiles, TERT has proposed using the following NMVOC emission calculation methods: the second paragraph of Section 3.2.1. Dry Cleaning in GB2016 explains that solvent emissions directly from the cleaning machine into the air represent little more than 40 % for a closed-circuit machine, which is most likely the main type of machines currently used for dry cleaning. Open-circuit equipment may be in use somewhere in small quantities, but it was basically removed from the use around the 1990s. According to the previous explanation, TERT has recommended that it should be assumed that the EF for dry cleaning can be 400 g of NMVOC / kg solvent. The same method is applied in the Estonian Inventory. In addition to data from the Eurostat database (2001-onward), for the NMVOC emission calculation from this source for the period 1990-2000, the annual statistical reports on industrial production (annual PRODCOM results) and expert estimates for the quantities of dry cleaning products based on GDP were used.

The emission factor is expressed as the amount of NMVOC emissions per annual product unit (solvent) for dry cleaning, and it is shown in Annex 4. Activity data for NFR code 2.D.3.f is represented in Table 5.4-2.

Table 5.4-2 Activity data for NFR codes 2.D.3.b, 2.D.3.c, 2.D.3.d, 2.D.3.e and 2.D.3.f, represented by the relevant SNAP code

NFR	2.D.3.b	2.D.3.c	2.D.3.d	2.D.3.d	2.D.3.d	2.D.3.e	2.D.3.f
Name	Road paving with asphalt	Asphalt roofing	Decorative coating application	Industrial coating application	Other coating application	Degreasing	Dry clean-ing
SNAP	040611	040610	060100	060100	060100	060201	060202
Unit	kt	kt	t	t	t	t	t
1990	200.42	24.52	28819.10	28819.10	28819.10	14792.60	428.40
1991	143.65	14.45	20840.03	20840.03	20840.03	6108.50	338.10
1992	35.60	14.34	14493.30	14493.30	14493.30	1839.80	298.40
1993	28.01	13.02	13355.30	13355.30	13355.30	1692.20	274.60
1994	254.33	13.62	13014.20	13014.20	13014.20	2782.40	295.50
1995	270.20	14.83	13863.73	13863.73	13863.73	27874.40	315.20
1996	338.82	19.65	15231.27	15231.27	15231.27	19951.50	335.50
1997	511.19	6.03	16263.90	16263.90	16263.90	2439.20	352.40
1998	500.75	9.87	16483.20	16483.20	16483.20	2436.20	358.80
1999	547.49	13.57	15941.83	15941.83	15941.83	2186.80	356.50
2000	491.33	23.41	15471.97	15471.97	15471.97	2614.70	368.90
2001	385.04	11.63	15480.43	15480.43	15480.43	2344.50	380.40
2002	741.29	9.50	16434.57	16434.57	16434.57	2488.00	390.80
2003	1139.45	24.74	17151.77	17151.77	17151.77	2506.80	403.30
2004	1350.26	24.87	18860.13	18860.13	18860.13	3269.90	288.50
2005	1212.13	43.79	19481.90	19481.90	19481.90	2944.00	261.00
2006	1118.12	72.73	21080.07	21080.07	21080.07	3423.10	230.80
2007	1108.25	46.82	18429.30	18429.30	18429.30	3911.50	224.20
2008	1338.68	25.28	21103.13	21103.13	21103.13	3778.90	176.70
2009	1107.73	23.49	16636.07	16636.07	16636.07	3370.30	143.60
2010	915.53	17.96	16047.40	16047.40	16047.40	3627.80	132.80
2011	973.45	16.60	16160.30	16160.30	16160.30	3097.30	132.10
2012	863.56	9.96	15173.50	15173.50	15173.50	2985.80	112.70
2013	669.99	16.53	14051.83	14051.83	14051.83	155.50	65.80
2014	780.64	13.08	14170.17	14170.17	14170.17	84.40	144.10
2015	763.90	38.49	13911.90	13911.90	13911.90	142.70	98.90
2016	749.65	17.34	16368.70	16368.70	16368.70	85.40	122.60
2017	814.11	17.28	12207.33	12207.33	12207.33	145.50	86.70

Source: CBS, EUROSTAT; Processing: Ekonerg Ltd

Chemical products (NFR 2.D.3.g)

Emission calculation from the source category Chemical products is performed with Tier 2 of EMEP/EEA methodology. For the Tier 2 approach, both the activity data and the emission factors need to be stratified according to the different products that are used in Croatia, represented by the relevant SNAP codes. For chemical products with SNAP code as following: Polyvinyl-chloride processing (SNAP 060302), Polyurethane solid and soft foam processing (SNAP 060303), Rubber processing (SNAP 060305), Pharmaceutical products manufacturing (SNAP 060306), Paints manufacturing (SNAP 060307), Inks manufacturing (SNAP 060308), Glues manufacturing (SNAP 060309), recommended emission factors from *CORINAIR Technical Annexes. Vol. 2 Default emission factors handbook (1994)* were used. Emission factor is expressed as the amount of NMVOC emissions per unit of annual production/consumption, or per population. For the following activities Tier 2 default emission factors from EMEP/EEA 2016 are used: Polyester processing and Polystyrene foam processing. Emission factors are presented in Appendix 4. Activity data for various activities in the scope of NFR code 2.D.3.g are represented in Table 5.4-3.

Table 5.4-3 Activity data for NFR code 2.D.3.g, represented by the relevant SNAP codes

NFR 2.D.3.g	Polyester process.	Polyvinylchloride process.	Polyure-thane process.	Polystyrene foam process.	Rubber process.	Pharmaceutical products manufact.	Paints manufac.	Inks manufac.	Glues manufac.	Adhesive, magnetic tapes, films and photogr. manufac.
SNAP	060301	060302	060303	060304	060305	060306	060307	060308	060309	060311
Unit	kt	kt	kt	kt	kt	1000 caput	kt	kt	kt	m^2
1990	6.05	49.71	3.76	7.84	5.74	4778	21.96	4.71	21.59	1009000
1991	4.16	30.72	2.80	7.34	5.44	4513	13.83	3.65	13.45	776000
1992	3.52	19.98	1.68	6.74	2.44	4470	9.49	1.37	7.15	469000
1993	2.57	15.15	2.05	6.60	2.48	4641	9.06	1.05	10.91	299000
1994	2.55	5.51	2.46	9.28	2.34	4649	10.80	1.48	11.17	239000
1995	2.23	5.35	2.91	6.45	2.29	4669	10.77	1.42	10.08	320000
1996	3.37	5.34	1.82	7.61	1.28	4494	13.93	1.47	17.20	592000
1997	7.02	5.21	1.75	10.41	0.03	4573	15.00	1.45	10.87	404000
1998	8.26	4.16	1.83	9.95	0.02	4501	15.47	1.09	10.38	419000
1999	5.61	2.90	1.83	5.35	0.02	4554	15.19	0.81	8.21	257000
2000	12.85	1.46	1.86	3.65	0.02	4381	15.11	0.92	10.36	344000
2001	9.66	1.04	2.75	1.42	0.02	4305	16.79	0.83	12.39	339000
2002	14.69	8.39	5.61	NO	0.02	4305	15.17	0.87	25.85	323000
2003	9.70	8.39	2.93	NO	0.01	4306	15.33	0.79	30.87	138000
2004	10.95	10.06	2.48	1.02	0.01	4311	14.98	0.88	46.12	27000
2005	10.89	9.40	2.92	1.68	4.0E-03	4312	16.39	0.67	56.57	109000
2006	14.11	8.05	2.36	10.97	4.0E-03	4314	17.32	0.69	71.33	108000
2007	16.55	8.61	1.87	15.77	NO	4312	20.10	0.92	81.77	75330
2008	16.55	9.34	1.87	16.23	NO	4310	19.72	0.94	77.70	93351
2009	13.99	6.82	1.03	11.05	NO	4303	15.19	0.62	33.82	95430
2010	7.27	4.67	0.78	10.13	NO	4290	16.39	0.34	35.51	95200
2011	7.07	3.83	0.62	0.58	NO	4281	16.62	0.42	28.72	74000
2012	7.66	3.77	0.56	NO	NO	4268	14.26	0.26	28.80	41000
2013	7.87	3.16	0.55	NO	NO	4256	12.62	0.28	31.62	NO
2014	7.28	0.70	0.56	NO	NO	4238	14.18	0.30	21.62	NO
2015	8.51	0.90	0.40	NO	NO	4204	14.56	0.35	18.81	NO
2016	8.11	0.95	0.64	NO	NO	4174	17.36	0.33	18.96	NO
2017	8.75	0.93	0.51	NO	NO	4125	17.32	0.34	16.53	NO

Source: CBS, Processing: Ekonerg Ltd

Printing (NFR 2.D.3.h)

Emission calculation includes methodology based on the amounts of ink used (imported, exported and produced) in the printing industry.

The calculation was performed by using Tier 1 EMEP/EEA 2016 methodology.

Data on the amounts of ink (import/export/production) were taken from the Eurostat database (from the year 2001 onward). In addition to data from the Eurostat database (2001-onward), for the NMVOC emission calculation from this source for the period 1990-2000, the annual statistical reports on industrial production (annual PRODCOM results) and expert estimates for the quantities of ink for printing industry based on GDP were used.

The emission factor (GB2016, Tier 1) is expressed as the amount of NMVOC emissions per annual unit of ink used, and it is shown in Annex 4. Activity data for NFR code 2.D.3.h are represented in Table 5.4-3.

Other solvent and product use (NFR 2.D.3.i, 2.G)

The methodology for emission estimation is based on the Tier 2 of EMEP/EEA 2016 methodology; multiplication of annual products amount by the appropriate emission factor. Used Tier 2 emission factors for all activities, except Application of glues and adhesives, are expressed as the amount of NMVOC emissions per annual consumption unit. For the activity - Application of glues and adhesives, EFs were defined taking into account rates of penetration of abatement technologies in application of glues, modelled on IIASA data taken from the GAINS model for the Republic of Croatia. This was done for 1990, 2005, 2010 and 2030. For other years, data were estimated by linear interpolation.

Emission factors for source category 2.D.3.i, 2.G are shown in Appendix 4.

For this source category basic activity statistics are stratified by the activities involved and are separated to sub-categories 2.D.3.i Other solvent use and 2.G Other product use.

For activity under SNAP code 060404 Oil extractions, relevant activity statistics are the quantities of seed used in units of tonnes per year.

For activity under SNAP 060405 Application of glues and adhesives, relevant activity statistic are quantity of glues produced in units of tonnes per year for industry, DIY/buildings (construction) and domestic uses.

For activities under SNAP 060406 Wood preservation (Creosote preservation type and Organic solvent-borne preservative), the preservative consumption data is not available and the "quantity of wood preserved" (volume of wood impregnated with creosote (m^3/yr) and volume of wood impregnated with solvent borne preservative (m^3/yr) is combined with proposed assumptions in EMEP/EEA 2016.

For Car dewaxing (SNAP 060409), relevant activity data is annual number of motor vehicles (passenger and light cargo) imported by sea on Croatian territory. Data are available for the period 2000 - 2012, and for other years expert assessment was applied. Data are the result of processing the Uniform Customs declaration for the customs procedure of release goods into free circulation (import) by Croatian Ministry of Finance, Customs Administration.

For activity under SNAP 060601 Use of fireworks, relevant activity statistics are amounts of prepared explosives, other than propellent powders, and signalling flares.

For activity under SNAP 060602 Tobacco combustion, relevant activity statistics are the quantities of cigarettes and cigars used in units of tonnes per year combined with assumptions that one cigarette contains 1g of tobacco and one cigar contains 5g of tobacco.

For Use of shoes (SNAP 060603), relevant activity statistics is annual number of sold pairs of shoes.

For Concrete additive (SNAP 060604-1), relevant activity statistics is annual quantity of sold additives for construction activities.

For Cooling lubricant (SNAP 060604-2) and Lubricant (SNAP 060604-3) national energy balance was used as source of activity data. Relevant activity data is non-energy use of various lubricants in energy sector, petrochemical industry, other industry, construction, transport and agriculture. Annual aggregated value on non-energy use of various lubricants was available for whole trend. Detail data by various type was available since 1999, and for years in trend from 1990 to 1998 the average factor by lubricant type was estimate. Types of lubricants are following: white spirit, oil and fats, paraffin and wax and other lubricants. Cooling lubricants (SNAP 060604-2) are assumed to be oils and fats and all other types of lubricant are assumed to be Lubricant (SNAP 060604-3).

Basic activity statistics are taken from Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS). Activity data for SNAP 060406 and 060406 in the scope of NFR code 2.D.3.i and for SNAP codes: 060602 and 060601 within NFR 2.G are shown in Table 5.4-4. Activity data for SNAP codes: 060404, 060405, 060409 within NFR 2.D.3.i and for SNAP codes: 0600603, 060604-1, 060604-2, 060604-3 within NFR 2.G are shown in Table 5 4-5.

Table 5.4-4 Activity data for NFR codes 2.D.3.h, 2.D.3.i, 2G, represented by the relevant SNAP codes

NFR	2.D.3.h	2.D.3.i		2.G	
Name	Printing	Wood preservation with solvent borne preservative	Wood preservation with creosote	Tobacco combustion	Use of fireworks
SNAP	060403	060406b	060406a	060602	060601
Unit	kt	t	t	t	t
1990	6.53	31.69	334.83	12091	709
1991	5.09	11.77	124.32	11232	709
1992	2.63	25.50	269.43	12428	709
1993	2.17	21.40	226.08	11271	709
1994	2.67	51.41	508.73	4856	709
1995	2.71	50.68	362.50	11845	1214
1996	2.84	50.05	473.00	11327	1787
1997	2.95	43.21	409.63	11185	1766
1998	2.62	47.91	402.58	11965	1197
1999	2.33	33.54	434.43	13839	973
2000	2.50	34.33	243.73	13531	707
2001	2.47	37.54	234.65	17674	1659
2002	2.59	53.54	334.65	18350	8292
2003	2.95	60.63	1145.83	19070	11487
2004	3.33	53.11	1761.98	14256	6201
2005	3.61	32.86	1361.48	14634	2773
2006	4.09	18.54	971.35	14422	2088
2007	4.47	96.01	1451.90	14595	1471
2008	4.46	422.14	1337.15	15405	1024
2009	4.03	2058.15	1750.10	11335	456
2010	4.06	401.83	1819.20	13279	181
2011	4.20	448.51	1319.18	11665	156
2012	4.14	421.02	1712.98	11144	11
2013	4.79	572.80	2600.20	9598	1455
2014	4.71	518.98	364.18	8377	1036
2015	4.69	675.70	617.23	8157	1000
2016	4.70	507.70	290.00	8162	1278
2017	4.71	1240.47	622.78	9097	1349

Source: CBS, EUROSTAT; Processing: Ekonerg Ltd

Table 5.4-5 Activity data for NFR code 2.D.3.i, 2.G, represented by the relevant SNAP code

NFR	2.D.3.i	2.G

Name	Fat, edible and non-edible oil extraction	Use of adhesives	Vehicles dewaxing	Use of Shoes	Concrete additive	Cooling lubricant	Lubricant
SNAP	060404	060405	060409	060412-1	060412-2	060412-3	060412-4
Unit	t	t of glue	number of vehicle	pair of shoes	t	t	t
1990	121158	21591	751	26384000	3109	130496	63304
1991	28401	13209	704	11977000	1152	111631	54153
1992	72700	7079	657	8751000	757	79388	38512
1993	42622	7479	438	13865000	778	97300	47200
1994	72922	6280	503	8407000	1081	108198	52487
1995	73551	7180	548	9408000	934	105380	51120
1996	69991	8972	588	5766000	964	113931	55269
1997	132847	10874	648	6715000	1124	124705	60495
1998	157060	10379	687	5191800	1102	93394	45306
1999	100509	8206	729	5159000	1123	33500	15500
2000	25260	10355	768	2381000	603	30000	14600
2001	24256	12385	673	2279000	539	31100	20600
2002	155631	25851	58	3891000	912	33600	24200
2003	151524	30873	7	4935000	1583	29000	25100
2004	95505	46119	36	7130000	1983	39400	19400
2005	123783	56573	152	5477000	4724	35400	21700
2006	129269	71330	45	5776000	6319	38100	19400
2007	98045	81768	70	5803000	3872	45100	16400
2008	96740	77701	48	5443000	2023	38900	17200
2009	76898	33849	25	5069000	1722	37300	14800
2010	83669	35507	26	5276000	2449	33200	11200
2011	86646	28722	10	4966000	1668	33400	10300
2012	26214	28801	16	4486000	1989	29700	10200
2013	34087	31622	5	4533000	1394	28700	9700
2014	44358	21616	5	5148000	522	29800	12200
2015	51005	18810	5	5010000	500	32200	10900
2016	47170	18955	5	4989000	827	34500	18400
2017	61879	16530	5	6086000	1660	33900	16900

Source: CBS, Croatian Ministry of Finance, Customs Administration, Energy balance; Processing: Ekonerg Ltd

Pulp and paper industry (NFR 2.H.1)

The methodology for emission estimation is based on the Tier 2 of EMEP/EEA 2016 methodology; multiplication of annual products amount by the appropriate emission factor. For all activities in the source category 2.H.1 Pulp and paper recommended Tier 2 emission factors are used according to the EMEP/EEA 2016. Emission factor is expressed as the amount of NMVOC emissions per annual production unit and are shown in Appendix 4. Activity data for different SNAP codes within the NFR code 2.H.1 are represented in Table 5.4-6.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Activity data for different SNAP codes within the NFR code 2.H.1 are represented in Table 5.4-6.

Table 5.4-6 Activity data for NFR codes 2.H.1, 2.I and 2.K, represented by the relevant SNAP codes

NFR	2.H.1			2.I	2.K
Name	Paper pulp (Neutral Sulphite Semi-Chemical process)	Paper pulp (Acid sulphite process)	Paper pulp (Kraft process)	Wood processing	Consumption of POPs and heavy metals
SNAP	040604	040603	040602	040620	060508 (includes: 060502, 060504, 060507)

Unit	t	t	t	t	population
1990	94703	1623	14609	91422	4778000
1991	68778	1074	NO	60789	4513000
1992	62985	703	NO	74862	4470000
1993	74304	476	NO	69093	4641000
1994	92838	71	NO	63325	4649000
1995	78246	NO	NO	52779	4669000
1996	62933	NO	NO	53954	4494000
1997	69885	NO	NO	50541	4572500
1998	57552	NO	NO	52254	4501000
1999	71158	NO	NO	47461	4554000
2000	88607	NO	NO	50308	4381000
2001	77232	NO	NO	51038	4305494
2002	78247	NO	NO	54988	4305384
2003	52526	NO	NO	62789	4305725
2004	66065	NO	NO	68151	4310861
2005	55489	NO	NO	89565	4312487
2006	63331	NO	NO	110134	4313530
2007	49554	NO	NO	121040	4311967
2008	52122	NO	NO	123953	4309796
2009	36946	NO	NO	94985	4302847
2010	53340	NO	NO	93545	4289857
2011	61192	NO	NO	97483	4280622
2012	42966	NO	NO	102444	4267558
2013	40366	NO	NO	143088	4255689
2014	32648	NO	NO	134822	4238389
2015	31957	NO	NO	134552	4203604
2016	33596	NO	NO	87228	4174349
2017	38912	NO	NO	117871	4124531

Source: CBS, Processing: Ekonerg Ltd

Food and beverages industry (NFR 2.H.2)

The methodology for emission estimation is based on the Tier 2 of EMEP/EEA 2016 methodology; multiplication of annual products amount by the appropriate emission factor. For all activities in the source category Food and beverages recommended emission factors are used according to the EMEP/EEA 2016. Tier 2 default emission factors are used and they are based on various food and beverages products. Emission factors used for the preparation of the inventory are presented by NFR sectors and pollutants in Appendix 4. Activity data for different SNAP codes within the NFR code 2.H.2 are represented in Table 5.4-7.

Table 5.4-7 Activity data for NFR code 2.H.2, represented by the relevant SNAP codes

NFR 2.H.2	Bread	Wine	Beer	Spirit	Cakes, biscuits, cereals	Margar-ine and solid fats	Animal feed	Sugar	Meat frying/ curing	Coffee roasting
SNAP	040605	040606	040607	040608	040615	040616	040617	040625	040626	040630
Unit	t	hl	hl	hl	t	t	t	t	t	t
1990	250489	129955	28002	1222	40848	24507	970853	20064	135315	12905
1991	205425	111499	22475	1125	32337	21000	755750	10016	104501	12591
1992	202327	109924	27200	6119	23525	17723	653431	94666	90577	8248
1993	185419	851302	24813	5517	21307	14687	650745	78847	86103	7296
1994	201668	858680	31566	3238	22371	13094	530053	11544	86112	8420
1995	172510	829480	31701	3106	23505	24507	519900	17534	86795	8003
1996	154330	793676	32919	4187	24146	16637	477753	19531	89773	8144

NFR 2.H.2	Bread	Wine	Beer	Spirit	Cakes, biscuits, cereals	Margar-ine and solid fats	Animal feed	Sugar	Meat frying/ curing	Coffee roasting
SNAP	040605	040606	040607	040608	040615	040616	040617	040625	040626	040630
Unit	t	hl	hl	hl	t	t	t	t	t	t
1997	154443	548426	36628	3582	26151	16170	476549	14138	84603	8643
1998	139070	626098	37594	3157	26507	15755	537653	13920	82321	8429
1999	124364	483515	36065	3267	25666	16124	496339	11396	79562	7639
2000	122585	612812	39934	3208	26320	20261	694835	56729	134297	7768
2001	123620	548667	37792	2537	26943	16414	530348	13069	84992	7955
2002	138063	600463	36385	2652	29454	22232	559542	17389	101742	11056
2003	136241	638412	37011	2475	36822	27378	583495	14656	101212	11181
2004	140597	631784	36063	2187	34988	30635	758976	21493	101972	10545
2005	136930	504248	34959	2816	36322	25427	534785	24538	106546	9697
2006	144683	534735	36889	2039	36313	31814	590284	32034	116218	13040
2007	202890	652852	38102	4958	39349	29600	643886	32832	115739	13549
2008	194473	508689	38798	5265	46395	4688	637284	31576	223998	12832
2009	191204	556945	36743	4882	47396	17284	602422	25595	133945	13934
2010	193074	463463	34389	5561	49494	16136	599633	26156	131874	13010
2011	192282	488750	37383	5130	49221	17542	654202	32932	141720	14203
2012	193307	441905	36251	4192	47762	16200	656880	29672	137243	12129
2013	157647	487803	34434	5350	47365	15010	654983	27384	130385	11667
2014	194812	452727	34166	4992	50662	13574	736066	33538	130027	11620
2015	190523	472699	33962	4460	49691	12839	517659	24882	125013	11927
2016	183009	484895	33658	4133	47555	12039	696173	33386	135622	14513
2017	185677	460889	33430	4387	48755	11615	675234	33194	143199	13497

Source: CBS; Processing: Ekonerg Ltd

Wood processing (NFR 2.I)

The methodology for emission estimation is based on the Tier 1 of EMEP/EEA 2016 methodology; multiplication of annual products amount by the appropriate emission factor. Proposed Tier 1 emission factors are used according to the EMEP/EEA GB2016 and are presented in Appendix 4. Activity data is from the Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS). Activity data for NFR code 2.I is represented in Table 5.4-6.

Consumption of POPs and heavy metals (NFR 2.K)

For PCBs and Hg emission calculation from sub-sector 2.K, a Tier 1 default emission factors were used which is according to GB2016 only available Tier 1 method. Tier 1 emission factors are expressed as the quantity of pollutant by population in Croatia and are presented in Appendix 4. Annual national population statistics is using as activity data for pollutants emission calculation (Table 5.4-6).

Recalculations and improvements

Degreasing (NFR 2.D.3.e)

Recalculation for the trend was performed taking into account the amount of solvent used, and by removing the previously used cold cleaning sub-category from the calculation.

Printing (NFR 2.D.3.h)

Recalculation for 2016 was performed due to the error in calculation.

For the rest of the categories, there were no recalculations or other improvements.

6. Agriculture (NFR 3)

This chapter gives an overview of the sector 3 Agriculture and contains information on methodologies, activity data, emission factors, recalculations used for the calculation of emission estimates and planned improvements. Under NFR sector 3, emissions of ammonia, particles (TSP, $PM_{2.5}$ and PM_{10}) and NOx are reported. This sector includes the following sub-sectors from which certain pollutant emissions in the Republic of Croatia are reported:

- 3.B Manure Management
    - 3.B.1.a Dairy cattle
    - 3.B.1.b Non-dairy cattle
    - 3.B.2 Sheep
    - 3.B.3 Swine
    - 3.B.4.d Goats
    - 3.B.4.e Horses
    - 3.B.4.f Mules and asses
    - 3.B.4.g.i Poultry
    - 3.B.4.g.i Laying hens
    - 3.B.4.g.ii Broilers
    - 3.B.4.g.iii Turkeys
    - 3.B.4.g.iv Other poultry
- 3.D Crop production and agricultural soils
    - 3.D.1.a Mineral N-fertilizers
    - 3.D.a.2.a Animal manure applied to soils
    - 3.D.a.2.b Sewage sludge applied to soils
    - 3.D.a.3 Urine and dung deposited by grazing animals
    - 3.D.b Indirect emissions from managed soils
    - 3.D.c Farm-level agricultural operations including storage, handling and transport of agricultural products
    - 3.D.f Use of pesticides

For source category NFR 3.F Field burning of agricultural residues the notation key “NE” is used (no AD available).

There are five main sources of activity data for emission calculation: the Central Bureau of Statistics (CBS), Croatian Agricultural Agency (CAA), Ministry of Environment and Energy (MEE), FAOSTAT and fertilizer companies.

6.1. Manure management (NFR 3.B)

Source category description

The manure management is source of emissions of NH3, NO, NMVOC and PM. The NH3, NO, NMVOC arise from the excreta of agricultural livestock deposited in and around buildings and collected as liquid slurry, solid manure or litter-based farmyard manure (FYM) and the last two are observed together as solid. Those emissions take place from buildings housing livestock and outdoor yard areas, from manure stores, following land spreading of manures and during grazing. The PM emissions arise mainly from feed, and also from bedding, animal skin or feathers, and take place from buildings housing livestock. There are five main sources of emissions from animal husbandry and manure management: livestock feeding (PM), livestock housing and holding areas (NH3, PM, NMVOC), manure storage (NH3, NO, NMVOC), field-applied manure (NH3, NO, NMVOC) and manure deposited during grazing (NH3, NO, NMVOC). Croatia is reported ammonia, NOx and PM emissions for animal husbandry, while NMVOC emission is not reported for now.

Listed below, are national specifics for manure management regarding key categories.

National specifics regarding Swine:

Currently in Croatia, swine production is based on the using of high producing breeds (landrace type breeds or hybreed such as PIC, Topics etc.) in housing system based on slurry manure type. The type of production is similar to that in Western European countries (Netherlands, Denmark, and Germany), from where are animals and equipment imported. Local characteristics (climate condition in each part of Croatia) should be also taken into account. In the period 2000 - 2010 there were changes which resulted in intensifying of the pig production. The number of sows, especially sows kept outdoors in partial or full time grazing system decrease (to the proportion of < 5 %), as well the number of sows in litter based housing (about 40% in 2012 and 2013, compared to > 80 % in the period 1990 - 2000). Intensive fattening of pigs makes > 90 % and takes place in housing system based on slatted floor and liquid/slurry manure type, which is a significant change in comparison to 1990 in which it is estimated that was less than 50 %. Increasing the number of piglets produced per sow per year, increasing the daily gain and the higher meatiness of pigs (52% in 1990 to 58 % in 2012), result in higher nutritional demand of pigs to protein (N) in feed. It is estimated that fattening pigs intake about 20.0 kg of N by feed, from which about 13.5 kg or 70 % is excreted with excrements (feces and urine; IPCC, 2006; SN, 2012). For breeding sows N intake is estimated to 48.7 kg animal from which about 30.8 kg per animal per year is excreted with excrements. This amount of N is the basis for the TAN content in manure and ammonia emission, depending on the method of manure removal (4.5 kg N), storage (0.85 kg N per m2 per year) and the application of manure (> 15 % TAN). For grazing sows (outdoor production system) N loss is < 3.0 kg per animal (Misselbrook et al., 2000).

National specifics regarding Cattle dairy:

In the 1990s the milk production was based on keeping the double purpose dairy cows (milk and meat) in extensive production system. The average milk production amounted to 1,930.0 kg cow-1 year-1 in 1990 and 2307.0 kg in 2000 (CBS, 1990-2000). Because the average milk production per cow was relatively low during this time period, N excretion by manure was low due to the low nutritional demand of cow to protein (N) content in the feed. Increase in milk production per cow is closely associated with increase in DMI and the protein (N) content. Assuming that about 20% of N intake with feed is retained in the organism of the cow for milk synthesis and demands of their own tissues, the rest (80%) is excreted with faeces and urine and makes a pool for the emission of ammonia (IPCC, 2006). In the 1990s more than 80% of the dairy cows were in production system which was based on a combination of grazing (6 months) and housing (6 months) system or only housing system with the use of large amounts of litter (> 7.0 kg head day). Only about 20% of dairy cows were in the housing system based on liquid manure type. In the last 15 years significant changes in the structure of milk production could be observed. The number of cows was reduced, but the average production of milk per cow has significantly increased. In 2010 milk production per cow amounted to 4370 kg and for 2013 it is estimated to approach 5000 kg per cow per year. Above mentioned results in significantly greater demands to feed protein (N) intake and consequently a greater amount of N excreted with feces and urine as the basis for the emission of ammonia. In spite of this the nutritional protein demands risen more than twice and despite of higher efficiency of protein digestion increase the amount of N excreted in faeces and urine. Recently, milk production is based on a smaller number of specialized dairy farms in comparison to 15 years ago. The share of dairy cows kept in housing system based on liquid/slurry manure type (slatted floor or solid floor) increased. This is particularly evident after the adoption of the "Operative program for development of cattle production in Croatia" by the Croatian government that has resulted in building of new and reconstruction of existing farms dairy modelled on a farm in western European countries (Germany, Netherlands and Austria) that are based on the liquid manure. Milk production based on using of large amounts of litter and pasture as the favourable production systems from the point of ammonia emissions, are gradually reduced (currently their share is less than 30%) and are retained mainly on smaller farms with lower milk production per cow. In housing systems based on liquid manure, excrements are collected in lagoons (above ground level, open plan, solid floor) or in the pit storage (closed type, below the ground level, slatted floor). Housing system based on liquid manure and solid floor (the use of scrapers) as well the manure storage in lagoons is significantly less favourable from the point of ammonia emissions in comparison to previous using grazing system or housing system based on high amount of bedding material. Change from the grazing to the housing system has resulted in average increase of ammonia emission, while the move from the litter based to liquid/slurry based housing has resulted in additional increase of ammonia emission. In addition, the amount of ammonia which is lost during storage and during the application of manure should also be accounted for (Misselbrook et al., 2000).

National specifics regarding Cattle non-dairy:

The category of non-dairy cattle represents the ammonia emission from the beef and/or suckling cows and finishing cattle (calves, bulls, heifers). Beef cows make up 5% of the total number of cows in Croatia and are characterized by full time grazing with feed supplement during winter season and use of poor pasture in relation to crude protein content (N). The fattening of cattle takes place in housing with predominantly slurry based system (slatted) or more rarely with litter. Intensive fattening is based on using of high amounts of grains and maize silage, which brings about 45 kg N per animal per year of which 36 kg N per animal per year is excreted with the faeces and urine as a basis of TAN and the ammonia emissions from manure (SN, 2012). In the period 1990 - 2013 there were no significant changes in beef cattle production systems and manure management.

National specifics regarding Poultry:

Average annual N feed intake and in excretion is dependent on the type of poultry and their purpose (production of eggs, meat, and breeding flocks). The N intake in broilers is about 1.05 kg per animal per year, from which around 0.55 kg N is excreted with excrements as uric acid. In laying hens the amount of excreted N is about 0.75 kg animal per year, in ducks 0.76 kg animal per year and in turkey 1.71 kg animal per year (SN, 2012). The above mentioned is resulting with different emission of ammonia for different animal category. It should be noted that the production of poultry meat and eggs in Croatia in their characteristics are compatible with the same production in Western European countries (Netherlands, Germany, the same genetic basis of animal, housing and feeding, manure management).

Methodology, emission factors and activity data

The methodology used is in accordance with the GB2016. For the calculation of NH_3 and NOx emissions from the NFR sector 3.B Animal husbandry and manure management, Tier 2 "mass-flow" methodology was used. National specifics described in the previous chapter were implemented within the Tier 2 methodology. Emission factors used for emission are presented in Appendix 4. Emission factor for a certain part of the poultry sub-category "Other poultry" (pheasants, quails, guinea fowls, ostriches, chickens other than laying hens) correspond to the emission factor for ducks, in accordance with the ERT recommendation.

National implemented proportions of livestock category housed on slurry and solid based systems and national specifics in manure management (nitrogen exchange rate (Nex), animal mass, N rate) were developed by the experts from the Faculty of Agriculture, University of Zagreb and are presented in Table 6.1-1 for the year 2017.

Table 6.1-1 Animal categories N rate, Nex and percentage of slurry % for the year 2017

Animal category	N rate	Nex	Slurry manure type (%)
Dairy cows (100501)	0.415	89.37	59.4
Other cattle (100502)	0.342	49.93	42
Sheep (100505)	0.88	8.03	82
Goats (100511)	1.28	16.35	82
Horses etc. (100506)	0.285	41.61	70
Fattening pigs (100953)	0.535	9.76	90.8
Sows (100504)	0.445	30.86	81
Layers (100507)	0.837	0.55	10
Broilers (100508)	1.1	0.4	2
Turkeys (100509)	0.74	1.62	3
Ducks (100509)	0.83	0.76	7
Geese (100509)	0.83	1.21	10

NMVOC methodology and EF used for emissions calculation was Tier 1 methodology, using the default Tier 1 EFs for NMVOCs (Table 3.4, GB2016) for the whole time period. Since default EFs (Table 3.3, GB2016) are provided for silage and without silage feeding, proportion of animals on silage feed was estimated by the experts from the Faculty of Agriculture, University of Zagreb, and are presented in Table 6.1-2.

Table 6.1-2 Percentage (%) of animal categories on sillage feeding for selected years and year 2017

Year	Dairy cows (SNAP 100901)	Other cattle (SNAP 100902)	Sheep & goats (SNAP 100905)
1990	20	10	0
2000	50	50	0.5
2010	70	65	0.5
2016	82	71	1

For PM, GB2016 Tier 1 methodology and default EF (Table 3.5, GB2016) were used for emissions calculation. Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Relevant activity data are the number of certain livestock categories in Croatia which were attained in more detail. The categories were defined according to typical examples provided in the Guidebook; thus including goats and mules/asses in the emission calculation. Camels, buffalo and fur animals were not included because the first two animal categories do not exist in Croatia while data on fur animals' number are not available. Since the total poultry number in Croatia includes some other animals such as pheasants, quails, guinea fowls, ostriches and chickens other than laying hens, in order to ensure the completeness of the calculation and the comparability with statistical data, they were attributed to the reported sub-category Other poultry. Therefore sub-category Other poultry includes ducks, geese, pheasants, quails, guinea fowls, ostriches and chickens other than laying hens.

The main data source is the Central Bureau of Statistics, Croatian Agricultural Agency (dairy cattle) and for some categories the FAOSTAT database. Data sources for each year and livestock category are presented in Table 6.1-3. Trend of animal number for each livestock category is presented in Tables 6.1-4 and 6.1-5.

Table 6.1-3 Sources for activity data for NFR code 4.B Animal husbandry and manure management

Livestock categories	CBS	FAO	CAA	Extrapolation
Dairy cattle			2008-2017	1990-2007
Other cattle	1990-2017			
Sheep	1990-2017			
Goats	1990-1991; 1999-2017	1992-1998		
Horses	1990-1994		1995-2017	
Mules/assess	1990-1991	1992-1994	1995-2017	
Swine	1990-2017			
Poultry	1990-2017			

Table 6.1-4 Activity data for NFR codes 3.B.1.a, 3.B.1.b, 3.B.2, 3.B.3, 3.B.4.d, 3.B.4.e and 3.B.4.f

NFR	3.B.1.a	3.B.1.b		3.B.2	3.B.4.d	3.B.4.e	3.B.4.f	3.B.3	
SNAP	100501	100502	100502	100505	100511	100506	100512	100503	100504
Naziv	Muzne krave	Ostala goveda	Ostala goveda (telad)	Ovce	Koze	Konji	Mule i magarci	Krmače	Tovne svinje
Jedinica	životinja	životinja	životinja	životi nja	životi nja	život inja	životi nja	životinja	životinja
1990	487511	47405	315804	751000	172000	39000	17000	232000	1341000
1991	467535	65873	268586	753000	133000	36000	13000	234000	1387000
1992	448378	29830	195326	539000	113809	26000	13440	180000	1002000
1993	430006	47269	209368	525000	105000	22000	12430	193000	1069000
1994	412386	28338	162736	444000	107685	21000	6640	198000	1149000
1995	395489	35873	149209	453000	107292	4685	1549	182000	993000
1996	379283	36373	141822	427000	105271	5274	1750	181000	1016000
1997	363742	33965	137815	453000	99544	5886	1902	185000	991000
1998	348838	38451	134112	427000	84403	6540	2077	186000	980000
1999	334544	29339	140920	488000	78000	7309	2255	205000	1157000
2000	320836	26933	137428	528675	79393	9611	2518	185249	1048296
2001	307690	28104	156223	539498	92943	10871	2780	187102	1046721
2002	295082	32285	137802	580016	96534	13570	3097	190189	1096308
2003	282991	29424	162685	586641	86087	15217	3033	200907	1145756
2004	271396	48078	191568	721578	126060	17057	3195	229446	1259889
2005	260275	38787	197272	796480	134483	17883	3146	199351	1005609
2006	249610	37300	212682	679839	102877	18885	3299	198668	1289820
2007	239382	21928	209618	645992	91902	18075	3415	182635	1165708
2008	226000	30526	203131	643384	83877	19687	3591	162063	941819
2009	224719	28102	206647	619044	76119	19958	3617	167649	1082225
2010	209336	47626	214243	629437	75215	20537	3722	163956	1066618
2011	206291	26742	236127	638608	70030	21836	3365	129375	1104031
2012	191354	29175	244547	679313	71978	22426	3363	125966	1056381
2013	180946	39447	236940	620000	69000	21256	3273	127643	983007
2014	178827	45282	218954	604866	60697	21144	2159	119277	1036943
2015	174805	66613	236157	607711	62057	21868	2468	150377	1044762
2016	167628	72104	243746	618896	75530	22775	2862	152593	1040696
2017	160560	53718	255792	636808	76771	23209	3270	128364	992668

Source: CBS, FAO, CAA; Processing: Ekonerg Ltd

Table 6.1-5 Activity data for NFR codes 3.B.4.g.i, 3.B.4.g.ii, 3.B.4.g.iii, and 3.B.4.g.iv

NFR	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv		
SNAP	100507	100508	100509a	100509z		
Name	Laying hens	Broilers	Turkeys	Ducks	Gees	Other poultry
Unit	animal	animal	animal	animal	animal	animal
1990	7756000	4416916	854870	345557	113147	3615510
1991	7671000	4264538	825378	333635	109243	3308206
1992	6648000	3394171	656923	265542	86948	2090416
1993	6321000	3279241	634679	256551	84003	2121525
1994	6253000	3229137	624982	252631	82720	2060530
1995	6503000	3105426	601038	242953	79551	1492032
1996	6260000	2839151	549502	222121	72730	1049497
1997	6089000	2826754	547103	221151	72412	1188581
1998	5853000	2572101	497816	201228	65889	768967
1999	5851000	2673000	545000	219655	71923	1510422
2000	5988000	3235000	516000	227435	74470	1215096
2001	5709000	3352000	497000	237356	77718	1873926
2002	5775000	3686000	528000	235699	77176	1363126
2003	5610000	3936000	477000	237982	77923	1439095
2004	6447000	2634000	599000	226000	74000	1205000
2005	6056000	2520000	431000	175000	68000	1390000
2006	5758000	2068000	573000	219000	76000	1394000
2007	5529907	2097961	677474	191000	70000	1487000
2008	5486401	2281879	577486	184000	57000	1429000
2009	5673000	3111000	584000	186976	62203	1170187
2010	4357905	3377605	726301	200785	45972	760873
2011	4078789	4420993	608666	172387	39176	203421
2012	3696170	4980156	470701	210080	45994	757258
2013	3979081	4524637	444116	120215	26213	212428
2014	3722447	5556971	369446	96024	49011	523209
2015	3017389	5974694	495034	74476	21675	606517
2016	3496860	5362104	511844	91514	21009	373016
2017	3843140	5838080	493072	80848	13284	160976

Source: CBS; Processing: Ekonerg Ltd

Recalculations and improvements

Recalculations of NOx and NH_3 emissions were performed for the years 2015 (for fattening pigs) and 1994 (for breeding pigs) due to the correction of AD used.

Emissions of NH_3 and NOx from livestock manure applied to land for the entire time period were reported in the appropriate category (3.D.a.2.a) instead of IE reporting within this category, which resulted in recalculation and decrease of emissions reported in 3.B.

Recalculations of NOx for the 1990-2016 period was performed for laying hens, other poultry, turkey, geese and for 1990-2016 period due to correction of an error which resulted in an overstimate of emissions. In addition, due to AD correction (2016 year only) for laying hens and other poultry, NH_3 and NOx was recalculated for 2016.

6.2. Crop production and agricultural soils (NFR 3.D)

Source category description

Crop production and agricultural soils sector is a source of NH_3, NO, NMVOC and PM emission. There are four main sources of emissions from crop production and agricultural soils: fertiliser application (NH_3), soil microbial processes (NO), crop processes (NH_3 and NMVOC) and soil cultivation and crop harvesting (PM).

This chapter gives information for sub-sector Mineral N-fertilizers (NFR 3.D.1.a), Livestock manure applied to soils (NFR 3.D.a.2.a), Sewage sludge applied to soils (NFR 3.D.a.2.b), Livestock manure applied to soils category (NFR 3.D.a.3), Farm-level agricultural operations including storage, handling and transport of agricultural products (NFR 3.D.c), Cultivated crops (NFR 3.D.e).

Emissions for the source categories which are not estimated: NFR 3.D.a.2.c Other organic fertilizers (due to lack of AD), NFR 3.D.a.4 Crop residues applied to soils (no EF and methodology provided in GB2016), NFR 3.D.b Indirect emissions from managed soils (no EF and provided in GB2016), NFR 3.D.d Off-farm storage, handling and transport of bulk agricultural products (no EF and provided in GB2016).

Emissions of NMVOC regarding source category NFR 3.D.f Use of pesticides are presented in the scope of source category NFR 2.D.3.a Domestic solvent use including fungicides.

Mineral N-fertilizers (NFR 3.D.1.a)

Emissions of NH_3 and NOx resulting from the application of N fertilizers, including urea.

Livestock manure applied to soils (NFR 3.D.a.2.a)

Emissions of NH_3 and NOx due to manure applied to agricultural land. This source is presented separately starting with this report which is an improvement – in previous reports it was reported within the category 3.B. The emissions are calculated within the 3.B calculation, using mass-flow approach (see Chapter 6.1).

Sewage sludge applied to soils (NFR 3.D.a.2.b)

Emissions of NH_3 and NOx from usage of sewage sludge is - according to Croatian legislation - permitted only when it does not contain more heavy metals or organic matter than is allowed within the articles 5 and 6 od the „Guidance on sludge from waste water purification when that sludge is used in agriculture" (*Pravilnik o gospodarenju muljem iz uređaja za pročišćavanje otpadnih voda kada se mulj koristi u poljoprivredi*, Official Gazette 38/08) and only when all potential patogens are removed/destroyed. According to the aforementioned Guidance, the sludge is to be used in accordance with the crop needs and in such manner to keep the quality of water bodies at the required level.

Up to the year 2010 only the sludge from the waste water of food industry was used in agriculture, while from the year 2012 onwards the sludge from comunal waste water purifiers was also used. For the year 2017, 11 sludge producers and 13 sludge users are reported.

Livestock manure applied to soils category (NFR 3.D.a.3)

Emissions of NH_3 and NOx ue to manure applied to grazing land. The emissions are calculated within the 3.B calculation, using mass-flow approach (see Chapter 6.1).

Farm-level agricultural operations including storage, handling and transport of agricultural products (NFR 3.D.c)

Relates to the particle emissions from agricultural operations, using the data on utilized agricultural area (UAA). This source is presented separately starting with this report, a inventory improvement – in previous reports it was reported within the category 3.D.1.a.

Cultivated crops (NFR 3.D.e)

Relates to the NMVOC emissions from agricultural operations, using the data on utilized agricultural area (UAA). This source is presented separately starting with this report, a inventory improvement – in previous reports it was reported within the category 3.D.1.a.

Methodology, emission factors and activity data

Mineral N-fertilizers (NFR 3.D.1.a)

For NH_3 emission calculation from the source category 3.D.1.a Mineral N fertilizers, Tier 2 GB2016 methodology was used and for NOx emission calculations Tier 1 GB2016 methodology was used. Emission factors used for NH_3 emission calculation from source category NFR 3.D.1.a Mineral N fertilizers are default Tier 2 factors attained from GB2016, Table 3.2. Entire agricultural land area in Croatia is in "Cool" climate zone, with a median temperature of 10-11°C according to the literature (*Zaninović, M. et al*). As for the normal/high pH ratios - 32% of the land is estimated to have pH below 7 (*Mesić, M. et al*).

Methodology also includes preparation of activity data that includes the calculation of the amount of nitrogen (N) in each of mineral fertilizers produced (accounting also for mineral fertilizers exported from and mineral fertilizers imported in Croatia). This calculation is performing on the basis of data obtained from all fertilizers producer in Croatia and amounts of a particular mineral fertilizer formulation and N content in each formulation. An assumption is made that all mineral fertilizers sold and imported in Croatia are actually applied to soil is used for emissions calculation.

Relevant activity data for ammonia emission calculation is the mineral N-fertilizer consumed (applied). The consumed amount refers to the amount produced and sold for domestic use and also to the imported amounts. The activity data providers are producers of mineral fertilizers in Croatia. There are three mineral fertilizer producers in Croatia, among whom one produces a dominant share. The other two have started with production in the year 2006 and 2010, respectively. Preparation of activity data relates to calculation of the amount of nitrogen (N) in each of the mineral fertilizer type produced, excluding mineral fertilizers exported and including mineral fertilizers imported in Croatia. This calculation is performed using information on particular mineral fertilizer formulation and N content in each formulation obtained from fertilizers producer in Croatia. Regarding activity data received from the main fertilizer company, due to lack of data, the consumed amount was estimated by extrapolation method for the years 1990 and 1991 using the trend from the 1992 to 2006 time period. The activity data on import before the year 2000 were negligible due to tariffs which were eliminated in 2000; thus, the activity data regarding imported amounts is available from 2000 onwards. Regarding activity data received from fertilizer company that started with production in 2006, for period 2007 – 2010, due to lack of formulation data, interpolation was conducted to obtain N in mineral fertilizer (NIR 2012). Activity data for nitrogen (N) applied for each type of mineral fertilizer is shown in Table 6.2-1.

Table 6.2-1 Activity data for NFR code 3.D.1.a

NFR 3.D.1a	N (nitrogen) applied					
Name	Urea	Calcium ammonium nitrate	NPK	Ammonium nitrate	Urea ammonium nitrate	TOTAL
Unit	kg N	kg N	kg N	kg N	kg N	kg N
1990	31376015	39030122	36285992	721273	NO	107413402
1991	31957265	38643459	37441717	672217	NO	108714658
1992	41093640	43521030	39921424	282405	NO	124818499
1993	32705540	27743580	29856295	1053575	NO	91358990
1994	29839280	36707850	29814546	549065	NO	96910741
1995	29038880	35701020	28395908	279725	NO	93415533
1996	32894140	34644780	30768659	81740	NO	98389319
1997	42897760	43609050	35924213	920915	NO	123351938
1998	27755940	38790630	28358872	341030	NO	95246472
1999	31669160	34221420	39495688	235170	NO	105621438
2000	38179540	39921660	39861790	41875	NO	118004865
2001	57768640	37933110	32340631	300495	NO	128342876
2002	50655660	38065680	31650894	96815	NO	120469049

NFR 3.D.1a	N (nitrogen) applied					
Name	Urea	Calcium ammonium nitrate	NPK	Ammonium nitrate	Urea ammonium nitrate	TOTAL
Unit	kg N	kg N	kg N	kg N	kg N	kg N
2003	42176480	31017330	33360691	5203220	1863300	113621021
2004	45109440	32069520	33626100	5126170	1647300	117578530
2005	41939580	36264780	36438613	4983125	1682700	121308798
2006	37505180	36121410	34055422	2729580	1390200	111801792
2007	44424040	37700910	38342618	3415660	777300	124660528
2008	46659180	39456180	34110027	332990	589500	121147877
2009	39667180	36485910	31102130	18760	737400	108011380
2010	40999128	34811640	23196556	21105	498000	99526430
2011	51674687	35651194	26631440	17755	603528	114578604
2012	53465647	31327414	22413618	NO	661994	107868673
2013	37397929	32440150	18356241	NO	314577	88508897
2014	30539658	31633103	18212749	NO	321603	80707112
2015	35377731	32176818	19825933	8375	347040	87735897
2016	35377731	33633469	16499227	689815	417549	86617792
2017	40110160	33901808	24070802	268000	377939	98728709

Source: CBS; Processing: Ekonerg Ltd

Livestock manure applied to soils (NFR 3.D.a.2.a)

Methodology used for NH_3 emissions is GB2016, Tier 2 – NH_3 emissions were calculated within the NFR 3.B category ("mass-flow" approach) using the same AD set.

For NOx emissions, GB2016 Tier 1 methodology was used (no Tier 2 methodology is available in GB2016). Applied N was calculated in the 3.B „mass-flow“ approach (sum of $m_{applic\_slurry\_N}$ and $m_{applic\_solid\_N}$).

NH_3 emissions were calculated for all animal categories. NOx emissions for swine and poultry (3.B.3, 3.B.4.g.i, 3.B.4.g.ii, 3.B.4.g.iii and .3B.4.g.iv) were calculated and reported here, while NOx emissions for other (predominantly pasture animals) are reported in 3.D.a.3. Livestock manure applied to soils category in accordance with the GB2016 methodology.

Sewage sludge applied to soils (NFR 3.D.a.2.b)

NH_3 and NOx emissions from source 3.D.a.2.b Sewage sludge applied to soil were reported for the first time in 2018 submission, IIR 1990 – 2017. Following the revision, TERT recommended (HR-3Da2b-2018-0001) to modify the default Tier1 methodolody and change the used AD from population numbers to readily available "applied N from sewage sludge" (CRF data), and to change EF to 0.04 kg NO_2 (2016 EMEP/EEA Guidebook, Annex 2) and 0.13 kg NH_3 (2016 EMEP/EEA Guidebook, Annex 1). These changes were implemented in this report. AD on this source was provided from the Croatian Agency for Environment and Nature and is available from 2005 onwards while for the period 1990-2004 currently there is no data available.

Table 6.2-2 Activity data for NFR code 3.D.a.2.b

NFR 3Da2b	Applied N (kg/y)
1990	NE
1991	NE
1992	NE
1993	NE
1994	NE
1995	NE
1996	NE
1997	NE

NFR 3Da2b	Applied N (kg/y)
1998	NE
1999	NE
2000	NE
2001	NE
2002	NE
2003	NE
2004	NE
2005	330
2006	660
2007	770
2008	1760
2009	17859
2010	16886
2011	26574
2012	37196
2013	60968
2014	35756
2015	51397
2016	60501
2017	50191

Source: MEE; Processing: Ekonerg Ltd.

Livestock manure applied to soils category (NFR 3.D.a.3)

Methodology used for NH_3 emissions is GB2016, Tier 2 – NH_3 emissions were calculated within the 3.B category ("mass-flow" approach).

For NOx emissions, GB2016 Tier 1 methodology was used (no Tier 2 methodology is available in GB2016). Applied N was calculated in the 3.B „mass-flow" approach (m_{graz_N}).

NH_3 and NOx emissions were calculated and reported for 3.B.1.a, 3.b.1.b, 3.B.2, 3.B.4.d, 3.B.4.e, 3.B.4.f animal categories , while NOx emissions for swine and poultry are reported within the NFR 3.D.a.2.a source, in accordance with GB2016 methodology.

Farm-level agricultural operations including storage, handling and transport of agricultural products (NFR 3.D.c)

Currently the calculation for PM is performed using Tier 1 methodology, where $E_{pollutant} = AR_{area} \times EF_{pollutant}$, using default EF for PMs (0.06 for PM_{10} and $PM_{2.5}$ and 1.56 kg/ha for TSP, GB2016, Table 3.1). Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Activity data (AR_{area}) used for PM emission calculations is the total utilized agricultural area (UAA), data provided by Croatian Bureau of Statistics. AD for the period 1990 – 2017 is presented in table 6.2-3.

Table 6.2-3 Activity data for NFR code 3.D.c

NFR 3.D.c	Total utilized agricultural area (UAA)
Unit	ha
1990	3059733
1991	3048915
1992	2120536
1993	2153750
1994	2179271
1995	2178453
1996	2576871
1997	2658509

NFR 3.D.c	Total utilized agricultural area (UAA)
Unit	ha
1998	2791681
1999	2754371
2000	1168705
2001	1177999
2002	1181138
2003	1195734
2004	1176161
2005	1210790
2006	1230183
2007	1201756
2008	1289091
2009	1299582
2010	1333835
2011	1326083
2012	1330973
2013	1568881
2014	1508885
2015	1537629
2016	1546019
2017	1496663

Source: CBS

Cultivated crops (NFR 3.D.e)

Currently the calculation for NMVOC is performed using Tier 1 methodology, where $E_{pollutant} = AR_{area} \times EF_{pollutant}$, using default EF for NMVOC (0.86 kg/ha, GB2016, Table 3.1).

Activity data (AR_{area}) used for NMVOC emission calculations is the total utilized agricultural area (UAA), data provided by Croatian Bureau of Statistics. AD for the period 1990 – 2017 is shared with NFR 3.D.c and presented in table 6.2-3.

Recalculations and improvements

Inorganic N fertilizers (including urea) (NFR 3.D.1.a)

The whole time period was recalculated due to a mistake where emissions were reported as NH_3-N instead of NH_3. In addition, ratio of soils with pH > 7.0 was corrected for the entire period 1990-2016, resulting in an increase of calculated emissions.

Livestock manure applied to soils (NFR 3.D.a.2.a)

A new source of emissions introduced in this report. For the entire time series, the calculated and included NH_3 emissions for all animal categories and NOx emissions for the animal categories: pigs and poultry (3.B.3, 3.B.4.gi, 3.B.4.g.ii, 3 .B.4.g.iii and 3.B.4.g.iv). Until this year, these emissions were reported within category 3.B.

Sewage sludge applied to soils (NFR 3.D.a.2.b)

The whole period was recalculated due to the TERT recommendation (see the methodology chapter for details). AD was changed from the population number to applied N from sewage sludge. The EF used now are 0.04 kg NO_2 (GB2016, Annex 2) 0.13 kg NH_3 (GB2016, Annex 1)

Livestock manure applied to soils category (NFR 3.D.a.3)

NH_3 and NOx emissions were calculated for the entire time period for 3.B.1.a, 3.B.1.b, 3.B.2, 3.B.4.d, 3.B.4.e, 3.B.4.f animal categories.

7. Waste (NFR 5)

Croatia reports for the following source categories of the sector NFR 5 Waste:

- 5.A Biological treatment of waste - Solid waste disposal on land
- 5.B.1 Biological treatment of waste - Composting
- 5.C Waste Incineration
    - 5.C.1.b.i Industrial waste incineration
    - 5.C.1.b.iii Clinical waste incineration
    - 5.C.1.b.v Cremation
- 5.D Wastewater Handling
    - 5.D.1 Domestic wastewater handling
    - 5.D.1 Industrial wastewater handling
    - 5.D.2 Other wastewater handling
- 5.E Other Waste
    - SNAP code 091009 Car fire
    - SNAP code 091010 Detached house fire
    - SNAP code 091011 Undetached house fire
    - SNAP code 091012 Apartment building fire
    - SNAP code 091013 Industrial building fire

Source category description

The source category NFR 5.A includes emissions of NMVOC and PMs; 5.B.1 includes emission of NH_3; 5.C includes emissions of NOx, NMVOC, SO_2, PMs, heavy metals, PCDD/PCDF, PAHs, HCB and PCBs; 5.D includes emissions of NMVOC and NH_3; 5.E includes emissions of PMs, heavy metals and PCDD/PCDF.

Implementation and establishment of the integral waste management system in Croatia are ensured by applying and fulfilling the objectives defined by the Sustainable Waste Management Act [20] and Waste Management Plan[21]. The main act regulating waste management issues in the Republic of Croatia is the Sustainable Waste Management Act. There are a number of ordinances that have been adopted according to Sustainable Waste Management Act, some of them regulating certain waste management operations, some regulating management of specific waste types. Waste Framework Directive[22] is transposed in the area of waste management into the Croatian legislation by the Sustainable Waste Management Act which is adopted in 2013. The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy: (a) prevention; (b) preparing for re-use; (c) recycling; (d) other recovery, e.g. energy recovery; and (e) disposal. Avoiding and reducing of waste generation has the highest priority and results in reduction of quantity and adversity of produced waste which enters into the next phase. Reuse/recovery of produced waste

20 Sustainable Waste Management Act (OG 94/2013, 73/2017, 14/2019)
21 Waste Management Plan of the Republic of Croatia for the period 2017 - 2022 (OG 3/2017)
22 Waste Framework Directive 2008/98/EC

has the purpose to use material and energy potentials of waste, in the framework of technical, ecological and economic possibilities. Disposal of remaining inert waste at the managed controlled landfills has the lowest rank in the waste management hierarchy. According to the Waste Management Plan the backbone of the system will be recycling centres with sorting of waste. Waste management system in Croatia will be organized as integral unit of all subjects at the national, regional and local level.

Methodology, emission factors and activity data

In general the EMEP/EEA simple methodology, multiplying activity data for each sub category with an emission factor, is applied.

Emission factors are expressed as the quantity of pollutant emission per unit of waste treated. Used emission factors are from GB2016 and GB2009 (for emission factors not estimated in GB2016, for NFR 5.C.1.b.i). The source of emission factors used for emission calculation is noted in each of sub-sector under NFR code 5. Emission factors used for the preparation of the IIR 2019, presented by NFR sectors and pollutants, are given in Appendix 4.

Generally four sources of information concerning activity and emission data for the source category waste have been used:

- Activity data as reported annually by facilities in legally required forms under the Croatian Environmental Emission Register and Waste Management Information System (MEE);
- National statistical reports at national level from the Croatian CBS (the Annual Statistical Reports and Releases, Census1981, Census 1991, Census 2001 and Census 2011);
- Plant specific activity data collected by direct contacts with facility (e.g. facilities for cremation, industrial combustion facility);
- Ministry of Interior.

7.1. Biological treatment of waste – solid waste disposal on land (NFR 5.A)

Source category description

This source is only a minor source of air pollutant emissions, greenhouse gas CH_4 is the major pollutant. Small quantities of NMVOC, PM_{10}, $PM_{2.5}$, TSP, NH_3 and CO may be emitted. Croatia reports emissions of NMVOC and PMs from solid waste disposal.

Following information, which are relevant for IIR, are taken from GHG emissions report (NIR). As a result of the in-country review 2018, inventory problem in terms of missing estimate was defined for 5.A Solid waste disposal. Detailed explanations of the data sources and methods of assessment the data for emission estimates are contained in the NIR 2019.

Data source for disposed waste amounts is Ministry of Environment and Energy /MEE. Data collection system for waste is based on the Sustainable Waste Management Act and by-laws and enforcement regulations. All detail regarding data collection is in detail described in Croatian NIR, according to IPCC methodology. The MEE is collecting and processing waste data, among other the data reported to the Environmental Pollution Register; data on waste management permits and certificates, and data for Waste Management Information System. By the Ordinance on the Environmental Pollution Register (OG 87/2015), adopted according to Environment Protection Act, the MEE is collecting data on the quantities and types of waste produced, collected, recovered or disposed. Data on quantities are available for each waste code (based on European LoW- List of Waste) and NACE activity. Four forms are available for data delivery (for waste producer, waste collector of municipal waste, waste collector for industrial waste and operator of waste treatment facility). Waste data are reported by operators electronically, using internet based application, on annual basis. Validation and verification of data is done first by county offices (with appropriate support from the environment protection inspectors), and then by the MEE. The MEE is cooperating with competent offices in counties and with companies collecting municipal solid waste (MSW) or operating landfills, in order to strengthen data quality. Data is checked for completeness, correctness and consistency in time-series. In cases that collected or disposed waste is not reported, quantities are determined on the basis of previous year report or calculation on the basis of average MSW production per capita. Quality of municipal data is gradually improving as scales are installed at landfills, but still large amount of municipal waste is not being weighted, which usually lead to overestimation of collected and disposed quantities.

Main source for activity data on MSW is Environmental Pollution Register database and Waste Management Information System database, operated by MEE from 2005 onwards. Total annual MSW disposed to SWDSs for the period 1990-1998 has been evaluated from available relevant data compiled into Report; Fundurulja, D., Mužinić, M. (2000) *Estimation of the Quantities of Municipal Solid Waste in the Republic of Croatia in the period 1990 – 1998 and 1998 – 2010*, Zagreb, in the framework of the preparation the documents for the 1st NC[23]. Insufficient data for the quantity of disposed MSW in 1999 were evaluated by interpolation method. Data for the quantity of disposed MSW in 2000 were obtained from *Report of Environment Condition*, Ministry of Environmental and Nature Protection. Data for the quantity of disposed MSW in 2005 were obtained from *Waste Management Plan in the Republic of Croatia for 2007 - 2015* (OG *85/2007, 126/2010, 31/2011, 46/2015*). Taking into account the pattern over 2000 and 2005, quantity of disposed MSW for the period 2001 to 2004 were assessed by interpolation method. Data on the quantity of disposed MSW for the period 2006 - 2017 were obtained from the Environmental Pollution Register and Waste Management Information System. Due to low quality of data for the period 2006 - 2009 provided by operators of landfills, the data were taken from the reports of companies collecting the MSW (reporting destination of MSW). Data on the quantity of generated and disposed MSW for the period 2010 - 2017 were obtained from the Environmental Pollution Register - reports delivered by the operators of active landfills. Data on the quantity of disposed biodegradable MSW for the period 2010 - 2017 were obtained from the Waste Management Information System - reports on landfills and waste disposal.

Data on the quantity of disposed industrial waste for the period 1990 - 2009 are not available and were estimated by linear extrapolation method. Historical data were extrapolated based on average for the period 2010 - 2016. Data for the first year in the time series (1955) were calculated using the ratio of the total amount of disposed MSW in 1955 and the average of disposed MSW for the period 2010 - 2016. Data on the quantity of generated and disposed industrial waste for the period 2010 - 2017 were obtained from the Environmental Pollution Register - reports delivered by the operators of active landfills. Data on the quantity of disposed biodegradable industrial waste for the period 2010 - 2017 were obtained from the Waste Management Information System - reports on landfills and waste disposal.

Data on the quantity of disposed sludge from wastewater treatment for the period 1990 - 2009 are not available and were estimated using the average for the period 2010 - 2016. Data on the quantity of disposed sludge for the period 2010 - 2017 were obtained from the Waste Management Information System - reports on landfills and waste disposal. Linear extrapolation method was not used due to high discrepancy of the data for the period 2010 - 2016. Average value 2010 - 2016 was used to

[23] The First National Communication of the Republic of Croatia to the United Nations Framework Convention on Climate Change (UNFCCC), Republic of Croatia, Ministry of Environmental Protection and Physical Planning, 2001

construct the time series - back in time was done by overlapping data for 1990 - 2012 with average 2010 - 2016.

Waste Management Information System contains various data on landfills, such as implementation of technical measures (e.g. fence, scale, flares…) or environment protection measures (e.g. degassing, compacting, aligning, monitoring etc.). Database also contains data on the status of remediation of landfills (in preparation/ongoing/finished) and status of operation (active/closed). Active landfills for municipal waste are obligated by legislation to deliver this data to CEAN in prescribed form (Form on landfills and landfilling of waste), as for the rest (closed landfills and landfills for the industrial waste) the data forms are periodically sent to landfill operators by MEE or the update is done upon receiving the information on individual landfill from other sources. Data on remediation status is requested by MEE once a year from the Environment Protection and Energy Efficiency Fund which is co-financing remediation of almost all of official landfills.

Methodology, emission factors and activity data

The Tier 1 EMEP/EEA methodology from GB2016 is used for emissions calculation. Tier 2 is not available for this source. Recommended Tier 1 emission factors from GB2016 that expressed as the amount of pollutant per amount of landfilled waste are used (emission factors is presented in Appendix 4). Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Relevant activity data is an annual amount of landfilled waste. The activity data is presented in Table 7.1-1. A fluctuating trend for solid waste disposal by type at landfills during the period 1990 - 2017 was due to multiple factors. For the period 1990 - 1998, there was increasing trend for generation of waste per capita, mainly caused by increasing of living standard. The increasing trend was continued after 2000, until 2009. After 2009 there is a decrease in quantities registered, caused primary by economic crisis but also other factors regarding to effects of measures undertaken to avoid/reduce and recycle waste. In the period 2010 - 2017 quantities of generated waste are more or less stable, with the exception for 2013 for which the quantities are higher because of the increased quantities coming from remediation of illegal landfills and waste soil and stones.

Further, a number of new legislation acts have been adopted with the purpose to increase separate collection, recycling and recovery of different waste types. National schemes based on „extended producer responsibility" have been introduced for collection and recovery of different waste categories.

All these activities influence emissions of pollutants from landfills.

Table 7.1-1 Activity data for NFR codes 5.A, 5.B.1, 5.C.1.b.i, 5.C.1.b.iii, 5.C.1.b.v, 5.D.1, 5.D.2 and 5.D.3, represented by the relevant SNAP codes

NFR	5.A	5.B.1	5.C.1.b.i	5.C.1.b.iii	5.C.1.b.v	5.D.1	5.D.2	5.D.3
SNAP	090401	091005	090202	090207	090901	091002	091001	091007
Name	Solid waste disposal on land	Compo sting	Industrial waste incineration	Clinical waste incineration	Cremati on	Domestic wastewat er	Industrial wastewat er	Latrines
Unit	t	t	t	t	corps	1000 m^3	1000 m^3	popul.
1990	1050436	NE	250,00	140,00	1464	NO	104000	433305
1991	1061948	NE	250,00	140,00	1786	NO	94488	431084
1992	1078940	NE	250,00	140,00	2287	NO	46785	428862
1993	1111838	NE	250,00	140,00	2760	NO	87343	428862
1994	1148735	NE	250,00	140,00	3037	NO	34419	426640
1995	1210797	NE	250,00	140,00	3109	54353	33758	422196
1996	1264429	NE	250,00	140,00	3385	58009	93836	419974
1997	1327111	NE	1031,00	140,00	3476	61661	41857	417752

NFR	5.A	5.B.1	5.C.1.b.i	5.C.1.b.iii	5.C.1.b.v	5.D.1	5.D.2	5.D.3
SNAP	090401	091005	090202	090207	090901	091002	091001	091007
Name	Solid waste disposal on land	Compo sting	Industrial waste incineration	Clinical waste incineration	Cremati on	Domestic wastewat er	Industrial wastewat er	Latrines
Unit	t	t	t	t	corps	1000 m^3	1000 m^3	popul.
1998	1395683	NE	2167,74	140,00	3312	87796	30985	415531
1999	1461113	NE	2580,45	140,00	3201	88785	28924	413309
2000	1426158	NE	3652,49	141,50	3080	86579	22208	411087
2001	1497490	NE	3967,23	155,58	2972	83533	21337	408865
2002	1570222	NE	2205,96	158,45	3254	81196	21883	406643
2003	1642954	NE	400,00	162,64	3392	84283	28408	404421
2004	1714686	NE	120,00	173,20	3404	160277	22468	402199
2005	1787497	NE	4,50	175,70	3633	132280	15984	399978
2006	1952135	NE	350,00	187,56	3593	140906	19758	397756
2007	2116773	10966	285,00	204,89	3962	140228	14118	395534
2008	2240286	10699	315,78	165,00	3911	192033	16507	393312
2009	2290490	8993	IE	185,17	4060	206042	17445	391090
2010	1998998	9706	IE	54,40	4314	205709	26679	388868
2011	2033592	10094	IE	57,45	4344	209150	7205	386646
2012	1951002	18691	IE	93,10	4478	259135	11536	384425
2013	1992832	28517	IE	48,00	4601	295264	12574	382203
2014	1830499	28594	IE	51,08	4803	268002	13301	379981
2015	1918659	61607	IE	51,79	5373	256690	12943	377759
2016	1769572	27436	IE	55,68	5128	275162	11901	375537
2017	1683640	27436	IE	NO	5496	281020	15117	373315

Source: 5.A, 5.B.1 and 5.C MEE, 5.D CBS, Processing: Ekonerg Ltd

Recalculation and improvements

New data for industrial waste and sludge are included for entire time series 1990 - 2016. Accordingly, recalculation was performed for the period 1990 - 2016.

7.2. Biological treatment of waste- composting (NFR 5.B.1)

Source category description

According to GB2016, NH_3 emission resulting from composting are included in this category (Technologies – Compost production, SNAP 091005). Emissions from anaerobic digestion of organic waste at biogas facilities (NFR 5.B.2) are included in the Energy sector, due to energy recovery.

NH_3 emission from composting of municipal and industrial solid waste, sludge and other organic waste are included in emission estimates for the period 2007 – 2017. Data on different types of waste (dry weight) have been used for NH_3 emission calculation for the period 2007 – 2017. Data for 2017 are not available and assessed according to the data for 2016. Emissions for previous period (1990 – 2006) are not estimated because activity data are not available. The notation key "NE" (not estimated) is used for the period 1990 – 2006. It is necessary to collect accurate data for NH_3 emission calculations for the entire reporting period.

The official source of activity data for waste composting is MEE that is collecting and processing waste data, among other data reported to the Environmental Pollution Register and Waste Management Information System. By the Ordinance on the Environmental Pollution Register (OG 87/2015), adopted according to Environment Protection Act, the MEE is collecting data on the quantities and types of waste produced, collected, recovered or disposed. The MEE coordinates activities relating to data quality assurance and control.

Methodology, emission factors and activity data

The Tier 2 EMEP/EEA methodology and recommended Tier 2 emission factor from GB2016 are used for NH_3 emission calculation. The NH_3 emission factor is presented in Appendix 4. Relevant activity data is the annual quantity of municipal and industrial solid waste, sludge and other organic waste composted. The activity data is presented in Table 7.1-1.

A fluctuating trend for composting waste during the period 2007 - 2017 was due to multiple factors, which depend primarily on the separate collection of biodegradable waste, as well as the treatment of biodegradable waste in biogas facilities for the production of biogas used for energy generation.

All these activities influence emissions of pollutants from composting.

Recalculation and improvements

There was no recalculation in this report.

Future improvements are related primarily to aggregation of accurate data for NH_3 emission calculations for the entire reporting period, which is included in the Annual Data Collection Plan. When the competent authority provides all necessary information and data that will be included in the inventory.

7.3. Waste incineration(NFR 5.C)

Source category description

This sector considers the emission of pollutants from activities in the industrial waste incineration (NFR 5.C.1.b.i), clinical waste incineration (NFR 5.C.1.b.iii) and cremation (NFR 5.C.1.b.v), without energy recovery. There is no incineration of municipal waste (NFR 5.C.1.a), neither incineration of sludge from wastewater treatment (NFR 5.C.1.b.iv) in Croatia, and notation key "NO" (not occurring) for that source activities are reported. Also, there is no incineration of carcasses in Croatia.

Emissions that occur as a result of waste incineration with energy recovery are presented in the Energy Sector 1.A.

Industrial waste incineration (NFR 5.C.1.b.i)

The official source of activity data for industrial waste incineration is MEE that collects data from emission point sources in the Environmental Pollution Register database. According to the Article 21 of Ordinance on the Environmental Pollution Register (OG 87/2015), the completed forms should be submitted for the previous calendar year not later than March 31 of the current year. The competent authority (administrative department of the county and the City of Zagreb) ensures the checking of data submitted in terms of their completeness, consistency and credibility. The MEE coordinates activities relating to data quality assurance and control.

In the period from 1997 to 2002, an incineration of hazardous waste was existed in Croatia and those emissions are reported in the scope of source category NFR 5.C.1.b.i Industrial waste incineration. For the source category NFR 5.C.1.b.ii Hazardous waste incineration the notation key "IE" is used, due to energy recovery. Croatia uses EWC codes for waste classification that is part of the Regulation on categories, types and classification of waste with a Waste Catalogue and List of hazardous waste (OG 50/05 and 39/09) and Ordinance on Waste Catalogue (OG 90/2015).

Clinical waste incineration (NFR 5.C.1.b.iii)

The official source of activity data for clinical waste incineration is MEE that collects data from emission point sources in the Environmental Pollution Register database. According to the Article 21 of

Ordinance on the Environmental Pollution Register (OG 87/2015), the completed forms should be submitted for the previous calendar year not later than March 31 of the current year.

In the period from 1990 to 2016, an incineration of clinical waste was existed in Croatia and those emissions are reported in the scope of source category NFR 5.C.1.b.iii. There was no incineration of clinical waste without energy recovery in 2017.

Cremation (NFR 5.C.1.b.v)

The official source of activity data for cremation is MEE that collects data from a crematorium in Croatia, located in the city of Zagreb.

Methodology, emission factors and activity data

Industrial waste incineration (NFR 5.C.1.b.i)

The Tier 1 EMEP/EEA methodology and recommended Tier 1 emission factors from GB2016 (and GB2009 for emission factors not estimated in GB2016) are used for emissions calculation. Emission factors are presented in Appendix 4.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Relevant activity data is the annual quantity of industrial waste incinerated.

Data for the period 1990 -2007 were obtained in direct contact with facilities for industrial and hazardous waste incineration. For years 2007 and 2008, plant specific emission factors were used. These are based on direct emission reported in EPR database. Data for the period 2009 - 2017 on the total amount of incinerated waste by operation D10 (Waste incineration on land) and operation R1 (Waste usage as a fuel or other means to generate energy) have been based on validated PL-OPKO forms - Registration form for entities carrying out the municipal and/or industrial waste recovery/disposal. Regarding previously mentioned, since 2009 there is no more facility operating without energy recovery, so from 2009 all emissions regarding Industrial waste incineration are reported in the scope of energy sector. From 2009 for source category Industrial waste incineration (NFR 5.C.1.b.i) the notation key "IE" is reported. The activity data is presented in Table 7.1-1.

Clinical waste incineration (NFR 5.C.1.b.iii)

The Tier 1 EMEP/EEA methodology and recommended Tier 1 emission factors from GB2016 are used for emissions calculation. Emission factors are presented in Appendix 4.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Relevant activity data for clinical waste incineration is the annual quantity of clinical waste incinerated. The activity data is presented in Table 7.1-1.

The trend of incineration of clinical waste during the period 1990 - 1999 is steady, while in the period 2000 - 2009 the quantity of incinerated clinical waste has been increased. After 2010, there is decrease in incinerated quantities of clinical waste, with a fluctuating trend. This is the result of incineration of clinical waste with energy recovery, which is presented in the Energy sector.

All these activities influence emissions of pollutants from incineration of clinical waste.

Cremation (NFR 5.C.1.b.v)

The Tier 1 EMEP/EEA methodology and recommended Tier 1 emission factors from GB2016 are used for emissions calculation. Emission factors are presented in Appendix 4.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Relevant activity data for cremation is the number of corps incinerated. The activity data is presented in Table 7.1-1.

During the reporting period (1990 - 2017) there is a fluctuating, mainly the growing trend of cremated bodies.

Recalculation and improvements

Industrial waste incineration (NFR 5.C.1.b.i)

Clinical waste incineration (NFR 5.C.1.b.iii)

Cremation (NFR 5.C.1.b.v)

There was no recalculation and other improvement for these source categories.

7.4. Wastewater handling (NFR 5.D)

Source category description

This section covers emissions from Wastewater handling (NFR 5.D). Activities considered within this sector in Croatia are biological treatment plants for Domestic wastewater handling (NFR 5.D.1), Industrial wastewater handling (NFR 5.D.2) and Other wastewater handling – latrines (NFR 5.D.3).

Domestic wastewater handling (NFR 5.D.1) and Industrial wastewater handling (NFR 5.D.2)

Processing wastewater is most commonly used aerobic biological treatment. Only, disposal of domestic and commercial wastewater, particularly in rural areas, where systems such as septic tanks, are used partly anaerobic treatment. Biological treatment plants have minor influence on the emissions of pollutants. Only NMVOC emissions are reporting in this two source categories.

Other wastewater handling (NFR 5.D.3)

In the scope of source category Other wastewater handling Croatia is reporting emissions from latrines. A latrine is a simple "dry" toilet built outside the house, usually in a backyard without water flushing. A storage tank under the latrine can be a hole dug in the ground, or a concrete reservoir. Capacity of the tank can vary between 1 m^3 and 2 m^3. The time of storage can vary between a few months and "forever". Latrines are source of NH_3 emissions in Croatia.

Methodology, emission factors and activity data

Domestic wastewater handling (NFR 5.D.1)

The Tier 2 EMEP/EEA methodology and recommended Tier 2 emission factor from GB2016 are used for NMVOC emission calculation. The NMVOC emission factor is presented in Appendix 4. The relevant activity data is the annual amount of total wastewater treated in residential / commercial sectors. The source of activity data is Statistical Bureau of Statistics – First Release; Public Sewage System; Source, Treatment and Discharge of Waste Waters. Unavailable data for 1997 was estimated with interpolation method. Data for other years in the period 1990 – 2017 are available from statistical reports and releases. The activity data is presented in Table 7.1-1.

During the reporting period (1990 - 2017) there is an increasing trend of the quantity of wastewater treated in residential/commercial sectors, which is the result of construction and improving the public sewerage system.

Industrial wastewater handling (NFR 5.D.2)

The Tier 2 EMEP/EEA methodology and recommended Tier 2 emission factor from GB2016 are used for NMVOC emission calculation. The NMVOC emission factor is presented in Appendix 4. The relevant activity data is the annual amount of total wastewater treated in industry sectors. The source of activity data is Statistical Bureau of Statistics – First Release; Utilization of Waters and Protection of Waters from Pollution in Industry; Discharge of Treated Waste Water, according to NKD 2007. Unavailable data for 1997 was estimated with interpolation method. Data for other years in the period 1990 – 2017 are available from statistical reports and releases. The activity data is presented in Table 7.1-1.

During the reporting period (1990 - 2017) there is a fluctuating trend in the quantity of wastewater treated in industry sectors. The quantities of wastewater treated in the industry sectors were higher in the period up to 2010. After 2010 amounts are reduced, while maintaining the fluctuating trend, which is influenced by the volume of industrial production.

Other wastewater handling (NFR 5.D.3)

The Tier 2 EMEP/EEA methodology and recommended Tier 2 emission factor from GB2016 are used for NH_3 emission calculation. The NH_3 emission factor is presented in Appendix 4. The relevant activity data is the number of residents who use latrines. The source of activity data is Statistical Bureau of Statistics; Census 1981, Census 1991, Census 2001 and Census 2011. Activity data that is the number of population in the housing units without toilets was collected for years: 1981, 1991, 2001 and 2011. Data for other years in the period 1990 – 2017 are assessed according to these statistical data with extrapolation method. The activity data is presented in Table 7.1-1.

During the reporting period (1990 - 2017) there is a decreasing trend in the in the number of inhabitants using septic tanks, caused by increasing of living standard i.e. increase in the number of inhabitants connected to public drainage systems.

Recalculation and improvements

Domestic wastewater handling (NFR 5.D.1)

Correction of AD has been made for 2016. Accordingly, recalculation was performed for 2016.

Industrial wastewater handling (NFR 5.D.2)

Other wastewater handling (NFR 5.D.3)

There was no recalculation and other improvement for these source categories.

7.5. Other waste (NFR 5.E)

Source category description

The source category Other waste (NFR 5.E) in Croatia covers the emissions from the activities car fires and house fires. Car and house fires include mostly unwanted fires in cars and various types of houses. Types of fires in house that are covered are: detached house fire, undetached house fire, apartment building fire and industrial building fire.

Methodology, emission factors and activity data

The Tier 2 EMEP/EEA methodology and recommended Tier 2 emissions factor from GB2016 are used for emissions calculation. Emission factors are presented in Appendix 4. Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provide in Appendix 9 of this Report.

Both the activity data and the emission factors are stratified according to the different activity. For car and house fires, the relevant activity statistics are the standard statistics on number of fires per year, collected by MIA. The activity data is presented in Table 7.5-1.

Table 7.5-1 Activity data for NFR code 5.E, represented by the relevant SNAP codes

NFR	5.E				
Name	Car fire	Detached house fire	Undetached house fire	Apartment building fire	Industrial building fire
SNAP	091009	091010	091011	091012	091013
Unit	fire	fire	fire	fire	fire
1990	306	1655	185	73	742
1991	278	1119	164	68	554
1992	294	2127	155	86	844
1993	291	1095	154	54	687
1994	383	1406	174	69	708
1995	484	1698	214	69	907
1996	487	1726	211	57	860
1997	474	1552	219	55	1030
1998	559	1645	187	54	1042
1999	576	1759	204	35	873
2000	639	1735	141	60	1031
2001	565	1616	150	47	999
2002	544	1527	130	48	922
2003	604	1723	152	60	1141
2004	562	1425	120	67	1011
2005	537	1444	146	37	1189
2006	542	1438	141	39	1189
2007	486	1357	141	33	1256
2008	484	1326	190	32	1061
2009	461	1239	134	41	1076
2010	415	1200	148	28	851
2011	415	1280	172	31	1116
2012	379	1261	132	24	1016
2013	353	1157	149	31	845
2014	314	767	89	19	626
2015	433	845	98	21	690
2016	439	854	99	22	697
2017	488	926	108	23	756

Source: MIA, Processing: Ekonerg Ltd

Recalculation and improvements

There was no recalculation and other improvement in this report.

8. Natural sources (NFR 11)

8.1. Forest fires (NFR 11.B)

Source category description

Forest fires (NFR 11.B) are classified as natural source of emissions although they may be caused by the intentional or unintentional human activity. These emissions are reported as memo items and are not included in the national total of pollutant emissions.

Methodology, emission factors and activity data

For emission calculation from forest fires source category Tier 1 methodology and emission factors recommended by the EMEP/EEA GB2016 were applied. Croatia estimates the emission of SO_2, NOx, NMVOC, CO and NH_3 from this source category. The emission of other pollutants (TSP, PM_{10}, $PM_{2.5}$, BC) will be calculated at the moment when the specific activity data kg wood burned proposed recommended by the EMEP/EEA GB2016 will be available.

The activity data is the area of land burned (source: annual Statistical Yearbook, CBS). The overview of activity data used for emission calculation from forest fire are presented in Table 8.1-1.

Table 8.1-1 Activity data of the sector 11.B

NFR 11.B	Area of forest burnt
Unit	ha
1990	3805
1991	3805
1992	964
1993	8196
1994	3723
1995	633
1996	2550
1997	4025
1998	7660
1999	483
2000	14030
2001	3503
2002	1798
2003	8270
2004	355
2005	629
2006	2981
2007	12628
2008	3449
2009	2789
2010	1944
2011	3277
2012	5668
2013	1999
2014	191
2015	6064
2016	6733
2017	48543

Data source: CBS, St.Y.

Recalculation and improvements

No recalculations, neither improvement was made for reporting round 2016.

9. Recalculations and improvements

This chapter gives an overview of all recalculations and other changes included into this report within the chapters from 3 to 9. Also, reasons for performed recalculations and other changes is given as well the result of performed recalculations within the meaning of decrease or increase of pollutant emission.

9.1. Recalculations and other changes

Energy sector

Public electricity and Heat production (NFR 1.A.1.c)

Two types of recalculations were carried out in this sector. The emissions for the period 1990 - 2016 have been recalculated due to emission factor correction (alignment with 2016 EMEP / EEA Guidance) and the biogas consumption was added for the period from 2013 to 2016.

Other sectors-Commercial/Institutional (NFR 1.A.4.a)

The emissions for the period 1990 - 2016 have been recalculated due to emission factor correction (alignment with 2016 EMEP / EEA Guidance).

Distribution of oil products (NFR 1.B.2.a.v)

Relevan emissions for FCC (SNAP 040102a - Catalytic Cracking Units, partial combustion without boiler CO) for the period 2013 - 2016 were recalculated due to correction of activity data.

Refining, storage (1.B.2.a.iv)

NMHOS emissions for SNAP 050501 Refinery dispatchers, railway tankers and ship tankers for 2016 were recalculated due to correction of activity data.

NMHOS emissions for SNAP SNAP 050503 Gas stations were recalculated for 2016 due to correction of activity data.

Natural gas - Exploration, production, transport (NFR 1.B.2.b)

The NMVOC emission for category NFR 1.B.2.b.2 for 2016 was recalculated due to FE NMHOS correction.

Industrial processes and product use sector

Cement production (NFR 2.A.1)

Recalculation was performed for the period 1990-1997, 2012 and 2014-2016, due to harmonization of activity data with NIR2019.

Lime production (NFR 2.A.2)

Recalculation was performed for 1990-1991, 2008-2010 and 2013-2015, due to harmonization of activity data with NIR2019.

Ammonia production (NFR 2.B.1)

NH_3 emission recalculation was performed for the whole time series due to incorrect use of EF (Tier 1 EF was used instead of Tier 2, GB2016). Furthermore, NMVOC EF (Tier 2, GB2016) was included in emissions calculations for this activity and NMVOC emissions were calculated for the whole time series.

Degreasing (NFR 2.D.3.e)

Recalculation for the trend was performed taking into account the amount of solvent used, and by removing the previously used cold cleaning sub-category from the calculation.

Printing (NFR 2.D.3.h)

Recalculation for 2016 was performed due to the error in calculation.

Agriculture sector

Manure Management (NFR 3.B)

Recalculations of NOx and NH_3 emissions were performed for the years 2015 (for fattening pigs) and 1994 (for breeding pigs) due to the correction of AD used.

Emissions of NH_3 and NOx from livestock manure applied to land for the entire time period were reported in the appropriate category (3.D.a.2.a) instead of IE reporting within this category, which resulted in recalculation and decrease of emissions reported in 3.B.

Recalculations of NOx for the 1990-2016 period was performed for laying hens, other poultry, turkey, geese and for 1990-2016 period due to correction of an error which resulted in an overstimate of emissions. In addition, due to AD correction (2016 year only) for laying hens and other poultry, NH_3 and NOx was recalculated for 2016.

Inorganic N fertilizers (including urea) (NFR 3.D.1.a)

The whole time period was recalculated due to a mistake where emissions were reported as NH_3-N instead of NH_3. In addition, ratio of soils with pH > 7.0 was corrected for the entire period 1990-2016, resulting in an increase of calculated emissions.

Livestock manure applied to soils (NFR 3.D.a.2.a)

A new source of emissions introduced in this report. For the entire time series, the calculated and included NH_3 emissions for all animal categories and NOx emissions for the animal categories: pigs and poultry (3.B.3, 3.B.4.gi, 3.B.4.g.ii, 3 .B.4.g.iii and 3.B.4.g.iv). Until this year, these emissions were reported within category 3.B.

Sewage sludge applied to soils (NFR 3.D.a.2.b)

The whole period was recalculated due to the TERT recommendation. AD was changed from the population number to applied N from sewage sludge. The EF used were 0.04 kg NO_2 (GB2016, Annex 2) 0.13 kg NH_3 (GB2016, Annex 1)

Livestock manure applied to soils category(NFR 3.D.a.3)

NH_3 and NOx emissions were calculated for the entire time period for 3.B.1.a, 3.B.1.b, 3.B.2, 3.B.4.d, 3.B.4.e, 3.B.4.f animal categories.

Farm-level agricultural operations including storage, handling and transport of agricultural products (NFR 3.D.c)

PM emissions are now reported in this category instead of IE in 3.D.a.1.

Cultivated crops (NFR 3.D.e)

NMVOC emissions are now reported in this category instead of IE in 3.D.a.1.

Waste sector

Biological treatment of waste – Solid waste disposal on land (5.A.1)

New data for industrial waste and sludge are included for entire time series 1990 – 2016. Accordingly, recalculation was performed for the period 1990 - 2016.

Domestic wastewater handling (NFR 5.D.1)

Correction of AD has been made for 2016. Accordingly, recalculation was performed for 2016.

9.2. Planned improvements

Energy sector

Public electricity and Heat production (NFR 1.A.1.a)

As long term goal Croatia will take certain steps to justify the use of direct emissions for large point sources in the inventory.

Stationary combustion in manufacturing industries and construction (NFR 1.A.2)

On short term basis it is planned to divide total consumption of fuel to appropriate branches for the whole period from 1990 to 2000.

For NOx emission calculation Croatia uses methodology disaggregated by fuel types (gas oil, fuel oil, natural gas, etc.) but not disaggregated by technology. As long term goal Croatia will estimate NOx emission by technology type.

Aviation (civil) (NFR 1.A.3.a)

For the harmonization of the calculation methodology with the GB2016 for the aviation, it is necessary to estimate the representative aircraft. For that it is necessary to collect more detailed data on aircrafts and their movements in all airports in Croatia, i.e. annual number of take-off and landing by type of aircraft and at airports and average flight length by type of airplane for domestic aviation and international air traffic. In respect of international air traffic by category of flights shorter than 1,000 nm and for flights of more than 1,000 nm (km or nm airline).

Road Transportation (NFR 1.A.3.b)

The application of COPERT 5 software programme is planned for next submission.

Also, during the processing of "raw" data (Ministry of interior vehicle data base in text form), it was noted that some vehicles are missing, so clarification of data was requested from the Ministry of Interior. Interior Ministry drew attention to the different categorization of vehicles in 2014. Consequently the model for the processing of "raw" vehicle data was amended and it was found that the model should be applied to the whole historical trend, because some vehicles due to insufficiently described categorization were not counting. The above improvement will be carried out in one of the following submissions.

Include the national values for gasoline pressure in accordance with regulations in the Republic of Croatia instead of using the defoult COPERT 5 model values.

In 2014 Croatia reported annual mileage of each vehicle type to Odyssee database. It is planned to incorporate those data in COPERT 5 model

Croatia calculates emissions from all lubricants in the scope of 2D3i Other Solvent Use, 2G. As long term goal Croatia will divide lubricant used for solvent purposes and lubricant used for road transportation purposes according EMEP/EEA Guidebook and TERT recommendation.

Industrial processes and product use sector

Glass production (NFR 2.A.3)

Currently, both glass which is nationally produced and glass which is imported and then processed in Croatia, is being included in calculations as nationally produced glass products, due to unavailability of disaggregated statistical data. Revision of applied method for emission calculation in line with specific national circumstances should be made to avoid overestimation of emissions for this category. At the moment, this matter is categorised as a long term plan for improvement, provided the required financial resources are made available.

Construction and demolition (NFR 2.A.5.b)

The plan is to recalculate emissions for the entire reporting period for this category after collecting the required activity data according to Tier 1 EMEP/EEA GB2016 methodology, which would include: Construction of houses, Construction of apartments, Non-residential construction and Road construction. In order to achieve this, efforts will be made to collect these data for one of the the next submissions.

Iron and steel production (NFR 2.C.1)

Additional and revised data regarding iron and steel production category have been obtained within the scope of the 2018 in-country review of the NIR. Due to insufficient time to process these data, it was not possible to include revised emissions calculations in this submission. All data regarding this category will be harmonized with NIR and included in IIR in the next submission.

Coating applications (NFR 2.D.3.d)

The plan is to recalculate the trend (entire reporting period) for this category after further investigation of available data which would enable transition to Tier 2 EMEP/EEA GB2016 methodology. Since trend analysis should be carried out, the recalculations will be included in one of the next submissions.

Chemical products (NFR 2.D.3.g)

A new inventory improvement project, which will be led by MEE, is planned for the upcoming period. This project will, inter alia, include updating EFs for this source category according to the GB2016. This improvement and revised emissions will be included in one of the next submissions.

In addition, following the recommendation for inventory improvement given by the ERT during the 2018 review, it was found that the asphalt blowing activity (SNAP 060310) is present in Croatia, and emissions from this activity will be calculated after collecting all the activity data, which is expected for one of the next submissions.

Printing (NFR 2.D.3.h)

The plan is to recalculate the trend (entire reporting period) for this category after further investigation of available data which would enable transition to Tier 2 EMEP/EEA GB2016 methodology. Since trend analysis should be carried out, the recalculations will be included in one of the next submissions.

Agriculture sector

Manure management (NFR 3.B)

Improving emission calculation of NMVOC by moving from emission calculation Tier 1 to Tier 2 methodology is a planned long-term improvement.

The plan is also to improve emission calculation of NH_3 (Nex and other parameters used in the emission estimates are taken from the „Improvement of NH3, CH4 i N2O emission calculation from manure management and development of national factors“, developed by the experts from the Faculty of Agriculture, 2015). Factors and parameters in question will undergo a revision during a new project that is planned due to issues raised by the ERT in the NIR reviews in 2016. As a part of this revised project, updated national emission factors and parameters are expected. The above mentioned improvement will be carried out in one of the following submissions.

Other organic fertilizers applied to soils (including composts) (3.D.a.2.c)

It is necessary to check on availability of AD on other organic fertilizers. This improvement will be made in one of the upcoming reports.

Field burning of agricultural residues (NFR 3.F)

Although the activity of burning of agricultural residues in the open field is forbidden according to Croatian low, according to IIASA statement such activities are carried out on Croatia territory (in possession of satellite images that confirmed the statement). A plan is to calculate relevant emissions from this source category, when the activity data will be available.

Waste sector

Biological treatment of waste - Composting (5.B.1)

Future improvements are related primarily to aggregation of accurate data for NH_3 emission calculations for the entire reporting period, which is included in the Annual Data Collection Plan. When the competent authority provides all necessary information and data that will be included in the inventory.

10. Projections

The text in subdivisions is taken from the "Report on implementation of policies and measures that reduce greenhouse gas emissions by sources and enhance removals by sinks" and "Report on projections of greenhouse gas emissions" submitted by the Republic of Croatia to the UNFCCC and EC and supplemented with information on emission projections for air pollutants.

"Report on implementation of policies and measures that reduce greenhouse gas emissions by sources and enhance removals by sinks" and "Report on projections of greenhouse gas emissions" (hereinafter: Reports) are an integral part of the national system for monitoring the implementation of policies and measures for GHGs emission reductions and emission projections of GHGs related to the fulfilment of commitments under the United Nations Framework Convention on Climate Change (hereinafter: the UNFCCC) and the Kyoto Protocol. The Republic of Croatia is required to report to the European Commission on monitoring the implementation of these policies and measures and emission projections, based on the EU legislation. The legal basis for preparation of the Report in the national legislation is primarily in Article 75 Paragraph 3 of the Air Protection Act (OG 130/11, 47/14, 61/17).

The emission projections of air pollutants is fully coordinated with the emission projections of greenhouse gases in the Republic of Croatia. In the preparation of emission projections of GHGs and of air pollutants, the stakeholders have realized the importance and need for mutual understanding. As a follow-up, all activity data required to prepare emission projections of air pollutants are based on identical initial assumptions and parameters as for the preparation of GHGs emission projections.

10.1. Methodology

Methodology for estimating projections is prescribed in chapter 8 Projections, Part A: general guidance chapters EMEP / EEA guidebook - 2016 (hereinafter: GB2016). Two groups of scenarios were considered: scenario with existing measures (WM) and scenario with additional measures (WAM).

Scenario with existing measures (WM): projection includes policies and measures currently implement and adopted:

- Implemented policies and measures: legislation in force, or one or more voluntary agreements have been established or financial resources have been allocated or human resources have been mobilized.
- The adopted policies and measures: an official government decision has been made and there is a clear commitment to proceed with implementation.

Scenario with additional measures (WAM): encompasses planned policies and measures

- Planned policies and measures: options under discussion and having a realistic chance of being adopted and implemented in future.

To understand the meaning of the states following terms:

- Planned policies / measures are those that have not yet been formally laid down in the legislation;
- Adopted policies / measures are those that have been agreed and stipulated in the legislation,
- Implementation of policies / measures when action taken or is being taken to undertake activities that are often carried out over several years.

Emission projections are the function of (future) activity data combined with an emission factor. On a range of datasets including projections of economic growth (Gross domestic product (GDP)), industrial growth, population growth, changes in land use patterns, and transportation demand. Future emission factors reflect technological advances, environmental regulations, improvement in operating conditions and rates of penetration of new technologies and/or controls and any other expected changes.

For estimating projection the Tier 2 model from GB2016 is applied which includes sector-specific projections of activity data and, where appropriate, the inclusion of future emission factors depending on the sector (and pollutants) when measures are included in the concerned industry. In this sense, the application of the Tier 2 model included the stratification of defined source categories on the sub-activities and thus, it is possible to include the penetration of new technologies in emission factor. The stratification allows for over the years to include measures intended only for that particular activity in an appropriate volume (capacity controlled) for each year of the projection.

Emission projections of air pollutants originate from the official national data set for all sectors: The Republic of Croatia 2018 Informative Inventory Report (1990-2016) (IIR 2018). This means that sectoral sets of activity data and sets of pollutant emission factors are updated in accordance with the official submission in 2018 and included as a starting point for the production of emission projections.

The model used for projection is the LEAP (The Long-Range Energy Alternatives Planning System). LEAP is a software tool used to analyze energy policies and assess ways to mitigate climate change. It represents an integrated modeling tool designed to create energy balances and planning the development of particular energy sectors and energy as a whole, making it suitable for monitoring energy consumption, production and exploitation of raw materials in all sectors of the economy and its advantage is that it can be used for analysis and emission projections of air pollutants at local, regional and national level. The model and methodology used in the design of projections are also described by sectors, below the chapters.

The with measures and with additional measures scenarios included policies and measures for reduction of emissions from sources and increase greenhouse gases sinks. In order to determine the contribution of each individual policy and measure for emissions reduction, the reduction potential was determined. In cases where the emission reduction potential of individual policies and measures cannot be expressed separately, reports are aggregated with other potential policies and measures.

Projections cover the period until 2035, with five-year steps.

The observation time horizon until 2035 can be divided into three periods: 1) First commitment period of the Kyoto Protocol from 2008 to 2012, which has ended; 2) Second commitment period from 2013 to 2020; and 3) Third period after 2020. The second commitment period until 2020 is characterized by the regulation of the transfer of the EU acquis, mostly the climate and energy package adopted in 2009. After 2020, the trend should be towards the established long-term goals defined by the EU document Roadmap for moving to a competitive low-carbon economy in 2050 (the aim of the European Union to reduce greenhouse gas emissions by 85 % - 95 % until 2050).

Republic of Croatia is in the process of adopting of the Low-Carbon Development Strategy of the Republic of Croatia for the period until 2030 with a view to 2050 where a range of possible measures and scenarios for achieving this objective will be closely considered in it. The current legal framework and policies and measures as well as guidelines and recommended parameters of the European Commission from 14th June 2016 which comply with EU baseline scenario 2016 were taken into account while preparing the scenarios.

Energy (stationary combustion)

The overview of the strategical and planning framework for reduction of emissions in the energy sector is shown in the Figure 10.1-1.

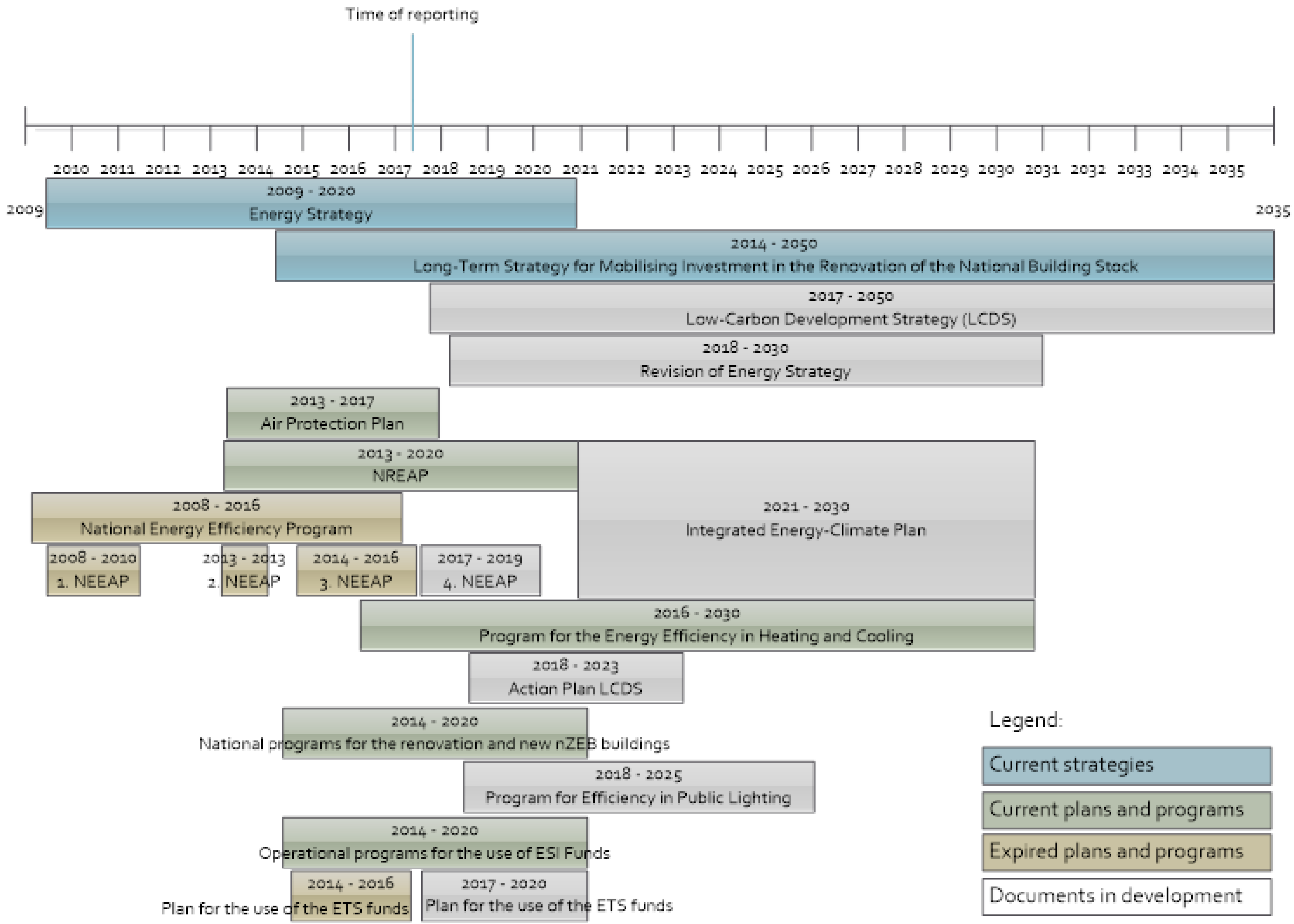


Figure 10.1-1 Overview of the strategical and planning framework for reduction of GHG emissions in the energy sector

The important currently actual strategies and plans include:

- Energy Strategy (OG 130/09),
- Long-Term Strategy for Mobilising Investment in the Renovation of the National Building Stock (OG 74/14),
- Plan for protection of air, ozone layer and climate change mitigation in the Republic of Croatia for the period from 2013 to 2017 (OG 139/13),
- National Renewable Energy Action Plan (ME, 2013),
- Program for the Energy Efficiency in Heating and Cooling (ME, 2016),
- set of national programs and plans for the renovation of existing buildings and increase of nearly-zero energy buildings (described later) and
- set of national Operational programs for the use of EU Funds[24].

Planning periods of some of the existing plans have expired, but very important policy documents are either available in draft versions or in the process of development, among them are:

- Low-Carbon Development strategy until 2030 with a view to 2050,
- Revision of the Energy Strategy,
- 4th National Energy Efficiency Action Plan for the Period 2017-2019,
- Action Plan for the Implementation of the Low-Carbon Development Strategy for the First 5-year Period,
- Program for the Energy Efficiency in Public Lighting until 2025,
- Integrated Energy-Climate Plan for the Period 2021-2030 as well as
- new Plan for the use of Funds from the Sale of Emission Allowances in the EU ETS for the Period 2017-2020.

The measures included in projection of energy sector are taken from the listed documents, but also from the other national or EU legislation if applicable for the reduction of GHG emissions and/or air pollutants emissions.

The projections of GHG emissions and air pollutant emissions in the energy sector are based on assumptions, objectives, measures and guidelines provided by the draft of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050.

The Strategy provided projections of the final energy consumption and gross final energy consumption until 2030, with a view of 2050, for the reference scenario and two scenarios with additional measures. The Strategy was based on the assumption of macroeconomic indicators as defined by The Recommended parameters of the EC for 2017 [19].

The with measures scenario represents a group effect of measures that are under implementation or adopted with enforcement of existing instruments and measures arising from the transfer of the EU acquis. The detail list and description of measures included is listed in the separated Report on Policy and Measures. The with measures scenario is equivalent of the Reference scenario of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050.

The with additional measures scenario is based on the application of the planned policy and measures, as listed in the Report on Policy and Measures. It is equivalent of the Low-Carbon Scenario 1 (NU1) from the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050. For some of the goals from the Strategy the instruments are not yet defined but it is expected that they will be defined by the Action plan for Strategy implementation.

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[24] http://www.strukturnifondovi.hr/

Energy (mobile combustion)

In total final energy consumption, the transport sector accounts for approximately 33% [25.], the largest share of energy consumption is in the road transport with almost 90%.

The with measures scenario represents a group effect of measures that are under implementation and adopted with enforcement of existing instruments and measures arising from the transfer of the EU acquis. The detail list and description of measures included are listed in the separated Report on Policy and Measures. The with measures scenario is equivalent of the Reference scenario of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050.

The with additional measures scenario is based on the application of the planned measures as listed in the Report on Policy and Measures. It is equivalent of the Low-Carbon Scenario 1 (NU1) from the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050. For some of the goals from the Strategy the instruments are not yet defined but it is expected that they will be defined by the Action plan for Strategy implementation.

Industrial Proceses and Product Use

The Industrial Strategy of the Republic of Croatia 2014 – 2020 defines objectives of industrial development and key indicators of the Croatian industry in the period 2014 – 2020. According to the "realistic scenario", by the year 2020 achieving the level of physical volume of industrial production on the level of 2008 is expected, when it reached the highest level of economic activity in Croatia.

The projections of emissions of greenhouse gases and pollutants in the sector Industrial processes and product use are based on assumptions, objectives and measures provided by the draft of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050.

The with measures scenario assumes that production in Industrial processes and product use sector will reach planned, maximum values until 2035, which will affect the increase in emissions. It is equivalent of the Reference scenario (NUR) provided by the draft of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050.

The with additional measures scenario includes implementation of cost- effective measures to reduce emissions of greenhouse gases and pollutants from energy consumption by industry branch and process emissions in the production of cement, glass and nitric acid and the reduction of emissions of volatile organic compounds, controlled substances and fluorinated greenhouse gases. The scenario comprises process emissions. Emissions from fuel combustion are included in the Energy sector.

The with additional measures scenario is equivalent of the Low-Carbon Scenario 1 (NU1) provided by the draft of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050. It is based on the application of the planned measures as listed in the Report on Policy and Measures.

Process measures for reducing emissions of greenhouse gases and pollutants from Industrial processes and product use sector include:

- reduction of clinker factor in cement production;
- increase of recycled glass in the glass production;
- reduction of N_2O emission in nitric acid production (catalytic decomposition);
- reducing emissions of volatile organic compounds in Product Use sector;
- handling of substances that deplete the ozone layer and fluorinated greenhouse gases;
- technical and organizational measures for collection, reuse, recovery and destruction of controlled substances and fluorinated greenhouse gases;
- capacity building and strengthening knowledge of authorized repairers;
- leakage detection of controlled substances and fluorinated greenhouse gases.

Agriculture

In the period until 2035, a recovery of agricultural production and increase of the number of animals is expected.

Both scenarios: with measures and with additional measures assume that there will be an increase in agricultural production (restoration of the livestock fund in the period from 2015 to 2020 and continued population increase until 2035, with the of crop production based on indicative trends in the period from 2000 to 2009) and sustainable consumption of fertilizer (on the level of the 2007-2014 period average).

Policies and measures included in the development of the <u>with measures</u> scenario:

- executing the Rural Development Programme for the period 2014-2020, including changing the system of cattle farming (manure removal system and genetic improvement) and diet (increasing digestibility, improving the quality of voluminous forage, improving grazing systems, use of additives in animal feed)

Scenario <u>with additional measures</u> assumes implementation of additional measures:

- change in diet of cattle and pigs and animal feed quality,
- changes in animals waste management systems, including aerobic decomposition of manure and biogas production
- improvements in synthetic fertilizer application methods,
- hydromeliorative field interventions,
- introduction of new cultivars, varieties and cultures.

Waste

For the purpose of effective implementation of the measures included in the Waste sector, along with the already adopted sectoral legislation that is harmonized with EU legislation, it is necessary to adopt a more significant number of by-lows.

The projections of emissions of greenhouse gases and pollutants in the Waste sector are based on assumptions, objectives and measures provided by the draft of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050.

The with measures scenario includes projections of emissions of greenhouse gases and pollutants from solid waste disposal, biological treatment (composting) of solid waste, incineration of waste and wastewater treatment and discharge. It is equivalent of the Reference scenario (NUR) provided by the draft of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050.

The with measures scenarios assume a continuous increase of waste quantities in the period until 2035 as a result of higher living standards, despite the effects of measures undertaken to avoid/reduce and recycle waste. The implementation of measures is prescribed by the sectoral legislation.

The with additional measures scenario includes projections of emissions of greenhouse gases and pollutants from solid waste disposal and biological treatment (composting) of solid waste since the remaining activities are not provided for measures to reduce emissions of greenhouse gases and pollutants. The scenario includes a more intensive application of measures defined by sectoral strategic documents, in relation to the with measures scenario. In the period until 2035, reduction of emissions of greenhouse gases and pollutants in waste management could be achieved by implementing the measures that are defined by the waste management priority order. The scenario assumes implementation of measures defined by the Sustainable Waste Management Act (OG 94/13, 73/17, 14/19) and Waste Management Plan of the Republic of Croatia for the period 2017 – 2022 (OG 3/17).

The with additional measures scenario is equivalent of the Low-Carbon Scenario 1 (NU1) provided by the draft of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to

2050. It is based on the application of the planned measures as listed in the Report on Policy and Measures.

Measures for reducing emissions of greenhouse gases and pollutants from Waste sector include:

- preventing the generation and reducing the amount of municipal waste;
- increasing the amount of separately collected and recycled municipal waste;
- methane flaring;
- reducing the amount of disposed biodegradable municipal waste;
- use of biogas for electricity and heat generation.

10.2. Parameters

For the preparation of the Report on GHG Emission Projections for 2017, and also for pollutant emission projections, parameters and data sources for the parameters used in the following table by sectors were used.

Table 10.2-1 Parameters and their sources used to produce projections by sectors

Sector	Data type	Data source
General parameters	GDP – yearly growth rate Population Coal price Crude oil price Natural gas price	European Commission recommendations
Energy	Fuel consumption Electricity generation Electricity imports Final energy demand	National energy balance Draft of Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050
Transport	Number of passenger kilometres Number of tonne-kilometres Energy demand in transport sector	ODYSSEE database Draft of Low-Carbon Development Strategy of the Republic of Croatia until 2030 with a view to 2050
Industry	Production index	Sectorial studies (cement, glass and nitric acid production) National Bureau of Statistics
	Use of solvents	Inventory Report of air pollutants on the Croatian territory under the Convention on Long-range Transboundary Air Pollution (CLRTAP)
Agriculture	Number and type of livestock	National Bureau of Statistics Croatian Agricultural Agency Faculty of Agriculture FAOSTAT database
	Plant production	National Bureau of Statistics Statistical reports on plant production FAOSTAT database
Waste	The amount of generated municipal waste The amount of municipal waste disposed of at landfill The organic fraction of municipal solid waste	Sustainable Waste Management Act Waste Management Plan of the Republic of Croatia for the period 2017 – 2022

10.3. Sectoral methodologies

Energy (stationary and mobile combustion)

In preparing the projections, a software package LEAP (eng. Long-range Energy Alternatives Planning System) [25] was used, in which was created a model of the energy sector in Croatia. For the needs of detailed modelling of the development and optimization of the power sector, more advanced model were used, whose outputs were the inputs for the energy model in LEAP. Output data are structured in accordance with the structure of inventory of the United Nations Framework Convention on Climate Change. It is the engineering simulation model in which are the scenarios simulated and certain processes and decisions optimized in regard to the assumptions and limitations. The model is detailed to the level of individual production units, present and future.

Projections were made until 2035, with a single step every year. The model is of 'bottom-up' type, because it starts from the sectoral data and individual emission sources in the power sector and calculates GHG emissions projections of GHGs and air pollutants.

Assumptions used in the preparation of projections are shown in table below.

Table 10.3-1 Assumptions for projections – Energy (stationary and mobile combustion)

ENERGY (STATIONARY AND MOBILE COMBUSTION)	
Projections of GHG emissions for this report are taken from the draft of the Low-Carbon Development Strategy of Croatia until 2030 with a view to 2050. Below is a more detailed description of the methodology used.	
Final energy demand	Final energy demand is projected in different sectors - industry, transport, services, households and agriculture, fisheries and forestry. The bases for projections of activities are macroeconomic parameters and guidelines provided by the EC to Member States to harmonize the key parameters. For the projections of energy intensities, a development of technology and changing of lifestyles was taken into account. The scenarios 'with existing measures' and 'with additional measures' modelled the impacts of each measure. The analyses were performed by sub-sectors: – industry - by industry and type of fuel used, – transport – by type of transport (road, air, marine and rail) and types of means of transport (cars, buses, motorcycles, light and heavy vans) and by type of technology and fuel used – services – by branches (tourism, trade, education, health), climatic zone (coastal or continental Croatia), purpose (heating, water heating, cooking, cooling, electrical appliances and lighting), type of fuel used, heating demand is modelled on the level of useful and final energy – households – by climatic zone (coastal or continental Croatia), purpose (heating, water heating, cooking, cooling, electrical appliances and lighting) and by type of fuel, heating demand is modelled on the level of useful and final energy – agriculture, fisheries and forestry - by type of fuel
	Demographic trends - assumes a scenario of average fertility and average migration, in accordance with the guidelines of the EC.
With measures scenario	
	In the period until 2020, energy efficiency improvements are in line with the existing measures listed in the National Action Plan for Energy Efficiency for the Period 2017-2019 (listed in the Report on Policy and Measures), while for the post-2020 period, there are no yet implemented measures, so only assessed market improvements are integrated: – market driven improvements of energy efficiency and fuel switches in industrial sector; – renovation of 0,5% surface are of the buildings annually to the standard as listed in the Technical regulation on rational use of energy in buildings (OG 97/14) ; – all new buildings built according to the same Regulation;

[25] More information available at http://www.energycommunity.org/default.asp?action=47

ENERGY (STATIONARY AND MOBILE COMBUSTION)	
	– it is assumed that all emissions from the new vehicles will be in line with the Regulation EU no. 333/2014 for the personal vehicles, i.e. average emissions of new vehicles will be below 95 g CO2/km and Regulation EU no. 510/2011 to reduce the average emissions of light duty vehicles below 174 g CO2/km after 2017 and below 147 gCO2/km after 2020; – it assumed that there will be stagnation in the use of rail and inland waterways transport; – – it is assumed that 6% of the vehicles will be electric vehicles in 2050 (based on the EU Reference scenario 2016).
With additional measures scenario	
	Continued support to energy efficiency after 2020, with the following key assumptions: - renovation of 2% of the buildings annually to the nearly-zero energy standard (include the use of renewable sources); - support for the development of the share of electric vehicles to 25% of the personal vehicles in 2050; - intermodal shift with the goal to shift 7% of the transport of passengers and goods to rails until 2030 and 20% until 2050; – improvements of energy efficiency in industry together with fuel switch towards the use of renewable energy and electricity.
Energy transformations and resources	The power system was analysed by the simulation of market development with the software for the hourly optimization of operation and development of the power system. The price of the emission allowances in the EU ETS was assumed as in the EU Reference scenario 2016. The simulation of the operation of the refineries was done to satisfy the domestic demand as possible with the existing capacities, which mean reducing production in 'with existing measures' and 'with additional measures' scenarios.
With measures scenario	
	Assumptions: - Until 2020, installed capacities of renewable energy sources power plants are as defined by the National Action Plan for Renewable Energy Sources by 2020 and Tariff system for renewable energy and efficient cogeneration (OG 133/2013, 151/2013, 20/2014, 107/2014 i 100/2015); - for the post-2020 period the simulation of the market development with the software for the hourly optimization of operation and development of the power system was done. The price of the emission allowances in the EU ETS was assumed as in the EU Reference scenario 2016. The analysis showed that renewable energy sources will be competent to certain extent without the need of the public support for the solar PV system and wind. - no new coal power plants; – no net imports of electricity after 2030.
With additional measures scenario	
	Assumptions include continuous development of renewable energy policy even after 2020: - the simulation of the market development with the software for the hourly optimization of operation and development of the power system was done. The price of the emission allowances in the EU ETS was assumed as in the EU Reference scenario 2016. - Due to lower demand for energy compared to the 'with existing measures' due to the energy efficiency improvements, the costs to achieve higher shares of renewable energy are lower.

ENERGY (STATIONARY AND MOBILE COMBUSTION)	
	- no new coal power plants; - no net imports of electricity after 2030.

Source: Report on projections of greenhouse gas emissions, Ekonerg Ltd.

Industrial Proceses and Product Use

In preparing the projections, the engineering simulation model derived in tabular calculation interface was used. The model is structured in accordance with the table structure of the inventory of United Nations Framework Convention on Climate Change (UNFCCC) and Convention on Long-range Transboundary Air Pollution (CLRTAP).

The model is detailed for LPC to the level of individual production units, the present and future ones while for the other source categories is on level of NFR categories.

Projections are made until 2035, in steps of five years. The model is of 'bottom-up' type, because it starts from the sectoral data and individual emission sources.

Assumptions used in the preparation of projections are shown in table below.

Table 10.3-2 Assumptions for projections – Industrial Proceses and Product Use

INDUSTRIAL PROCESES AND PRODUCT USE	
	The projections were carried out based on the expected development of certain industries, which includes the production goals by 2035. Emission projections start from the situation and projections of macroeconomic parameters in 2015 (The 2015 Ageing Report) - the projected dynamics of the annual growth rate of gross domestic product and gross value added and the decline of population, as well the results of sectoral analysis and studies (cement, ammonia, nitric acid, sulphuric acid and mineral fertilizers production).
With measures scenario	
	Assumptions: – no installation of additional capacity; – production will reach the maximum value by 2035; – The Industrial Strategy of the Republic of Croatia 2014 – 2020 defines objectives of industrial development and key indicators of the Croatian industry in the period 2014 – 2020. According to the “realistic scenario”, by the year 2020 achieving the level of physical volume of industrial production on the level of 2008 is expected, when it reached the highest level of economic activity in Croatia; – process emissions from economic activities included in the sector Industrial processes and product use were estimated on the basis of detailed sectoral projections of production of cement, ammonia, nitric acid, sulphuric acid and mineral fertilizers and the projected macroeconomic indicators of gross value added by other industrial branches, annual increase rate in gross domestic product and decline of population. The scenario includes the implementation of measures defined in the strategic and sectoral planning documents included in the business policy of cement, ammonia, nitric acid, sulphuric acid and mineral fertilizers manufacturers, conditioned by market demands, laws and regulations and the requirements of the application of best available techniques in the production process.
With additional measures scenario	
	Assumptions: – the application of cost- effective measures to reduce emissions of greenhouse gases and pollutants in the production of cement, glass and nitric acid and the reduction of emissions of volatile organic compounds, controlled substances and fluorinated

INDUSTRIAL PROCESES AND PRODUCT USE	
	greenhouse gases; – there are no additional measures for the air pollutants emission reductions.
According to good practice	
	Assumptions: – the projections were made for activity data and emission factors; – activity data – applying grade of 1, 2 and 3 methods (projections of macroeconomic parameters, effects of policies and measures, sectoral analysis and studies); – emission factors – applying grade of 1 and 2 methods (projections based on average values for the previous five-year period, effects of policies and measures, sectoral analysis and studies).

Source: Report on projections of greenhouse gas emissions, Ekonerg Ltd.

Agriculture

In preparing the projections, a model derived in tabular Calculation interface was used. The model is structured in accordance with the table structure of the inventory of United Nations Framework Convention on Climate Change. It is the engineering simulation model.

The model is detailed to the level of individual sources, the present and future ones.

Projections are made by 2020, indicative until 2035, in steps of five years. The model is of 'bottom-up' type, because it starts from the sectoral data and individual emission sources.

Assumptions used in the preparation of projections are shown in table below.

Table 10.3-3 Assumptions for projections - Agriculture

AGRICULTURE	
	The projections were carried out based on the expected future state of key parameters. In order to determine the key parameters for projections (number and types of livestock, crop production), the extrapolation of historical input data was used and expert assessment that includes historical data and sectoral strategic and development documents.
	Assumptions: – uncertainties due to the lack of adequate and reliable statistics and economic indicators.

Source: Report on projections of greenhouse gas emissions, Ekonerg Ltd.

Waste

In preparing the projections, the engineering simulation model derived in tabular calculation interface was used. The model is structured in accordance with the table structure of the inventory of United Nations Framework Convention on Climate Change (UNFCCC) and Convention on Long-range Transboundary Air Pollution (CLRTAP).

The model is detailed to the level of individual sources, the present and future ones.

Projections are made until 2035, in steps of five years. The model is of 'bottom-up' type, because it starts from the sectoral data and individual emission sources.

Assumptions used in the preparation of projections are shown in table below.

Table 10.3-4 Assumptions for projections – Waste

WASTE	
	The projections were carried out on the basis of expected development and future state of parameters relating to the amount of generated solid waste, amount of waste disposed at landfills, the organic fraction of municipal solid waste . Emission projections start from the situation and projections of macroeconomic parameters

WASTE	
	in 2015 (The 2015 Ageing Report) - the projected dynamics of the annual growth rate of gross domestic product and gross value added and the decline of population, which includes the goals by 2035.
With measures scenario	
	Assumptions: Includes projections of emissions of greenhouse gases and pollutants from solid waste disposal, biological treatment (composting) of solid waste, incineration of waste and wastewater treatment and discharge: – solid waste disposal on land - continuous increase of generated and disposed waste quantities in the period until 2035 as a result of higher living standards, despite the effects of measures undertaken to avoid/reduce and recycle waste (the objectives are defined by sectoral strategic documents); – composting - continuous increase in the amount of solid waste that is being processed by composting; – incineration of waste - continuous increase in the quantity of incinerated clinical waste as well decrease in the number of cremated bodies; – wastewater treatment and discharge – continuous increase in the quantity of wastewater treated in industry sectors and decrease in the quantity of wastewater treated in residential/commercial sectors, decrease the number of population with individual system of drainage (septic tank) and the number of residents in households without sanitary facilities; – other waste - slight continuous increase in the number of fires in almost all categories. Emissions of greenhouse gases and pollutants that are included in the Waste sector (according to the IPCC and EMEP/EEA methodology) were estimated on the basis of sectoral analysis and projected macroeconomic indicators on the annual increase in gross domestic product, gross value aded and decline of population. The scenario includes the implementation of measures defined in the strategic and planning sectoral documents – Sustainable Waste Management Act and Waste Management Plan of the Republic of Croatia for the period 2017 – 2022.
With additional measures scenario	
	Assumptions: Includes projections for solid waste disposal on land and biological treatment (composting) of solid waste: – solid waste disposal on land - decrease of generated and disposed solid waste due to application of the measures defined by strategic documents harmonized with EU legislation. Quantitative targets for the amount and composition of solid waste and other parameters in the models for estimating emissions from landfills, which are not defined by the strategic documents, are estimated by expert judgment; – composting - assumes a continuous increase in the amount of solid waste that is being processed by composting due to the application of measures defined by strategic documents harmonized with EU legislation (depends on the reduction of the amount of disposed biodegradable waste). The with additional measures scenario includes a more intensive application of measures defined by sectoral legislation, in relation to the with measures scenario, with the implementation of binding targets in accordance with EU legislation.
According to good practice	
	Assumptions: – the projections were made for activity data, emission factors and parameters of the models; – applying grade of 1, 2 and 3 methods (projections of macroeconomic parameters, effects of policies and measures, sectoral analysis and studies, expert judgement).

Source: Report on projections of greenhouse gas emissions, Ekonerg Ltd.

10.4. Results

Results of emission projections for NOx, SO_2, NMVOCs, NH_3, and $PM_{2.5}$ are presented in Figures 10.4-1 to 10.4-5. Each of the graphic figures gives an overview by individual pollutant of the historical emission trend (1990 - 2017) according to submission in 2018, applied scenarios, compliance with emission quotas and reduction commitments from 2020 to 2029, and reduction commitments from 2030 according to the NEC Regulation.

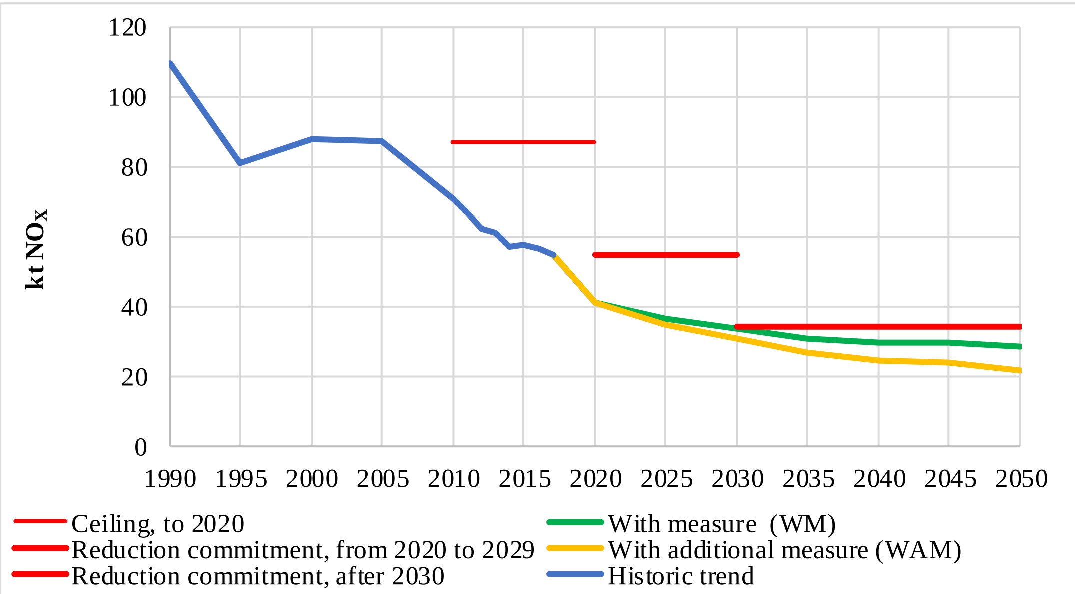

Figure 10.4-1 Trend and projections of NOx emissions

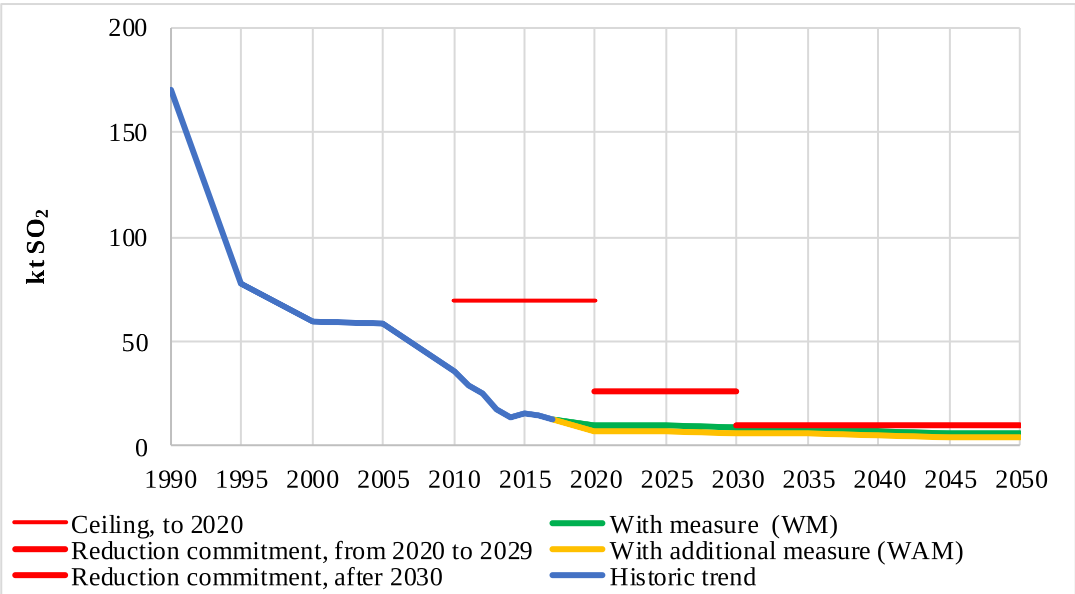

Figure 10.4-2 Trend and projections of SO_2 emissions

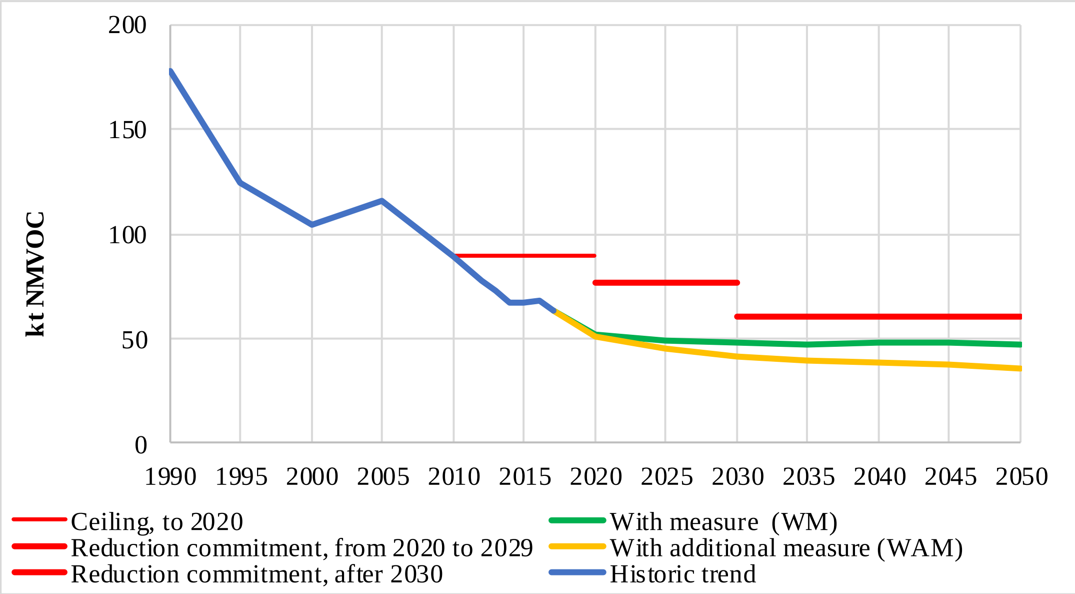

Figure 10.4-3 Trend and projections of NMVOC emissions

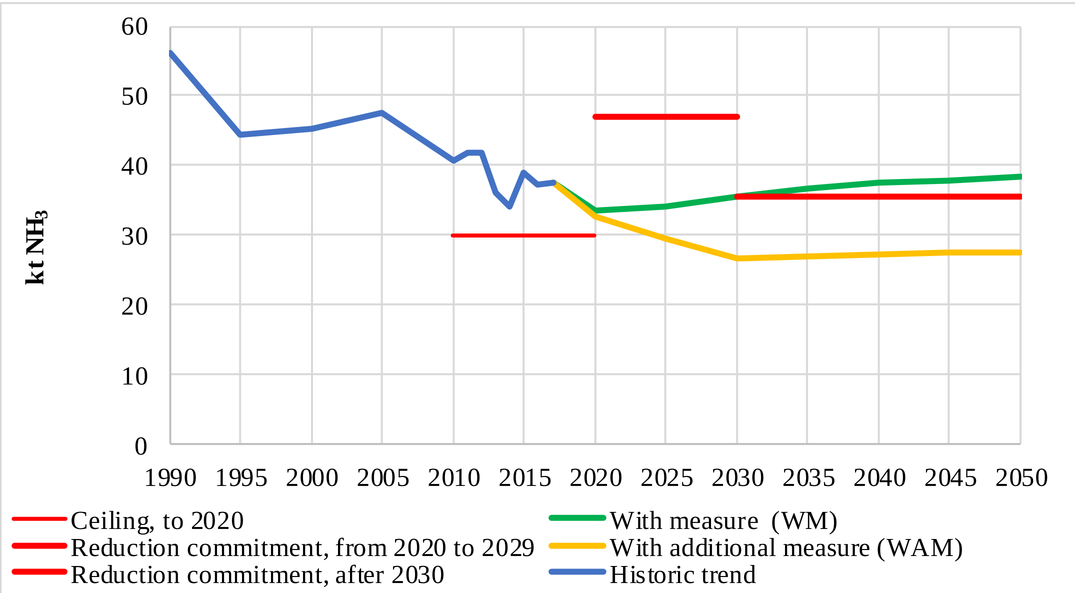

Figure 10.4-4 Trend and projections of NH_3 emissions

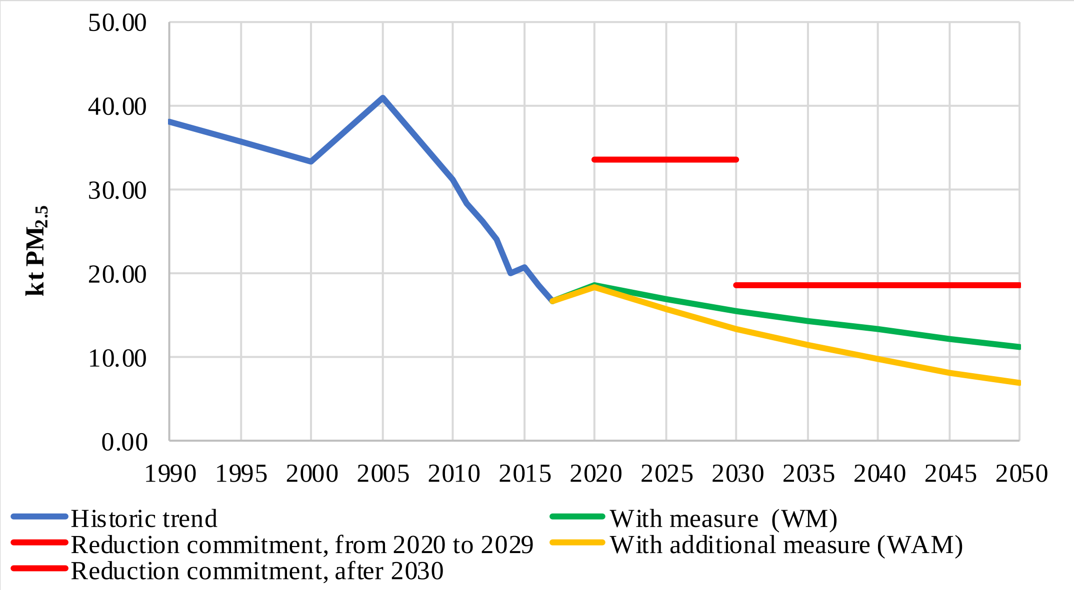

Figure 10.4-5 Trend and projections of $PM_{2.5}$ emissions

10.5. Sensitivity

This section analyzes the sensitivity of projections to several selected sizes, which largely determine uncertainty. The selected sizes analyzed below are:

- GDP growth,
- influence of change in temperature on heating and cooling energy demand (heating and cooling requirements, Other impacts on energy),
- hydrology in the production of hydroelectric power,
- input parameters in the power sector,
- development of agriculture.

GDP growth

The increase of GDP is assumed by 2050 in all analysed scenarios in average of 1.66% by 2050 which makes a nominal increase of 78% compared to 2010.

In an optimistic macroeconomic scenario, Croatian economy is expected to grow at an average annual rate of 2.15% by 2050 (demographic projection remains the same as in the main scenario). The resulting increase in real GDP per capita by 2050 is about 138% in comparison with 2012. A faster closure of the development gap than the EU average can be expected. Therefore, Croatia reaches 91% of the EU average development level by 2050 in an optimistic scenario. However, according to the pessimistic macroeconomic scenario, an average annual growth rate of 0.8% and a cumulative rise in real GDP per capita of only 44% is expected by 2050. The assumption is that growth would be slower than the growth of the total EU, thus real per capita income in Croatia could drop to 55% in comparison to current EU average level of about 60%.

The optimistic scenario of economic growth expects the emission to be about 7.1% higher in 2030 and about 18.1% by 2050 compared to the presented scenarios, assuming the same carbon intensity of the economy. However, the implementation of emission reduction measures will reduce and cut the link between GDP and emissions in the long term. Thus, the GDP growth can also contribute to emissions reduction when it comes to investments in low carbon technology, industry and services.

The pessimistic scenario has an average GDP growth of 0.97% by 2050, so greenhouse gas emissions would be lower than the average scenario. However, the problem of financing the transition could occur in this scenario, thus any additional financing for the implementation of the measures may be questionable.

Influence of change in temperature on heating and cooling energy demand

Change in temperature will affect the decrease in heating energy demand, but on the other side, it will increase the cooling energy demand. The goal of climate policy is to keep the global temperature rise within 2°C. The temperature increase has been determined in Croatia since the measurements have been carried out. An increase of about 1°C is assumed by 2050.

Heating requirements - The indoor temperature in buildings is mainly 20°C but the temperature of the heated rooms is usually maintained at the level up to 24°C. In addition to these assumptions, the reduction in heat required for heating could be between 7.7 and 11.3% in the continental part of Croatia and between 12.7 and 24.2% in the coastal part of Croatia.

Cooling requirements - Unlike heating requirements, there is no such dependence between the need for comfortable cooling and the outdoor air temperature, since in the influence of heat gains due to solar radiation is dominant in this case. At the moment it is not possible to estimate the influence of external temperature change on cooling requirements due to data availability. The only possible estimation suggests that the impact will be less expressed comparing to heating requirements.

Other impacts on energy - Changes in temperature, precipitation and wind energy will affect the production of renewable energy sources. These impacts need to be quantified and embedded in operational planning, especially at the regional and local level where large variations are possible.

Hydrology in the production of hydroelectric power

Generation from large hydropower plants varies from 4 TWh to 8 TWh, depending on hydrology. This represents 20% or 40% of the total electricity generation in Croatia. Emissions from the electroenergy sector can vary considerably based on the cycles of dry and humid years that can last for several years.

The lack of generation from hydropower plants is supplemented by increased production from thermal power plants or by increased imports. In the case of extreme drought, the increase in emission could occur in 2030 in the scenario with additional measures in amount of 4.2% of the total emissions in Croatia respectively.

Input parameters in the power sector

Along with the sensitivity analysis of the hydrology, the sensitivity analysis was performed also for the other parameters in the power sector. The analysis showed:

- in WEM scenario:
    - import of up to 30% of electricity, instead of zero net imports (except imports from the nuclear power plant Krško), would lead to reduction of domestic emissions by 2,1% in 2030;
    - constant price of EUA at 15 EUR/EUA, instead of growth of prices of allowances as in EU Reference scenario 2016, would lead to increase in total emissions by 2,1% in 2030;
- in WAM scenario:
    - import of up to 30% of electricity, instead of zero net imports (except imports from the nuclear power plant Krško), would lead to reduction of domestic emissions by 2,6% in 2030;
    - import of up to 30% of electricity, instead of zero net imports (except imports from the nuclear power plant Krško), but in combination with the 30% lower natural gas prices (compared to EU Reference scenario 2016) would lead to reduction of domestic emissions by 1,5% in 2030.

The overview of analysis is shown in the following figure.

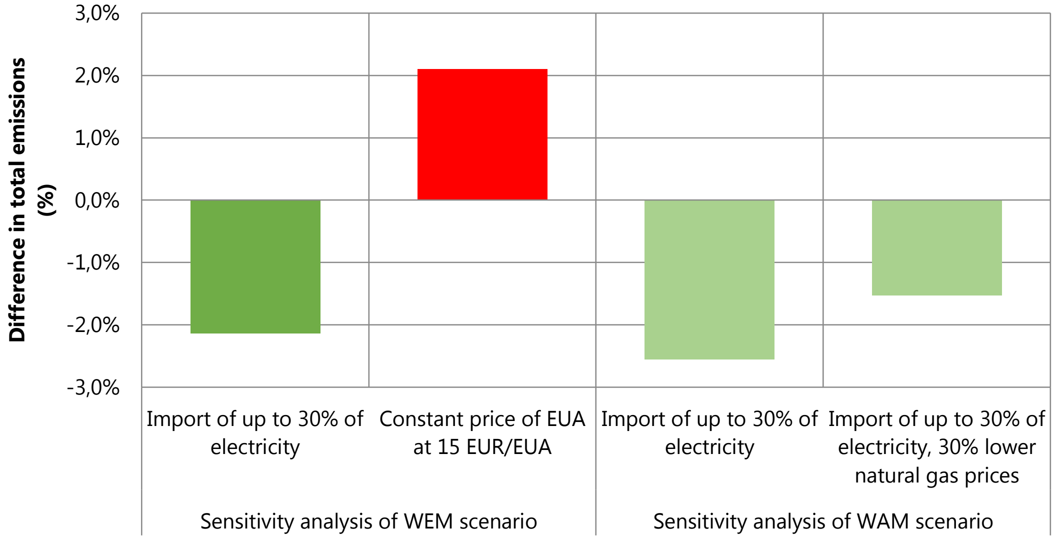

Figure 10.5-1 Sensitivity analysis of total emissions for some of the input parameters in power sector

Development of agriculture

The characteristics of agriculture in Croatia are extremely small estates; the average family farm has only 2 ha. According to the 2003 Agriculture Census, only 20% of the processed land is in private ownership with an average of 159 ha. The similar situation is in the field of cattle breeding. Thus, for example, 96% of all diary producers own only 15 cows while 90% of pork production is handled by 200,000 small farms where 170,000 farms have less than 10 pigs. Such fragmentation and predominantly old populations prevent faster development. Agriculture will change slowly thus Croatia will have a big challenge in emissions.

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12. IIR Appendices

APPENDIX 1: QA/QC activities

APPENDIX 2: Description of SNAP97 sectors

APPENDIX 3: NFR and correspond SNAP codes

APPENDIX 4: Emission factors – 2017

APPENDIX 5: National energy balance for 2017

APPENDIX 6: NFR 2015

APPENDIX 7: Uncertainty analysis

APPENDIX 8: Influence of recalculations 1990 – 2016 in respect to pollutant and SNAP97 sector

APPENDIX 9: Inclusion/exclusion of the condensable component from PM10 and PM2.5 emission factors

12.1. Appendix 1. QA/QC activities

Table A1-1 QA/QC activities

Activity	QC checks / reviews		QC others (Correction)	
	Expert name	Period / deadline	QA / QC manager / other person	Deadline
DATA COLLECTION ACTIVITIES				
Checks all input data for emission calculations properly referenced	Mirela Poljanac	Until the beginning of December	Vladimir Jelavić	December
Check availability of literature material	Mirela Poljanac	=	Vladimir Jelavić	December
Confirm that bibliographical data references are properly cited	Mirela Poljanac	=	Vladimir Jelavić	December
ACTIVITY DATA ENTRY IN DATABASES AND EMISSION CALCULATION				
Check whether the documented assumptions and criteria for selection of activity data, emission factors and other necessary parameters for emissions calculation	Mirela Poljanac	December	Vladimir Jelavić	December
Cross-check descriptions of input data and the emission factors with information about categories	Mirela Poljanac	December	Vladimir Jelavić	December
Check the correctness of interpretation and use of activity data and emission factors	Mirela Poljanac	December	Vladimir Jelavić	December
Check that the parameters and units are accurately recorded	Mirela Poljanac	December	Vladimir Jelavić	December
Check that used appropriate conversion factors	Mirela Poljanac	December	Vladimir Jelavić	December
Check whether the unit is properly marked in the worksheets	Mirela Poljanac	December	Vladimir Jelavić	December
Check the consistency of data between the categories	Mirela Poljanac	December	Vladimir Jelavić	December
Identified e.g. activity data common to several categories	Mirela Poljanac	December	Vladimir Jelavić	December
Check the consistency of the activity data	Mirela Poljanac	December	Vladimir Jelavić	December
Check the consistency of time series of input activity data for each category	Mirela Poljanac	December	Vladimir Jelavić	December
DATABASES ITEMS				
Check whether all the categories covered by the emission sources that exist in the country, if not whether there are marked with the appropriate notation key („NO“)	Mirela Poljanac	December	Vladimir Jelavić	December
Check whether there is double counting, i.e. duplication of entries	Mirela Poljanac	December	Vladimir Jelavić	December
Check out the use of units and all necessary conversions of the same	Mirela Poljanac	December	Vladimir Jelavić	December
Used to check the consistency of data on activities for each pollutant within each category.	Mirela Poljanac	December	Vladimir Jelavić	December
DATABASES ITEMS				
Check the correctness of the emissions calculation	Mirela Poljanac	December	Vladimir Jelavić	December
Check the consistency of trends	Mirela	December	Vladimir Jelavić	December

Activity	QC checks / reviews		QC others (Correction)	
	Expert name	Period / deadline	QA / QC manager / other person	Deadline
	Poljanac			
Check *Tier 2* method for emissions calculation by using *Tier 1*	Mirela Poljanac	December	Vladimir Jelavić	December
FILLING ANNEXES TABLES (Annex_I_Emissions_reporting_template, Annex_IV_Projections_reporting_template, Annex_VI_LPS_emissions_template)				
Check pollutants emission totals by pollutants and by sectors	Mirela Poljanac	beginning February	Nina Zovko/ Vladimir Jelavić	week before the 15th February
Check NFR national totals	Mirela Poljanac	beginning February	Nina Zovko/ Vladimir Jelavić	week before the 15th February
Check for major changes compared to previous year	Mirela Poljanac	beginning February	Nina Zovko/ Vladimir Jelavić	week before the 15th February
Check totals in NFR codes with totals in SNAP codes	Mirela Poljanac	beginning February	Nina Zovko/ Vladimir Jelavić	week before the 15th February
Check longitude, latitude and height class of LPSs	Mirela Poljanac	beginning February	Mirela Poljanac	week before the 15th February
Automate work due to avoid errors by linking working Excels	Mirela	beginning February	Mirela Poljanac	week before the 15th February
PREPARING IIR (INFORMATIVE INVENTORY REPORT)				
Check the values in the text and excel tables	Mirela Poljanac	10. February to 14th March	Nina Zovko / Vladimir Jelavić	the 14th March
Check out the Figures	Mirela Poljanac	10. February to 14th March	Nina Zovko / Vladimir Jelavić	the 14th March
ARCHIVING				
Production of "*hard*" copies of the database	Mirela Poljanac	from April -...	-	-
Archiving Excel Table	Mirela Poljanac	from April -...	-	-
Archiving of data sources	Mirela Poljanac	from April -...	-	-
Archiving of all manuals	Mirela Poljanac	from April -...	-	-
Archiving IIR	Mirela Poljanac	from April -...	-	-

12.2. Appendix 2. Description of SNAP97 sectors

SNAP 01: Combustion in energy transformation industry

This sector covers emissions from boilers, gas turbines and stationary engines as point sources and emission from combustion plants as area sources where the fossil fuel is combusted for the purpose of electricity generation and thermal production. This sector also includes emissions from combustion processes within a refinery for the heating of crude and petroleum products without contact between flame and products (crude oil transformation into derivates such as benzene, diesel, gas oil, kerosene, etc.), emissions from solid fuel transformation plants and combustion during oil / gas extraction and coal mining. Production of electricity and thermal energy for own consumption is also included. Dominant emissions from sector 01 are the following: SO_2, NO_x, TSP and heavy metals (arsenic, cadmium, chrome, mercury, zinc and nickel).

SNAP 02: Non-industrial combustion plants

Sector 02 includes all stationary energy plants with the exception of combustion in manufacturing industry (sector 03) and energy transformation industry (sector 01). Mainly, this sector includes emissions from small and medium combustion plants for thermal energy production like, commercial and institutional plants, residential plants and plants in agriculture, forestry and aquaculture. Production of electricity and thermal energy for own consumption is also included. Dominant emissions from sector 02 are the following: SO_2, NO_x, NMVOC, CO, TSP, particulate matter, heavy metals (cadmium, zinc and mercury) and persistent organic pollutants (PAHs, DIOX).

SNAP 03: Combustion in manufacturing industry

Emission because of production process (sector 04) and emission due to fuel combustion in manufacturing industry (sector 03) must be distinguished. The sector Combustion in manufacturing industry covers emissions released from: electricity generation and thermal energy production for manufacturing processes, combustion in order to generate thermal energy for processes without contact and non-energy fuel consumption. Non-energy fuel consumption comprises natural gas consumption for fertilizers, ethane, paraffin and wax production in chemical industry, bitumen production in construction industry and oil and fat production in different areas of application. Dominant emissions from sector 03 are the following: SO_2, NO_X, CO, TSP, particulate matter and heavy metals (arsenic, cadmium, chrome, mercury, zinc and nickel).

SNAP 04: Production processes

Sector 04 includes emissions which are the result of different production processes. These are the processes in petroleum industries, iron and steel industries, non-ferrous metal industries, inorganic and organic chemical industries, wood, paper pulp, food, drink, cement, glass and other industries, etc. The dominant emissions from sector 04 are: NO_X, NMVOC, NH_3, CO, TSP, particulate matter and heavy metals (cadmium, arsenic, chrome, selenium and zinc).

SNAP 05: Extraction and distribution of fossil fuel and geothermal energy

The extraction and first treatment of solid, oil and gas fuel results in non-methane volatile organic compounds emissions (NMVOC) and it is a dominant emission from sector 05. The largest NMVOCs emissions are the fugitive emissions from gas stations and emissions that occur during loading of gaseous and liquid fossil fuel from on-shore and offshore facilities. During the gaseous fossil fuel extraction and first treatment, emissions of mercury (Hg) occur. Those emissions can be of considerable amount if the mercury concentration in gaseous fossil fuel is high and if no additional measures for emission reduction are implemented. This sector also includes emissions from geothermal energy extraction. The SNAP code 05 is a key source of NMVOC emissions.

SNAP 06: Solvent and other product use

All activities, in which organic solvents are used and are emitted, are included in sector 06. Solvent use is a major contributor to NMVOC emissions. These emissions come from paint application, degreasing, dry cleaning and electronics, production or processing of chemical products and other use of solvents and related activities. The SNAP code 06 is also a key source of PCBs emission.

SNAP 07: Road transport

This sector includes emissions from all types of vehicles (passenger cars, light and heavy duty vehicles, buses, mopeds and motorcycles), emissions from gasoline evaporation from vehicles and also emissions from automobile tyre and brake wear. For emission calculation in road transport COPERT 4 (v11.3) software, developed for the purposes of European Environmental Agency, was used. Road transport is the key source of heavy metals emissions (lead, chrome, zinc and copper), NO_x, NMVOC, CO, and TSP, and particulate matter.

SNAP 08: Other mobile source and machinery

Emissions from sector 08 include emissions from off-road machinery. In other words, emissions from railways, inland waterways, maritime activities, air traffic. Furthermore, the emissions from agriculture, forestry, industry, household, gardening and other off-road mobile machinery are calculated. Emissions from international air traffic and waterways are excluded. Dominant emissions from this sector are: NO_x and $PM_{2.5}$.

SNAP 09: Waste treatment and disposal

Sector 09 includes emissions which are the result of biological treatment of waste - solid waste disposal on land, waste incineration (waste thermal treatment and cremation), wastewater handling and other activities such as car fires and house fires.

The dominant emissions from sector 09 are NMVOC and NH_3.

If the waste is used as fuel for energy and thermal generation, the emissions that occur must be included in one of the stationary sectors (sectors 01, 02 and 03).

SNAP 10: Agriculture

The sector agriculture includes emissions that occur from application of nitrogen (N)-containing fertilizers and pesticides on agricultural land and also emissions from manure management, regarding organic compounds (emissions from animal excreta). The dominant emission from sector 10 is emission of ammonia (NH_3). Production and use of HCH (Lindane) has been permanently prohibited since July 2001. Therefore, the emission of Lindane no longer occurs on the territory of the Republic of Croatia.

SNAP 11: Other sources and sinks

Sector 11 is the only sector that includes non-anthropogenic emissions (caused by nature). This sector includes emissions from non-managed and managed deciduous and coniferous forests and forests soils, natural grassland and other vegetation, marshes and waters (rivers and lakes), volcanoes, lightning, changes in forest and other woody biomass stocks, etc. In Croatia only SNAP code 110300 Forest and other vegetation fires is considering within sector 11. The SNAP 11 is not the key source of emissions.

12.3. Appendix 3. NFR and correspond SNAP codes

Table A3-1 NFR and correspond SNAP codes

NFR Code	Long name	SNAP code
1 A	Energy – fuel combustion	
1 A 1	Energy industry	01 00 00
1 A 1 a	Public Electricity and Heat Production	01 01 and 01 02
1 A 1 b	Petroleum refining	01 03 00
1 A 1 c	Manufacture of Solid Fuel and Other Energy Industries	01 05 00
1 A 2	Manufacturing Industries and Construction	01 00 00
1 A 2 a	Stationary Combustion in Manufacturing Industries and Construction: Iron and Steel	-
1 A 2 b	Stationary Combustion in Manufacturing Industries and Construction: Non-ferrous Metals	-
1 A 2 c	Stationary Combustion in Manufacturing Industries and Construction: Chemicals	-
1 A 2 d	Stationary Combustion in Manufacturing Industries and Construction: Pulp, Paper and Print	-
1 A 2 e	Stationary Combustion in Manufacturing Industries and Construction: Food Processing, Beverages and Tobacco	-
1 A 2 f	Stationary Combustion in Manufacturing Industries and Construction: Non- metallic minerals	03 01 and 03 03
1 A 2 g vii	Mobile Combustion in Manufacturing Industries and Construction	08 08 01
1 A 3	Transport	
1 A 3 a ii (i)	Civil Aviation (Domestic, LTO)	08 05 01
1 A 3 a i (i)	International Aviation (LTO)	08 85 02
1 A 3 b i	Road Transport:, Passenger cars	07 07 01
1 A 3 b ii	Road Transport:, Light duty vehicles	07 07 02
1 A 3 b iii	Road Transport:, Heavy duty vehicles	07 07 03
1 A 3 b iv	Road Transport:, Mopeds & Motorcycles	07 07 04 and 07 07 05
1 A 3 b v	Road Transport:, Gasoline evaporation	07 07 06
1 A 3 b vi	Road Transport:, Automobile tyre and brake wear	07 07 07
1 A 3 b vii	Road Transport:, Automobile road abrasion	07 07 08
1 A 3 c	Railways	08 02
1 A 3 d i (ii)	International inland waterways	-
1 A 3 d ii	National Navigation (Shipping)	08 03 and 08 04
1 A 3 e	Pipeline compressors	-
1 A 4	Other sectors	
1 A 4 a i	Commercial / Institutional: Stationary	02 01 00
1 A 4 a ii	Commercial / Institutional: Mobile	
1 A 4 b i	Residential: Stationary plants	02 02 00
1 A 4 b ii	Residential: Household and gardening (mobile)	08 09 01
1 A 4 c i	Agriculture/Forestry/Fishing: Stationary	02 03 00
1 A 4 c ii	Agriculture/Forestry/Fishing: Off-road Vehicles and Other Machinery	08 06 and 08 07
1 A 5	Other (including Military)	
1 A 5 a	Other, Stationary (including Military)	-
1 A 5 b	Other, Mobile (Including military, land based and recreational boats)	-
1 B	Fugitive emission from Fuel	
1 B 1	Fugitive emission from Solid Fuel	
1 B 1 a	Coal Mining and Handling	-
1 B 1 b	Solid fuel transformation	-
1 B 1 c	Other fugitive emissions from solid fuel	-
1 B 2	Fugitive emission from oil and natural gas	

NFR Code	Long name	SNAP code
1 B 2 a i	Exploration Production, Transport	
1 B 2 a iv	Refining / Storage	04 01
1 B 2 a v	Distribution of oil products	05 04 and 05 05
1 B 2 a vi	Geothermal energy extraction	-
1 B 2 b	Natural gas	05 03 and 05 06
1 B 2 c	Venting and flaring	09 02 03 and 09 02 06
2 A	Mineral Products	
2 A 1	Cement Production	04 06 12
2 A 2	Lime Production	04 06 14
2 D 3 c	Asphalt Roofing	04 04 10
2 D 3 b	Road Paving with Asphalt	04 04 11
2 A 5 a	Quarrying and mining of minerals other than coal	04 06 23
2 A 5 b	Construction and demolition	04 06 24
2 A 3	Other Mineral products	04 06 13
2 B	Chemical industry	
2 B 1	Ammonia Production	04 04 03
2 B 2	Nitric Acid Production	04 04 02
2 B 10 a	Other chemical industry	04 04, 04 05
2 C	Metal production	
2 C 1	Iron and Steel Production	04 02
2 C 2	Ferroalloys Production	04 03 02
2 C 3	Aluminium Production	04 03 01
2 C 5 a	Copper Production	-
2 C 5 b	Lead Production	-
2 C 5 c	Nickel Production	-
2 C 5 d	Zinc Production	-
2 C 5 e	Other metal production	-
2 C 5 f	Storage, handling and transport of metal products	-
2 D 3 a	Domestic solvent use including fungicides	06 04 08
2 D 3 d	Coating application	06 01 00
2 D 3 e	Metal degreasing	06 02 01
2 D 3 f	Dry cleaning	06 02 02
2 D 3 g	Chemical products	06 03
2 D 3 h	Printing	06 04 03
2 H 1	Pulp and Paper	04 06 02, 04 06 03 and 04 06 04
2 H 2	Food and Drink	04 06 05, 04 06 06 and 04 06 08
2 I	Wood processing	-
2 K	Consumption of POPs and Heavy Metals (e.g. electrical and scientific equipment)	06 05 08
2 D 3 i, 2 G	Other	
3 B	Manure management	
3 B 1 a	Cattle Dairy	10 05 01
3 B 1 b	Cattle Non-Dairy	10 05 02
3 B 2	Sheep	10 05 05
3 B 4 d	Goats	-
3 B 4 e	Horses	10 05 06
3 B 4 f	Mules and Asses	-
3 B 3	Swine	10 05 03 and 10 05 04
3 B 4 g i	Laying Hens	10 05 07
3 B 4 g ii	Broilers	10 05 08
3 B 4 g iii	Turkeys	10 05 09a
3 B 4 g iv	Other Poultry	10 05 09z
3 D 1	Direct Soil Emission	

NFR Code	Long name	SNAP code
3 D 1 a	Inorganic N-fertilizers	10 01
3 D f	Use of pesticide	
3 F	FIELD BURNING OF AGRICULTURAL WASTES	-
3 G	Agriculture OTHER	10 06
5 A	SOLID WASTE DISPOSAL ON LAND	09 04 01
5 C	Waste incineration	
5 C 1 b iii	Clinical Waste Incineration	09 02 07
5 C 1 b i	Industrial Waste Incineration	09 02 02
5 C 1 d	Cremation	09 02 01
5 C e	Small Scale Waste Burning	-
5 D 1	Domestic wastewater handling	09 10 01
5 D 2	Industrial wastewater handling	09 10 02
5 D 3	Other wastewater handling (latrines)	09 10 07
Memo Items	NOT TO BE INCLUDED IN NATIONAL TOTALS	
1 A 3 a ii (ii)	Civil Aviation (Domestic, Cruise)	-
1 A 3 a i (ii)	International Aviation (Cruise)	-
1 A 3 d i (i)	International maritime Navigation	08 04 04
11 B	Forest fires	11 03

12.4. Appendix 4. Emission factors – 2017

Table A4-1 Emission factors for the year 2017

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
3	Residual fuel oil	1.A.1.a	As	24.88	mg/GJ
3	Residual fuel oil	1.A.1.a	Cr	62.2	mg/GJ
3	Residual fuel oil	1.A.1.a	Cu	24.88	mg/GJ
3	Residual fuel oil	1.A.1.a	Se	1.24	mg/GJ
3	Residual fuel oil	1.A.1.a	Zn	24.88	mg/GJ
3	Residual fuel oil	1.A.1.a	DIOX	2.5	ng/GJ
3	Residual fuel oil	1.A.1.a	Benzo(b)	505.1	µg/GJ
3	Residual fuel oil	1.A.1.a	Benzo(k)	99.03	µg/GJ
3	Residual fuel oil	1.A.1.a	Benzo(a)	116.45	µg/GJ
3	Residual fuel oil	1.A.1.a	Indeno	188.36	µg/GJ
3	Residual fuel oil	1.A.1.a	NH3	0.01	g/GJ
3	Residual fuel oil	1.A.1.a	NMVOC	3	g/GJ
6	Natural gas	1.A.1.a	DIOX	0.5	ng/GJ
6	Natural gas	1.A.1.a	NH3	0.15	g/GJ
6	Natural gas	1.A.1.a	NMVOC	4	g/GJ
6	Natural gas	1.A.1.a	Benzo(a)	0.6	µg/GJ
6	Natural gas	1.A.1.a	Benzo(b)	0.8	µg/GJ
6	Natural gas	1.A.1.a	Benzo(k)	0.8	µg/GJ
6	Natural gas	1.A.1.a	Indeno	0.8	µg/GJ
14	Gas oil	1.A.1.a	As	1.17	mg/GJ
14	Gas oil	1.A.1.a	Cr	0.47	mg/GJ
14	Gas oil	1.A.1.a	Cu	1.17	mg/GJ
14	Gas oil	1.A.1.a	Se	0.023	mg/GJ
14	Gas oil	1.A.1.a	Zn	2.34	mg/GJ
14	Gas oil	1.A.1.a	DIOX	1.5	ng/GJ
14	Gas oil	1.A.1.a	Benzo(b)	475.3	µg/GJ
14	Gas oil	1.A.1.a	Benzo(k)	93.19	µg/GJ
14	Gas oil	1.A.1.a	Benzo(a)	109.58	µg/GJ
14	Gas oil	1.A.1.a	Indeno	177.24	µg/GJ
14	Gas oil	1.A.1.a	NH3	0.01	g/GJ
14	Gas oil	1.A.1.a	NMVOC	3	g/GJ
5294	gaseous fuel	1.A.1.a	Pb	0.011	mg/GJ
5294	gaseous fuel	1.A.1.a	Se	0.058	mg/GJ
5294	gaseous fuel	1.A.1.a	Zn	0.73	mg/GJ
5294	gaseous fuel	1.A.1.a	DIOX	0.52	ng/GJ
5294	gaseous fuel	1.A.1.a	Benzo(b)	2.9	µg/GJ
5294	gaseous fuel	1.A.1.a	Benzo(k)	1.1	µg/GJ
5294	gaseous fuel	1.A.1.a	Benzo(a)	0.72	µg/GJ
5294	gaseous fuel	1.A.1.a	Indeno	1.08	µg/GJ
5294	gaseous fuel	1.A.1.a	SO2	0.67	g/GJ
5294	gaseous fuel	1.A.1.a	NOX	74	g/GJ
5294	gaseous fuel	1.A.1.a	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.1.a	CO	29	g/GJ
5294	gaseous fuel	1.A.1.a	TSP	0.78	g/GJ
5294	gaseous fuel	1.A.1.a	PM25	0.78	g/GJ
5294	gaseous fuel	1.A.1.a	PM10	0.78	g/GJ
5294	gaseous fuel	1.A.1.a	BC	0.0312	g/GJ
5294	gaseous fuel	1.A.1.a	As	0.1	mg/GJ
5294	gaseous fuel	1.A.1.a	Cd	1.8	mg/GJ
5294	gaseous fuel	1.A.1.a	Cr	0.013	mg/GJ
5294	gaseous fuel	1.A.1.a	Cu	0.0026	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5294	gaseous fuel	1.A.1.a	Hg	0.54	mg/GJ
5294	gaseous fuel	1.A.1.a	Ni	0.013	mg/GJ
5294	gaseous fuel	1.A.1.a	NH3	0.15	g/GJ
1	Plomin	1.A.1.a	NMVOC	3	g/GJ
1	Plomin	1.A.1.a	NH3	0.31	g/GJ
1	Plomin	1.A.1.a	As	2.13	mg/GJ
1	Plomin	1.A.1.a	Cr	1.55	mg/GJ
1	Plomin	1.A.1.a	Cu	3.99	mg/GJ
1	Plomin	1.A.1.a	Se	0.27	mg/GJ
1	Plomin	1.A.1.a	Zn	9.88	mg/GJ
1	Plomin	1.A.1.a	Benzo(b)	0.28	µg/GJ
1	Plomin	1.A.1.a	Benzo(k)	0.28	µg/GJ
1	Plomin	1.A.1.a	Benzo(a)	0.14	µg/GJ
1	Plomin	1.A.1.a	Indeno	0.27	µg/GJ
1	Plomin	1.A.1.a	DIOX	10	ng/GJ
1	Plomin	1.A.1.a	PCBs	170	µg/GJ
1	Plomin	1.A.1.a	HCB	0.62	µg/GJ
6158	TE-TO Zg 2017	1.A.1.a	Cd	0.164	mg/GJ
6158	TE-TO Zg 2017	1.A.1.a	Hg	1.957	mg/GJ
6158	TE-TO Zg 2017	1.A.1.a	Ni	202.438	mg/GJ
6158	TE-TO Zg 2017	1.A.1.a	Pb	15.453	mg/GJ
6158	TE-TO Zg 2017	1.A.1.a	SO2	438.48	g/GJ
6158	TE-TO Zg 2017	1.A.1.a	NOX	528.85	g/GJ
6158	TE-TO Zg 2017	1.A.1.a	CO	87.11	g/GJ
6158	TE-TO Zg 2017	1.A.1.a	TSP	29.36	g/GJ
6158	TE-TO Zg 2017	1.A.1.a	PM25	7.34	g/GJ
6158	TE-TO Zg 2017	1.A.1.a	PM10	14.68	g/GJ
6158	TE-TO Zg 2017	1.A.1.a	BC	0.2	g/GJ
6150	EL-TO Zg 2017	1.A.1.a	Cd	0	mg/GJ
6150	EL-TO Zg 2017	1.A.1.a	Hg	0.611	mg/GJ
6150	EL-TO Zg 2017	1.A.1.a	Ni	0	mg/GJ
6150	EL-TO Zg 2017	1.A.1.a	Pb	0.004	mg/GJ
6150	EL-TO Zg 2017	1.A.1.a	SO2	111.42	g/GJ
6150	EL-TO Zg 2017	1.A.1.a	NOX	543.4049	g/GJ
6150	EL-TO Zg 2017	1.A.1.a	CO	268.1597	g/GJ
6150	EL-TO Zg 2017	1.A.1.a	TSP	8.6809	g/GJ
6150	EL-TO Zg 2017	1.A.1.a	PM25	2.170225	g/GJ
6150	EL-TO Zg 2017	1.A.1.a	PM10	4.34045	g/GJ
6150	EL-TO Zg 2017	1.A.1.a	BC	0.05	g/GJ
6151	KTE Jertovec 2017	1.A.1.a	Hg	0.028	mg/GJ
6151	KTE Jertovec 2017	1.A.1.a	SO2	0	g/GJ
6151	KTE Jertovec 2017	1.A.1.a	NOX	41.53	g/GJ
6151	KTE Jertovec 2017	1.A.1.a	CO	1.57	g/GJ
6151	KTE Jertovec 2017	1.A.1.a	TSP	0	g/GJ
6151	KTE Jertovec 2017	1.A.1.a	PM25	0	g/GJ
6151	KTE Jertovec 2017	1.A.1.a	PM10	0	g/GJ
6151	KTE Jertovec 2017	1.A.1.a	Cd	0	mg/GJ
6151	KTE Jertovec 2017	1.A.1.a	Pb	0	mg/GJ
6151	KTE Jertovec 2017	1.A.1.a	Ni	0	mg/GJ
6151	KTE Jertovec 2017	1.A.1.a	BC	0	g/GJ
6157	TE Sisak 2017	1.A.1.a	Cd	0	mg/GJ
6157	TE Sisak 2017	1.A.1.a	Hg	0	mg/GJ
6157	TE Sisak 2017	1.A.1.a	BC	0	g/GJ
6157	TE Sisak 2017	1.A.1.a	Ni	0	mg/GJ
6157	TE Sisak 2017	1.A.1.a	Pb	0	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6157	TE Sisak 2017	1.A.1.a	SO2	0	g/GJ
6157	TE Sisak 2017	1.A.1.a	NOX	0	g/GJ
6157	TE Sisak 2017	1.A.1.a	CO	0	g/GJ
6157	TE Sisak 2017	1.A.1.a	TSP	0	g/GJ
6157	TE Sisak 2017	1.A.1.a	PM25	0	g/GJ
6157	TE Sisak 2017	1.A.1.a	PM10	0	g/GJ
6153	TE Plomin1-2017	1.A.1.a	Cd	0.734	mg/GJ
6153	TE Plomin1-2017	1.A.1.a	Hg	26.21	mg/GJ
6153	TE Plomin1-2017	1.A.1.a	Ni	35.64	mg/GJ
6153	TE Plomin1-2017	1.A.1.a	Pb	29.88	mg/GJ
6153	TE Plomin1-2017	1.A.1.a	SO2	882.54	g/GJ
6153	TE Plomin1-2017	1.A.1.a	NOX	675.52	g/GJ
6153	TE Plomin1-2017	1.A.1.a	CO	11.17	g/GJ
6153	TE Plomin1-2017	1.A.1.a	TSP	189.8	g/GJ
6153	TE Plomin1-2017	1.A.1.a	PM25	47.45	g/GJ
6153	TE Plomin1-2017	1.A.1.a	PM10	94.9	g/GJ
6153	TE Plomin1-2017	1.A.1.a	BC	1.04	g/GJ
6155	TE Plomin2-2017	1.A.1.a	Cd	2.212	mg/GJ
6155	TE Plomin2-2017	1.A.1.a	Hg	79	mg/GJ
6155	TE Plomin2-2017	1.A.1.a	Ni	107.44	mg/GJ
6155	TE Plomin2-2017	1.A.1.a	Pb	90.06	mg/GJ
6155	TE Plomin2-2017	1.A.1.a	SO2	168.76	g/GJ
6155	TE Plomin2-2017	1.A.1.a	NOX	825.47	g/GJ
6155	TE Plomin2-2017	1.A.1.a	CO	48.73	g/GJ
6155	TE Plomin2-2017	1.A.1.a	TSP	55.36	g/GJ
6155	TE Plomin2-2017	1.A.1.a	PM25	13.84	g/GJ
6155	TE Plomin2-2017	1.A.1.a	PM10	27.68	g/GJ
6155	TE Plomin2-2017	1.A.1.a	BC	0.61	g/GJ
6156	TE Rijeka-2017	1.A.1.a	Cd	0	g/GJ
6156	TE Rijeka-2017	1.A.1.a	Hg	0	mg/GJ
6156	TE Rijeka-2017	1.A.1.a	Ni	0	mg/GJ
6156	TE Rijeka-2017	1.A.1.a	Pb	0	mg/GJ
6156	TE Rijeka-2017	1.A.1.a	SO2	0	mg/GJ
6156	TE Rijeka-2017	1.A.1.a	NOX	0	g/GJ
6156	TE Rijeka-2017	1.A.1.a	CO	0	g/GJ
6156	TE Rijeka-2017	1.A.1.a	TSP	0	g/GJ
6156	TE Rijeka-2017	1.A.1.a	PM25	0	g/GJ
6156	TE Rijeka-2017	1.A.1.a	PM10	0	g/GJ
6156	TE Rijeka-2017	1.A.1.a	BC	0	g/GJ
6154	TE-TO Os-2017	1.A.1.a	Cd	0.016	mg/GJ
6154	TE-TO Os-2017	1.A.1.a	Hg	0.201	mg/GJ
6154	TE-TO Os-2017	1.A.1.a	Ni	19.503	mg/GJ
6154	TE-TO Os-2017	1.A.1.a	Pb	1.489	mg/GJ
6154	TE-TO Os-2017	1.A.1.a	SO2	32.59	g/GJ
6154	TE-TO Os-2017	1.A.1.a	NOX	77.51	g/GJ
6154	TE-TO Os-2017	1.A.1.a	CO	2.33	g/GJ
6154	TE-TO Os-2017	1.A.1.a	TSP	6.5	g/GJ
6154	TE-TO Os-2017	1.A.1.a	PM25	1.625	g/GJ
6154	TE-TO Os-2017	1.A.1.a	PM10	3.25	g/GJ
6154	TE-TO Os-2017	1.A.1.a	BC	0.04	g/GJ
6152	PTE Os-2017	1.A.1.a	Hg	0.028	mg/GJ
6152	PTE Os-2017	1.A.1.a	NOX	35.12	mg/GJ
6152	PTE Os-2017	1.A.1.a	CO	0.92	mg/GJ
6152	PTE Os-2017	1.A.1.a	SO2	0	mg/GJ
6152	PTE Os-2017	1.A.1.a	TSP	0.12	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6152	PTE Os-2017	1.A.1.a	PM25	0.03	g/GJ
6152	PTE Os-2017	1.A.1.a	PM10	0.06	g/GJ
6152	PTE Os-2017	1.A.1.a	Cd	0	g/GJ
6152	PTE Os-2017	1.A.1.a	Pb	0	g/GJ
6152	PTE Os-2017	1.A.1.a	Ni	0	g/GJ
6152	PTE Os-2017	1.A.1.a	BC	0.00075	g/GJ
6408	biomass	1.A.1.a	Pb	20.6	mg/GJ
6408	biomass	1.A.1.a	Se	1.2	mg/GJ
6408	biomass	1.A.1.a	Zn	181	mg/GJ
6408	biomass	1.A.1.a	DIOX	50	ng/GJ
6408	biomass	1.A.1.a	Benzo(b)	0.043	mg/GJ
6408	biomass	1.A.1.a	Benzo(k)	0.0155	mg/GJ
6408	biomass	1.A.1.a	Benzo(a)	1.12	mg/GJ
6408	biomass	1.A.1.a	Indeno	0.0374	mg/GJ
6408	biomass	1.A.1.a	NOX	81	g/GJ
6408	biomass	1.A.1.a	NMVOC	7.31	g/GJ
6408	biomass	1.A.1.a	CO	90	g/GJ
6408	biomass	1.A.1.a	TSP	172	g/GJ
6408	biomass	1.A.1.a	PM25	133	g/GJ
6408	biomass	1.A.1.a	PM10	155	g/GJ
6408	biomass	1.A.1.a	BC	4.389	g/GJ
6408	biomass	1.A.1.a	PCBs	3.5	μg/GJ
6408	biomass	1.A.1.a	HCB	5	μg/GJ
6408	biomass	1.A.1.a	As	9.46	mg/GJ
6408	biomass	1.A.1.a	Cd	1.76	mg/GJ
6408	biomass	1.A.1.a	Cr	9.03	mg/GJ
6408	biomass	1.A.1.a	Cu	21.1	mg/GJ
6408	biomass	1.A.1.a	Hg	0.56	mg/GJ
6408	biomass	1.A.1.a	Ni	14.2	mg/GJ
6408	biomass	1.A.1.a	SO2	10.8	g/GJ
6420	gas oil_2017	1.A.1.a	Pb	0.08	mg/GJ
6420	gas oil_2017	1.A.1.a	Se	0.11	mg/GJ
6420	gas oil_2017	1.A.1.a	Zn	29	mg/GJ
6420	gas oil_2017	1.A.1.a	DIOX	1.4	ng/GJ
6420	gas oil_2017	1.A.1.a	Benzo(b)	15	μg/GJ
6420	gas oil_2017	1.A.1.a	Benzo(k)	1.7	μg/GJ
6420	gas oil_2017	1.A.1.a	Benzo(a)	1.9	μg/GJ
6420	gas oil_2017	1.A.1.a	Indeno	1.5	μg/GJ
6420	gas oil_2017	1.A.1.a	SO2	40.27	g/GJ
6420	gas oil_2017	1.A.1.a	NOX	513	g/GJ
6420	gas oil_2017	1.A.1.a	NMVOC	25	g/GJ
6420	gas oil_2017	1.A.1.a	CO	66	g/GJ
6420	gas oil_2017	1.A.1.a	TSP	20	g/GJ
6420	gas oil_2017	1.A.1.a	PM25	20	g/GJ
6420	gas oil_2017	1.A.1.a	PM10	20	g/GJ
6420	gas oil_2017	1.A.1.a	BC	11.2	g/GJ
6420	gas oil_2017	1.A.1.a	As	0.03	mg/GJ
6420	gas oil_2017	1.A.1.a	Cd	0.006	mg/GJ
6420	gas oil_2017	1.A.1.a	Cr	0.2	mg/GJ
6420	gas oil_2017	1.A.1.a	Cu	0.22	mg/GJ
6420	gas oil_2017	1.A.1.a	Hg	0.12	mg/GJ
6420	gas oil_2017	1.A.1.a	Ni	0.008	mg/GJ
6420	gas oil_2017	1.A.1.a	NH3	0.01	g/GJ
6421	residual fuel_2017	1.A.1.a	Pb	0.08	mg/GJ
6421	residual fuel_2017	1.A.1.a	Se	0.11	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6421	residual fuel_2017	1.A.1.a	Zn	29	mg/GJ
6421	residual fuel_2017	1.A.1.a	DIOX	1.4	ng/GJ
6421	residual fuel_2017	1.A.1.a	Benzo(b)	15	µg/GJ
6421	residual fuel_2017	1.A.1.a	Benzo(k)	1.7	µg/GJ
6421	residual fuel_2017	1.A.1.a	Benzo(a)	1.9	µg/GJ
6421	residual fuel_2017	1.A.1.a	Indeno	1.5	µg/GJ
6421	residual fuel_2017	1.A.1.a	SO2	437.42	g/GJ
6421	residual fuel_2017	1.A.1.a	NOX	513	g/GJ
6421	residual fuel_2017	1.A.1.a	NMVOC	25	g/GJ
6421	residual fuel_2017	1.A.1.a	CO	66	g/GJ
6421	residual fuel_2017	1.A.1.a	TSP	20	g/GJ
6421	residual fuel_2017	1.A.1.a	PM25	20	g/GJ
6421	residual fuel_2017	1.A.1.a	PM10	20	g/GJ
6421	residual fuel_2017	1.A.1.a	BC	11.2	g/GJ
6421	residual fuel_2017	1.A.1.a	As	0.03	mg/GJ
6421	residual fuel_2017	1.A.1.a	Cd	0.006	mg/GJ
6421	residual fuel_2017	1.A.1.a	Cr	0.2	mg/GJ
6421	residual fuel_2017	1.A.1.a	Cu	0.22	mg/GJ
6421	residual fuel_2017	1.A.1.a	Hg	0.12	mg/GJ
6421	residual fuel_2017	1.A.1.a	Ni	0.008	mg/GJ
6421	residual fuel_2017	1.A.1.a	NH3	0.01	g/GJ
4507	Petroleum refining	1.A.1.b	As	0.343	mg/GJ
4507	Petroleum refining	1.A.1.b	Cd	0.712	mg/GJ
4507	Petroleum refining	1.A.1.b	Cr	2.74	mg/GJ
4507	Petroleum refining	1.A.1.b	Cu	2.22	mg/GJ
4507	Petroleum refining	1.A.1.b	Hg	0.086	mg/GJ
4507	Petroleum refining	1.A.1.b	Ni	3.6	mg/GJ
4507	Petroleum refining	1.A.1.b	Pb	1.79	mg/GJ
4507	Petroleum refining	1.A.1.b	Benzo(b)	1.14	µg/GJ
4507	Petroleum refining	1.A.1.b	Benzo(k)	0.631	µg/GJ
4507	Petroleum refining	1.A.1.b	Benzo(a)	0.669	µg/GJ
4507	Petroleum refining	1.A.1.b	Indeno	0.631	µg/GJ
4507	Petroleum refining	1.A.1.b	SO2	0.281	g/GJ
4507	Petroleum refining	1.A.1.b	NOX	63	g/GJ
4507	Petroleum refining	1.A.1.b	NMVOC	2.58	g/GJ
4507	Petroleum refining	1.A.1.b	CO	39.3	g/GJ
4507	Petroleum refining	1.A.1.b	TSP	0.89	g/GJ
4507	Petroleum refining	1.A.1.b	PM25	0.89	g/GJ
4507	Petroleum refining	1.A.1.b	PM10	0.89	g/GJ
4507	Petroleum refining	1.A.1.b	BC	0.1638	g/GJ
4507	Petroleum refining	1.A.1.b	Se	0.42	mg/GJ
4507	Petroleum refining	1.A.1.b	Zn	25.5	mg/GJ
5452	Natural gas	1.A.1.b	As	0.12	mg/GJ
5452	Natural gas	1.A.1.b	Cd	0.00025	mg/GJ
5452	Natural gas	1.A.1.b	Cr	0.00076	mg/GJ
5452	Natural gas	1.A.1.b	Cu	7.6E-05	mg/GJ
5452	Natural gas	1.A.1.b	Hg	0.1	mg/GJ
5452	Natural gas	1.A.1.b	Ni	0.00051	mg/GJ
5452	Natural gas	1.A.1.b	Pb	0.0015	mg/GJ
5452	Natural gas	1.A.1.b	Benzo(b)	0.84	µg/GJ
5452	Natural gas	1.A.1.b	Benzo(k)	0.84	µg/GJ
5452	Natural gas	1.A.1.b	Benzo(a)	0.56	µg/GJ
5452	Natural gas	1.A.1.b	Indeno	0.84	µg/GJ
5452	Natural gas	1.A.1.b	SO2	0.281	g/GJ
5452	Natural gas	1.A.1.b	NOX	63	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5452	Natural gas	1.A.1.b	NMVOC	2.58	g/GJ
5452	Natural gas	1.A.1.b	CO	39.3	g/GJ
5452	Natural gas	1.A.1.b	TSP	0.89	g/GJ
5452	Natural gas	1.A.1.b	PM25	0.89	g/GJ
5452	Natural gas	1.A.1.b	PM10	0.89	g/GJ
5452	Natural gas	1.A.1.b	DIOX	0.5	ng/GJ
5452	Natural gas	1.A.1.b	Se	0.0112	mg/GJ
5452	Natural gas	1.A.1.b	Zn	0.0015	mg/GJ
5452	Natural gas	1.A.1.b	BC	0.077	g/GJ
5881	Residual oil_2017	1.A.1.b	DIOX	2.5	ng/GJ
5881	Residual oil_2017	1.A.1.b	As	3.98	mg/GJ
5881	Residual oil_2017	1.A.1.b	Cd	1.2	mg/GJ
5881	Residual oil_2017	1.A.1.b	Cr	14.8	mg/GJ
5881	Residual oil_2017	1.A.1.b	Cu	11.9	mg/GJ
5881	Residual oil_2017	1.A.1.b	Hg	0.3	mg/GJ
5881	Residual oil_2017	1.A.1.b	Ni	1030	mg/GJ
5881	Residual oil_2017	1.A.1.b	Pb	4.6	mg/GJ
5881	Residual oil_2017	1.A.1.b	Benzo(b)	3.7	μg/GJ
5881	Residual oil_2017	1.A.1.b	Benzo(k)	0.2	μg/GJ
5881	Residual oil_2017	1.A.1.b	Benzo(a)	0.6	μg/GJ
5881	Residual oil_2017	1.A.1.b	Indeno	1.3	μg/GJ
5881	Residual oil_2017	1.A.1.b	SO2	437.42	g/GJ
5881	Residual oil_2017	1.A.1.b	NOX	142	g/GJ
5881	Residual oil_2017	1.A.1.b	NMVOC	2.3	g/GJ
5881	Residual oil_2017	1.A.1.b	CO	15	g/GJ
5881	Residual oil_2017	1.A.1.b	TSP	20	g/GJ
5881	Residual oil_2017	1.A.1.b	PM25	9	g/GJ
5881	Residual oil_2017	1.A.1.b	PM10	15	g/GJ
5881	Residual oil_2017	1.A.1.b	BC	0.504	g/GJ
5881	Residual oil_2017	1.A.1.b	Se	2.1	mg/GJ
5881	Residual oil_2017	1.A.1.b	Zn	49.3	mg/GJ
5427	Petroleum coke	1.A.1.b	Zn	49.3	mg/GJ
5427	Petroleum coke	1.A.1.b	DIOX	2.5	ng/GJ
5427	Petroleum coke	1.A.1.b	As	3.98	mg/GJ
5427	Petroleum coke	1.A.1.b	Cd	1.2	mg/GJ
5427	Petroleum coke	1.A.1.b	Cr	14.8	mg/GJ
5427	Petroleum coke	1.A.1.b	Cu	11.9	mg/GJ
5427	Petroleum coke	1.A.1.b	Hg	0.3	mg/GJ
5427	Petroleum coke	1.A.1.b	Ni	1030	mg/GJ
5427	Petroleum coke	1.A.1.b	Pb	4.6	mg/GJ
5427	Petroleum coke	1.A.1.b	Benzo(b)	3.7	μg/GJ
5427	Petroleum coke	1.A.1.b	Benzo(k)	0.2	μg/GJ
5427	Petroleum coke	1.A.1.b	Benzo(a)	0.6	μg/GJ
5427	Petroleum coke	1.A.1.b	Indeno	1.3	μg/GJ
5427	Petroleum coke	1.A.1.b	SO2	485	g/GJ
5427	Petroleum coke	1.A.1.b	NOX	142	g/GJ
5427	Petroleum coke	1.A.1.b	NMVOC	2.3	g/GJ
5427	Petroleum coke	1.A.1.b	CO	15	g/GJ
5427	Petroleum coke	1.A.1.b	TSP	20	g/GJ
5427	Petroleum coke	1.A.1.b	PM25	9	g/GJ
5427	Petroleum coke	1.A.1.b	PM10	15	g/GJ
5427	Petroleum coke	1.A.1.b	BC	0.504	g/GJ
5427	Petroleum coke	1.A.1.b	Se	2.1	mg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	As	0.12	mg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Cd	0.00025	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5974	1.A.1.b_GF_LPG	1.A.1.b	Cr	0.00076	mg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Cu	7.6E-05	mg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Hg	0.1	mg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Ni	0.00051	mg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Pb	0.0015	mg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Benzo(b)	0.84	µg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Benzo(k)	0.84	µg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Benzo(a)	0.56	µg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Indeno	0.84	µg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	SO2	0.281	g/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	NOX	89	g/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	NMVOC	2.6	g/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	CO	39	g/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	TSP	0.89	g/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	PM25	0.89	g/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	PM10	0.89	g/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Se	0.0112	mg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	Zn	0.0015	mg/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	BC	0.02225	g/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	DIOX	0.5	ng/GJ
5294	gaseous fuel	1.A.1.c	Pb	0.011	mg/GJ
5294	gaseous fuel	1.A.1.c	Se	0.058	mg/GJ
5294	gaseous fuel	1.A.1.c	Zn	0.73	mg/GJ
5294	gaseous fuel	1.A.1.c	DIOX	0.52	ng/GJ
5294	gaseous fuel	1.A.1.c	Benzo(b)	2.9	µg/GJ
5294	gaseous fuel	1.A.1.c	Benzo(k)	1.1	µg/GJ
5294	gaseous fuel	1.A.1.c	Benzo(a)	0.72	µg/GJ
5294	gaseous fuel	1.A.1.c	Indeno	1.08	µg/GJ
5294	gaseous fuel	1.A.1.c	SO2	0.67	g/GJ
5294	gaseous fuel	1.A.1.c	NOX	74	g/GJ
5294	gaseous fuel	1.A.1.c	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.1.c	CO	29	g/GJ
5294	gaseous fuel	1.A.1.c	TSP	0.78	g/GJ
5294	gaseous fuel	1.A.1.c	PM25	0.78	g/GJ
5294	gaseous fuel	1.A.1.c	PM10	0.78	g/GJ
5294	gaseous fuel	1.A.1.c	BC	0.0312	g/GJ
5294	gaseous fuel	1.A.1.c	As	0.1	mg/GJ
5294	gaseous fuel	1.A.1.c	Cd	1.8	mg/GJ
5294	gaseous fuel	1.A.1.c	Cr	0.013	mg/GJ
5294	gaseous fuel	1.A.1.c	Cu	0.0026	mg/GJ
5294	gaseous fuel	1.A.1.c	Hg	0.54	mg/GJ
5294	gaseous fuel	1.A.1.c	Ni	0.013	mg/GJ
5294	gaseous fuel	1.A.1.c	NH3	0.15	g/GJ
5289	Petroleum coke	1.A.2.a	Pb	0.08	mg/GJ
5289	Petroleum coke	1.A.2.a	Se	0.11	mg/GJ
5289	Petroleum coke	1.A.2.a	Zn	29	mg/GJ
5289	Petroleum coke	1.A.2.a	DIOX	1.4	ng/GJ
5289	Petroleum coke	1.A.2.a	Benzo(b)	15	µg/GJ
5289	Petroleum coke	1.A.2.a	Benzo(k)	1.7	µg/GJ
5289	Petroleum coke	1.A.2.a	Benzo(a)	1.9	µg/GJ
5289	Petroleum coke	1.A.2.a	Indeno	1.5	µg/GJ
5289	Petroleum coke	1.A.2.a	SO2	47	g/GJ
5289	Petroleum coke	1.A.2.a	NOX	513	g/GJ
5289	Petroleum coke	1.A.2.a	NMVOC	25	g/GJ
5289	Petroleum coke	1.A.2.a	CO	66	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5289	Petroleum coke	1.A.2.a	TSP	20	g/GJ
5289	Petroleum coke	1.A.2.a	PM25	20	g/GJ
5289	Petroleum coke	1.A.2.a	PM10	20	g/GJ
5289	Petroleum coke	1.A.2.a	BC	11.2	g/GJ
5289	Petroleum coke	1.A.2.a	As	0.03	mg/GJ
5289	Petroleum coke	1.A.2.a	Cd	0.006	mg/GJ
5289	Petroleum coke	1.A.2.a	Cr	0.2	mg/GJ
5289	Petroleum coke	1.A.2.a	Cu	0.22	mg/GJ
5289	Petroleum coke	1.A.2.a	Hg	0.12	mg/GJ
5289	Petroleum coke	1.A.2.a	Ni	0.008	mg/GJ
5240	Gaseous fuels	1.A.2.a	Pb	0.011	mg/GJ
5240	Gaseous fuels	1.A.2.a	Se	0.058	mg/GJ
5240	Gaseous fuels	1.A.2.a	Zn	0.73	mg/GJ
5240	Gaseous fuels	1.A.2.a	DIOX	0.52	ng/GJ
5240	Gaseous fuels	1.A.2.a	Benzo(b)	2.9	µg/GJ
5240	Gaseous fuels	1.A.2.a	Benzo(k)	1.1	µg/GJ
5240	Gaseous fuels	1.A.2.a	Benzo(a)	0.72	µg/GJ
5240	Gaseous fuels	1.A.2.a	Indeno	1.08	µg/GJ
5240	Gaseous fuels	1.A.2.a	SO2	0.67	g/GJ
5240	Gaseous fuels	1.A.2.a	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.a	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.a	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.a	TSP	0.78	g/GJ
5240	Gaseous fuels	1.A.2.a	PM25	0.78	g/GJ
5240	Gaseous fuels	1.A.2.a	PM10	0.78	g/GJ
5240	Gaseous fuels	1.A.2.a	BC	0.0312	g/GJ
5240	Gaseous fuels	1.A.2.a	As	0.1	mg/GJ
5240	Gaseous fuels	1.A.2.a	Cd	0.0009	mg/GJ
5240	Gaseous fuels	1.A.2.a	Cr	0.013	mg/GJ
5240	Gaseous fuels	1.A.2.a	Cu	0.0026	mg/GJ
5240	Gaseous fuels	1.A.2.a	Hg	0.54	mg/GJ
5240	Gaseous fuels	1.A.2.a	Ni	0.013	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	PM25	108	g/GJ
5288	Solid fuels (coals)	1.A.2.a	PM10	117	g/GJ
5288	Solid fuels (coals)	1.A.2.a	BC	6.912	g/GJ
5288	Solid fuels (coals)	1.A.2.a	PCBs	170	µg/GJ
5288	Solid fuels (coals)	1.A.2.a	HCB	0.62	µg/GJ
5288	Solid fuels (coals)	1.A.2.a	As	4	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Cd	1.8	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Cr	13.5	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Cu	17.5	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Hg	0.56	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Ni	13	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Pb	27	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Se	1.8	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Zn	200	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	DIOX	203	ng/GJ
5288	Solid fuels (coals)	1.A.2.a	Benzo(b)	58.9	µg/GJ
5288	Solid fuels (coals)	1.A.2.a	Benzo(k)	23.7	µg/GJ
5288	Solid fuels (coals)	1.A.2.a	Benzo(a)	45.5	µg/GJ
5288	Solid fuels (coals)	1.A.2.a	Indeno	18.5	µg/GJ
5288	Solid fuels (coals)	1.A.2.a	SO2	900	g/GJ
5288	Solid fuels (coals)	1.A.2.a	NOX	173	g/GJ
5288	Solid fuels (coals)	1.A.2.a	NMVOC	88.8	g/GJ
5288	Solid fuels (coals)	1.A.2.a	CO	931	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5288	Solid fuels (coals)	1.A.2.a	TSP	124	g/GJ
5287	Biomass	1.A.2.a	PM25	140	g/GJ
5287	Biomass	1.A.2.a	PM10	143	g/GJ
5287	Biomass	1.A.2.a	BC	39.2	g/GJ
5287	Biomass	1.A.2.a	PCBs	0.06	µg/GJ
5287	Biomass	1.A.2.a	HCB	5	µg/GJ
5287	Biomass	1.A.2.a	As	0.19	mg/GJ
5287	Biomass	1.A.2.a	Cd	13	mg/GJ
5287	Biomass	1.A.2.a	Cr	23	mg/GJ
5287	Biomass	1.A.2.a	Cu	6	mg/GJ
5287	Biomass	1.A.2.a	Hg	0.56	mg/GJ
5287	Biomass	1.A.2.a	Ni	2	mg/GJ
5287	Biomass	1.A.2.a	Pb	27	mg/GJ
5287	Biomass	1.A.2.a	Se	0.5	mg/GJ
5287	Biomass	1.A.2.a	Zn	512	mg/GJ
5287	Biomass	1.A.2.a	DIOX	100	ng/GJ
5287	Biomass	1.A.2.a	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.a	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.a	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.a	Indeno	4	µg/GJ
5287	Biomass	1.A.2.a	SO2	11	g/GJ
5287	Biomass	1.A.2.a	NOX	91	g/GJ
5287	Biomass	1.A.2.a	NH3	37	g/GJ
5287	Biomass	1.A.2.a	NMVOC	300	g/GJ
5287	Biomass	1.A.2.a	CO	570	g/GJ
5287	Biomass	1.A.2.a	TSP	150	g/GJ
6413	Gas oil_2017	1.A.2.a	As	4.2	mg/GJ
6413	Gas oil_2017	1.A.2.a	Cd	0.4	mg/GJ
6413	Gas oil_2017	1.A.2.a	Cr	3.1	mg/GJ
6413	Gas oil_2017	1.A.2.a	Cu	2	mg/GJ
6413	Gas oil_2017	1.A.2.a	Hg	4.4	mg/GJ
6413	Gas oil_2017	1.A.2.a	Ni	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.a	Pb	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.a	Se	1.8	mg/GJ
6413	Gas oil_2017	1.A.2.a	Zn	10.4	mg/GJ
6413	Gas oil_2017	1.A.2.a	DIOX	9.07	ng/GJ
6413	Gas oil_2017	1.A.2.a	Benzo(b)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.a	Benzo(k)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.a	Benzo(a)	32.2	µg/GJ
6413	Gas oil_2017	1.A.2.a	Indeno	967.03	µg/GJ
6413	Gas oil_2017	1.A.2.a	SO2	40.27	g/GJ
6413	Gas oil_2017	1.A.2.a	NOX	155	g/GJ
6413	Gas oil_2017	1.A.2.a	NH3	0.31	g/GJ
6413	Gas oil_2017	1.A.2.a	NMVOC	20	g/GJ
6413	Gas oil_2017	1.A.2.a	CO	73	g/GJ
6413	Gas oil_2017	1.A.2.a	TSP	100	g/GJ
6413	Gas oil_2017	1.A.2.a	PM25	35	g/GJ
6413	Gas oil_2017	1.A.2.a	PM10	60	g/GJ
6413	Gas oil_2017	1.A.2.a	HCB	0.62	µg/GJ
6413	Gas oil_2017	1.A.2.a	PCBs	170	µg/GJ
6411	LF-HFO_2017	1.A.2.a	Pb	0.08	mg/GJ
6411	LF-HFO_2017	1.A.2.a	Se	0.11	mg/GJ
6411	LF-HFO_2017	1.A.2.a	Zn	29	mg/GJ
6411	LF-HFO_2017	1.A.2.a	DIOX	1.4	ng/GJ
6411	LF-HFO_2017	1.A.2.a	Benzo(b)	15	µg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6411	LF-HFO_2017	1.A.2.a	Benzo(k)	1.7	µg/GJ
6411	LF-HFO_2017	1.A.2.a	Benzo(a)	1.9	µg/GJ
6411	LF-HFO_2017	1.A.2.a	Indeno	1.5	µg/GJ
6411	LF-HFO_2017	1.A.2.a	SO2	437.42	g/GJ
6411	LF-HFO_2017	1.A.2.a	NOX	513	g/GJ
6411	LF-HFO_2017	1.A.2.a	NMVOC	25	g/GJ
6411	LF-HFO_2017	1.A.2.a	CO	66	g/GJ
6411	LF-HFO_2017	1.A.2.a	TSP	20	g/GJ
6411	LF-HFO_2017	1.A.2.a	PM25	20	g/GJ
6411	LF-HFO_2017	1.A.2.a	PM10	20	g/GJ
6411	LF-HFO_2017	1.A.2.a	BC	11.2	g/GJ
6411	LF-HFO_2017	1.A.2.a	As	0.03	mg/GJ
6411	LF-HFO_2017	1.A.2.a	Cd	0.006	mg/GJ
6411	LF-HFO_2017	1.A.2.a	Cr	0.2	mg/GJ
6411	LF-HFO_2017	1.A.2.a	Cu	0.22	mg/GJ
6411	LF-HFO_2017	1.A.2.a	Hg	0.12	mg/GJ
6411	LF-HFO_2017	1.A.2.a	Ni	0.008	mg/GJ
5287	Biomass	1.A.2.b	PM25	140	g/GJ
5287	Biomass	1.A.2.b	PM10	143	g/GJ
5287	Biomass	1.A.2.b	BC	39.2	g/GJ
5287	Biomass	1.A.2.b	PCBs	0.06	µg/GJ
5287	Biomass	1.A.2.b	HCB	5	µg/GJ
5287	Biomass	1.A.2.b	As	0.19	mg/GJ
5287	Biomass	1.A.2.b	Cd	13	mg/GJ
5287	Biomass	1.A.2.b	Cr	23	mg/GJ
5287	Biomass	1.A.2.b	Cu	6	mg/GJ
5287	Biomass	1.A.2.b	Hg	0.56	mg/GJ
5287	Biomass	1.A.2.b	Ni	2	mg/GJ
5287	Biomass	1.A.2.b	Pb	27	mg/GJ
5287	Biomass	1.A.2.b	Se	0.5	mg/GJ
5287	Biomass	1.A.2.b	Zn	512	mg/GJ
5287	Biomass	1.A.2.b	DIOX	100	ng/GJ
5287	Biomass	1.A.2.b	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.b	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.b	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.b	Indeno	4	µg/GJ
5287	Biomass	1.A.2.b	SO2	11	g/GJ
5287	Biomass	1.A.2.b	NOX	91	g/GJ
5287	Biomass	1.A.2.b	NH3	37	g/GJ
5287	Biomass	1.A.2.b	NMVOC	300	g/GJ
5287	Biomass	1.A.2.b	CO	570	g/GJ
5287	Biomass	1.A.2.b	TSP	150	g/GJ
5240	Gaseous fuels	1.A.2.b	Pb	0.011	mg/GJ
5240	Gaseous fuels	1.A.2.b	Se	0.058	mg/GJ
5240	Gaseous fuels	1.A.2.b	Zn	0.73	mg/GJ
5240	Gaseous fuels	1.A.2.b	DIOX	0.52	ng/GJ
5240	Gaseous fuels	1.A.2.b	Benzo(b)	2.9	µg/GJ
5240	Gaseous fuels	1.A.2.b	Benzo(k)	1.1	µg/GJ
5240	Gaseous fuels	1.A.2.b	Benzo(a)	0.72	µg/GJ
5240	Gaseous fuels	1.A.2.b	Indeno	1.08	µg/GJ
5240	Gaseous fuels	1.A.2.b	SO2	0.67	g/GJ
5240	Gaseous fuels	1.A.2.b	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.b	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.b	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.b	TSP	0.78	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5240	Gaseous fuels	1.A.2.b	PM25	0.78	g/GJ
5240	Gaseous fuels	1.A.2.b	PM10	0.78	g/GJ
5240	Gaseous fuels	1.A.2.b	BC	0.0312	g/GJ
5240	Gaseous fuels	1.A.2.b	As	0.1	mg/GJ
5240	Gaseous fuels	1.A.2.b	Cd	0.0009	mg/GJ
5240	Gaseous fuels	1.A.2.b	Cr	0.013	mg/GJ
5240	Gaseous fuels	1.A.2.b	Cu	0.0026	mg/GJ
5240	Gaseous fuels	1.A.2.b	Hg	0.54	mg/GJ
5240	Gaseous fuels	1.A.2.b	Ni	0.013	mg/GJ
6413	Gas oil_2017	1.A.2.b	As	4.2	mg/GJ
6413	Gas oil_2017	1.A.2.b	Cd	0.4	mg/GJ
6413	Gas oil_2017	1.A.2.b	Cr	3.1	mg/GJ
6413	Gas oil_2017	1.A.2.b	Cu	2	mg/GJ
6413	Gas oil_2017	1.A.2.b	Hg	4.4	mg/GJ
6413	Gas oil_2017	1.A.2.b	Ni	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.b	Pb	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.b	Se	1.8	mg/GJ
6413	Gas oil_2017	1.A.2.b	Zn	10.4	mg/GJ
6413	Gas oil_2017	1.A.2.b	DIOX	9.07	ng/GJ
6413	Gas oil_2017	1.A.2.b	Benzo(b)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.b	Benzo(k)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.b	Benzo(a)	32.2	µg/GJ
6413	Gas oil_2017	1.A.2.b	Indeno	967.03	µg/GJ
6413	Gas oil_2017	1.A.2.b	SO2	40.27	g/GJ
6413	Gas oil_2017	1.A.2.b	NOX	155	mg/GJ
6413	Gas oil_2017	1.A.2.b	NH3	0.31	ng/GJ
6413	Gas oil_2017	1.A.2.b	NMVOC	20	g/GJ
6413	Gas oil_2017	1.A.2.b	CO	73	g/GJ
6413	Gas oil_2017	1.A.2.b	TSP	100	g/GJ
6413	Gas oil_2017	1.A.2.b	PM25	35	g/GJ
6413	Gas oil_2017	1.A.2.b	PM10	60	g/GJ
6413	Gas oil_2017	1.A.2.b	HCB	0.62	µg/GJ
6413	Gas oil_2017	1.A.2.b	PCBs	170	µg/GJ
6411	LF-HFO_2017	1.A.2.b	Pb	0.08	mg/GJ
6411	LF-HFO_2017	1.A.2.b	Se	0.11	mg/GJ
6411	LF-HFO_2017	1.A.2.b	Zn	29	mg/GJ
6411	LF-HFO_2017	1.A.2.b	DIOX	1.4	ng/GJ
6411	LF-HFO_2017	1.A.2.b	Benzo(b)	15	µg/GJ
6411	LF-HFO_2017	1.A.2.b	Benzo(k)	1.7	µg/GJ
6411	LF-HFO_2017	1.A.2.b	Benzo(a)	1.9	µg/GJ
6411	LF-HFO_2017	1.A.2.b	Indeno	1.5	µg/GJ
6411	LF-HFO_2017	1.A.2.b	SO2	437.42	g/GJ
6411	LF-HFO_2017	1.A.2.b	NOX	513	mg/GJ
6411	LF-HFO_2017	1.A.2.b	NMVOC	25	ng/GJ
6411	LF-HFO_2017	1.A.2.b	CO	66	g/GJ
6411	LF-HFO_2017	1.A.2.b	TSP	20	g/GJ
6411	LF-HFO_2017	1.A.2.b	PM25	20	g/GJ
6411	LF-HFO_2017	1.A.2.b	PM10	20	g/GJ
6411	LF-HFO_2017	1.A.2.b	BC	11.2	g/GJ
6411	LF-HFO_2017	1.A.2.b	As	0.03	mg/GJ
6411	LF-HFO_2017	1.A.2.b	Cd	0.006	mg/GJ
6411	LF-HFO_2017	1.A.2.b	Cr	0.2	mg/GJ
6411	LF-HFO_2017	1.A.2.b	Cu	0.22	mg/GJ
6411	LF-HFO_2017	1.A.2.b	Hg	0.12	mg/GJ
6411	LF-HFO_2017	1.A.2.b	Ni	0.008	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
3700	1.A.2.a_203A	1.A.2.c	As	24.88	mg/GJ
3700	1.A.2.a_203A	1.A.2.c	Cd	24.88	mg/GJ
3700	1.A.2.a_203A	1.A.2.c	Cr	62.2	mg/GJ
3700	1.A.2.a_203A	1.A.2.c	Cu	24.88	mg/GJ
3700	1.A.2.a_203A	1.A.2.c	Hg	0	mg/GJ
3700	1.A.2.a_203A	1.A.2.c	Ni	870.86	mg/GJ
3700	1.A.2.a_203A	1.A.2.c	Pb	32.35	mg/GJ
3700	1.A.2.a_203A	1.A.2.c	Se	1.24	mg/GJ
3700	1.A.2.a_203A	1.A.2.c	Zn	24.88	mg/GJ
3700	1.A.2.a_203A	1.A.2.c	DIOX	2.5	ng/GJ
3700	1.A.2.a_203A	1.A.2.c	Benzo(b)	45.04	µg/GJ
3700	1.A.2.a_203A	1.A.2.c	Benzo(k)	70.17	µg/GJ
3700	1.A.2.a_203A	1.A.2.c	Benzo(a)	85.34	µg/GJ
3700	1.A.2.a_203A	1.A.2.c	Indeno	170.19	µg/GJ
3700	1.A.2.a_203A	1.A.2.c	NMVOC	3	g/GJ
3701	1.A.2.a_301A	1.A.2.c	Hg	0.61	mg/GJ
3701	1.A.2.a_301A	1.A.2.c	DIOX	0.03	DIOX [g]
3701	1.A.2.a_301A	1.A.2.c	NMVOC	7	g/GJ
5240	Gaseous fuels	1.A.2.c	Pb	0.011	mg/GJ
5240	Gaseous fuels	1.A.2.c	Se	0.058	mg/GJ
5240	Gaseous fuels	1.A.2.c	Zn	0.73	mg/GJ
5240	Gaseous fuels	1.A.2.c	DIOX	0.52	ng/GJ
5240	Gaseous fuels	1.A.2.c	Benzo(b)	2.9	µg/GJ
5240	Gaseous fuels	1.A.2.c	Benzo(k)	1.1	µg/GJ
5240	Gaseous fuels	1.A.2.c	Benzo(a)	0.72	µg/GJ
5240	Gaseous fuels	1.A.2.c	Indeno	1.08	µg/GJ
5240	Gaseous fuels	1.A.2.c	SO2	0.67	g/GJ
5240	Gaseous fuels	1.A.2.c	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.c	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.c	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.c	TSP	0.78	g/GJ
5240	Gaseous fuels	1.A.2.c	PM25	0.78	g/GJ
5240	Gaseous fuels	1.A.2.c	PM10	0.78	g/GJ
5240	Gaseous fuels	1.A.2.c	BC	0.0312	g/GJ
5240	Gaseous fuels	1.A.2.c	As	0.1	mg/GJ
5240	Gaseous fuels	1.A.2.c	Cd	0.0009	mg/GJ
5240	Gaseous fuels	1.A.2.c	Cr	0.013	mg/GJ
5240	Gaseous fuels	1.A.2.c	Cu	0.0026	mg/GJ
5240	Gaseous fuels	1.A.2.c	Hg	0.54	mg/GJ
5240	Gaseous fuels	1.A.2.c	Ni	0.013	mg/GJ
5287	Biomass	1.A.2.c	PM25	140	g/GJ
5287	Biomass	1.A.2.c	PM10	143	g/GJ
5287	Biomass	1.A.2.c	BC	39.2	g/GJ
5287	Biomass	1.A.2.c	PCBs	0.06	µg/GJ
5287	Biomass	1.A.2.c	HCB	5	µg/GJ
5287	Biomass	1.A.2.c	As	0.19	mg/GJ
5287	Biomass	1.A.2.c	Cd	13	mg/GJ
5287	Biomass	1.A.2.c	Cr	23	mg/GJ
5287	Biomass	1.A.2.c	Cu	6	mg/GJ
5287	Biomass	1.A.2.c	Hg	0.56	mg/GJ
5287	Biomass	1.A.2.c	Ni	2	mg/GJ
5287	Biomass	1.A.2.c	Pb	27	mg/GJ
5287	Biomass	1.A.2.c	Se	0.5	mg/GJ
5287	Biomass	1.A.2.c	Zn	512	mg/GJ
5287	Biomass	1.A.2.c	DIOX	100	ng/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5287	Biomass	1.A.2.c	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.c	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.c	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.c	Indeno	4	µg/GJ
5287	Biomass	1.A.2.c	SO2	11	g/GJ
5287	Biomass	1.A.2.c	NOX	91	g/GJ
5287	Biomass	1.A.2.c	NH3	37	g/GJ
5287	Biomass	1.A.2.c	NMVOC	300	g/GJ
5287	Biomass	1.A.2.c	CO	570	g/GJ
5287	Biomass	1.A.2.c	TSP	150	g/GJ
6161	Petrokemija	1.A.2.c	SO2	45	SO2 [Gg]
6161	Petrokemija	1.A.2.c	NOX	179.83	NOX [Gg]
6161	Petrokemija	1.A.2.c	CO	2.1	CO [Gg]
6413	Gas oil_2017	1.A.2.c	As	4.2	mg/GJ
6413	Gas oil_2017	1.A.2.c	Cd	0.4	mg/GJ
6413	Gas oil_2017	1.A.2.c	Cr	3.1	mg/GJ
6413	Gas oil_2017	1.A.2.c	Cu	2	mg/GJ
6413	Gas oil_2017	1.A.2.c	Hg	4.4	mg/GJ
6413	Gas oil_2017	1.A.2.c	Ni	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.c	Pb	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.c	Se	1.8	mg/GJ
6413	Gas oil_2017	1.A.2.c	Zn	10.4	mg/GJ
6413	Gas oil_2017	1.A.2.c	DIOX	9.07	ng/GJ
6413	Gas oil_2017	1.A.2.c	Benzo(b)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.c	Benzo(k)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.c	Benzo(a)	32.2	µg/GJ
6413	Gas oil_2017	1.A.2.c	Indeno	967.03	µg/GJ
6413	Gas oil_2017	1.A.2.c	SO2	40.27	g/GJ
6413	Gas oil_2017	1.A.2.c	NOX	155	g/GJ
6413	Gas oil_2017	1.A.2.c	NH3	0.31	g/GJ
6413	Gas oil_2017	1.A.2.c	NMVOC	20	g/GJ
6413	Gas oil_2017	1.A.2.c	CO	73	g/GJ
6413	Gas oil_2017	1.A.2.c	TSP	100	g/GJ
6413	Gas oil_2017	1.A.2.c	PM25	35	g/GJ
6413	Gas oil_2017	1.A.2.c	PM10	60	g/GJ
6413	Gas oil_2017	1.A.2.c	HCB	0.62	µg/GJ
6413	Gas oil_2017	1.A.2.c	PCBs	170	µg/GJ
6411	LF-HFO_2017	1.A.2.c	Pb	0.08	mg/GJ
6411	LF-HFO_2017	1.A.2.c	Se	0.11	mg/GJ
6411	LF-HFO_2017	1.A.2.c	Zn	29	mg/GJ
6411	LF-HFO_2017	1.A.2.c	DIOX	1.4	ng/GJ
6411	LF-HFO_2017	1.A.2.c	Benzo(b)	15	µg/GJ
6411	LF-HFO_2017	1.A.2.c	Benzo(k)	1.7	µg/GJ
6411	LF-HFO_2017	1.A.2.c	Benzo(a)	1.9	µg/GJ
6411	LF-HFO_2017	1.A.2.c	Indeno	1.5	µg/GJ
6411	LF-HFO_2017	1.A.2.c	SO2	437.42	g/GJ
6411	LF-HFO_2017	1.A.2.c	NOX	513	g/GJ
6411	LF-HFO_2017	1.A.2.c	NMVOC	25	g/GJ
6411	LF-HFO_2017	1.A.2.c	CO	66	g/GJ
6411	LF-HFO_2017	1.A.2.c	TSP	20	g/GJ
6411	LF-HFO_2017	1.A.2.c	PM25	20	g/GJ
6411	LF-HFO_2017	1.A.2.c	PM10	20	g/GJ
6411	LF-HFO_2017	1.A.2.c	BC	11.2	g/GJ
6411	LF-HFO_2017	1.A.2.c	As	0.03	mg/GJ
6411	LF-HFO_2017	1.A.2.c	Cd	0.006	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6411	LF-HFO_2017	1.A.2.c	Cr	0.2	mg/GJ
6411	LF-HFO_2017	1.A.2.c	Cu	0.22	mg/GJ
6411	LF-HFO_2017	1.A.2.c	Hg	0.12	mg/GJ
6411	LF-HFO_2017	1.A.2.c	Ni	0.008	mg/GJ
5240	Gaseous fuels	1.A.2.d	Pb	0.011	mg/GJ
5240	Gaseous fuels	1.A.2.d	Se	0.058	mg/GJ
5240	Gaseous fuels	1.A.2.d	Zn	0.73	mg/GJ
5240	Gaseous fuels	1.A.2.d	DIOX	0.52	ng/GJ
5240	Gaseous fuels	1.A.2.d	Benzo(b)	2.9	µg/GJ
5240	Gaseous fuels	1.A.2.d	Benzo(k)	1.1	µg/GJ
5240	Gaseous fuels	1.A.2.d	Benzo(a)	0.72	µg/GJ
5240	Gaseous fuels	1.A.2.d	Indeno	1.08	µg/GJ
5240	Gaseous fuels	1.A.2.d	SO2	0.67	g/GJ
5240	Gaseous fuels	1.A.2.d	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.d	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.d	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.d	TSP	0.78	g/GJ
5240	Gaseous fuels	1.A.2.d	PM25	0.78	g/GJ
5240	Gaseous fuels	1.A.2.d	PM10	0.78	g/GJ
5240	Gaseous fuels	1.A.2.d	BC	0.0312	g/GJ
5240	Gaseous fuels	1.A.2.d	As	0.1	mg/GJ
5240	Gaseous fuels	1.A.2.d	Cd	0.0009	mg/GJ
5240	Gaseous fuels	1.A.2.d	Cr	0.013	mg/GJ
5240	Gaseous fuels	1.A.2.d	Cu	0.0026	mg/GJ
5240	Gaseous fuels	1.A.2.d	Hg	0.54	mg/GJ
5240	Gaseous fuels	1.A.2.d	Ni	0.013	mg/GJ
5287	Biomass	1.A.2.d	PM25	140	g/GJ
5287	Biomass	1.A.2.d	PM10	143	g/GJ
5287	Biomass	1.A.2.d	BC	39.2	g/GJ
5287	Biomass	1.A.2.d	PCBs	0.06	µg/GJ
5287	Biomass	1.A.2.d	HCB	5	µg/GJ
5287	Biomass	1.A.2.d	As	0.19	mg/GJ
5287	Biomass	1.A.2.d	Cd	13	mg/GJ
5287	Biomass	1.A.2.d	Cr	23	mg/GJ
5287	Biomass	1.A.2.d	Cu	6	mg/GJ
5287	Biomass	1.A.2.d	Hg	0.56	mg/GJ
5287	Biomass	1.A.2.d	Ni	2	mg/GJ
5287	Biomass	1.A.2.d	Pb	27	mg/GJ
5287	Biomass	1.A.2.d	Se	0.5	mg/GJ
5287	Biomass	1.A.2.d	Zn	512	mg/GJ
5287	Biomass	1.A.2.d	DIOX	100	ng/GJ
5287	Biomass	1.A.2.d	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.d	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.d	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.d	Indeno	4	µg/GJ
5287	Biomass	1.A.2.d	SO2	11	g/GJ
5287	Biomass	1.A.2.d	NOX	91	g/GJ
5287	Biomass	1.A.2.d	NH3	37	g/GJ
5287	Biomass	1.A.2.d	NMVOC	300	g/GJ
5287	Biomass	1.A.2.d	CO	570	g/GJ
5287	Biomass	1.A.2.d	TSP	150	g/GJ
6413	Gas oil_2017	1.A.2.d	As	4.2	mg/GJ
6413	Gas oil_2017	1.A.2.d	Cd	0.4	mg/GJ
6413	Gas oil_2017	1.A.2.d	Cr	3.1	mg/GJ
6413	Gas oil_2017	1.A.2.d	Cu	2	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6413	Gas oil_2017	1.A.2.d	Hg	4.4	mg/GJ
6413	Gas oil_2017	1.A.2.d	Ni	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.d	Pb	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.d	Se	1.8	mg/GJ
6413	Gas oil_2017	1.A.2.d	Zn	10.4	mg/GJ
6413	Gas oil_2017	1.A.2.d	DIOX	9.07	ng/GJ
6413	Gas oil_2017	1.A.2.d	Benzo(b)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.d	Benzo(k)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.d	Benzo(a)	32.2	µg/GJ
6413	Gas oil_2017	1.A.2.d	Indeno	967.03	µg/GJ
6413	Gas oil_2017	1.A.2.d	SO2	40.27	g/GJ
6413	Gas oil_2017	1.A.2.d	NOX	155	g/GJ
6413	Gas oil_2017	1.A.2.d	NH3	0.31	g/GJ
6413	Gas oil_2017	1.A.2.d	NMVOC	20	g/GJ
6413	Gas oil_2017	1.A.2.d	CO	73	g/GJ
6413	Gas oil_2017	1.A.2.d	TSP	100	g/GJ
6413	Gas oil_2017	1.A.2.d	PM25	35	g/GJ
6413	Gas oil_2017	1.A.2.d	PM10	60	g/GJ
6413	Gas oil_2017	1.A.2.d	HCB	0.62	µg/GJ
6413	Gas oil_2017	1.A.2.d	PCBs	170	µg/GJ
6411	LF-HFO_2017	1.A.2.d	Pb	0.08	mg/GJ
6411	LF-HFO_2017	1.A.2.d	Se	0.11	mg/GJ
6411	LF-HFO_2017	1.A.2.d	Zn	29	mg/GJ
6411	LF-HFO_2017	1.A.2.d	DIOX	1.4	ng/GJ
6411	LF-HFO_2017	1.A.2.d	Benzo(b)	15	µg/GJ
6411	LF-HFO_2017	1.A.2.d	Benzo(k)	1.7	µg/GJ
6411	LF-HFO_2017	1.A.2.d	Benzo(a)	1.9	µg/GJ
6411	LF-HFO_2017	1.A.2.d	Indeno	1.5	µg/GJ
6411	LF-HFO_2017	1.A.2.d	SO2	437.42	g/GJ
6411	LF-HFO_2017	1.A.2.d	NOX	513	g/GJ
6411	LF-HFO_2017	1.A.2.d	NMVOC	25	g/GJ
6411	LF-HFO_2017	1.A.2.d	CO	66	g/GJ
6411	LF-HFO_2017	1.A.2.d	TSP	20	g/GJ
6411	LF-HFO_2017	1.A.2.d	PM25	20	g/GJ
6411	LF-HFO_2017	1.A.2.d	PM10	20	g/GJ
6411	LF-HFO_2017	1.A.2.d	BC	11.2	g/GJ
6411	LF-HFO_2017	1.A.2.d	As	0.03	mg/GJ
6411	LF-HFO_2017	1.A.2.d	Cd	0.006	mg/GJ
6411	LF-HFO_2017	1.A.2.d	Cr	0.2	mg/GJ
6411	LF-HFO_2017	1.A.2.d	Cu	0.22	mg/GJ
6411	LF-HFO_2017	1.A.2.d	Hg	0.12	mg/GJ
6411	LF-HFO_2017	1.A.2.d	Ni	0.008	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	PM25	108	g/GJ
5288	Solid fuels (coals)	1.A.2.e	PM10	117	g/GJ
5288	Solid fuels (coals)	1.A.2.e	BC	6.912	g/GJ
5288	Solid fuels (coals)	1.A.2.e	PCBs	170	g/GJ
5288	Solid fuels (coals)	1.A.2.e	HCB	0.62	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	As	4	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Cd	1.8	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Cr	13.5	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Cu	17.5	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Hg	0.56	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Ni	13	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Pb	27	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Se	1.8	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5288	Solid fuels (coals)	1.A.2.e	Zn	200	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	DIOX	203	ng/GJ
5288	Solid fuels (coals)	1.A.2.e	Benzo(b)	58.9	µg/GJ
5288	Solid fuels (coals)	1.A.2.e	Benzo(k)	23.7	µg/GJ
5288	Solid fuels (coals)	1.A.2.e	Benzo(a)	45.5	µg/GJ
5288	Solid fuels (coals)	1.A.2.e	Indeno	18.5	µg/GJ
5288	Solid fuels (coals)	1.A.2.e	SO2	900	g/GJ
5288	Solid fuels (coals)	1.A.2.e	NOX	173	g/GJ
5288	Solid fuels (coals)	1.A.2.e	NMVOC	88.8	g/GJ
5288	Solid fuels (coals)	1.A.2.e	CO	931	g/GJ
5288	Solid fuels (coals)	1.A.2.e	TSP	124	g/GJ
5240	Gaseous fuels	1.A.2.e	Pb	0.011	mg/GJ
5240	Gaseous fuels	1.A.2.e	Se	0.058	mg/GJ
5240	Gaseous fuels	1.A.2.e	Zn	0.73	mg/GJ
5240	Gaseous fuels	1.A.2.e	DIOX	0.52	ng/GJ
5240	Gaseous fuels	1.A.2.e	Benzo(b)	2.9	µg/GJ
5240	Gaseous fuels	1.A.2.e	Benzo(k)	1.1	µg/GJ
5240	Gaseous fuels	1.A.2.e	Benzo(a)	0.72	µg/GJ
5240	Gaseous fuels	1.A.2.e	Indeno	1.08	µg/GJ
5240	Gaseous fuels	1.A.2.e	SO2	0.67	g/GJ
5240	Gaseous fuels	1.A.2.e	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.e	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.e	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.e	TSP	0.78	g/GJ
5240	Gaseous fuels	1.A.2.e	PM25	0.78	g/GJ
5240	Gaseous fuels	1.A.2.e	PM10	0.78	g/GJ
5240	Gaseous fuels	1.A.2.e	BC	0.0312	g/GJ
5240	Gaseous fuels	1.A.2.e	As	0.1	mg/GJ
5240	Gaseous fuels	1.A.2.e	Cd	0.0009	mg/GJ
5240	Gaseous fuels	1.A.2.e	Cr	0.013	mg/GJ
5240	Gaseous fuels	1.A.2.e	Cu	0.0026	mg/GJ
5240	Gaseous fuels	1.A.2.e	Hg	0.54	mg/GJ
5240	Gaseous fuels	1.A.2.e	Ni	0.013	mg/GJ
5287	Biomass	1.A.2.e	PM25	140	g/GJ
5287	Biomass	1.A.2.e	PM10	143	g/GJ
5287	Biomass	1.A.2.e	BC	39.2	g/GJ
5287	Biomass	1.A.2.e	PCBs	0.06	µg/GJ
5287	Biomass	1.A.2.e	HCB	5	µg/GJ
5287	Biomass	1.A.2.e	As	0.19	mg/GJ
5287	Biomass	1.A.2.e	Cd	13	mg/GJ
5287	Biomass	1.A.2.e	Cr	23	mg/GJ
5287	Biomass	1.A.2.e	Cu	6	mg/GJ
5287	Biomass	1.A.2.e	Hg	0.56	mg/GJ
5287	Biomass	1.A.2.e	Ni	2	mg/GJ
5287	Biomass	1.A.2.e	Pb	27	mg/GJ
5287	Biomass	1.A.2.e	Se	0.5	mg/GJ
5287	Biomass	1.A.2.e	Zn	512	mg/GJ
5287	Biomass	1.A.2.e	DIOX	100	ng/GJ
5287	Biomass	1.A.2.e	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.e	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.e	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.e	Indeno	4	µg/GJ
5287	Biomass	1.A.2.e	SO2	11	g/GJ
5287	Biomass	1.A.2.e	NOX	91	g/GJ
5287	Biomass	1.A.2.e	NH3	37	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5287	Biomass	1.A.2.e	NMVOC	300	g/GJ
5287	Biomass	1.A.2.e	CO	570	g/GJ
5287	Biomass	1.A.2.e	TSP	150	g/GJ
6413	Gas oil_2017	1.A.2.e	As	4.2	mg/GJ
6413	Gas oil_2017	1.A.2.e	Cd	0.4	mg/GJ
6413	Gas oil_2017	1.A.2.e	Cr	3.1	mg/GJ
6413	Gas oil_2017	1.A.2.e	Cu	2	mg/GJ
6413	Gas oil_2017	1.A.2.e	Hg	4.4	mg/GJ
6413	Gas oil_2017	1.A.2.e	Ni	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.e	Pb	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.e	Se	1.8	mg/GJ
6413	Gas oil_2017	1.A.2.e	Zn	10.4	mg/GJ
6413	Gas oil_2017	1.A.2.e	DIOX	9.07	ng/GJ
6413	Gas oil_2017	1.A.2.e	Benzo(b)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.e	Benzo(k)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.e	Benzo(a)	32.2	µg/GJ
6413	Gas oil_2017	1.A.2.e	Indeno	967.03	µg/GJ
6413	Gas oil_2017	1.A.2.e	SO2	40.27	g/GJ
6413	Gas oil_2017	1.A.2.e	NOX	155	g/GJ
6413	Gas oil_2017	1.A.2.e	NH3	0.31	g/GJ
6413	Gas oil_2017	1.A.2.e	NMVOC	20	g/GJ
6413	Gas oil_2017	1.A.2.e	CO	73	g/GJ
6413	Gas oil_2017	1.A.2.e	TSP	100	g/GJ
6413	Gas oil_2017	1.A.2.e	PM25	35	g/GJ
6413	Gas oil_2017	1.A.2.e	PM10	60	g/GJ
6413	Gas oil_2017	1.A.2.e	HCB	0.62	µg/GJ
6413	Gas oil_2017	1.A.2.e	PCBs	170	µg/GJ
6411	LF-HFO_2017	1.A.2.e	Pb	0.08	mg/GJ
6411	LF-HFO_2017	1.A.2.e	Se	0.11	mg/GJ
6411	LF-HFO_2017	1.A.2.e	Zn	29	mg/GJ
6411	LF-HFO_2017	1.A.2.e	DIOX	1.4	ng/GJ
6411	LF-HFO_2017	1.A.2.e	Benzo(b)	15	µg/GJ
6411	LF-HFO_2017	1.A.2.e	Benzo(k)	1.7	µg/GJ
6411	LF-HFO_2017	1.A.2.e	Benzo(a)	1.9	µg/GJ
6411	LF-HFO_2017	1.A.2.e	Indeno	1.5	µg/GJ
6411	LF-HFO_2017	1.A.2.e	SO2	437.42	g/GJ
6411	LF-HFO_2017	1.A.2.e	NOX	513	g/GJ
6411	LF-HFO_2017	1.A.2.e	NMVOC	25	g/GJ
6411	LF-HFO_2017	1.A.2.e	CO	66	g/GJ
6411	LF-HFO_2017	1.A.2.e	TSP	20	g/GJ
6411	LF-HFO_2017	1.A.2.e	PM25	20	g/GJ
6411	LF-HFO_2017	1.A.2.e	PM10	20	g/GJ
6411	LF-HFO_2017	1.A.2.e	BC	11.2	g/GJ
6411	LF-HFO_2017	1.A.2.e	As	0.03	mg/GJ
6411	LF-HFO_2017	1.A.2.e	Cd	0.006	mg/GJ
6411	LF-HFO_2017	1.A.2.e	Cr	0.2	mg/GJ
6411	LF-HFO_2017	1.A.2.e	Cu	0.22	mg/GJ
6411	LF-HFO_2017	1.A.2.e	Hg	0.12	mg/GJ
6411	LF-HFO_2017	1.A.2.e	Ni	0.008	mg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	As	4	mg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Cd	1.8	mg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Cr	13.5	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
4833	coke oven coke from browe coal	1.A.2.f.1	Cu	17.5	mg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Hg	7.9	mg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Ni	13	mg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Pb	134	mg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Se	1.8	mg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Zn	200	mg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	DIOX	203	ng/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	HCB	0.62	µg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	PCBs	170	µg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Benzo(a)	45.5	µg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Benzo(b)	58.9	µg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Benzo(k)	23.7	g/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Indeno	18.5	g/GJ
4834	natural gas	1.A.2.f.1	As	0.09	mg/GJ
4834	natural gas	1.A.2.f.1	Cd	0.5	mg/GJ
4834	natural gas	1.A.2.f.1	Cr	0.7	mg/GJ
4834	natural gas	1.A.2.f.1	Cu	0.4	mg/GJ
4834	natural gas	1.A.2.f.1	Hg	0.2	mg/GJ
4834	natural gas	1.A.2.f.1	Ni	1	mg/GJ
4834	natural gas	1.A.2.f.1	Pb	0.2	mg/GJ
4834	natural gas	1.A.2.f.1	Se	0.01	mg/GJ
4834	natural gas	1.A.2.f.1	Zn	14	mg/GJ
4834	natural gas	1.A.2.f.1	DIOX	2	ng/GJ
4834	natural gas	1.A.2.f.1	Benzo(a)	0.6	µg/GJ
4834	natural gas	1.A.2.f.1	Benzo(b)	0.8	µg/GJ
4834	natural gas	1.A.2.f.1	Benzo(k)	0.8	µg/GJ
4834	natural gas	1.A.2.f.1	Indeno	0.8	µg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	As	0.09	mg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Cd	0.5	mg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Cr	0.7	mg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Cu	0.4	mg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Hg	0.2	mg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Ni	1	mg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Pb	0.2	mg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Se	0.01	mg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Zn	14	mg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	DIOX	2	ng/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Benzo(a)	0.6	µg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Benzo(b)	0.8	µg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Benzo(k)	0.8	µg/GJ
4948	derived gas - gas oil (ELLU)	1.A.2.f.1	Indeno	0.8	µg/GJ
5240	Gaseous fuels	1.A.2.f.1	Pb	0.011	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5240	Gaseous fuels	1.A.2.f.1	Se	0.058	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Zn	0.73	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	DIOX	0.52	ng/GJ
5240	Gaseous fuels	1.A.2.f.1	Benzo(b)	2.9	µg/GJ
5240	Gaseous fuels	1.A.2.f.1	Benzo(k)	1.1	µg/GJ
5240	Gaseous fuels	1.A.2.f.1	Benzo(a)	0.72	µg/GJ
5240	Gaseous fuels	1.A.2.f.1	Indeno	1.08	µg/GJ
5240	Gaseous fuels	1.A.2.f.1	SO2	0.67	g/GJ
5240	Gaseous fuels	1.A.2.f.1	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.f.1	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.f.1	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.f.1	TSP	0.78	g/GJ
5240	Gaseous fuels	1.A.2.f.1	PM25	0.78	g/GJ
5240	Gaseous fuels	1.A.2.f.1	PM10	0.78	g/GJ
5240	Gaseous fuels	1.A.2.f.1	BC	0.0312	g/GJ
5240	Gaseous fuels	1.A.2.f.1	As	0.1	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Cd	0.0009	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Cr	0.013	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Cu	0.0026	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Hg	0.54	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Ni	0.013	mg/GJ
5287	Biomass	1.A.2.f.1	PM25	140	g/GJ
5287	Biomass	1.A.2.f.1	PM10	143	g/GJ
5287	Biomass	1.A.2.f.1	BC	39.2	g/GJ
5287	Biomass	1.A.2.f.1	PCBs	0.06	µg/GJ
5287	Biomass	1.A.2.f.1	HCB	5	µg/GJ
5287	Biomass	1.A.2.f.1	As	0.19	mg/GJ
5287	Biomass	1.A.2.f.1	Cd	13	mg/GJ
5287	Biomass	1.A.2.f.1	Cr	23	mg/GJ
5287	Biomass	1.A.2.f.1	Cu	6	mg/GJ
5287	Biomass	1.A.2.f.1	Hg	0.56	mg/GJ
5287	Biomass	1.A.2.f.1	Ni	2	mg/GJ
5287	Biomass	1.A.2.f.1	Pb	27	mg/GJ
5287	Biomass	1.A.2.f.1	Se	0.5	mg/GJ
5287	Biomass	1.A.2.f.1	Zn	512	mg/GJ
5287	Biomass	1.A.2.f.1	DIOX	100	ng/GJ
5287	Biomass	1.A.2.f.1	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.f.1	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.f.1	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.f.1	Indeno	4	µg/GJ
5287	Biomass	1.A.2.f.1	SO2	11	g/GJ
5287	Biomass	1.A.2.f.1	NOX	91	g/GJ
5287	Biomass	1.A.2.f.1	NH3	37	g/GJ
5287	Biomass	1.A.2.f.1	NMVOC	300	g/GJ
5287	Biomass	1.A.2.f.1	CO	570	g/GJ
5287	Biomass	1.A.2.f.1	TSP	150	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	PM25	108	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	PM10	117	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	BC	6.912	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	PCBs	170	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	HCB	0.62	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	As	4	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Cd	1.8	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Cr	13.5	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Cu	17.5	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5288	Solid fuels (coals)	1.A.2.f.1	Hg	0.56	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Ni	13	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Pb	27	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Se	1.8	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Zn	200	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	DIOX	203	ng/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Benzo(b)	58.9	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Benzo(k)	23.7	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Benzo(a)	45.5	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Indeno	18.5	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	SO2	900	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	NOX	173	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	NMVOC	88.8	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	CO	931	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	TSP	124	g/GJ
5289	Petroleum coke	1.A.2.f.1	Pb	0.08	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Se	0.11	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Zn	29	mg/GJ
5289	Petroleum coke	1.A.2.f.1	DIOX	1.4	ng/GJ
5289	Petroleum coke	1.A.2.f.1	Benzo(b)	15	µg/GJ
5289	Petroleum coke	1.A.2.f.1	Benzo(k)	1.7	µg/GJ
5289	Petroleum coke	1.A.2.f.1	Benzo(a)	1.9	µg/GJ
5289	Petroleum coke	1.A.2.f.1	Indeno	1.5	µg/GJ
5289	Petroleum coke	1.A.2.f.1	SO2	47	g/GJ
5289	Petroleum coke	1.A.2.f.1	NOX	513	g/GJ
5289	Petroleum coke	1.A.2.f.1	NMVOC	25	g/GJ
5289	Petroleum coke	1.A.2.f.1	CO	66	g/GJ
5289	Petroleum coke	1.A.2.f.1	TSP	20	g/GJ
5289	Petroleum coke	1.A.2.f.1	PM25	20	g/GJ
5289	Petroleum coke	1.A.2.f.1	PM10	20	g/GJ
5289	Petroleum coke	1.A.2.f.1	BC	11.2	g/GJ
5289	Petroleum coke	1.A.2.f.1	As	0.03	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Cd	0.006	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Cr	0.2	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Cu	0.22	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Hg	0.12	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Ni	0.008	mg/GJ
6789	Rockwool_2017	1.A.2.f.1	NOX	86.06	t DE
6789	Rockwool_2017	1.A.2.f.1	CO	3.31	t DE
6789	Rockwool_2017	1.A.2.f.1	SO2	389.1	t DE
6413	Gas oil_2017	1.A.2.f.1	As	4.2	mg/GJ
6413	Gas oil_2017	1.A.2.f.1	Cd	0.4	mg/GJ
6413	Gas oil_2017	1.A.2.f.1	Cr	3.1	mg/GJ
6413	Gas oil_2017	1.A.2.f.1	Cu	2	mg/GJ
6413	Gas oil_2017	1.A.2.f.1	Hg	4.4	mg/GJ
6413	Gas oil_2017	1.A.2.f.1	Ni	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.f.1	Pb	3.9	mg/GJ
6413	Gas oil_2017	1.A.2.f.1	Se	1.8	mg/GJ
6413	Gas oil_2017	1.A.2.f.1	Zn	10.4	mg/GJ
6413	Gas oil_2017	1.A.2.f.1	DIOX	9.07	ng/GJ
6413	Gas oil_2017	1.A.2.f.1	Benzo(b)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.f.1	Benzo(k)	1285.71	µg/GJ
6413	Gas oil_2017	1.A.2.f.1	Benzo(a)	32.2	µg/GJ
6413	Gas oil_2017	1.A.2.f.1	Indeno	967.03	µg/GJ
6413	Gas oil_2017	1.A.2.f.1	SO2	40.27	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6413	Gas oil_2017	1.A.2.f.1	NOX	155	g/GJ
6413	Gas oil_2017	1.A.2.f.1	NH3	0.31	g/GJ
6413	Gas oil_2017	1.A.2.f.1	NMVOC	20	g/GJ
6413	Gas oil_2017	1.A.2.f.1	CO	73	g/GJ
6413	Gas oil_2017	1.A.2.f.1	TSP	100	g/GJ
6413	Gas oil_2017	1.A.2.f.1	PM25	35	g/GJ
6413	Gas oil_2017	1.A.2.f.1	PM10	60	g/GJ
6413	Gas oil_2017	1.A.2.f.1	HCB	0.62	µg/GJ
6413	Gas oil_2017	1.A.2.f.1	PCBs	170	µg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Pb	0.08	mg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Se	0.11	mg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Zn	29	mg/GJ
6411	LF-HFO_2017	1.A.2.f.1	DIOX	1.4	ng/GJ
6411	LF-HFO_2017	1.A.2.f.1	Benzo(b)	15	µg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Benzo(k)	1.7	µg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Benzo(a)	1.9	µg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Indeno	1.5	µg/GJ
6411	LF-HFO_2017	1.A.2.f.1	SO2	437.42	g/GJ
6411	LF-HFO_2017	1.A.2.f.1	NOX	513	g/GJ
6411	LF-HFO_2017	1.A.2.f.1	NMVOC	25	g/GJ
6411	LF-HFO_2017	1.A.2.f.1	CO	66	g/GJ
6411	LF-HFO_2017	1.A.2.f.1	TSP	20	g/GJ
6411	LF-HFO_2017	1.A.2.f.1	PM25	20	g/GJ
6411	LF-HFO_2017	1.A.2.f.1	PM10	20	g/GJ
6411	LF-HFO_2017	1.A.2.f.1	BC	11.2	g/GJ
6411	LF-HFO_2017	1.A.2.f.1	As	0.03	mg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Cd	0.006	mg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Cr	0.2	mg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Cu	0.22	mg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Hg	0.12	mg/GJ
6411	LF-HFO_2017	1.A.2.f.1	Ni	0.008	mg/GJ
6417	Cemex_2017	1.A.2.f.1	Cd	0.008	g/t
6417	Cemex_2017	1.A.2.f.1	Hg	0.049	g/t
6417	Cemex_2017	1.A.2.f.1	As	0.0265	g/t
6417	Cemex_2017	1.A.2.f.1	Cr	0.041	g/t
6417	Cemex_2017	1.A.2.f.1	Cu	0.0647	g/t
6417	Cemex_2017	1.A.2.f.1	Ni	0.049	g/t
6417	Cemex_2017	1.A.2.f.1	Se	0.0253	g/t
6417	Cemex_2017	1.A.2.f.1	Zn	0.424	g/t
6417	Cemex_2017	1.A.2.f.1	HCB	4.6	µg/t
6417	Cemex_2017	1.A.2.f.1	PCBs	103	µg/t
6417	Cemex_2017	1.A.2.f.1	DIOX	4.1	ng/t
6417	Cemex_2017	1.A.2.f.1	Benzo(a)	6.5E-05	g/t
6417	Cemex_2017	1.A.2.f.1	Benzo(b)	0.00028	g/t
6417	Cemex_2017	1.A.2.f.1	Benzo(k)	7.7E-05	g/t
6417	Cemex_2017	1.A.2.f.1	Indeno	4.3E-05	g/t
6417	Cemex_2017	1.A.2.f.1	SO2	22.86992	g/t
6417	Cemex_2017	1.A.2.f.1	NOX	1217.64395	g/t
6417	Cemex_2017	1.A.2.f.1	NMVOC	18	g/t
6417	Cemex_2017	1.A.2.f.1	CO	3721.35304	g/t
6417	Cemex_2017	1.A.2.f.1	Pb	0.098	g/t
6414	Našicecement_2017	1.A.2.f.1	Pb	0.098	g/t
6414	Našicecement_2017	1.A.2.f.1	Cd	0.008	g/t
6414	Našicecement_2017	1.A.2.f.1	Hg	0.049	g/t
6414	Našicecement_2017	1.A.2.f.1	As	0.0265	g/t

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6414	Našicecement_2017	1.A.2.f.1	Cr	0.041	g/t
6414	Našicecement_2017	1.A.2.f.1	Cu	0.0647	g/t
6414	Našicecement_2017	1.A.2.f.1	Ni	0.049	g/t
6414	Našicecement_2017	1.A.2.f.1	Se	0.0253	g/t
6414	Našicecement_2017	1.A.2.f.1	Zn	0.424	g/t
6414	Našicecement_2017	1.A.2.f.1	HCB	4.6	µg/t
6414	Našicecement_2017	1.A.2.f.1	PCBs	103	µg/t
6414	Našicecement_2017	1.A.2.f.1	DIOX	4.1	ng/t
6414	Našicecement_2017	1.A.2.f.1	Benzo(a)	6.5E-05	g/t
6414	Našicecement_2017	1.A.2.f.1	Benzo(b)	0.00028	g/t
6414	Našicecement_2017	1.A.2.f.1	Benzo(k)	7.7E-05	g/t
6414	Našicecement_2017	1.A.2.f.1	Indeno	4.3E-05	g/t
6414	Našicecement_2017	1.A.2.f.1	SO2	409.06	g/t
6414	Našicecement_2017	1.A.2.f.1	NOX	636.79319	g/t
6414	Našicecement_2017	1.A.2.f.1	NMVOC	123.951	g/t
6414	Našicecement_2017	1.A.2.f.1	CO	1177.71635	g/t
6418	Holcim_2017	1.A.2.f.1	Cd	0.008	g/t
6418	Holcim_2017	1.A.2.f.1	Hg	0.049	g/t
6418	Holcim_2017	1.A.2.f.1	As	0.0265	g/t
6418	Holcim_2017	1.A.2.f.1	Cr	0.041	g/t
6418	Holcim_2017	1.A.2.f.1	Cu	0.0647	g/t
6418	Holcim_2017	1.A.2.f.1	Ni	0.049	g/t
6418	Holcim_2017	1.A.2.f.1	Se	0.0253	g/t
6418	Holcim_2017	1.A.2.f.1	Zn	0.424	g/t
6418	Holcim_2017	1.A.2.f.1	HCB	4.6	µg/t
6418	Holcim_2017	1.A.2.f.1	PCBs	103	µg/t
6418	Holcim_2017	1.A.2.f.1	DIOX	4.1	ng/t
6418	Holcim_2017	1.A.2.f.1	Benzo(a)	6.5E-05	g/t
6418	Holcim_2017	1.A.2.f.1	Benzo(b)	0.00028	g/t
6418	Holcim_2017	1.A.2.f.1	Benzo(k)	7.7E-05	g/t
6418	Holcim_2017	1.A.2.f.1	Indeno	4.3E-05	g/t
6418	Holcim_2017	1.A.2.f.1	SO2	48.853	g/t
6418	Holcim_2017	1.A.2.f.1	NOX	397.219	g/t
6418	Holcim_2017	1.A.2.f.1	NMVOC	54.3	g/t
6418	Holcim_2017	1.A.2.f.1	CO	617.5715	g/t
6418	Holcim_2017	1.A.2.f.1	Pb	0.098	g/t
6419	CALUCEM_2017	1.A.2.f.1	Pb	0.098	g/t
6419	CALUCEM_2017	1.A.2.f.1	Cd	0.008	g/t
6419	CALUCEM_2017	1.A.2.f.1	Hg	0.049	g/t
6419	CALUCEM_2017	1.A.2.f.1	As	0.0265	g/t
6419	CALUCEM_2017	1.A.2.f.1	Cr	0.041	g/t
6419	CALUCEM_2017	1.A.2.f.1	Cu	0.0647	g/t
6419	CALUCEM_2017	1.A.2.f.1	Ni	0.049	g/t
6419	CALUCEM_2017	1.A.2.f.1	Se	0.0253	g/t
6419	CALUCEM_2017	1.A.2.f.1	Zn	0.424	g/t
6419	CALUCEM_2017	1.A.2.f.1	HCB	4.6	µg/t
6419	CALUCEM_2017	1.A.2.f.1	PCBs	103	µg/t
6419	CALUCEM_2017	1.A.2.f.1	DIOX	4.1	ng/t
6419	CALUCEM_2017	1.A.2.f.1	Benzo(a)	6.5E-05	g/t
6419	CALUCEM_2017	1.A.2.f.1	Benzo(b)	0.00028	g/t
6419	CALUCEM_2017	1.A.2.f.1	Benzo(k)	7.7E-05	g/t
6419	CALUCEM_2017	1.A.2.f.1	Indeno	4.3E-05	g/t
6419	CALUCEM_2017	1.A.2.f.1	SO2	175.642	g/t
6419	CALUCEM_2017	1.A.2.f.1	NOX	281.583	g/t
6419	CALUCEM_2017	1.A.2.f.1	NMVOC	18	g/t

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6419	CALUCEM_2017	1.A.2.f.1	CO	1956.011	g/t
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	PM25	1.93	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	PM10	1.93	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Benzo(k)	1.7	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Indeno	1.5	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	DIOX	1.4	ng/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Hg	0.12	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	As	0.03	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Cd	0.006	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Cr	0.2	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Cu	0.22	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Ni	0.008	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Pb	0.08	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Se	0.11	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Zn	29	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Benzo(b)	15	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	BC	0.93	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	Benzo(a)	1.9	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	SO2	16.11	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	NOX	228.86	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	NMVOC	13.79	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	CO	325.36	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.1.1	TSP	1.93	g/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	PM25	1.93	g/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	PM10	1.93	g/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Benzo(k)	1.7	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Indeno	1.5	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	DIOX	1.4	ng/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Hg	0.12	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	As	0.03	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Cd	0.006	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Cr	0.2	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Cu	0.22	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Ni	0.008	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Pb	0.08	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Se	0.11	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Zn	29	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Benzo(b)	15	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	BC	0.93	g/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	Benzo(a)	1.9	mg/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	SO2	16.11	g/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	NOX	228.86	g/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	NMVOC	13.79	g/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	CO	325.36	g/GJ
6166	1.A.3.a_kerosene_LTO2_2017	1.A.3.a.1.1	TSP	1.93	g/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Hg	0.12	g/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	As	0.03	g/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Cd	0.006	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Cr	0.2	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Cu	0.22	ng/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Ni	0.008	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Pb	0.08	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Se	0.11	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Zn	29	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Benzo(b)	15	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Benzo(a)	1.9	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	SO2	16.11	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	NOX	291.17	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	NMVOC	11.37	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	CO	25.02	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	TSP	4.55	g/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	PM25	4.55	mg/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	PM10	4.55	g/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Benzo(k)	1.7	g/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	Indeno	1.5	g/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	DIOX	1.4	g/GJ
6167	1.A.3.a_kerosene_cruise2_2017	1.A.3.a.1.2	BC	2.18	g/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Cu	60.555	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Ni	0.77	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Pb	6140.899	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Se	0.072	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Zn	71.602	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Benzo(b)	226.509	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Benzo(a)	137.657	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	SO2	0.269	g/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	NOX	89.706	g/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	NH3	7.04	g/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	NMVOC	426.105	g/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	CO	26911.864	g/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	TSP	6.099	g/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	PM25	3.626	g/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	PM10	6.099	g/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Benzo(k)	92.881	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Indeno	261.54	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	DIOX	0.006	ng/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Cd	0.276	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	Cr	3.008	mg/GJ
6168	1.A.3.a_gasoline_2017	1.A.3.a.2.1	BC	0.544	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	PM25	1.93	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	PM10	1.93	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Benzo(k)	1.7	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Indeno	1.5	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	DIOX	1.4	ng/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Hg	0.12	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	As	0.03	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Cd	0.006	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Cr	0.2	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Cu	0.22	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Ni	0.008	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Pb	0.08	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Se	0.11	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Zn	29	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Benzo(b)	15	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	BC	0.93	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	Benzo(a)	1.9	mg/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	SO2	16.11	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	NOX	228.86	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	NMVOC	13.79	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	CO	325.36	g/GJ
6165	1.A.3.a_kerosene_LTO1_2017	1.A.3.a.2.1	TSP	1.93	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Benzo(b)	15	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Benzo(a)	1.9	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	SO2	16.11	g/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	NOX	234.3	g/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	NMVOC	2.27	g/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	CO	45.5	g/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	TSP	4.55	g/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	PM25	4.55	g/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	PM10	4.55	g/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Benzo(k)	1.7	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Indeno	1.5	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	DIOX	1.4	ng/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Hg	0.12	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	As	0.03	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Cd	0.006	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Cr	0.2	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Cu	0.22	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Ni	0.008	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Pb	0.08	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Se	0.11	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	Zn	29	mg/GJ
6096	1.A.3.a_kerosene_cruise1_2017	1.A.3.a.2.2	BC	2.18	g/GJ
4725	1.A.3.b.7-Passenger Cars	1.A.3.b.7	TSP	15	g/k(veh*km)
4725	1.A.3.b.7-Passenger Cars	1.A.3.b.7	PM25	4.1	g/k(veh*km)
4725	1.A.3.b.7-Passenger Cars	1.A.3.b.7	PM10	7.5	g/k(veh*km)
4726	1.A.3.b.7-Two-wheelers	1.A.3.b.7	TSP	6	g/k(veh*km)
4726	1.A.3.b.7-Two-wheelers	1.A.3.b.7	PM25	1.6	g/k(veh*km)
4726	1.A.3.b.7-Two-wheelers	1.A.3.b.7	PM10	3	g/k(veh*km)
4723	1.A.3.b.7-Heavy Duty Vehicles	1.A.3.b.7	TSP	76	g/k(veh*km)
4723	1.A.3.b.7-Heavy Duty Vehicles	1.A.3.b.7	PM25	20.5	g/k(veh*km)
4723	1.A.3.b.7-Heavy Duty Vehicles	1.A.3.b.7	PM10	38	g/k(veh*km)
4724	1.A.3.b.7-Light Duty Vehicles	1.A.3.b.7	TSP	15	g/k(veh*km)
4724	1.A.3.b.7-Light Duty Vehicles	1.A.3.b.7	PM25	4.1	g/k(veh*km)
4724	1.A.3.b.7-Light Duty Vehicles	1.A.3.b.7	PM10	7.5	g/k(veh*km)
6425	1.A.3.c_diesel-2017	1.A.3.c	Ni	1.64	mg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	NH3	0.16	g/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Pb	0.08	mg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Se	0.23	mg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Zn	23.41	mg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	DIOX	1.4	ng/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Benzo(b)	1.17	mg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Benzo(k)	1.7	µg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Benzo(a)	0.7	mg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Indeno	1.5	µg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	SO2	0.3	g/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	NOX	1226.88	g/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	NMVOC	108.87	g/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	CO	250.53	g/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	TSP	35.59	g/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	PM25	32.08	g/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	PM10	33.72	g/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	BC	0.21	g/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	As	0.03	mg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Cd	0.23	mg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Cr	1.17	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6425	1.A.3.c_diesel-2017	1.A.3.c	Cu	39.8	mg/GJ
6425	1.A.3.c_diesel-2017	1.A.3.c	Hg	0.12	mg/GJ
5980	International navigation	1.A.3.d.1	As	0.94	mg/GJ
5980	International navigation	1.A.3.d.1	Hg	0.7	mg/GJ
5980	International navigation	1.A.3.d.1	Pb	3.04	mg/GJ
5980	International navigation	1.A.3.d.1	HCB	1.87	µg/GJ
5980	International navigation	1.A.3.d.1	DIOX	3.04	µg/GJ
5980	International navigation	1.A.3.d.1	PCBs	0.89	ng/GJ
5980	International navigation	1.A.3.d.1	Cd	0.234	mg/GJ
5980	International navigation	1.A.3.d.1	Cr	1.171	mg/GJ
5980	International navigation	1.A.3.d.1	Cu	20.604	mg/GJ
5980	International navigation	1.A.3.d.1	Ni	23.414	mg/GJ
5980	International navigation	1.A.3.d.1	Se	2.341	mg/GJ
5980	International navigation	1.A.3.d.1	Zn	28.096	mg/GJ
5980	International navigation	1.A.3.d.1	Benzo(b)	1170.686	µg/GJ
5980	International navigation	1.A.3.d.1	Benzo(a)	702.412	µg/GJ
5980	International navigation	1.A.3.d.1	SO2	46.83	g/GJ
5980	International navigation	1.A.3.d.1	NOX	1837.98	g/GJ
5980	International navigation	1.A.3.d.1	NH3	0.164	g/GJ
5980	International navigation	1.A.3.d.1	NMVOC	65.56	g/GJ
5980	International navigation	1.A.3.d.1	CO	173.26	g/GJ
5980	International navigation	1.A.3.d.1	TSP	35.12	g/GJ
5980	International navigation	1.A.3.d.1	PM10	35.12	g/GJ
5980	International navigation	1.A.3.d.1	PM25	32.78	g/GJ
5980	International navigation	1.A.3.d.1	BC	0.102	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	As	0.94	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Cd	0.234	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Cr	1.171	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Cu	39.803	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Ni	1.639	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Se	0.234	ng/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Zn	23.414	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Benzo(b)	1170.686	µg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Benzo(a)	702.412	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	SO2	0.3	µg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	NOX	899.09	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	NH3	163.9	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	NMVOC	174.43	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	CO	463.59	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	TSP	107.7	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	PM10	107.7	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	PM25	107.7	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Hg	0.7	g/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	Pb	3.04	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	HCB	1.87	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	DIOX	3.04	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	PCBs	8.9	mg/GJ
6426	1.A.3.d.2_diesel_2017	1.A.3.d.2	BC	0.59	mg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	Pb	3.04	mg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	HCB	1.87	µg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	DIOX	3.04	ng/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	PCBs	0.89	µg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	As	0.94	mg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	Cd	0.234	mg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	Cr	1.171	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	Cu	20.604	mg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	Ni	23.414	mg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	Se	2.341	mg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	BC	0.59	g/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	Zn	28.096	mg/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	SO2	0.3	g/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	NOX	899.09	g/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	NH3	0.164	g/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	NMVOC	174.43	g/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	CO	463.59	g/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	TSP	107.7	g/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	PM10	107.7	g/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	PM25	107.7	g/GJ
6427	1.A.3.d.ii_gas oil/diesel_2017	1.A.3.d.2	Hg	0.7	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Hg	0.5	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Pb	4.48	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	HCB	3.48	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	PCBs	14.18	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	DIOX	11.69	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Cd	0.5	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Cr	17.91	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Cu	31.1	µg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Ni	796.22	µg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Se	5.23	g/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Zn	29.86	g/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Benzo(b)	1244.091	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	Benzo(a)	746.454	g/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	SO2	969.33	g/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	NOX	1973.13	g/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	NH3	0.174	g/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	NMVOC	67.18	g/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	CO	184.13	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	TSP	154.27	mg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	PM10	154.27	µg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	PM25	139.34	ng/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	BC	0.167	µg/GJ
6436	1.A.3.d.ii_ fuel oil_2017	1.A.3.d.2	As	16.92	g/GJ
5294	gaseous fuel	1.A.4.a.1	Pb	0.011	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Se	0.058	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Zn	0.73	mg/GJ
5294	gaseous fuel	1.A.4.a.1	DIOX	0.52	ng/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(b)	2.9	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(k)	1.1	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(a)	0.72	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Indeno	1.08	µg/GJ
5294	gaseous fuel	1.A.4.a.1	SO2	0.67	g/GJ
5294	gaseous fuel	1.A.4.a.1	NOX	74	g/GJ
5294	gaseous fuel	1.A.4.a.1	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.4.a.1	CO	29	g/GJ
5294	gaseous fuel	1.A.4.a.1	TSP	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM25	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM10	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	BC	0.0312	g/GJ
5294	gaseous fuel	1.A.4.a.1	As	0.1	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cd	1.8	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5294	gaseous fuel	1.A.4.a.1	Cr	0.013	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cu	0.0026	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Hg	0.54	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Ni	0.013	mg/GJ
5294	gaseous fuel	1.A.4.a.1	NH3	0.15	g/GJ
5294	gaseous fuel	1.A.4.a.1	Pb	0.011	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Se	0.058	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Zn	0.73	mg/GJ
5294	gaseous fuel	1.A.4.a.1	DIOX	0.52	ng/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(b)	2.9	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(k)	1.1	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(a)	0.72	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Indeno	1.08	µg/GJ
5294	gaseous fuel	1.A.4.a.1	SO2	0.67	g/GJ
5294	gaseous fuel	1.A.4.a.1	NOX	74	g/GJ
5294	gaseous fuel	1.A.4.a.1	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.4.a.1	CO	29	g/GJ
5294	gaseous fuel	1.A.4.a.1	TSP	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM25	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM10	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	BC	0.0312	g/GJ
5294	gaseous fuel	1.A.4.a.1	As	0.1	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cd	1.8	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cr	0.013	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cu	0.0026	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Hg	0.54	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Ni	0.013	mg/GJ
5294	gaseous fuel	1.A.4.a.1	NH3	0.15	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	Pb	134	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Se	1.8	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Zn	200	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	DIOX	203	ng/GJ
5290	sub-bituminous coal	1.A.4.a.1	Benzo(b)	58.9	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Benzo(k)	23.7	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Benzo(a)	45.5	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Indeno	18.5	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	SO2	2469.14	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	NOX	173	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	NH3	0.3	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	NMVOC	88.8	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	CO	931	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	TSP	124	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	PM25	108	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	PM10	117	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	BC	6.912	g/GJ
5290	sub-bituminous coal	1.A.4.a.1	PCBs	170	µg/GJ
5290	sub-bituminous coal	1.A.4.a.1	HCB	0.62	µg/GJ
5290	sub-bituminous coal	1.A.4.a.1	As	4	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Cd	1.8	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Cr	13.5	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Cu	17.5	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Hg	7.9	mg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Ni	13	mg/GJ
5291	lignit	1.A.4.a.1	Pb	134	mg/GJ
5291	lignit	1.A.4.a.1	Se	1.8	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5291	lignit	1.A.4.a.1	Zn	200	mg/GJ
5291	lignit	1.A.4.a.1	DIOX	203	ng/GJ
5291	lignit	1.A.4.a.1	Benzo(b)	58.9	mg/GJ
5291	lignit	1.A.4.a.1	Benzo(k)	23.7	mg/GJ
5291	lignit	1.A.4.a.1	Benzo(a)	45.5	mg/GJ
5291	lignit	1.A.4.a.1	Indeno	18.5	mg/GJ
5291	lignit	1.A.4.a.1	SO2	1648.35	g/GJ
5291	lignit	1.A.4.a.1	NOX	173	g/GJ
5291	lignit	1.A.4.a.1	NH3	0.3	g/GJ
5291	lignit	1.A.4.a.1	NMVOC	88.8	g/GJ
5291	lignit	1.A.4.a.1	CO	931	g/GJ
5291	lignit	1.A.4.a.1	TSP	124	g/GJ
5291	lignit	1.A.4.a.1	PM25	108	g/GJ
5291	lignit	1.A.4.a.1	PM10	117	g/GJ
5291	lignit	1.A.4.a.1	BC	6.912	g/GJ
5291	lignit	1.A.4.a.1	PCBs	170	µg/GJ
5291	lignit	1.A.4.a.1	HCB	0.62	µg/GJ
5291	lignit	1.A.4.a.1	As	4	mg/GJ
5291	lignit	1.A.4.a.1	Cd	1.8	mg/GJ
5291	lignit	1.A.4.a.1	Cr	13.5	mg/GJ
5291	lignit	1.A.4.a.1	Cu	17.5	mg/GJ
5291	lignit	1.A.4.a.1	Hg	7.9	mg/GJ
5291	lignit	1.A.4.a.1	Ni	13	mg/GJ
5295	biomass	1.A.4.a.1	Pb	27	mg/GJ
5295	biomass	1.A.4.a.1	Se	0.5	mg/GJ
5295	biomass	1.A.4.a.1	Zn	512	mg/GJ
5295	biomass	1.A.4.a.1	DIOX	100	ng/GJ
5295	biomass	1.A.4.a.1	Benzo(b)	16	mg/GJ
5295	biomass	1.A.4.a.1	Benzo(k)	5	mg/GJ
5295	biomass	1.A.4.a.1	Benzo(a)	10	mg/GJ
5295	biomass	1.A.4.a.1	Indeno	4	mg/GJ
5295	biomass	1.A.4.a.1	SO2	11	g/GJ
5295	biomass	1.A.4.a.1	NOX	91	g/GJ
5295	biomass	1.A.4.a.1	NH3	37	g/GJ
5295	biomass	1.A.4.a.1	NMVOC	300	g/GJ
5295	biomass	1.A.4.a.1	CO	570	g/GJ
5295	biomass	1.A.4.a.1	TSP	150	g/GJ
5295	biomass	1.A.4.a.1	PM25	140	g/GJ
5295	biomass	1.A.4.a.1	PM10	143	g/GJ
5295	biomass	1.A.4.a.1	BC	39.2	g/GJ
5295	biomass	1.A.4.a.1	PCBs	0.06	µg/GJ
5295	biomass	1.A.4.a.1	HCB	5	µg/GJ
5295	biomass	1.A.4.a.1	As	0.19	mg/GJ
5295	biomass	1.A.4.a.1	Cd	13	mg/GJ
5295	biomass	1.A.4.a.1	Cr	23	mg/GJ
5295	biomass	1.A.4.a.1	Cu	6	mg/GJ
5295	biomass	1.A.4.a.1	Hg	0.56	mg/GJ
5295	biomass	1.A.4.a.1	Ni	2	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Pb	0.011	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Se	0.058	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Zn	0.73	mg/GJ
5294	gaseous fuel	1.A.4.a.1	DIOX	0.52	ng/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(b)	2.9	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(k)	1.1	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(a)	0.72	µg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5294	gaseous fuel	1.A.4.a.1	Indeno	1.08	µg/GJ
5294	gaseous fuel	1.A.4.a.1	SO2	0.67	g/GJ
5294	gaseous fuel	1.A.4.a.1	NOX	74	g/GJ
5294	gaseous fuel	1.A.4.a.1	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.4.a.1	CO	29	g/GJ
5294	gaseous fuel	1.A.4.a.1	TSP	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM25	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM10	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	BC	0.0312	g/GJ
5294	gaseous fuel	1.A.4.a.1	As	0.1	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cd	1.8	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cr	0.013	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cu	0.0026	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Hg	0.54	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Ni	0.013	mg/GJ
5294	gaseous fuel	1.A.4.a.1	NH3	0.15	g/GJ
5294	gaseous fuel	1.A.4.a.1	Pb	0.011	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Se	0.058	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Zn	0.73	mg/GJ
5294	gaseous fuel	1.A.4.a.1	DIOX	0.52	ng/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(b)	2.9	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(k)	1.1	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(a)	0.72	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Indeno	1.08	µg/GJ
5294	gaseous fuel	1.A.4.a.1	SO2	0.67	g/GJ
5294	gaseous fuel	1.A.4.a.1	NOX	74	g/GJ
5294	gaseous fuel	1.A.4.a.1	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.4.a.1	CO	29	g/GJ
5294	gaseous fuel	1.A.4.a.1	TSP	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM25	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM10	0.78	g/GJ
5294	gaseous fuel	1.A.4.a.1	BC	0.0312	g/GJ
5294	gaseous fuel	1.A.4.a.1	As	0.1	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cd	1.8	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cr	0.013	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cu	0.0026	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Hg	0.54	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Ni	0.013	mg/GJ
5294	gaseous fuel	1.A.4.a.1	NH3	0.15	g/GJ
6420	gas oil_2017	1.A.4.a.1	Pb	8	mg/GJ
6420	gas oil_2017	1.A.4.a.1	Se	0.1	mg/GJ
6420	gas oil_2017	1.A.4.a.1	Zn	18	mg/GJ
6420	gas oil_2017	1.A.4.a.1	DIOX	1.4	ng/GJ
6420	gas oil_2017	1.A.4.a.1	Benzo(b)	15	µg/GJ
6420	gas oil_2017	1.A.4.a.1	Benzo(k)	1.7	µg/GJ
6420	gas oil_2017	1.A.4.a.1	Benzo(a)	1.9	µg/GJ
6420	gas oil_2017	1.A.4.a.1	Indeno	1.5	µg/GJ
6420	gas oil_2017	1.A.4.a.1	SO2	40.27	g/GJ
6420	gas oil_2017	1.A.4.a.1	NOX	306	g/GJ
6420	gas oil_2017	1.A.4.a.1	NMVOC	20	g/GJ
6420	gas oil_2017	1.A.4.a.1	CO	93	g/GJ
6420	gas oil_2017	1.A.4.a.1	TSP	20	g/GJ
6420	gas oil_2017	1.A.4.a.1	HCB	0.22	µg/GJ
6420	gas oil_2017	1.A.4.a.1	PCB	0.13	µg/GJ
6420	gas oil_2017	1.A.4.a.1	PM25	18	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6420	gas oil_2017	1.A.4.a.1	PM10	21	g/GJ
6420	gas oil_2017	1.A.4.a.1	BC	10.08	g/GJ
6420	gas oil_2017	1.A.4.a.1	As	0.5	mg/GJ
6420	gas oil_2017	1.A.4.a.1	Cd	0.15	mg/GJ
6420	gas oil_2017	1.A.4.a.1	Cr	10	mg/GJ
6420	gas oil_2017	1.A.4.a.1	Cu	3	mg/GJ
6420	gas oil_2017	1.A.4.a.1	Hg	0.1	mg/GJ
6420	gas oil_2017	1.A.4.a.1	Ni	125	mg/GJ
6420	gas oil_2017	1.A.4.a.1	NH3	0	g/GJ
6421	residual fuel_2017	1.A.4.a.1	HCB	0.22	µg/GJ
6421	residual fuel_2017	1.A.4.a.1	PCB	0.13	µg/GJ
6421	residual fuel_2017	1.A.4.a.1	Pb	8	mg/GJ
6421	residual fuel_2017	1.A.4.a.1	Se	0.1	mg/GJ
6421	residual fuel_2017	1.A.4.a.1	Zn	18	mg/GJ
6421	residual fuel_2017	1.A.4.a.1	DIOX	6	ng/GJ
6421	residual fuel_2017	1.A.4.a.1	Benzo(b)	15	µg/GJ
6421	residual fuel_2017	1.A.4.a.1	Benzo(k)	1.7	µg/GJ
6421	residual fuel_2017	1.A.4.a.1	Benzo(a)	1.9	µg/GJ
6421	residual fuel_2017	1.A.4.a.1	Indeno	1.5	µg/GJ
6421	residual fuel_2017	1.A.4.a.1	SO2	437.42	g/GJ
6421	residual fuel_2017	1.A.4.a.1	NOX	306	g/GJ
6421	residual fuel_2017	1.A.4.a.1	NMVOC	20	g/GJ
6421	residual fuel_2017	1.A.4.a.1	CO	93	g/GJ
6421	residual fuel_2017	1.A.4.a.1	TSP	20	g/GJ
6421	residual fuel_2017	1.A.4.a.1	PM25	18	g/GJ
6421	residual fuel_2017	1.A.4.a.1	PM10	21	g/GJ
6421	residual fuel_2017	1.A.4.a.1	BC	10.08	g/GJ
6421	residual fuel_2017	1.A.4.a.1	As	0.5	mg/GJ
6421	residual fuel_2017	1.A.4.a.1	Cd	0.15	mg/GJ
6421	residual fuel_2017	1.A.4.a.1	Cr	10	mg/GJ
6421	residual fuel_2017	1.A.4.a.1	Cu	3	mg/GJ
6421	residual fuel_2017	1.A.4.a.1	Hg	0.1	mg/GJ
6421	residual fuel_2017	1.A.4.a.1	Ni	125	mg/GJ
6421	residual fuel_2017	1.A.4.a.1	NH3	0	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Pb	27	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Se	0.5	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Zn	512	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	DIOX	550	ng/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Benzo(b)	111	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Benzo(k)	42	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Benzo(a)	121	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Indeno	71	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	SO2	11	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	NOX	80	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	NH3	74	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	NMVOC	350	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	CO	4000	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	TSP	500	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	PM25	470	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	PM10	480	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	BC	75.2	g/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	PCBs	0.06	µg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	HCB	5	µg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	As	0.19	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Cd	13	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5155	Single house boilers <50kWth	1.A.4.b.1	Cr	23	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Cu	6	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Hg	0.56	mg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Ni	2	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Pb	27	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Se	0.5	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Zn	512	mg/GJ
5154	Open fireplaces	1.A.4.b.1	DIOX	800	ng/GJ
5154	Open fireplaces	1.A.4.b.1	Benzo(b)	111	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Benzo(k)	42	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Benzo(a)	121	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Indeno	71	mg/GJ
5154	Open fireplaces	1.A.4.b.1	SO2	11	g/GJ
5154	Open fireplaces	1.A.4.b.1	NOX	50	g/GJ
5154	Open fireplaces	1.A.4.b.1	NH3	74	g/GJ
5154	Open fireplaces	1.A.4.b.1	NMVOC	600	g/GJ
5154	Open fireplaces	1.A.4.b.1	CO	4000	g/GJ
5154	Open fireplaces	1.A.4.b.1	TSP	880	g/GJ
5154	Open fireplaces	1.A.4.b.1	PM25	820	g/GJ
5154	Open fireplaces	1.A.4.b.1	PM10	840	g/GJ
5154	Open fireplaces	1.A.4.b.1	BC	57.4	g/GJ
5154	Open fireplaces	1.A.4.b.1	PCBs	0.06	µg/GJ
5154	Open fireplaces	1.A.4.b.1	HCB	5	µg/GJ
5154	Open fireplaces	1.A.4.b.1	As	0.19	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Cd	13	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Cr	23	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Cu	6	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Hg	0.56	mg/GJ
5154	Open fireplaces	1.A.4.b.1	Ni	2	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Pb	27	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Se	0.5	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Zn	512	mg/GJ
5156	Domestic stoves	1.A.4.b.1	DIOX	800	ng/GJ
5156	Domestic stoves	1.A.4.b.1	Benzo(b)	111	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Benzo(k)	42	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Benzo(a)	121	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Indeno	71	mg/GJ
5156	Domestic stoves	1.A.4.b.1	SO2	11	g/GJ
5156	Domestic stoves	1.A.4.b.1	NOX	50	g/GJ
5156	Domestic stoves	1.A.4.b.1	NH3	70	g/GJ
5156	Domestic stoves	1.A.4.b.1	NMVOC	600	g/GJ
5156	Domestic stoves	1.A.4.b.1	CO	4000	g/GJ
5156	Domestic stoves	1.A.4.b.1	TSP	800	g/GJ
5156	Domestic stoves	1.A.4.b.1	PM25	740	g/GJ
5156	Domestic stoves	1.A.4.b.1	PM10	760	g/GJ
5156	Domestic stoves	1.A.4.b.1	BC	74	g/GJ
5156	Domestic stoves	1.A.4.b.1	PCBs	0.06	µg/GJ
5156	Domestic stoves	1.A.4.b.1	HCB	5	µg/GJ
5156	Domestic stoves	1.A.4.b.1	As	0.19	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Cd	13	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Cr	23	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Cu	6	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Hg	0.56	mg/GJ
5156	Domestic stoves	1.A.4.b.1	Ni	2	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Pb	27	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5825	Pellete stoves and boilers	1.A.4.b.1	Se	0.5	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Zn	512	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	DIOX	100	ng/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Benzo(b)	16	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Benzo(k)	5	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Benzo(a)	10	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Indeno	4	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	SO2	11	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	NOX	80	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	NH3	12	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	NMVOC	10	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	CO	300	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	TSP	31	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	PM25	29	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	PM10	29	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	BC	4.35	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	PCBs	0.01	µg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	HCB	5	µg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	As	0.19	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Cd	13	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Cr	23	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Cu	6	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Hg	0.56	mg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Ni	2	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Pb	27	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Se	0.5	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Zn	512	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	DIOX	100	ng/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Benzo(b)	16	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Benzo(k)	5	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Benzo(a)	10	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Indeno	4	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	SO2	11	g/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	NOX	95	g/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	NH3	37	g/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	NMVOC	250	g/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	CO	2000	g/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	TSP	100	g/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	PM25	93	g/GJ
5878	Advanced/ecolabelled stoves	1.A.4.b.1	PM10	95	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
	and boilers				
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	BC	26.04	g/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	PCBs	0.007	µg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	HCB	5	µg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	As	0.19	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Cd	13	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Cr	23	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Cu	6	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Hg	0.56	mg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Ni	2	mg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Pb	100	mg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Se	2	mg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Zn	200	mg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	DIOX	1000	ng/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Benzo(b)	400	µg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Benzo(k)	150	µg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Benzo(a)	250	µg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Indeno	120	µg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	SO2	1648.35	g/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	NOX	100	g/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	NH3	0.3	g/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	NMVOC	600	g/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	CO	5000	g/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	TSP	500	g/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	PM25	450	g/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	PM10	450	g/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	BC	28.8	g/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	PCBs	170	µg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	HCB	0.62	µg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	As	1.5	mg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Cd	1	mg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Cr	10	mg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Cu	20	mg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Hg	5	mg/GJ
5237	BC - Sub-bituminous_STOVES	1.A.4.b.1	Ni	10	mg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Pb	200	mg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Se	2	mg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Zn	300	mg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	DIOX	500	ng/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Benzo(b)	250	µg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Benzo(k)	100	µg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Benzo(a)	270	µg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Indeno	90	µg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	SO2	1648.35	g/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	NOX	158	g/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	NH3	0.3	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	NMVOC	174	g/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	CO	4787	g/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	TSP	261	g/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	PM25	201	g/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	PM10	225	g/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	BC	12.864	g/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	PCBs	170	μg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	HCB	0.62	μg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	As	5	mg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Cd	4	mg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Cr	15	mg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Cu	30	mg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Hg	6	mg/GJ
5236	BC - Sub-bituminous_SHB	1.A.4.b.1	Ni	20	mg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Pb	100	mg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Se	2	mg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Zn	200	mg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	DIOX	1000	ng/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Benzo(b)	400	μg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Benzo(k)	150	μg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Benzo(a)	250	μg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Indeno	120	μg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	SO2	2469.14	g/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	NOX	100	g/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	NH3	0.3	g/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	NMVOC	600	g/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	CO	5000	g/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	TSP	500	g/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	PM25	450	g/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	PM10	450	g/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	BC	28.8	g/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	PCBs	170	μg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	HCB	0.62	μg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	As	1.5	mg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Cd	1	mg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Cr	10	mg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Cu	20	mg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Hg	5	mg/GJ
5231	BC - Lignit_STOVES	1.A.4.b.1	Ni	10	mg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Pb	200	mg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Se	2	mg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Zn	300	mg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	DIOX	500	ng/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Benzo(b)	250	μg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Benzo(k)	100	μg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Benzo(a)	270	μg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Indeno	90	μg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	SO2	2469.14	g/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	NOX	158	g/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	NH3	0.3	g/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	NMVOC	174	g/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	CO	4787	g/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	TSP	261	g/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	PM25	201	g/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	PM10	225	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5235	BC - Lignit_SHB	1.A.4.b.1	BC	12.864	g/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	PCBs	170	µg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	HCB	0.62	µg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	As	5	mg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Cd	4	mg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Cr	15	mg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Cu	30	mg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Hg	6	mg/GJ
5235	BC - Lignit_SHB	1.A.4.b.1	Ni	20	mg/GJ
5157	Gaseous fuels	1.A.4.b.1	Pb	0.0015	mg/GJ
5157	Gaseous fuels	1.A.4.b.1	Se	0.011	mg/GJ
5157	Gaseous fuels	1.A.4.b.1	Zn	0.0015	mg/GJ
5157	Gaseous fuels	1.A.4.b.1	DIOX	1.5	ng/GJ
5157	Gaseous fuels	1.A.4.b.1	Benzo(b)	0.84	µg/GJ
5157	Gaseous fuels	1.A.4.b.1	Benzo(k)	0.84	µg/GJ
5157	Gaseous fuels	1.A.4.b.1	Benzo(a)	0.56	µg/GJ
5157	Gaseous fuels	1.A.4.b.1	Indeno	0.84	µg/GJ
5157	Gaseous fuels	1.A.4.b.1	SO2	0.3	g/GJ
5157	Gaseous fuels	1.A.4.b.1	NOX	51	g/GJ
5157	Gaseous fuels	1.A.4.b.1	NMVOC	1.9	g/GJ
5157	Gaseous fuels	1.A.4.b.1	CO	26	g/GJ
5157	Gaseous fuels	1.A.4.b.1	TSP	1.2	g/GJ
5157	Gaseous fuels	1.A.4.b.1	PM25	1.2	g/GJ
5157	Gaseous fuels	1.A.4.b.1	PM10	1.2	g/GJ
5157	Gaseous fuels	1.A.4.b.1	BC	0.06	g/GJ
5157	Gaseous fuels	1.A.4.b.1	As	0.12	mg/GJ
5157	Gaseous fuels	1.A.4.b.1	Cd	0.00025	mg/GJ
5157	Gaseous fuels	1.A.4.b.1	Cr	0.00076	mg/GJ
5157	Gaseous fuels	1.A.4.b.1	Cu	7.6E-05	mg/GJ
5157	Gaseous fuels	1.A.4.b.1	Hg	0.68	mg/GJ
5157	Gaseous fuels	1.A.4.b.1	Ni	0.00051	mg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Cd	0.001	mg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Cr	0.2	mg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Cu	0.13	mg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Hg	0.12	mg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Ni	0.005	mg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Pb	0.012	mg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Se	0.002	mg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Zn	0.42	mg/GJ
6423	LF-HFO_2017	1.A.4.b.1	DIOX	5.9	ng/GJ
6423	LF-HFO_2017	1.A.4.b.1	Benzo(b)	40	µg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Benzo(k)	70	µg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Benzo(a)	80	µg/GJ
6423	LF-HFO_2017	1.A.4.b.1	Indeno	160	µg/GJ
6423	LF-HFO_2017	1.A.4.b.1	SO2	437.42	g/GJ
6423	LF-HFO_2017	1.A.4.b.1	NOX	51	g/GJ
6423	LF-HFO_2017	1.A.4.b.1	NMVOC	0.69	g/GJ
6423	LF-HFO_2017	1.A.4.b.1	CO	57	g/GJ
6423	LF-HFO_2017	1.A.4.b.1	TSP	1.9	g/GJ
6423	LF-HFO_2017	1.A.4.b.1	PM25	1.9	g/GJ
6423	LF-HFO_2017	1.A.4.b.1	PM10	1.9	g/GJ
6423	LF-HFO_2017	1.A.4.b.1	BC	0.16	g/GJ
6423	LF-HFO_2017	1.A.4.b.1	As	0.002	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	TSP	1.9	g/GJ
6422	LF-GO_2017	1.A.4.b.1	PM25	1.9	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6422	LF-GO_2017	1.A.4.b.1	PM10	1.9	g/GJ
6422	LF-GO_2017	1.A.4.b.1	BC	0.16	g/GJ
6422	LF-GO_2017	1.A.4.b.1	As	0.002	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	Cd	0.001	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	Cr	0.2	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	Cu	0.13	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	Hg	0.12	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	Ni	0.005	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	Pb	0.012	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	Se	0.002	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	Zn	0.42	mg/GJ
6422	LF-GO_2017	1.A.4.b.1	DIOX	5.9	ng/GJ
6422	LF-GO_2017	1.A.4.b.1	Benzo(b)	40	µg/GJ
6422	LF-GO_2017	1.A.4.b.1	Benzo(k)	70	µg/GJ
6422	LF-GO_2017	1.A.4.b.1	Benzo(a)	80	µg/GJ
6422	LF-GO_2017	1.A.4.b.1	Indeno	160	µg/GJ
6422	LF-GO_2017	1.A.4.b.1	SO2	40.27	g/GJ
6422	LF-GO_2017	1.A.4.b.1	NOX	51	g/GJ
6422	LF-GO_2017	1.A.4.b.1	NMVOC	0.69	g/GJ
6422	LF-GO_2017	1.A.4.b.1	CO	57	g/GJ
6424	LF-KER_2017	1.A.4.b.1	PM10	1.9	g/GJ
6424	LF-KER_2017	1.A.4.b.1	BC	0.16	g/GJ
6424	LF-KER_2017	1.A.4.b.1	As	0.002	mg/GJ
6424	LF-KER_2017	1.A.4.b.1	Cd	0.001	mg/GJ
6424	LF-KER_2017	1.A.4.b.1	Cr	0.2	mg/GJ
6424	LF-KER_2017	1.A.4.b.1	Cu	0.13	mg/GJ
6424	LF-KER_2017	1.A.4.b.1	Hg	0.12	mg/GJ
6424	LF-KER_2017	1.A.4.b.1	Ni	0.005	mg/GJ
6424	LF-KER_2017	1.A.4.b.1	Pb	0.012	mg/GJ
6424	LF-KER_2017	1.A.4.b.1	Se	0.002	mg/GJ
6424	LF-KER_2017	1.A.4.b.1	Zn	0.42	mg/GJ
6424	LF-KER_2017	1.A.4.b.1	DIOX	5.9	ng/GJ
6424	LF-KER_2017	1.A.4.b.1	Benzo(b)	40	µg/GJ
6424	LF-KER_2017	1.A.4.b.1	Benzo(k)	70	µg/GJ
6424	LF-KER_2017	1.A.4.b.1	Benzo(a)	80	µg/GJ
6424	LF-KER_2017	1.A.4.b.1	Indeno	160	µg/GJ
6424	LF-KER_2017	1.A.4.b.1	SO2	16.11	g/GJ
6424	LF-KER_2017	1.A.4.b.1	NOX	51	g/GJ
6424	LF-KER_2017	1.A.4.b.1	NMVOC	0.69	g/GJ
6424	LF-KER_2017	1.A.4.b.1	CO	57	g/GJ
6424	LF-KER_2017	1.A.4.b.1	TSP	1.9	g/GJ
6424	LF-KER_2017	1.A.4.b.1	PM25	1.9	g/GJ
5294	gaseous fuel	1.A.4.c.1	Pb	0.011	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Se	0.058	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Zn	0.73	mg/GJ
5294	gaseous fuel	1.A.4.c.1	DIOX	0.52	ng/GJ
5294	gaseous fuel	1.A.4.c.1	Benzo(b)	2.9	µg/GJ
5294	gaseous fuel	1.A.4.c.1	Benzo(k)	1.1	µg/GJ
5294	gaseous fuel	1.A.4.c.1	Benzo(a)	0.72	µg/GJ
5294	gaseous fuel	1.A.4.c.1	Indeno	1.08	µg/GJ
5294	gaseous fuel	1.A.4.c.1	SO2	0.67	g/GJ
5294	gaseous fuel	1.A.4.c.1	NOX	74	g/GJ
5294	gaseous fuel	1.A.4.c.1	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.4.c.1	CO	29	g/GJ
5294	gaseous fuel	1.A.4.c.1	TSP	0.78	g/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5294	gaseous fuel	1.A.4.c.1	PM25	0.78	g/GJ
5294	gaseous fuel	1.A.4.c.1	PM10	0.78	g/GJ
5294	gaseous fuel	1.A.4.c.1	BC	0.0312	g/GJ
5294	gaseous fuel	1.A.4.c.1	As	0.1	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Cd	1.8	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Cr	0.013	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Cu	0.0026	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Hg	0.54	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Ni	0.013	mg/GJ
5294	gaseous fuel	1.A.4.c.1	NH3	0.15	g/GJ
6420	gas oil_2017	1.A.4.c.1	Pb	8	mg/GJ
6420	gas oil_2017	1.A.4.c.1	Se	0.1	mg/GJ
6420	gas oil_2017	1.A.4.c.1	Zn	18	mg/GJ
6420	gas oil_2017	1.A.4.c.1	DIOX	1.4	ng/GJ
6420	gas oil_2017	1.A.4.c.1	Benzo(b)	15	µg/GJ
6420	gas oil_2017	1.A.4.c.1	Benzo(k)	1.7	µg/GJ
6420	gas oil_2017	1.A.4.c.1	Benzo(a)	1.9	µg/GJ
6420	gas oil_2017	1.A.4.c.1	Indeno	1.5	µg/GJ
6420	gas oil_2017	1.A.4.c.1	SO2	40.27	g/GJ
6420	gas oil_2017	1.A.4.c.1	NOX	306	g/GJ
6420	gas oil_2017	1.A.4.c.1	NMVOC	20	g/GJ
6420	gas oil_2017	1.A.4.c.1	CO	93	g/GJ
6420	gas oil_2017	1.A.4.c.1	TSP	20	g/GJ
6420	gas oil_2017	1.A.4.c.1	HCB	0.22	µg/GJ
6420	gas oil_2017	1.A.4.c.1	PCB	0.13	µg/GJ
6420	gas oil_2017	1.A.4.c.1	PM25	18	g/GJ
6420	gas oil_2017	1.A.4.c.1	PM10	21	g/GJ
6420	gas oil_2017	1.A.4.c.1	BC	10.08	g/GJ
6420	gas oil_2017	1.A.4.c.1	As	0.5	mg/GJ
6420	gas oil_2017	1.A.4.c.1	Cd	0.15	mg/GJ
6420	gas oil_2017	1.A.4.c.1	Cr	10	mg/GJ
6420	gas oil_2017	1.A.4.c.1	Cu	3	mg/GJ
6420	gas oil_2017	1.A.4.c.1	Hg	0.1	mg/GJ
6420	gas oil_2017	1.A.4.c.1	Ni	125	mg/GJ
6420	gas oil_2017	1.A.4.c.1	NH3	0	g/GJ
6421	residual fuel_2017	1.A.4.c.1	HCB	0.22	µg/GJ
6421	residual fuel_2017	1.A.4.c.1	PCB	0.13	µg/GJ
6421	residual fuel_2017	1.A.4.c.1	Pb	8	mg/GJ
6421	residual fuel_2017	1.A.4.c.1	Se	0.1	mg/GJ
6421	residual fuel_2017	1.A.4.c.1	Zn	18	mg/GJ
6421	residual fuel_2017	1.A.4.c.1	DIOX	6	ng/GJ
6421	residual fuel_2017	1.A.4.c.1	Benzo(b)	15	µg/GJ
6421	residual fuel_2017	1.A.4.c.1	Benzo(k)	1.7	µg/GJ
6421	residual fuel_2017	1.A.4.c.1	Benzo(a)	1.9	µg/GJ
6421	residual fuel_2017	1.A.4.c.1	Indeno	1.5	µg/GJ
6421	residual fuel_2017	1.A.4.c.1	SO2	437.42	g/GJ
6421	residual fuel_2017	1.A.4.c.1	NOX	306	g/GJ
6421	residual fuel_2017	1.A.4.c.1	NMVOC	20	g/GJ
6421	residual fuel_2017	1.A.4.c.1	CO	93	g/GJ
6421	residual fuel_2017	1.A.4.c.1	TSP	20	g/GJ
6421	residual fuel_2017	1.A.4.c.1	PM25	18	g/GJ
6421	residual fuel_2017	1.A.4.c.1	PM10	21	g/GJ
6421	residual fuel_2017	1.A.4.c.1	BC	10.08	g/GJ
6421	residual fuel_2017	1.A.4.c.1	As	0.5	mg/GJ
6421	residual fuel_2017	1.A.4.c.1	Cd	0.15	mg/GJ

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6421	residual fuel_2017	1.A.4.c.1	Cr	10	mg/GJ
6421	residual fuel_2017	1.A.4.c.1	Cu	3	mg/GJ
6421	residual fuel_2017	1.A.4.c.1	Hg	0.1	mg/GJ
6421	residual fuel_2017	1.A.4.c.1	Ni	125	mg/GJ
6421	residual fuel_2017	1.A.4.c.1	NH3	0	g/GJ
3824	1.B.2.a.1_201A	1.B.2.a.1	NMVOC	0.095	kg/t
4504	Sulphur recovery plants	1.B.2.a.4	SO2	140	kg/t
4505	Fluid coking units	1.B.2.a.4	As	2.2	g/m3
4505	Fluid coking units	1.B.2.a.4	Cu	0.015	g/m3
4505	Fluid coking units	1.B.2.a.4	Hg	0.03	g/m3
4505	Fluid coking units	1.B.2.a.4	Ni	0.57	g/m3
4505	Fluid coking units	1.B.2.a.4	Pb	0.045	g/m3
4505	Fluid coking units	1.B.2.a.4	Zn	0.045	g/m3
4505	Fluid coking units	1.B.2.a.4	NMVOC	0.046	kg/m3
4505	Fluid coking units	1.B.2.a.4	PM10	0.77	kg/m3
4505	Fluid coking units	1.B.2.a.4	TSP	1.5	kg/m3
4505	Fluid coking units	1.B.2.a.4	PM25	0.33	kg/m3
4505	Fluid coking units	1.B.2.a.4	Se	0.03	g/m3
4506	Diffuse NMVOC emissions	1.B.2.a.4	NMVOC	0.2	kg/t
4502	Catalytic reforming units	1.B.2.a.4	SO2	4	g/m3
4502	Catalytic reforming units	1.B.2.a.4	CO	42	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	As	0.014	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Cd	0.063	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Cu	0.14	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Hg	0.07	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Ni	0.61	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Pb	0.32	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Zn	0.12	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	SO2	1.4	kg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	NOX	0.2	kg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	NH3	0.16	kg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	NMVOC	0.63	kg/m3
4503	Catalytic Cracking unit regenerators-Partial burn	1.B.2.a.4	CO	39	kg/m3

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
	without CO boiler				
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	PM10	0.55	kg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	TSP	0.7	kg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	PM25	0.24	kg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	BC	0.000312	kg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Se	0.014	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	DIOX	0.019	µg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Cr	0.33	g/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Benzo(b)	1.2	mg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Benzo(k)	0.82	mg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Benzo(a)	0.71	mg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	Indeno	0.62	mg/m3
3826	Imported oil	1.B.2.a.5	NMVOC	0.3	kg/t
3827	Total crude oil	1.B.2.a.5	NMVOC	0.02	kg/t
6123	Road tanker, bottom loading, VRU	1.B.2.a.5	NMVOC	0.247	kg/kt*kPa
6126	Marine tanker, uncontrolled	1.B.2.a.5	NMVOC	5.48	kg/kt*kPa
6127	Storage tank-Filling without Stage 1B	1.B.2.a.5	NMVOC	32.88	kg/kt*kPa
6128	Storage tank-Breathing	1.B.2.a.5	NMVOC	4.11	kg/kt*kPa
6129	Storage tank-Auto refuelling uncontrolled	1.B.2.a.5	NMVOC	50.68	kg/kt*kPa
6130	Storage tank-Auto refuelling: drips and spills	1.B.2.a.5	NMVOC	2.74	kg/kt*kPa
6123	Road tanker, bottom loading, VRU	1.B.2.a.5	NMVOC	0.247	kg/kt*kPa
6125	Rail tanker, VRU	1.B.2.a.5	NMVOC	0.301	kg/kt*kPa
6125	Rail tanker, VRU	1.B.2.a.5	NMVOC	0.301	kg/kt*kPa
6122	Road tanker, top loading	1.B.2.a.5	NMVOC	12.33	kg/kt*kPa
6124	Rail tanker, uncontrolled	1.B.2.a.5	NMVOC	15.07	kg/kt*kPa
6124	Rail tanker, uncontrolled	1.B.2.a.5	NMVOC	15.07	kg/kt*kPa
4836	CPS I, II, III_2011	1.B.2.b.1	Hg	0.041	kg DE
5975	1.B.2.b.1	1.B.2.b.1	NMVOC	0.1	kg/1000 m3
6433	1.B.2.b.ii_NG	1.B.2.b.2	NMVOC	3.5447	kg/1000 m3

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
	transmission_2017				
6132	INA-RNS	1.B.2.c.1	NOX	32.2	g/GJ
6132	INA-RNS	1.B.2.c.1	CO	177	g/GJ
6132	INA-RNS	1.B.2.c.1	TSP	0.89	g/GJ
6132	INA-RNS	1.B.2.c.1	PM25	0.89	g/GJ
6132	INA-RNS	1.B.2.c.1	PM10	0.89	g/GJ
6132	INA-RNS	1.B.2.c.1	As	0.3	mg/GJ
6132	INA-RNS	1.B.2.c.1	Cd	0.7	mg/GJ
6132	INA-RNS	1.B.2.c.1	Cr	3	mg/GJ
6132	INA-RNS	1.B.2.c.1	Hg	0.09	mg/GJ
6132	INA-RNS	1.B.2.c.1	Cu	2	mg/GJ
6132	INA-RNS	1.B.2.c.1	Ni	4	mg/GJ
6132	INA-RNS	1.B.2.c.1	Pb	2	mg/GJ
6132	INA-RNS	1.B.2.c.1	Zn	26	mg/GJ
6132	INA-RNS	1.B.2.c.1	Benzo(b)	1.14	µg/GJ
6132	INA-RNS	1.B.2.c.1	Benzo(k)	0.63	µg/GJ
6132	INA-RNS	1.B.2.c.1	Benzo(a)	0.67	µg/GJ
6132	INA-RNS	1.B.2.c.1	Indeno	0.63	µg/GJ
6133	INA-RNS	1.B.2.c.1	SO2	77	g/m3
6133	INA-RNS	1.B.2.c.1	NMVOC	2	g/m3
6134	INA-RNR	1.B.2.c.1	SO2	77	g/m3
6134	INA-RNR	1.B.2.c.1	NMVOC	2	g/m3
6135	INA-RNR	1.B.2.c.1	NOX	32.2	g/GJ
6135	INA-RNR	1.B.2.c.1	CO	177	g/GJ
6135	INA-RNR	1.B.2.c.1	TSP	0.89	g/GJ
6135	INA-RNR	1.B.2.c.1	PM25	0.89	g/GJ
6135	INA-RNR	1.B.2.c.1	PM10	0.89	g/GJ
6135	INA-RNR	1.B.2.c.1	As	0.3	mg/GJ
6135	INA-RNR	1.B.2.c.1	Cd	0.7	mg/GJ
6135	INA-RNR	1.B.2.c.1	Cr	3	mg/GJ
6135	INA-RNR	1.B.2.c.1	Hg	0.09	mg/GJ
6135	INA-RNR	1.B.2.c.1	Cu	2	mg/GJ
6135	INA-RNR	1.B.2.c.1	Ni	4	mg/GJ
6135	INA-RNR	1.B.2.c.1	Pb	2	mg/GJ
6135	INA-RNR	1.B.2.c.1	Zn	26	mg/GJ
6135	INA-RNR	1.B.2.c.1	Benzo(b)	1.14	µg/GJ
6135	INA-RNR	1.B.2.c.1	Benzo(k)	0.63	µg/GJ
6135	INA-RNR	1.B.2.c.1	Benzo(a)	0.67	µg/GJ
6135	INA-RNR	1.B.2.c.1	Indeno	0.63	µg/GJ
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	NOX	1.4	kg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	NMVOC	1.8	kg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	CO	6.3	kg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	SO2	0.013	kg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	TSP	2.6	kg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	PM25	2.6	kg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	PM10	2.6	kg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	BC	0.624	kg/t waste gas

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Pb	4.9	mg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Cd	20	mg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Hg	4.7	mg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	As	3.8	mg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Cr	1.3	mg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Cu	1.6	mg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Ni	38	mg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Zn	520	mg/t waste gas
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Se	0.43	mg/t waste gas
4448	Forest Fires	11.A	SO2	20	kg/ha
4448	Forest Fires	11.A	NOX	100	kg/ha
4448	Forest Fires	11.A	NH3	20	kg/ha
4448	Forest Fires	11.A	NMVOC	300	kg/ha
4448	Forest Fires	11.A	CO	3000	kg/ha
5454	HOLCIM_abated FE	2.A.1	TSP	18.2	g/t
5454	HOLCIM_abated FE	2.A.1	PM25	78	g/t
5454	HOLCIM_abated FE	2.A.1	PM10	154.44	g/t
5454	HOLCIM_abated FE	2.A.1	BC	3.9	g/t
5372	CALUCEM_abated FE	2.A.1	TSP	18.2	g/t
5372	CALUCEM_abated FE	2.A.1	PM25	78	g/t
5372	CALUCEM_abated FE	2.A.1	PM10	154.44	g/t
5372	CALUCEM_abated FE	2.A.1	BC	3.9	g/t
5456	CEMEX_sve godine	2.A.1	TSP	18.2	g/t
5456	CEMEX_sve godine	2.A.1	PM25	78	g/t
5456	CEMEX_sve godine	2.A.1	PM10	154.44	g/t
5456	CEMEX_sve godine	2.A.1	BC	3.9	g/t
5455	NAŠICECEMENT_sve godine	2.A.1	TSP	18.2	g/t
5455	NAŠICECEMENT_sve godine	2.A.1	PM25	78	g/t
5455	NAŠICECEMENT_sve godine	2.A.1	PM10	154.44	g/t
5455	NAŠICECEMENT_sve godine	2.A.1	BC	3.9	g/t
5128	2.A.2_Tier 2_EMEP/EEA2013	2.A.2	TSP	400	g/t
5128	2.A.2_Tier 2_EMEP/EEA2013	2.A.2	PM25	30	g/t
5128	2.A.2_Tier 2_EMEP/EEA2013	2.A.2	PM10	200	g/t
5128	2.A.2_Tier 2_EMEP/EEA2013	2.A.2	BC	0.138	g/t
103	Mineral Industry, Asfalt Roofing	2.A.5	NMVOC	130	g/t
103	Mineral Industry, Asfalt Roofing	2.A.5	CO	9.5	g/t
103	Mineral Industry, Asfalt Roofing	2.A.5	TSP	1600	g/t
103	Mineral Industry, Asfalt Roofing	2.A.5	BC	0.0104	g/t
103	Mineral Industry, Asfalt Roofing	2.A.5	PM25	80	g/t
103	Mineral Industry, Asfalt Roofing	2.A.5	PM10	400	g/t

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
104	Mineral Production, Road Paving with Asphalt	2.A.6	NMVOC	16	g/t
104	Mineral Production, Road Paving with Asphalt	2.A.6	TSP	14000	g/t
104	Mineral Production, Road Paving with Asphalt	2.A.6	PM25	400	g/t
104	Mineral Production, Road Paving with Asphalt	2.A.6	PM10	3000	g/t
104	Mineral Production, Road Paving with Asphalt	2.A.6	BC	22.8	g/t
108	2.A.7.d_glass production	2.A.7.1	As	0.19	g/t
108	2.A.7.d_glass production	2.A.7.1	Cd	0.13	g/t
108	2.A.7.d_glass production	2.A.7.1	Cr	0.23	g/t
108	2.A.7.d_glass production	2.A.7.1	Cu	0.007	g/t
108	2.A.7.d_glass production	2.A.7.1	Hg	0.003	g/t
108	2.A.7.d_glass production	2.A.7.1	Ni	0.49	g/t
108	2.A.7.d_glass production	2.A.7.1	Pb	1.7	g/t
108	2.A.7.d_glass production	2.A.7.1	Se	0.8	g/t
108	2.A.7.d_glass production	2.A.7.1	Zn	0.37	g/t
108	2.A.7.d_glass production	2.A.7.1	TSP	300	g/t
108	2.A.7.d_glass production	2.A.7.1	PM25	240	g/t
108	2.A.7.d_glass production	2.A.7.1	PM10	270	g/t
108	2.A.7.d_glass production	2.A.7.1	BC	0.1488	g/t
6139	Rockwool_2017	2.A.7.1	NH3	77.853	t DE
6139	Rockwool_2017	2.A.7.1	NMVOC	24.152	t DE
6139	Rockwool_2017	2.A.7.1	TSP	18.001	t DE
6139	Rockwool_2017	2.A.7.1	PM25	13.965	t DE
6139	Rockwool_2017	2.A.7.1	PM10	15.844	t DE
6139	Rockwool_2017	2.A.7.1	BC	0.279294	t DE
4430	Mineral Industry, Quaring and mining of minerals other than coal	2.A.7.a	TSP	102	g/t
4430	Mineral Industry, Quaring and mining of minerals other than coal	2.A.7.a	PM25	5	g/t
4430	Mineral Industry, Quaring and mining of minerals other than coal	2.A.7.a	PM10	50	g/t
4432	Mineral Industry, Construction and demolition	2.A.7.b	TSP	0.162	kg/m2
4432	Mineral Industry, Construction and demolition	2.A.7.b	PM25	0.00812	kg/m2
4432	Mineral Industry, Construction and demolition	2.A.7.b	PM10	0.0812	kg/m2
6141	Ammonia-2017	2.B.1	NOX	2.077	kg/t
6141	Ammonia-2017	2.B.1	NH3	0.05	kg/t
6141	Ammonia-2017	2.B.1	CO	0.006	kg/t
6141	Ammonia-2017	2.B.1	NMVOC	0.09	kg/t
6142	Nitric acid-2017	2.B.2	NOX	0.585	kg/t
4436	Ammonium phosphate production	2.B.5.a	TSP	300	g/t
4436	Ammonium phosphate production	2.B.5.a	PM25	180	g/t
4436	Ammonium phosphate production	2.B.5.a	PM10	240	g/t

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
4436	Ammonium phosphate production	2.B.5.a	BC	9	g/t
5422	Formaldehid	2.B.5.a	NMVOC	7	kg/t
5422	Formaldehid	2.B.5.a	CO	12	kg/t
4652	Expended polystiren foam	2.B.5.a	NMVOC	3.2	kg/t
4652	Expended polystiren foam	2.B.5.a	TSP	30	g/t
4652	Expended polystiren foam	2.B.5.a	PM10	24	g/t
4652	Expended polystiren foam	2.B.5.a	PM25	18	g/t
4652	Expended polystiren foam	2.B.5.a	BC	0.324	g/t
4651	Polystirene; in primary forms	2.B.5.a	NMVOC	120	g/t
4651	Polystirene; in primary forms	2.B.5.a	TSP	4	g/t
4651	Polystirene; in primary forms	2.B.5.a	PM10	3.2	g/t
4651	Polystirene; in primary forms	2.B.5.a	PM25	2.4	g/t
4651	Polystirene; in primary forms	2.B.5.a	BC	0.324	g/t
4653	2.B.5.a_Polyethylene Low Density	2.B.5.a	NMVOC	2.4	kg/t
4653	2.B.5.a_Polyethylene Low Density	2.B.5.a	TSP	31	g/t
4653	2.B.5.a_Polyethylene Low Density	2.B.5.a	PM10	24.8	g/t
4653	2.B.5.a_Polyethylene Low Density	2.B.5.a	PM25	18.6	g/t
4653	2.B.5.a_Polyethylene Low Density	2.B.5.a	BC	0.335	g/t
6143	Sulfuric acid-2017	2.B.5.a	SO2	3.151	kg/t
6144	NPK-2017	2.B.5.a	NOX	0.1037	kg/t
6144	NPK-2017	2.B.5.a	NH3	6.4451	kg/t
6144	NPK-2017	2.B.5.a	TSP	0.2139	kg/t
6145	Urea-2017	2.B.5.a	NH3	1.197	kg/t
6145	Urea-2017	2.B.5.a	TSP	1.5	kg/t
6145	Urea-2017	2.B.5.a	PM25	0.9	kg/t
6145	Urea-2017	2.B.5.a	PM10	1.2	kg/t
6145	Urea-2017	2.B.5.a	BC	0.0162	kg/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	As	0.015	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	Cd	0.2	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	Cr	0.1	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	Cu	0.02	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	Hg	0.05	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	Ni	0.7	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	Pb	2.6	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	Zn	3.6	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	DIOX	3	µg/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	PAH	0.48	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	PCBs	2.5	mg/t

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	SO2	60	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	NOX	130	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	NMVOC	46	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	CO	1.7	kg/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	TSP	30	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	PM25	21	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	PM10	24	g/t
5425	Steelmaking, Electric Arc Furnace Steel Plant (EAF)	2.C.1.1	BC	0.0756	g/t
4428	Rolling mills - hot	2.C.1.5	NMVOC	7	g/t
4428	Rolling mills - hot	2.C.1.5	TSP	9	g/t
4487	Rolling mills - cold	2.C.1.5	TSP	96	g/t
3813	2.D.1_Paper pulp: Neutral Sulphite Semi-Chemical process	2.D.1	NMVOC	0.05	kg/t
4490	Margarine and solid cooking fats	2.D.2	NMVOC	10	kg/t
4494	Cakes, biscuits and breakfast cereals	2.D.2	NMVOC	1	kg/t
98	Bread (white bread)	2.D.2	NMVOC	2	kg/t
3815	White wine	2.D.2	NMVOC	0.035	kg/hl
3816	Wine (unspecified color)	2.D.2	NMVOC	0.08	kg/hl
3817	2.D.2_Beer	2.D.2	NMVOC	35	g/hl
3818	2.D.2_Spirits	2.D.2	NMVOC	15000	g/hl
4493	Coffee roasting	2.D.2	NMVOC	0.55	kg/t
4488	Meat, fish etc. frying / curing	2.D.2	NMVOC	0.3	kg/t
4489	Sugar	2.D.2	NMVOC	10	kg/t
4492	Animal feed	2.D.2	NMVOC	1	kg/t
4500	040620_wood processing	2.D.3	TSP	1	kg/t
4449	Consumption of POPs and HMs	2.F.8	Hg	0.01	g/inhabitant
4449	Consumption of POPs and HMs	2.F.8	PCBs	0.1	g/inhabitant
4647	Decorative coating application	3.A.1	NMVOC	150	kg/t
4649	Industrial coating application	3.A.2	NMVOC	400	kg/t
4650	Other coating application	3.A.3	NMVOC	200	kg/t
6431	Degreasing - Vapour cleaning	3.B.1	NMVOC	460	g/kg product
6434	Degreasing - Cold cleaning	3.B.1	NMVOC	0.7	kg/inhabitant
6429	Dry cleaning	3.B.2	NMVOC	400	g/kg product
120	Polyester processing	3.C	NMVOC	50	kg/t
3836	3.C_PVC process.	3.C	NMVOC	40	kg/t
3837	Polyurethane_Solid foam	3.C	NMVOC	15	kg/t
3838	Polyurethane_Soft foam	3.C	NMVOC	25	kg/t
3840	3.C_Rubber manufac.	3.C	NMVOC	15	kg/t
3841	3.C_Pharmaceuticals products manufac.	3.C	NMVOC	0.014	kg/inhabitant
3842	3.C_Paints manufac.	3.C	NMVOC	15	kg/t

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
3843	3.C_Inks manufac.	3.C	NMVOC	30	kg/t
3844	3.C_Glues manufac.	3.C	NMVOC	20	kg/t
4797	Expandible PS	3.C	NMVOC	60	kg/t
6148	Adhesive tape manufacturing	3.C	NMVOC	3	kg/t
6147	Other: Shoes manufacturing	3.C	NMVOC	0.045	kg/t
6149	Leather tanning	3.C	NH3	0.68	kg/t
6430	Printing industry	3.D.1	NMVOC	500	kg/t
5353	Pharmaceutical products	3.D.2	NMVOC	48	kg/t
5352	Cosmetics and toiletries	3.D.2	NMVOC	127	kg/t
5347	Household products	3.D.2	NMVOC	16	kg/t
5348	Car care product	3.D.2	NMVOC	180	kg/t
5349	DIY/buildings, Paint/varnish removers and solvents	3.D.2	NMVOC	950	kg/t
5350	DIY/buildings, Sealants, filling agents	3.D.2	NMVOC	45	kg/t
5351	Various_Hg (fluorescent tubes)	3.D.2	Hg	5.6	kg/t
5355	Various_Pesticide use incl. fungicides	3.D.2	NMVOC	150	kg/t
4846	2.G Tabacco combustion	3.D.3	Ni	2.7	g/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	Cd	5.4	g/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	Zn	2.7	g/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	Benzo(b)	0.045	g/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	NMVOC	4.84	kg/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	TSP	27	kg/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	PM25	27	kg/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	PM10	27	kg/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	NOX	1.8	kg/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	CO	55.1	kg/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	Cu	5.4	g/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	DIOX	0.1	µg/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	Benzo(k)	0.045	g/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	Benzo(a)	0.111	g/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	BC	12.15	kg/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	NH3	4.15	kg/t tobaccoa
4846	2.G Tabacco combustion	3.D.3	Indeno	0.045	g/t tobaccoa
4842	2.D.3.i Fat, edible and non-edible oil extraction	3.D.3	NMVOC	1.57	kg/t seed
4842	2.D.3.i Fat, edible and non-edible oil extraction	3.D.3	TSP	1.1	kg/t seed
4842	2.D.3.i Fat, edible and non-edible oil extraction	3.D.3	PM25	0.6	kg/t seed
4842	2.D.3.i Fat, edible and non-edible oil extraction	3.D.3	PM10	0.9	kg/t seed
4844	2.D.3.i Organic solventborne preservative	3.D.3	NMVOC	945	kg/t seed

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
4843	2.D.3.i Creosote preservative type	3.D.3	NMVOC	105	kg/t creosote
4843	2.D.3.i Creosote preservative type	3.D.3	Benzo(a)	1.05	g/t creosote
4843	2.D.3.i Creosote preservative type	3.D.3	Benzo(b)	0.53	g/t creosote
4843	2.D.3.i Creosote preservative type	3.D.3	Benzo(k)	0.53	g/t creosote
4843	2.D.3.i Creosote preservative type	3.D.3	Indeno	0.53	g/t creosote
5354	2.G Use of shoes	3.D.3	NMVOC	60	g/pair
5356	Car dewaxing	3.D.3	NMVOC	1	g/t
5358	2.G Other: Concrete aditive	3.D.3	NMVOC	915	g/t
5359	2.G Other: Cooling lubricant	3.D.3	NMVOC	1000	g/t
5360	2.G Other: Lubricant	3.D.3	NMVOC	28000	g/t
6137	Application of glues_2017	3.D.3	NMVOC	144922	g/t
6138	2.G Use of Firework	3.D.3	Ni	30	g/t
6138	2.G Use of Firework	3.D.3	Cd	1.48	g/t
6138	2.G Use of Firework	3.D.3	Zn	260	g/t
6138	2.G Use of Firework	3.D.3	TSP	109830	g/t
6138	2.G Use of Firework	3.D.3	PM25	51940	g/t
6138	2.G Use of Firework	3.D.3	PM10	99920	g/t
6138	2.G Use of Firework	3.D.3	NOX	260	g/t
6138	2.G Use of Firework	3.D.3	CO	7150	g/t
6138	2.G Use of Firework	3.D.3	Cu	444	g/t
6138	2.G Use of Firework	3.D.3	SO2	3020	g/t
6138	2.G Use of Firework	3.D.3	As	1.33	g/t
6138	2.G Use of Firework	3.D.3	Hg	0.057	g/t
6138	2.G Use of Firework	3.D.3	Pb	784	g/t
6138	2.G Use of Firework	3.D.3	Cr	15.6	g/t
6169	Dairy cattle	4.B.01.a	NH3	14.978020620507	kg/animal
6169	Dairy cattle	4.B.01.a	TSP	1.38	kg/animal
6169	Dairy cattle	4.B.01.a	PM25	0.41	kg/animal
6169	Dairy cattle	4.B.01.a	NOX	0.0468487371024658	kg/animal
6169	Dairy cattle	4.B.01.a	NMVOC	16.157	kg/animal
6169	Dairy cattle	4.B.01.a	PM10	0.63	kg/animal
6170	Calves (telad)	4.B.01.b	NH3	7.3348486934317	kg/animal
6170	Calves (telad)	4.B.01.b	TSP	0.34	kg/animal
6170	Calves (telad)	4.B.01.b	PM25	0.1	kg/animal
6170	Calves (telad)	4.B.01.b	NOX	0.072821523972681	kg/animal
6170	Calves (telad)	4.B.01.b	NMVOC	7.397	kg/animal
6170	Calves (telad)	4.B.01.b	PM10	0.16	kg/animal
6171	Non-dairy cattle	4.B.01.b	NH3	7.3348486934317	kg/animal
6171	Non-dairy cattle	4.B.01.b	TSP	0.59	kg/animal
6171	Non-dairy cattle	4.B.01.b	PM25	0.18	kg/animal
6171	Non-dairy cattle	4.B.01.b	NOX	0.072821523972681	kg/animal
6171	Non-dairy cattle	4.B.01.b	NMVOC	7.397	kg/animal
6171	Non-dairy cattle	4.B.01.b	PM10	0.27	kg/animal
6174	Sheep	4.B.03	NH3	0.0963837867428571	kg/animal
6174	Sheep	4.B.03	TSP	0.139	kg/animal
6174	Sheep	4.B.03	PM25	0.0167	kg/animal
6174	Sheep	4.B.03	NOX	0.000849441191428571	kg/animal
6174	Sheep	4.B.03	NMVOC	0.1701	kg/animal
6174	Sheep	4.B.03	PM10	0.0556	kg/animal
6175	Goats	4.B.04	NH3	0.19626542647045	kg/animal

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6175	Goats	4.B.04	TSP	0.139	kg/animal
6175	Goats	4.B.04	PM25	0.0167	kg/animal
6175	Goats	4.B.04	NOX	0.000849441191428571	kg/animal
6175	Goats	4.B.04	NMVOC	0.54282	kg/animal
6175	Goats	4.B.04	PM10	0.0556	kg/animal
6176	Horses	4.B.06	NH3	1.59807880714286	kg/animal
6176	Horses	4.B.06	TSP	0.48	kg/animal
6176	Horses	4.B.06	PM25	0.14	kg/animal
6176	Horses	4.B.06	NOX	0.0502853468571429	kg/animal
6176	Horses	4.B.06	NMVOC	4.275	kg/animal
6176	Horses	4.B.06	PM10	0.22	kg/animal
6177	Mules and asses	4.B.07	NH3	1.59807880714286	kg/animal
6177	Mules and asses	4.B.07	TSP	0.34	kg/animal
6177	Mules and asses	4.B.07	PM25	0.1	kg/animal
6177	Mules and asses	4.B.07	NOX	0.0502853468571429	kg/animal
6177	Mules and asses	4.B.07	NMVOC	1.47	kg/animal
6177	Mules and asses	4.B.07	PM10	0.16	kg/animal
6172	Swine: Sows	4.B.08	NH3	9.20820048521428	kg/animal
6172	Swine: Sows	4.B.08	TSP	1.53	kg/animal
6172	Swine: Sows	4.B.08	PM25	0.12	kg/animal
6172	Swine: Sows	4.B.08	NOX	0.0552524175257143	kg/animal
6172	Swine: Sows	4.B.08	NMVOC	1.704	kg/animal
6172	Swine: Sows	4.B.08	PM10	0.69	kg/animal
6173	Swine: Fattng pigs	4.B.08	NH3	3.24654215405714	kg/animal
6173	Swine: Fattng pigs	4.B.08	TSP	0.75	kg/animal
6173	Swine: Fattng pigs	4.B.08	PM25	0.06	kg/animal
6173	Swine: Fattng pigs	4.B.08	NOX	0.0090848523794286	kg/animal
6173	Swine: Fattng pigs	4.B.08	NMVOC	0.551	kg/animal
6173	Swine: Fattng pigs	4.B.08	PM10	0.34	kg/animal
6183	Laying hens	4.B.09.a	NMVOC	0.165	kg/animal
6183	Laying hens	4.B.09.a	PM10	0.119	kg/animal
6183	Laying hens	4.B.09.a	NH3	0.213194025	kg/animal
6183	Laying hens	4.B.09.a	TSP	0.119	kg/animal
6183	Laying hens	4.B.09.a	PM25	0.023	kg/animal
6183	Laying hens	4.B.09.a	NOX	0.0001545516989232	kg/animal
6182	Broilers	4.B.09.b	NMVOC	0.108	kg/animal
6182	Broilers	4.B.09.b	PM10	0.069	kg/animal
6182	Broilers	4.B.09.b	NH3	0.11368784	kg/animal
6182	Broilers	4.B.09.b	TSP	0.069	kg/animal
6182	Broilers	4.B.09.b	PM25	0.009	kg/animal
6182	Broilers	4.B.09.b	NOX	0.0032476788571429	kg/animal
6181	Turkeys	4.B.09.c	NMVOC	0.489	kg/animal
6181	Turkeys	4.B.09.c	PM10	0.52	kg/animal
6181	Turkeys	4.B.09.c	NH3	0.57167532	kg/animal
6181	Turkeys	4.B.09.c	TSP	0.52	kg/animal
6181	Turkeys	4.B.09.c	PM25	0.07	kg/animal
6181	Turkeys	4.B.09.c	NOX	0.0117578720571429	kg/animal
6178	Other polutry	4.B.09.d	NMVOC	0.489	kg/animal
6178	Other polutry	4.B.09.d	PM10	0.24	kg/animal
6178	Other polutry	4.B.09.d	NH3	0.1345081967	kg/animal
6178	Other polutry	4.B.09.d	TSP	0.24	kg/animal
6178	Other polutry	4.B.09.d	PM25	0.03	kg/animal
6178	Other polutry	4.B.09.d	NOX	0.005414127714286	kg/animal
6179	Other polutry	4.B.09.d	NMVOC	0.489	kg/animal
6179	Other polutry	4.B.09.d	PM10	0.24	kg/animal

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6179	Other polutry	4.B.09.d	NH3	0.55946286	kg/animal
6179	Other polutry	4.B.09.d	TSP	0.24	kg/animal
6179	Other polutry	4.B.09.d	PM25	0.03	kg/animal
6179	Other polutry	4.B.09.d	NOX	0.005414127714286	kg/animal
6180	Other polutry	4.B.09.d	NMVOC	0.489	kg/animal
6180	Other polutry	4.B.09.d	PM10	0.14	kg/animal
6180	Other polutry	4.B.09.d	NH3	0.1345081967	kg/animal
6180	Other polutry	4.B.09.d	TSP	0.14	kg/animal
6180	Other polutry	4.B.09.d	PM25	0.02	kg/animal
6180	Other polutry	4.B.09.d	NOX	0.0061901924	kg/animal
5410	N from fertilizers use	4.D.1.a	NOX	0.026	kg/kg
5413	Urea	4.D.1.a	NH3	0.195645714285714	kg/kg
5411	KAN	4.D.1.a	NH3	0.0171457142857143	kg/kg
5415	NPK	4.D.1.a	NH3	0.0945685714285714	kg/kg
5414	Amonij nitrat	4.D.1.a	NH3	0.0322514285714286	kg/kg
5412	Urea Amonij nitrat	4.D.1.a	NH3	0.195645714285714	kg/kg
6441	Horses,mules and asses - housing	4.D.1.b	NH3	2.07513034457143	kg/animal
6441	Horses,mules and asses - housing	4.D.1.b	NH3	2.07513034457143	kg/animal
6530	Non dairy (other) - housing	4.D.1.b	NH3	5.69028606200932	kg/animal
6558	Non dairy (young) - housing	4.D.1.b	NH3	5.69028606200932	kg/animal
6586	Fatting pigs	4.D.1.b	NH3	2.246895581327	kg/animal
6587	Geese	4.D.1.b	NH3	0.1368425421	kg/animal
6501	Dairy cows - housing	4.D.1.b	NH3	12.4066649569397	kg/animal
6616	Ducks	4.D.1.b	NH3	0.178509521088	kg/animal
6644	Turkeys	4.D.1.b	NH3	0.33943088556	kg/animal
6672	Broilers	4.D.1.b	NH3	0.12017750976	kg/animal
6674	Layers	4.D.1.b	NH3	0.15283186	kg/animal
6702	Goats	4.D.1.b	NH3	0.070146187992916	kg/animal
6730	Sows	4.D.1.b	NH3	6.20482205919266	kg/animal
6587	Geese	4.D.1.b	NOX	0.0917183450228571	kg/animal
6674	Layers	4.D.1.b	NOX	0.0452256250914286	kg/animal
6672	Broilers	4.D.1.b	NOX	0.03621330390857	kg/animal
6586	Fatting pigs	4.D.1.b	NOX	0.929628931858652	kg/animal
6730	Sows	4.D.1.b	NOX	3.04863099201669	kg/animal
6644	Turkeys	4.D.1.b	NOX	0.13636510824343	kg/animal
6616	Ducks	4.D.1.b	NOX	0.07062397753371	kg/animal
6781	NMVOC	4.D.1.c	NMVOC	0.86	kg/ha
6783	3Dc	4.D.2.a	TSP	1.56	kg/ha
6783	3Dc	4.D.2.a	PM25	0.06	kg/ha
6783	3Dc	4.D.2.a	PM10	1.56	kg/ha
6443	Mules and asses grazing	4.D.2.c	NH3	5.37795	kg/animal
6443	Mules and asses grazing	4.D.2.c	NOX	2.77182857142857	kg/animal
6460	Sheep- grazing	4.D.2.c	NH3	0.3946635	kg/animal
6460	Sheep- grazing	4.D.2.c	NOX	0.949256	kg/animal
6461	Dairy cows - grazing	4.D.2.c	NH3	2.47516423679061	kg/animal
6461	Dairy cows - grazing	4.D.2.c	NOX	4.46500215264188	kg/animal
6464	Non dairy (young)- grazing	4.D.2.c	NH3	0.822846068142733	kg/animal
6464	Non dairy (young)- grazing	4.D.2.c	NOX	2.47391628330495	kg/animal
6466	Non dairy (other) - grazing	4.D.2.c	NH3	0.822846068142733	kg/animal
6466	Non dairy (other) - grazing	4.D.2.c	NOX	2.47391628330495	kg/animal
6467	Goats - grazing	4.D.2.c	NH3	0.803580102739726	kg/animal
6467	Goats - grazing	4.D.2.c	NOX	1.93279397260274	kg/animal
6468	Horses - grazing	4.D.2.c	NH3	5.37795	kg/animal

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6468	Horses - grazing	4.D.2.c	NOX	2.77182857142857	kg/animal
6212	Sewage sludge applied to soil - faktor za stvarni mulj	4.D.4	NH3	0.13	kg/kg NH3 animal
6212	Sewage sludge applied to soil - faktor za stvarni mulj	4.D.4	NOX	0.04	kg/kg NO animal
4469	Solid waste disposal on land	6.A.1	NMVOC	1.56	kg/t
4469	Solid waste disposal on land	6.A.1	TSP	0.463	g/t
4469	Solid waste disposal on land	6.A.1	PM25	0.033	g/t
4469	Solid waste disposal on land	6.A.1	PM10	0.219	g/t
4471	Waste water treatment in industry	6.B.1	NMVOC	15	mg/1000 m3
4472	Waste water treatment in residental / commercial sector	6.B.2	NMVOC	15	mg/1000 m3
4470	Latrines	6.B.3	NH3	1.6	kg/inhabitant
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	As	0.2	g/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	Cd	8	g/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	Cr	2	g/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	Cu	98	g/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	Hg	43	g/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	Ni	2	g/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	Pb	62	g/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	DIOX	40	mg/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	PCBs	0.02	g/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	SO2	0.54	kg/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	NOX	2.3	kg/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	CO	0.19	kg/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	TSP	17	kg/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	HCB	0.1	g/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	PAH	0.04	mg/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	BC	0.391	kg/t
5362	5.C.1.b.iii Clinical waste incineration	6.C.a	NMVOC	0.7	kg/t
196	Incineration of industrial waste	6.C.b	As	0.016	g/t
196	Incineration of industrial waste	6.C.b	Cd	0.1	g/t
196	Incineration of industrial waste	6.C.b	Cr	0.3	g/t
196	Incineration of industrial waste	6.C.b	Cu	3	g/t

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
196	Incineration of industrial waste	6.C.b	Hg	0.056	g/t
196	Incineration of industrial waste	6.C.b	Ni	0.14	g/t
196	Incineration of industrial waste	6.C.b	Pb	1.3	g/t
196	Incineration of industrial waste	6.C.b	Zn	2.1	g/t
196	Incineration of industrial waste	6.C.b	HCB	0.002	g/t
196	Incineration of industrial waste	6.C.b	DIOX	350	µg/t
196	Incineration of industrial waste	6.C.b	PAH	0.02	g/t
196	Incineration of industrial waste	6.C.b	SO2	0.047	kg/t
196	Incineration of industrial waste	6.C.b	NOX	0.87	kg/t
196	Incineration of industrial waste	6.C.b	NMVOC	7.4	kg/t
196	Incineration of industrial waste	6.C.b	CO	0.07	kg/t
196	Incineration of industrial waste	6.C.b	TSP	0.01	kg/t
196	Incineration of industrial waste	6.C.b	PM25	0.004	kg/t
196	Incineration of industrial waste	6.C.b	PM10	0.007	kg/t
196	Incineration of industrial waste	6.C.b	BC	0.00014	kg/t
5361	5.C.1.b.v Cremation	6.C.d	Hg	1.49	g/body
5361	5.C.1.b.v Cremation	6.C.d	SO2	0.113	kg/body
5361	5.C.1.b.v Cremation	6.C.d	NOX	0.825	kg/body
5361	5.C.1.b.v Cremation	6.C.d	CO	0.14	kg/body
5361	5.C.1.b.v Cremation	6.C.d	TSP	38.56	g/body
5361	5.C.1.b.v Cremation	6.C.d	PM25	34.7	g/body
5361	5.C.1.b.v Cremation	6.C.d	PM10	34.7	g/body
5361	5.C.1.b.v Cremation	6.C.d	NMVOC	0.013	kg/body
5361	5.C.1.b.v Cremation	6.C.d	Pb	30.03	mg/body
5361	5.C.1.b.v Cremation	6.C.d	Cd	5.03	mg/body
5361	5.C.1.b.v Cremation	6.C.d	As	13.61	mg/body
5361	5.C.1.b.v Cremation	6.C.d	Cr	13.56	mg/body
5361	5.C.1.b.v Cremation	6.C.d	Cu	12.43	mg/body
5361	5.C.1.b.v Cremation	6.C.d	Ni	17.33	mg/body
5361	5.C.1.b.v Cremation	6.C.d	Se	19.78	mg/body
5361	5.C.1.b.v Cremation	6.C.d	Zn	160.12	mg/body
5361	5.C.1.b.v Cremation	6.C.d	PCBs	0.41	mg/body
5361	5.C.1.b.v Cremation	6.C.d	DIOX	0.027	µg/body
5361	5.C.1.b.v Cremation	6.C.d	HCB	0.15	mg/body
5361	5.C.1.b.v Cremation	6.C.d	Benzo(a)	13.2	µg/body
5361	5.C.1.b.v Cremation	6.C.d	Benzo(b)	7.21	µg/body
5361	5.C.1.b.v Cremation	6.C.d	Benzo(k)	6.44	µg/body
5361	5.C.1.b.v Cremation	6.C.d	Indeno	6.99	µg/body
4841	Car fire	6.D	DIOX	0.048	µg/fire
4841	Car fire	6.D	TSP	2.3	kg/fire

Tech. ID	Technology Name	Category	Pollutant	Emission Factor	Unit
4841	Car fire	6.D	PM25	2.3	kg/fire
4841	Car fire	6.D	PM10	2.3	kg/fire
4837	Detached house fire	6.D	As	1.35	mg/fire
4837	Detached house fire	6.D	Cd	0.85	mg/fire
4837	Detached house fire	6.D	Cr	1.29	mg/fire
4837	Detached house fire	6.D	Cu	2.99	mg/fire
4837	Detached house fire	6.D	Hg	0.85	mg/fire
4837	Detached house fire	6.D	Pb	0.42	mg/fire
4837	Detached house fire	6.D	DIOX	1.44	µg/fire
4837	Detached house fire	6.D	TSP	143.82	kg/fire
4837	Detached house fire	6.D	PM25	143.82	kg/fire
4837	Detached house fire	6.D	PM10	143.82	kg/fire
4838	Undetached house fire	6.D	As	0.58	mg/fire
4838	Undetached house fire	6.D	Cd	0.36	mg/fire
4838	Undetached house fire	6.D	Cr	0.55	mg/fire
4838	Undetached house fire	6.D	Cu	1.28	mg/fire
4838	Undetached house fire	6.D	Hg	0.36	mg/fire
4838	Undetached house fire	6.D	Pb	0.18	mg/fire
4838	Undetached house fire	6.D	DIOX	0.62	µg/fire
4838	Undetached house fire	6.D	TSP	61.62	kg/fire
4838	Undetached house fire	6.D	PM25	61.62	kg/fire
4838	Undetached house fire	6.D	PM10	61.62	kg/fire
4839	Apartment building fire	6.D	As	0.41	mg/fire
4839	Apartment building fire	6.D	Cd	0.26	mg/fire
4839	Apartment building fire	6.D	Cr	0.39	mg/fire
4839	Apartment building fire	6.D	Cu	0.91	mg/fire
4839	Apartment building fire	6.D	Hg	0.26	mg/fire
4839	Apartment building fire	6.D	Pb	0.13	mg/fire
4839	Apartment building fire	6.D	DIOX	0.44	µg/fire
4839	Apartment building fire	6.D	TSP	43.78	kg/fire
4839	Apartment building fire	6.D	PM25	43.78	kg/fire
4839	Apartment building fire	6.D	PM10	43.78	kg/fire
4840	Industrial building fire	6.D	As	0.25	mg/fire
4840	Industrial building fire	6.D	Cd	0.16	mg/fire
4840	Industrial building fire	6.D	Cr	0.24	mg/fire
4840	Industrial building fire	6.D	Cu	0.57	mg/fire
4840	Industrial building fire	6.D	Hg	0.16	mg/fire
4840	Industrial building fire	6.D	Pb	0.08	mg/fire
4840	Industrial building fire	6.D	DIOX	0.27	µg/fire
4840	Industrial building fire	6.D	TSP	27.23	kg/fire
4840	Industrial building fire	6.D	PM25	27.23	kg/fire
4840	Industrial building fire	6.D	PM10	27.23	kg/fire
6159	Compost production	6.D	NH3	0.24	kg/t waste

12.5. Appendix 5. The energy balance for the Republic of Croatia - 2017

Table A5-1: National Energy balance for 2017, natural units

ENERGY BALANCE 2016 *natural units*	Anthracite	Hard coal	Brown coal	Lignite	Crude oil	Natural gas
	103 t	103 t	103 t	103 t	103 t	106 m3
Production					744.5	1483.5
Import	0.3	623.8	41.7	7.3	2818.0	1818.3
Export		34.6				199.7
Import-processing						
Export-processing						
Stock change		-5.1			-23.9	-93.8
Bunkers						
Energy supplied	**0.3**	**584.1**	**41.7**	**7.3**	**3538.6**	**3008.3**
Production						
hydro power plants						
– small HPP						
Wind power plants						
Solar power plants						
Geothermal power plants						
thermal power plants						
public cogeneration plants						
public heating plants						
industrial cogeneration plants						
– in rafineries						
– in gas production						
Industrial heating plants						
Petroleum refineries						
NGL-plant						
Coke plant						
Gas works						
Total production						
Transformation sector						
hydro power plants						
– small HPP						
Wind power plants						
Solar power plants						
Geothermal power plants						
thermal power plants		526.9				5.3
public cogeneration plants						745.6
public heating plants						54.8
industrial cogeneration plants			37.8			315.7
– in rafineries						49.4
– in gas production						49.2
Industrial heating plants						59.6
Petroleum refineries					3483.3	98.3
NGL-plant					55.3	8.9
Coke plant						
Gas works						
Total transformation sector		**526.9**	**37.8**		**3538.6**	**1288.2**
Energy sector own use						
Oil and gas extraction						39.3
Coal production						
Electric energy supply industry						
hydro power plants						
thermal power plants						
public cogeneration plants						
industrial cogeneration plants						
Wind power						
Petroleum refineries						65.7
NGL-plant						23.7
Gas works						
Total energy sector own use						**128.7**
Losses						**32.2**
Final energy demand	**0.3**	**57.2**	**3.9**	**7.3**	**0.0**	**1559.2**
Non energy use						**493.6**
Energy sector						
Petrochemical industry						493.6
Other industry						
Construction						
Transport						
Agriculture						
Energy consumption	**0.3**	**57.2**	**3.9**	**7.3**	**0.0**	**1065.6**
Industry	**0.3**	**57.2**	**1.9**	**0.1**		**227.1**
Iron and steel						12.8
Non-ferrous metals						9.4
Non-metallic minerals						50.6
Chemical						9.2
Construction materials		57.2	1.9	0.1		52.0
Pulp and paper						7.4
Food production						46.1
Not elsewhere specified	0.3					39.6
Transport						**5.1**
Rail						
Road						0.2
Air						
– international						
– domestic						
Sea and River						
Public transport						4.9
Not elsewhere specified						
Other sectors			**2.0**	**7.2**		**833.4**
Households			1.9	7.0		578.1
Services			0.1	0.2		231.3
Agriculture						24.0
Construction						

Table A5-1: National Energy balance for 2017, natural units, cont.

ENERGY BALANCE 2016 *natural units*	Hydro energy	Fuel wood	Wind energy	Solar energy	Geothermal energy	Landfill gas	Biofuels	Other biomass
	TJ	103 m3	TJ	TJ	TJ	103 m3	103 t	TJ
Production	53807.2	5619.2	11762.4	1307.1	345.1	158506.0	0.4	14094.9
Import		64.0					0.3	950.2
Export		748.1						7220.1
Import-processing								
Export-processing								
Stock change								-148.3
Bunkers								
Energy supplied	**53807.2**	**4935.1**	**11762.4**	**1307.1**	**345.1**	**158506.0**	**0.7**	**7676.7**
Production								
hydro power plants								
– small HPP								
Wind power plants								
Solar power plants								
Geothermal power plants								
thermal power plants								
public cogeneration plants								
public heating plants								
industrial cogeneration plants								
– in rafineries								
– in gas production								
Industrial heating plants								
Petroleum refineries								
NGL-plant								
Coke plant								
Gas works								
Total production								
Transformation sector								
hydro power plants	53807.2							
– small HPP	969.1							
Wind power plants			11762.4					
Solar power plants				768.9				
Geothermal power plants								
thermal power plants						17784.0		
public cogeneration plants						133562.0		4244.8
public heating plants								3.0
industrial cogeneration plants						7160.0		
– in rafineries								
– in gas production								
Industrial heating plants								576.5
Petroleum refineries								
NGL-plant								
Coke plant								
Gas works								
Total transformation sector	**53807.2**		**11762.4**	**768.9**		**158506.0**		**4824.3**
Energy sector own use								
Oil and gas extraction								
Coal production								
Electric energy supply industry								
hydro power plants								
thermal power plants								
public cogeneration plants								
industrial cogeneration plants								
Wind power								
Petroleum refineries								
NGL-plant								
Gas works								
Total energy sector own use								
Losses								
Final energy demand		**4935.1**		**538.2**	**345.1**		**0.7**	**2852.4**
Non energy use								
Energy sector								
Petrochemical industry								
Other industry								
Construction								
Transport								
Agriculture								
Energy consumption		**4935.1**		**538.2**	**345.1**		**0.7**	**2852.4**
Industry		**42.2**						**867.7**
Iron and steel		0.3						3.2
Non-ferrous metals		0.4						
Non-metallic minerals								0.7
Chemical								
Construction materials		1.9						553.2
Pulp and paper		3.1						16.5
Food production		2.7						80.5
Not elsewhere specified		33.8						213.6
Transport							**0.7**	
Rail								
Road							0.7	
Air								
– international								
– domestic								
Sea and River								
Public transport								
Not elsewhere specified								
Other sectors		**4892.9**		**538.2**	**345.1**			**1984.7**
Households		4879.6		376.7				1757.8
Services		13.3		161.5	186.7			226.9
Agriculture					158.4			
Construction								

Table A5-1: National Energy balance for 2017, natural units, cont.

ENERGY BALANCE 2016 *natural units*	Coke oven coke	petroleum gases	motor gasoline	motor gasoline	Petroleum	Jet fuel	Diesel oil	Light heating oil	Low sulphur fuel oil	Standard fuel oil
	103 t	103 t	103 t	103 t	103 t	103 t	103 t	103 t	103 t	103 t
Production		283.4	1005.3			130.5	1331.8	159.7	10.6	566.0
Import	32.5	46.8	160.0	0.5	2.6	30.0	1371.5	42.3	47.5	
Export	1.2	188.1	643.2			15.0	900.2	38.8	16.6	503.5
Import-processing										
Export-processing										
Stock change	0.3	0.7	-8.9			4.9	-35.5	1.8	6.0	62.8
Bunkers							3.8			2.6
Energy supplied	**31.6**	**142.8**	**513.2**	**0.5**	**2.6**	**150.4**	**1763.8**	**165.0**	**47.5**	**122.7**
Production										
hydro power plants										
– small HPP										
Wind power plants										
Solar power plants										
Geothermal power plants										
thermal power plants										
public cogeneration plants										
public heating plants										
industrial cogeneration plants										
– in rafineries										
– in gas production										
Industrial heating plants										
Petroleum refineries		241.5	1005.3			130.5	1331.8	159.7	10.6	566.0
NGL-plant		41.9								
Coke plant										
Gas works										
Total production		**283.4**	**1005.3**			**130.5**	**1331.8**	**159.7**	**10.6**	**566.0**
Transformation sector										
hydro power plants										
– small HPP										
Wind power plants										
Solar power plants										
Geothermal power plants										
thermal power plants								1.2		
public cogeneration plants								0.5		34.1
public heating plants								4.2	2.6	
industrial cogeneration plants									40.0	3.1
– in rafineries									40.0	3.1
– in gas production										
Industrial heating plants										50.7
Petroleum refineries										
NGL-plant										
Coke plant										
Gas works										
Total transformation sector								**5.9**	**42.6**	**87.9**
Energy sector own use										
Oil and gas extraction										
Coal production										
Electric energy supply industry										
hydro power plants										
thermal power plants										
public cogeneration plants										
industrial cogeneration plants										
Wind power										
Petroleum refineries									1.9	26.0
NGL-plant										
Gas works										
Total energy sector own use									**1.9**	**26.0**
Losses										
Final energy demand	**31.6**	**142.8**	**513.2**	**0.5**	**2.6**	**150.4**	**1763.8**	**159.1**	**3.0**	**8.8**
Non energy use										
Energy sector										
Petrochemical industry										
Other industry										
Construction										
Transport										
Agriculture										
Energy consumption	**31.6**	**142.8**	**513.2**	**0.5**	**2.6**	**150.4**	**1763.8**	**159.1**	**3.0**	**8.8**
Industry	**31.6**	**8.9**			**2.6**		**11.5**	**16.0**	**0.9**	**8.0**
Iron and steel	0.3	1.1						0.7		0.5
Non-ferrous metals		0.6						0.2		
Non-metallic minerals		0.2								
Chemical					2.6			0.2		
Construction materials	26.6	1.4					11.5	3.4	0.9	2.2
Pulp and paper		0.1								
Food production	4.7	1.2						6.5		4.6
Not elsewhere specified		4.3						5.0		0.7
Transport		**70.7**	**502.0**	**0.5**		**150.4**	**1506.6**			
Rail							17.6			
Road		70.7	502.0				1419.8			
Air				0.5		150.4				
– international				0.1		140.8				
– domestic				0.4		9.6				
Sea and River							44.3			
Public transport							24.9			
Not elsewhere specified										
Other sectors		**63.2**	**11.2**				**245.7**	**143.1**	**2.1**	**0.8**
Households		46.5						83.4	1.3	
Services		12.1						43.5	0.8	
Agriculture		2.5	7.4				169.5	11.4		0.8
Construction		2.1	3.8				76.2	4.8		

Table A5-1: National Energy balance for 2017, natural units, cont.

ENERGY BALANCE 2016 *natural units*	Naphta	White spirit	Bitumen	Other oils	Lubricants	Petroleum coke	Etan	Other derivates
	103 t	103 t	103 t	103 t	103 t	103 t	103 t	103 t
Production	73.5			11.3		73.8		115.1
Import		3.2	121.0	31.5	7.9	163.1		
Export	49.8	0.1	17.3	8.9	0.2	3.0		99.3
Import-processing								
Export-processing								
Stock change	-1.8					6.3		-9.7
Bunkers								
Energy supplied	**21.9**	**3.1**	**103.7**	**33.9**	**7.7**	**240.2**		**6.1**
Production								
hydro power plants								
– small HPP								
Wind power plants								
Solar power plants								
Geothermal power plants								
thermal power plants								
public cogeneration plants								
public heating plants								
industrial cogeneration plants								
– in rafineries								
– in gas production								
Industrial heating plants								
Petroleum refineries	51.5			11.3		73.8		115.1
NGL-plant	22.0							
Coke plant								
Gas works								
Total production	**73.5**			**11.3**		**73.8**		**115.1**
Transformation sector								
hydro power plants								
– small HPP								
Wind power plants								
Solar power plants								
Geothermal power plants								
thermal power plants								
public cogeneration plants								
public heating plants								
industrial cogeneration plants								
– in rafineries								
– in gas production								
Industrial heating plants								
Petroleum refineries	21.9							
NGL-plant								
Coke plant								
Gas works								
Total transformation sector	**21.9**							
Energy sector own use								
Oil and gas extraction								
Coal production								
Electric energy supply industry								
hydro power plants								
thermal power plants								
public cogeneration plants								
industrial cogeneration plants								
Wind power								
Petroleum refineries						37.9		
NGL-plant								
Gas works								
Total energy sector own use						**37.9**		
Losses								
Final energy demand	**0.0**	**3.1**	**103.7**	**33.9**	**7.7**	**202.3**		**6.1**
Non energy use		**3.1**	**103.7**	**33.9**	**7.7**			**6.1**
Energy sector				2.3				
Petrochemical industry								
Other industry		3.1	9.9	6.6	7.7			6.1
Construction			93.8	0.9				
Transport				22.6				
Agriculture				1.5				
Energy consumption	**0.0**					**202.3**		
Industry						**202.3**		
Iron and steel						0.3		
Non-ferrous metals								
Non-metallic minerals								
Chemical								
Construction materials						202.0		
Pulp and paper								
Food production								
Not elsewhere specified								
Transport								
Rail								
Road								
Air								
– international								
– domestic								
Sea and River								
Public transport								
Not elsewhere specified								
Other sectors								
Households								
Services								
Agriculture								
Construction								

Table A5-1: National Energy balance for 2017, natural units, cont.

ENERGY BALANCE 2016 *natural units*	Refinery gas	Refinery semiproducts	Aditives	Gas works gas	Electricity	Steam and hot water	waste, non renewable
	103 t	103 t	103 t	103 m3	GWh	TJ	
Production	184.7				11983.5	27582.6	482.7
Import		287.5	61.9		9487.6		
Export					2533.9		
Import-processing							
Export-processing							
Stock change		23.8	1.5				
Bunkers							
Energy supplied	**184.7**	**311.3**	**63.4**		**18937.2**	**27582.6**	**482.7**
Production							
hydro power plants					5507.7		
– small HPP					99.2		
Wind power plants					1204.0		
Solar power plants					78.7		
Geothermal power plants							
thermal power plants					1395.9		
public cogeneration plants					3383.0	10658.3	
public heating plants						1771.9	
industrial cogeneration plants					414.2	10159.4	
– in rafineries					102.6	3354.0	
– in gas production					112.1	495.0	
Industrial heating plants						4325.9	
Petroleum refineries	184.7						
NGL-plant							
Coke plant							
Gas works							
Total production	**184.7**				**11983.5**	**26915.5**	
Transformation sector							
hydro power plants							
– small HPP							
Wind power plants							
Solar power plants							
Geothermal power plants							
thermal power plants							
public cogeneration plants							
public heating plants							
industrial cogeneration plants	25.6						
– in rafineries	25.6						
– in gas production							
Industrial heating plants	10.8						
Petroleum refineries		311.3	63.4				
NGL-plant							
Coke plant							
Gas works							
Total transformation sector	**36.4**	**311.3**	**63.4**				
Energy sector own use							
Oil and gas extraction					119.1	355.0	
Coal production						136.3	
Electric energy supply industry					28.2		
hydro power plants					356.1		
thermal power plants					132.2		
public cogeneration plants					232.2	1123.0	
industrial cogeneration plants							
Wind power					5.6		
Petroleum refineries	148.3				283.9	5216.0	
NGL-plant					54.1	140.0	
Gas works							
Total energy sector own use	**148.3**				**1211.4**	**6970.3**	
Losses					**1765.3**	**1533.7**	
Final energy demand					**15960.5**	**19078.6**	**482.7**
Non energy use							
Energy sector							
Petrochemical industry							
Other industry							
Construction							
Transport							
Agriculture							
Energy consumption					**15960.5**	**19078.6**	**482.7**
Industry					**3539.5**	**11742.9**	**482.7**
Iron and steel					258.1	87.5	
Non-ferrous metals					86.2		
Non-metallic minerals					152.4	82.8	
Chemical					312.1	5071.9	
Construction materials					557.5		482.7
Pulp and paper					228.5	980.3	
Food production					681.5	3087.5	
Not elsewhere specified					1263.2	2432.9	
Transport					**323.0**		
Rail					164.7		
Road							
Air					32.2		
– international							
– domestic					32.2		
Sea and River					23.4		
Public transport					63.9		
Not elsewhere specified					38.8		
Other sectors					**12098.0**	**7335.7**	
Households					6265.7	5566.9	
Services					5694.1	1533.9	
Agriculture					61.6	234.9	
Construction					76.6		

Table A5-2: National Energy balance for 2017, energy units

PJ	Anthracite	Hard coal	Brown coal	Lignite	Crude oil	Natural gas
Production	-	-	-	-	31.79	51.756
Import	0.01	15.65	0.82	0.09	120.33	63.095
Export	-	0.87	-	-	-	6.930
Import-processing	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-
Stock change	-	- 0.13	-	-	- 1.02	- 3.255
Bunkers	-	-	-	-	-	-
Energy supplied	**0.01**	**14.65**	**0.82**	**0.09**	**151.10**	**104.67**
Production	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-
– small HPP	-	-	-	-	-	-
Wind power plants	-	-	-	-	-	-
Solar power plants	-	-	-	-	-	-
Geothermal power plants	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-
public heating plants	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-
– in rafineries	-	-	-	-	-	-
– in gas production	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-
NGL-plant	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-
Gas works	-	-	-	-	-	-
Total production	**-**	**-**	**-**	**-**	**-**	**-**
Gross production	**0.01**	**14.65**	**0.82**	**0.09**	**151.10**	**104.67**
Transformation sector	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-
– small HPP	-	-	-	-	-	-
Wind power plants	-	-	-	-	-	-
Solar power plants	-	-	-	-	-	-
Geothermal power plants	-	-	-	-	-	-
thermal power plants	-	13.09	-	-	-	0.18
public cogeneration plants	-	-	-	-	-	25.87
public heating plants	-	-	-	-	-	1.90
industrial cogeneration plants	-	-	0.74	-	-	10.95
– in rafineries	-	-	-	-	-	1.71
– in gas production	-	-	-	-	-	1.71
Industrial heating plants	-	-	-	-	-	2.07
Petroleum refineries	-	-	-	-	148.74	3.41
NGL-plant	-	-	-	-	2.36	0.59
Coke plant	-	-	-	-	-	-
Gas works	-	-	-	-	-	-
Total transformation sector	**-**	**13.09**	**0.74**	**-**	**151.10**	**44.98**
Energy sector own use	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	1.36
Coal production	-	-	-	-	-	-
Electric energy supply industry	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	2.28
NGL-plant	-	-	-	-	-	0.82
Gas works	-	-	-	-	-	-
Total energy sector own use	**-**	**-**	**-**	**-**	**-**	**4.47**
Losses	-	-	-	-	-	1.12
Final energy demand	**0.01**	**1.56**	**0.08**	**0.09**	**-**	**54.10**
Non energy use	**-**	**-**	**-**	**-**	**-**	**17.13**
Energy sector	-	-	-	-	-	-
Petrochemical industry	-	-	-	-	-	17.13
Other industry	-	-	-	-	-	-
Construction	-	-	-	-	-	-
Transport	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-
Energy consumption	**0.01**	**1.56**	**0.08**	**0.09**	**-**	**36.98**
Industry	**0.01**	**1.56**	**0.04**	**0.00**	**-**	**7.88**
Iron and steel	-	-	-	-	-	0.44
Non-ferrous metals	-	-	-	-	-	0.33
Non-metallic minerals	-	-	-	-	-	1.76
Chemical	-	-	-	-	-	0.32
Construction materials	-	1.56	0.04	0.00	-	1.80
Pulp and paper	-	-	-	-	-	0.26
Food production	-	-	-	-	-	1.60
Not elsewhere specified	0.01	-	-	-	-	1.37
Transport	**-**	**-**	**-**	**-**	**-**	**0.18**
Rail	-	-	-	-	-	-
Road	-	-	-	-	-	0.01
Air	-	-	-	-	-	-
– international	-	-	-	-	-	-
– domestic	-	-	-	-	-	-
Sea and River	-	-	-	-	-	-
Public transport	-	-	-	-	-	0.17
Not elsewhere specified	-	-	-	-	-	-
Other sectors	**-**	**-**	**0.04**	**0.08**	**-**	**28.92**
Households	-	-	0.04	0.08	-	20.06
Services	-	-	0.00	0.00	-	8.03
Agriculture	-	-	-	-	-	0.83
Construction	-	-	-	-	-	-

Table A5-2: National Energy balance for 2017, energy units, cont.

PJ	Hydro energy	Fuel wood	Wind energy	Solar energy	Geothermal energy	Landfill gas	Biofuels	Other biomass
Production	53.81	50.573	11.762	1.307	0.345	2.6716	0.013	14.095
Import	-	0.58	-	-	-	-	0.01	0.95
Export	-	6.73	-	-	-	-	-	7.22
Import-processing	-	-	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-	-	-
Stock change	-	-	-	-	-	-	-	-0.15
Bunkers	-	-	-	-	-	-	-	-
Energy supplied	**53.81**	**44.42**	**11.76**	**1.31**	**0.35**	**2.6716**	**0.02**	**7.68**
Production	-	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-	-
– small HPP	-	-	-	-	-	-	-	-
Wind power plants	-	-	-	-	-	-	-	-
Solar power plants	-	-	-	-	-	-	-	-
Geothermal power plants	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-	-	-
public heating plants	-	-	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-	-	-
– in rafineries	-	-	-	-	-	-	-	-
– in gas production	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-	-	-
NGL-plant	-	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total production	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Gross production	**53.81**	**44.42**	**11.76**	**1.31**	**0.35**	**2.6716**	**0.02**	**7.68**
Transformation sector	-	-	-	-	-	-	-	-
hydro power plants	53.81	-	-	-	-	-	-	-
– small HPP	0.97	-	-	-	-	-	-	-
Wind power plants	-	-	11.76	-	-	-	-	-
Solar power plants	-	-	-	0.77	-	-	-	-
Geothermal power plants	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	0.3086	-	-
public cogeneration plants	-	-	-	-	-	2.2174	-	4.24
public heating plants	-	-	-	-	-	-	-	0.00
industrial cogeneration plants	-	-	-	-	-	0.1456	-	-
– in rafineries	-	-	-	-	-	-	-	-
– in gas production	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	0.58
Petroleum refineries	-	-	-	-	-	-	-	-
NGL-plant	-	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total transformation sector	**53.81**	**-**	**11.76**	**0.77**	**-**	**2.6716**	**-**	**4.82**
Energy sector own use	-	-	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	-	-	-
Coal production	-	-	-	-	-	-	-	-
Electric energy supply industry	-	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-	-	-
NGL-plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total energy sector own use	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Losses	-	-	-	-	-	-	-	-
Final energy demand	**-**	**44.42**	**-**	**0.54**	**0.35**	**-**	**0.02**	**2.85**
Non energy use	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Energy sector	-	-	-	-	-	-	-	-
Petrochemical industry	-	-	-	-	-	-	-	-
Other industry	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-
Transport	-	-	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-	-	-
Energy consumption	**-**	**44.42**	**-**	**0.54**	**0.35**	**-**	**0.02**	**2.85**
Industry	**-**	**0.38**	**-**	**-**	**-**	**-**	**-**	**0.87**
Iron and steel	-	0.00	-	-	-	-	-	0.00
Non-ferrous metals	-	0.00	-	-	-	-	-	-
Non-metallic minerals	-	-	-	-	-	-	-	0.00
Chemical	-	-	-	-	-	-	-	-
Construction materials	-	0.02	-	-	-	-	-	0.55
Pulp and paper	-	0.03	-	-	-	-	-	0.02
Food production	-	0.02	-	-	-	-	-	0.08
Not elsewhere specified	-	0.30	-	-	-	-	-	0.21
Transport	**-**	**-**	**-**	**-**	**-**	**-**	**0.02**	**-**
Rail	-	-	-	-	-	-	-	-
Road	-	-	-	-	-	-	0.02	-
Air	-	-	-	-	-	-	-	-
– international	-	-	-	-	-	-	-	-
– domestic	-	-	-	-	-	-	-	-
Sea and River	-	-	-	-	-	-	-	-
Public transport	-	-	-	-	-	-	-	-
Not elsewhere specified	-	-	-	-	-	-	-	-
Other sectors	**-**	**44.04**	**-**	**0.54**	**0.35**	**-**	**-**	**1.98**
Households	-	43.92	-	0.38	-	-	-	1.76
Services	-	0.12	-	0.16	0.19	-	-	0.23
Agriculture	-	-	-	-	0.16	-	-	-
Construction	-	-	-	-	-	-	-	-

Table A5-2: National Energy balance for 2017, energy units, cont.

PJ	Coke oven coke	Liquefied petroleum gases	Unleaded motor gasoline	Standard motor gasoline	Petroleum	Jet fuel	Diesel oil	Light heating oil	Low sulphur fuel oil	Standard fuel oil
Production	-	-	-	-	-	-	-	-	-	-
Import	0.95	2.19	7.13	0.02	0.11	1.32	58.58	1.81	1.91	-
Export	0.04	8.82	28.68	-	-	0.66	38.45	1.66	0.67	20.24
Import-processing	-	-	-	-	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-	-	-	-	-
Stock change	0.01	0.03	-0.40	-	-	0.22	-1.52	0.08	0.24	2.52
Bunkers	-	-	-	-	-	-	0.16	-	-	0.10
Energy supplied	**0.93**	**-6.59**	**-21.94**	**0.02**	**0.11**	**0.87**	**18.45**	**0.23**	**1.48**	**-17.82**
Production	-	-	-	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-	-	-	-
– small HPP	-	-	-	-	-	-	-	-	-	-
Wind power plants	-	-	-	-	-	-	-	-	-	-
Solar power plants	-	-	-	-	-	-	-	-	-	-
Geothermal power plants	-	-	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-	-	-	-	-
public heating plants	-	-	-	-	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-	-	-	-	-
– in rafineries	-	-	-	-	-	-	-	-	-	-
– in gas production	-	-	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	-	11.32	44.83	-	-	5.74	56.88	6.82	0.43	22.75
NGL-plant	-	1.96	-	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-	-	-
Total production	**-**	**13.29**	**44.83**	**-**	**-**	**5.74**	**56.88**	**6.82**	**0.43**	**22.75**
Gross production	**0.93**	**6.70**	**22.88**	**0.02**	**0.11**	**6.61**	**75.33**	**7.05**	**1.91**	**4.93**
Transformation sector	-	-	-	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-	-	-	-
– small HPP	-	-	-	-	-	-	-	-	-	-
Wind power plants	-	-	-	-	-	-	-	-	-	-
Solar power plants	-	-	-	-	-	-	-	-	-	-
Geothermal power plants	-	-	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-	0.05	-	-
public cogeneration plants	-	-	-	-	-	-	-	0.02	-	1.37
public heating plants	-	-	-	-	-	-	-	0.18	0.10	-
industrial cogeneration plants	-	-	-	-	-	-	-	-	1.61	0.12
– in rafineries	-	-	-	-	-	-	-	-	1.61	0.12
– in gas production	-	-	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	-	-	2.04
Petroleum refineries	-	-	-	-	-	-	-	-	-	-
NGL-plant	-	-	-	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-	-	-
Total transformation sector	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.25**	**1.71**	**3.53**
Energy sector own use	-	-	-	-	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	-	-	-	-	-
Coal production	-	-	-	-	-	-	-	-	-	-
Electric energy supply industry	-	-	-	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-	-	-	0.08	1.04
NGL-plant	-	-	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-	-	-
Total energy sector own use	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.08**	**1.04**
Losses	-	-	-	-	-	-	-	-	-	-
Final energy demand	**0.93**	**6.70**	**22.88**	**0.02**	**0.11**	**6.61**	**75.33**	**6.80**	**0.12**	**0.35**
Non energy use	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Energy sector	-	-	-	-	-	-	-	-	-	-
Petrochemical industry	-	-	-	-	-	-	-	-	-	-
Other industry	-	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-	-
Transport	-	-	-	-	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-	-	-	-	-
Energy consumption	**0.93**	**6.70**	**22.88**	**0.02**	**0.11**	**6.61**	**75.33**	**6.80**	**0.12**	**0.35**
Industry	**0.93**	**0.42**	**-**	**-**	**0.11**	**-**	**0.49**	**0.68**	**0.04**	**0.32**
Iron and steel	0.01	0.05	-	-	-	-	-	0.03	-	0.02
Non-ferrous metals	-	0.03	-	-	-	-	-	0.01	-	-
Non-metallic minerals	-	0.01	-	-	-	-	-	-	-	-
Chemical	-	-	-	-	0.11	-	-	0.01	-	-
Construction materials	0.78	0.07	-	-	-	-	0.49	0.15	0.04	0.09
Pulp and paper	-	0.00	-	-	-	-	-	-	-	-
Food production	0.14	0.06	-	-	-	-	-	0.28	-	0.18
Not elsewhere specified	-	0.20	-	-	-	-	-	0.21	-	0.03
Transport	**-**	**3.32**	**22.38**	**0.02**	**-**	**6.61**	**64.35**	**-**	**-**	**-**
Rail	-	-	-	-	-	-	0.75	-	-	-
Road	-	3.32	22.38	-	-	-	60.64	-	-	-
Air	-	-	-	0.02	-	6.61	-	-	-	-
– international	-	-	-	0.00	-	6.19	-	-	-	-
– domestic	-	-	-	0.02	-	0.42	-	-	-	-
Sea and River	-	-	-	-	-	-	1.89	-	-	-
Public transport	-	-	-	-	-	-	1.06	-	-	-
Not elsewhere specified	-	-	-	-	-	-	-	-	-	-
Other sectors	**-**	**2.96**	**0.50**	**-**	**-**	**-**	**10.49**	**6.11**	**0.08**	**0.03**
Households	-	2.18	-	-	-	-	-	3.56	0.05	-
Services	-	0.57	-	-	-	-	-	1.86	0.03	-
Agriculture	-	0.12	0.33	-	-	-	7.24	0.49	-	0.03
Construction	-	0.10	0.17	-	-	-	3.25	0.21	-	-

Table A5-2: National Energy balance for 2017, energy units, cont.

PJ	Naphta	White spirit	Bitumen	Lubricants	Paraffin and wax	Petroleum coke	Etan	Other derivates
Production	-	-	-	-	-	-	-	-
Import	-	0.11	4.05	1.06	0.26	5.06	-	-
Export	2.22	0.00	0.58	0.30	0.01	0.09	-	3.99
Import-processing	-	-	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-	-	-
Stock change	- 0.08	-	-	-	-	0.20	-	- 0.39
Bunkers	-	-	-	-	-	-	-	-
Energy supplied	**- 2.30**	**0.10**	**3.47**	**0.76**	**0.26**	**5.16**	**-**	**- 4.38**
Production	-	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-	-
– small HPP	-	-	-	-	-	-	-	-
Wind power plants	-	-	-	-	-	-	-	-
Solar power plants	-	-	-	-	-	-	-	-
Geothermal power plants	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-	-	-
public heating plants	-	-	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-	-	-
– in rafineries	-	-	-	-	-	-	-	-
– in gas production	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	-
Petroleum refineries	2.30	-	-	0.38	-	2.29	-	4.63
NGL-plant	0.98	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total production	**3.28**	**-**	**-**	**0.38**	**-**	**2.29**	**-**	**4.63**
Gross production	**0.98**	**0.10**	**3.47**	**1.14**	**0.26**	**7.45**	**-**	**0.25**
Transformation sector	-	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-	-
– small HPP	-	-	-	-	-	-	-	-
Wind power plants	-	-	-	-	-	-	-	-
Solar power plants	-	-	-	-	-	-	-	-
Geothermal power plants	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-	-	-
public heating plants	-	-	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-	-	-
– in rafineries	-	-	-	-	-	-	-	-
– in gas production	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	-
Petroleum refineries	0.98	-	-	-	-	-	-	-
NGL-plant	-	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total transformation sector	**0.98**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Energy sector own use	-	-	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	-	-	-
Coal production	-	-	-	-	-	-	-	-
Electric energy supply industry	-	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	1.17	-	-
NGL-plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total energy sector own use	**-**	**-**	**-**	**-**	**-**	**1.17**	**-**	**-**
Losses	-	-	-	-	-	-	-	-
Final energy demand	**0.00**	**0.10**	**3.47**	**1.14**	**0.26**	**6.27**	**-**	**0.25**
Non energy use	**-**	**0.1039**	**3.4740**	**1.1357**	**0.2580**	**-**	**-**	**0.2452**
Energy sector	-	-	-	0.08	-	-	-	-
Petrochemical industry	-	-	-	-	-	-	-	-
Other industry	-	0.10	0.33	0.22	0.26	-	-	0.25
Construction	-	-	3.14	0.03	-	-	-	-
Transport	-	-	-	0.76	-	-	-	-
Agriculture	-	-	-	0.05	-	-	-	-
Energy consumption	**0.00**	**-**	**-**	**-**	**-**	**6.27**	**-**	**-**
Industry	**-**	**-**	**-**	**-**	**-**	**6.27**	**-**	**-**
Iron and steel	-	-	-	-	-	0.01	-	-
Non-ferrous metals	-	-	-	-	-	-	-	-
Non-metallic minerals	-	-	-	-	-	-	-	-
Chemical	-	-	-	-	-	-	-	-
Construction materials	-	-	-	-	-	6.26	-	-
Pulp and paper	-	-	-	-	-	-	-	-
Food production	-	-	-	-	-	-	-	-
Not elsewhere specified	-	-	-	-	-	-	-	-
Transport	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Rail	-	-	-	-	-	-	-	-
Road	-	-	-	-	-	-	-	-
Air	-	-	-	-	-	-	-	-
– international	-	-	-	-	-	-	-	-
– domestic	-	-	-	-	-	-	-	-
Sea and River	-	-	-	-	-	-	-	-
Public transport	-	-	-	-	-	-	-	-
Not elsewhere specified	-	-	-	-	-	-	-	-
Other sectors	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Households	-	-	-	-	-	-	-	-
Services	-	-	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-

Table A5-2: National Energy balance for 2017, energy units, cont.

PJ	Refinery gas	Refinery semiproducts	Aditives	Gas works gas	Electricity	Steam and hot water	Industrial waste, non renewable
Production	-	-	-	-	-	0.67	0.48
Import	-	12.28	2.64	-	34.16	-	-
Export	-	-	-	-	9.12	-	-
Import-processing	-	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-	-
Stock change	-	1.02	0.06	-	-	-	-
Bunkers	-	-	-	-	-	-	-
Energy supplied	**-**	**13.29**	**2.71**	**-**	**25.03**	**0.67**	**0.48**
Production	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	19.83	-	-
– small HPP	-	-	-	-	0.36	-	-
Wind power plants	-	-	-	-	4.33	-	-
Solar power plants	-	-	-	-	0.28	-	-
Geothermal power plants	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	5.03	-	-
public cogeneration plants	-	-	-	-	12.18	10.66	-
public heating plants	-	-	-	-	-	1.77	-
industrial cogeneration plants	-	-	-	-	1.49	10.16	-
– in rafineries	-	-	-	-	0.37	3.35	-
– in gas production	-	-	-	-	0.40	0.50	-
Industrial heating plants	-	-	-	-	-	4.33	-
Petroleum refineries	7.87	-	-	-	-	-	-
NGL-plant	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-
Total production	**7.87**	**-**	**-**	**-**	**43.14**	**26.92**	**-**
Gross production	**7.87**	**13.29**	**2.71**	**-**	**68.17**	**27.58**	**0.48**
Transformation sector	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-
– small HPP	-	-	-	-	-	-	-
Wind power plants	-	-	-	-	-	-	-
Solar power plants	-	-	-	-	-	-	-
Geothermal power plants	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-	-
public heating plants	-	-	-	-	-	-	-
industrial cogeneration plants	1.09	-	-	-	-	-	-
– in rafineries	1.09	-	-	-	-	-	-
– in gas production	-	-	-	-	-	-	-
Industrial heating plants	0.46	-	-	-	-	-	-
Petroleum refineries	-	13.29	2.71	-	-	-	-
NGL-plant	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-
Total transformation sector	**1.55**	**13.29**	**2.71**	**-**	**-**	**-**	**-**
Energy sector own use	-	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	0.43	0.36	-
Coal production	-	-	-	-	-	0.14	-
Electric energy supply industry	-	-	-	-	0.10	-	-
hydro power plants	-	-	-	-	1.28	-	-
thermal power plants	-	-	-	-	0.48	-	-
public cogeneration plants	-	-	-	-	0.84	1.12	-
industrial cogeneration plants	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	0.02	-	-
Petroleum refineries	6.32	-	-	-	1.02	5.22	-
NGL-plant	-	-	-	-	0.19	0.14	-
Gas works	-	-	-	-	-	-	-
Total energy sector own use	**6.32**	**-**	**-**	**-**	**4.36**	**6.97**	**-**
Losses	-	-	-	-	6.36	1.53	-
Final energy demand	**- 0.00**	**- 0.00**	**-**	**-**	**57.46**	**19.08**	**0.48**
Non energy use	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Energy sector	-	-	-	-	-	-	-
Petrochemical industry	-	-	-	-	-	-	-
Other industry	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
Transport	-	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-	-
Energy consumption	**- 0.00**	**- 0.00**	**-**	**-**	**57.46**	**19.08**	**0.48**
Industry	**-**	**-**	**-**	**-**	**12.74**	**11.74**	**0.48**
Iron and steel	-	-	-	-	0.93	0.09	-
Non-ferrous metals	-	-	-	-	0.31	-	-
Non-metallic minerals	-	-	-	-	0.55	0.08	-
Chemical	-	-	-	-	1.12	5.07	-
Construction materials	-	-	-	-	2.01	-	0.48
Pulp and paper	-	-	-	-	0.82	0.98	-
Food production	-	-	-	-	2.45	3.09	-
Not elsewhere specified	-	-	-	-	4.55	2.43	-
Transport	**-**	**-**	**-**	**-**	**1.16**	**-**	**-**
Rail	-	-	-	-	0.59	-	-
Road	-	-	-	-	-	-	-
Air	-	-	-	-	0.12	-	-
– international	-	-	-	-	-	-	-
– domestic	-	-	-	-	0.12	-	-
Sea and River	-	-	-	-	0.08	-	-
Public transport	-	-	-	-	0.23	-	-
Not elsewhere specified	-	-	-	-	0.14	-	-
Other sectors	**-**	**-**	**-**	**-**	**43.55**	**7.34**	**-**
Households	-	-	-	-	22.56	5.57	-
Services	-	-	-	-	20.50	1.53	-
Agriculture	-	-	-	-	0.22	0.23	-
Construction	-	-	-	-	0.28	-	-

12.6. Appendix 6. NFR 2017

Table A6-1 Emissions data for the Main pollutants and particulate matter according to NFR categories

ANNEX 1: National sector emissions: Main pollutants, particulate matter, heavy metals and persistent organic pollutants

NFR 2014-1

COUNTRY:	HR	(as ISO2 code)
DATE:	22.1.2019	(as DD.MM.YYYY)
YEAR:	2017	(as YYYY, year of emissions and activity data)
Version:	v1.0	(as v1.0 for the initial submission)

XML Export for all entered years | Add a new year

HR: 22.1.2019: 2017	*NFR sectors to be reported*			Main Pollutants (from 1990)				Particulate Matter (from 2000)			
				NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC
NFR Aggregation for Gridding and LPS (GNFR)	NFR Code	Longname	Notes	kt	kt	kt	kt	kt	kt	kt	kt
A_PublicPower	1A1a	Public electricity and heat production		3,485735402	0,28089	1,73553	0,0085	0,645577	0,81227	1,029058	0,0235708
B_Industry	1A1b	Petroleum refining		1,67133	0,044	2,57903	NE	0,109657	0,143762	0,19641	0,00714657
B_Industry	1A1c	Manufacture of solid fuels and other energy industries		0,290142136	0,09018	0,00263	0,00059	0,003058	0,003058	0,003058	0,00012233
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel		0,069271233	0,01649	0,0258	0,00023	0,004145	0,004989	0,006288	0,00081788
B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals		0,027870846	0,0094	0,00062	0,00014	0,001079	0,001304	0,001671	0,00015217
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals		0,304807611	0,0587	0,07061	0,00	0,005073	0,008144	0,013058	3,0949E-05
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print		0,161695212	0,0542	0,03328	0,00186	0,009754	0,009905	0,010257	0,00283259
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco		0,679629599	0,23654	0,95247	0,00651	0,138736	0,154106	0,172577	0,01674374
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals		2,910815004	0,61945	1,12515	0,0411	0,216971	0,232266	0,256463	0,04950621
I_Offroad	1A2gvii	Mobile Combustion in manufacturing industries and construction: (please specify in the IIR)		1,35	0,27	0,00133	0,00	0,07	0,07	0,07	0,05
B_Industry	1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)		IE	IE	IE	IE	IE	IE	IE	IE
H_Aviation	1A3ai(i)	International aviation LTO (civil)		0,232135444	0,01399	0,01634	NE	0,001958	0,001958	0,001958	0,00094331
H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)		0,027980411	0,01107	0,00183	0,00016	0,0003	0,000355	0,000355	0,0001177
F_RoadTransport	1A3bi	Road transport: Passenger cars		11,3920751	2,31846	0,02199	0,46437	0,592284	0,592284	0,592284	0,42553185
F_RoadTransport	1A3bii	Road transport: Light duty vehicles		2,984506153	0,21122	0,00506	0,0107	0,195859	0,195859	0,195859	0,1185441
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses		8,990859558	0,44822	0,00698	0,0077	0,183578	0,183578	0,183578	0,11309972
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles		0,152625154	1,4774	0,00032	0,00146	0,02667	0,02667	0,02667	0,00452387
F_RoadTransport	1A3bv	Road transport: Gasoline evaporation		NA	1,03	NA	NA	NA	NA	NA	NA
F_RoadTransport	1A3bvi	Road transport: Automobile tyre and brake wear		NA	NA	NA	NA	0,324363	0,608827	0,608827	0,10904087
F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion		NA	NA	NA	NA	0,13755	0,252427	0,504854	NE
I_Offroad	1A3c	Railways		0,922240788	0,08184	0,00023	0,00012	0,024114	0,025347	0,026753	0,00015786
G_Shipping	1A3di(ii)	International inland waterways		IE	IE	IE	IE	IE	IE	IE	IE
G_Shipping	1A3dii	National navigation (shipping)		1,701125932	0,33003	0,00057	0,00031	0,203774	0,203774	0,203774	0,00111631
I_Offroad	1A3ei	Pipeline transport		NO	NO	NO	NO	NO	NO	NO	NO
I_Offroad	1A3eii	Other (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
C_OtherStationaryComb	1A4ai	Commercial/institutional: Stationary		1,255298697	0,34253	0,10726	0,01413	0,089806	0,096555	0,097121	0,03293996
I_Offroad	1A4aii	Commercial/institutional: Mobile		IE	IE	IE	IE	IE	IE	IE	IE
C_OtherStationaryComb	1A4bi	Residential: Stationary		5,207119555	14,6603	0,90349	2,05322	11,2443	11,51748	12,10213	1,66422651
I_Offroad	1A4bii	Residential: Household and gardening (mobile)		0,041698154	0,29901	0,00009	2,9E-05	0,008834	0,008834	0,008834	0,00044215
C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary		0,229129926	0,03223	0,03431	0,00014	0,010084	0,011641	0,011122	0,00526162
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery		2,57	0,24	0,00248	0,00	0,10	0,10	0,10	0,07
I_Offroad	1A4ciii	Agriculture/Forestry/Fishing: National fishing		IE	IE	IE	IE	IE	IE	IE	IE
C_OtherStationaryComb	1A5a	Other stationary (including military)		IE	IE	IE	IE	IE	IE	IE	IE
I_Offroad	1A5b	Other, Mobile (including military, land based and recreational boats)		IE	IE	IE	IE	IE	IE	IE	IE
D_Fugitive	1B1a	Fugitive emission from solid fuels: Coal mining and handling		NA	NO	NA	NA	NO	NO	NO	NO
D_Fugitive	1B1b	Fugitive emission from solid fuels: Solid fuel transformation		NO	NO	NO	NO	NO	NO	NO	NO
D_Fugitive	1B1c	Other fugitive emissions from solid fuels		NO	NO	NO	NO	NO	NO	NO	NO

HR: 22.1.2019: 2017	*NFR sectors to be reported*			Main Pollutants (from 1990)				Particulate Matter (from 2000)			
				NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport		NA	0,07073	NE	NA	NA	NA	NA	NA
D_Fugitive	1B2aiv	Fugitive emissions oil: Refining / storage		0,1488514	1,18635	4,42897	0,11908	0,214237	0,492443	0,682866	0,00023221
D_Fugitive	1B2av	Distribution of oil products		NA	2,19418	NE	NA	NA	NA	NA	NA
D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)		NA	0,16047	NE	NA	NA	NA	NA	NA
D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)		0,036708837	0,02381	0,3191	NE	0,023106	0,023106	0,023106	0,005382
D_Fugitive	1B2d	Other fugitive emissions from energy production	(a)	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2A1	Cement production		IE	IE	IE	IE	0,188065	0,372368	0,043882	0,00940324
B_Industry	2A2	Lime production		IE	IE	IE	IE	0,004371	0,029143	0,058286	2,0109E-05
B_Industry	2A3	Glass production		IE	0,02415	IE	0,07785	0,080766	0,090995	0,101502	0,00032071
B_Industry	2A5a	Quarrying and mining of minerals other than coal		NA	NA	NA	NA	0,118703	1,187032	2,421546	NA
B_Industry	2A5b	Construction and demolition		NA	NA	NA	NA	0,016771	0,167711	0,334595	NA
B_Industry	2A5c	Storage, handling and transport of mineral products		IE	IE	IE	IE	IE	IE	IE	IE
B_Industry	2A6	Other mineral products (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B1	Ammonia production		0,973687423	0,04219	NE	0,02344	NE	NA	NA	NA
B_Industry	2B2	Nitric acid production		0,188478284	NA	NA	NE	NE	NA	NA	NA
B_Industry	2B3	Adipic acid production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B5	Carbide production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B6	Titanium dioxide production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B7	Soda ash production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B10a	Chemical industry: Other (please specify in the IIR)		0,028710724	2,1E-05	0,17442	2,34026	0,41793	0,557241	0,755772	0,00752275
B_Industry	2B10b	Storage, handling and transport of chemical products (please specify in the IIR)		NA	NA	NA	NA	IE	IE	IE	IE
B_Industry	2C1	Iron and steel production		0,004343523	0,00163	0,002	IE	0,000702	0,000802	0,001121	2,5259E-06
B_Industry	2C2	Ferroalloys production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C3	Aluminium production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C4	Magnesium production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C5	Lead production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C6	Zinc production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7a	Copper production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7b	Nickel production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7c	Other metal production (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7d	Storage, handling and transport of metal products (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
E_Solvents	2D3a	Domestic solvent use including fungicides		NA	2,04984	NA	NA	NA	NA	NA	NA
E_Solvents	2D3b	Road paving with asphalt		NE	0,01303	NE	NA	0,325643	2,442321	11,3975	0,01856164
B_Industry	2D3c	Asphalt roofing		NE	0,00358	NA	NA	0,002206	0,011031	0,044122	2,868E-07
B_Industry	2D3d	Coating applications		NA	9,1555	NA	NA	NA	NA	NA	NA
E_Solvents	2D3e	Degreasing		NA	0,10331	NA	NA	NE	NA	NA	NA
E_Solvents	2D3f	Dry cleaning		NA	0,03468	NA	NA	NE	NA	NA	NA
E_Solvents	2D3g	Chemical products		NE	1,14532	NA	NA	NA	NA	NA	NA
E_Solvents	2D3h	Printing		NA	2,35695	NA	NA	NE	NA	NA	NE
E_Solvents	2D3i	Other solvent use (please specify in the IIR)		NE	3,73035	NE	NE	0,037127	0,055691	0,068067	NE

HR: 22.1.2019: 2017	*NFR sectors to be reported*			Main Pollutants (from 1990)				Particulate Matter (from 2000)			
				NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
E_Solvents	2G	Other product use (please specify in the IIR)		0,016725187	0,92	0,00	0,04	0,32	0,38	0,39	0,11
B_Industry	2H1	Pulp and paper industry		NE	0,00195	NE	NE	NE	NE	NE	NE
B_Industry	2H2	Food and beverages industry		NA	5,38256	NA	NA	NE	NE	NE	NE
B_Industry	2H3	Other industrial processes (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2I	Wood processing		NE	NE	NE	NE	NE	NE	0,117871	NE
B_Industry	2J	Production of POPs		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
K_AgriLivestock	3B1a	Manure management - Dairy cattle		0,007522033	2,59417	NA	2,40487	0,06583	0,101153	0,221573	NA
K_AgriLivestock	3B1b	Manure management - Non-dairy cattle		0,02	2,28945	NA	2,27021	0,035248	0,055431	0,118663	NA
K_AgriLivestock	3B2	Manure management - Sheep		0,00	0,10832	NA	0,06138	0,010635	0,035407	0,088516	NA
K_AgriLivestock	3B3	Manure management - Swine		0,016110664	0,76569	NA	4,40474	0,074964	0,426078	0,940898	NA
K_AgriLivestock	3B4a	Manure management - Buffalo		NO	NO	NA	NO	NO	NO	NO	NA
K_AgriLivestock	3B4d	Manure management - Goats		0,00	0,04167	NA	0,01507	0,001282	0,004268	0,010671	NA
K_AgriLivestock	3B4e	Manure management - Horses		0,00	0,1132	NA	0,04232	0,003707	0,005825	0,01271	NA
K_AgriLivestock	3B4f	Manure management - Mules and asses		0,00	0,00481	NA	0,00523	0,000327	0,000523	0,001112	NA
K_AgriLivestock	3B4gi	Manure mangement - Laying hens		0,00	0,63412	NA	0,81933	0,088392	0,457334	0,457334	NA
K_AgriLivestock	3B4gii	Manure mangement - Broilers		0,02	0,63051	NA	0,66372	0,052543	0,402828	0,402828	NA
K_AgriLivestock	3B4giii	Manure mangement - Turkeys		0,01	0,24111	NA	0,28188	0,034515	0,256397	0,256397	NA
K_AgriLivestock	3B4giv	Manure management - Other poultry		0,00	0,12475	NA	0,03996	0,006845	0,053141	0,053141	NA
K_AgriLivestock	3B4h	Manure management - Other animals (please specify in IIR)		NO	NO	NA	NO	NO	NO	NO	NA
L_AgriOther	3Da1	Inorganic N-fertilizers (includes also urea application)		2,654085018	NA	NA	11,4433	NA	NA	NA	NA
L_AgriOther	3Da2a	Animal manure applied to soils		1,76	NA	NA	8,26	NA	NA	NA	NA
L_AgriOther	3Da2b	Sewage sludge applied to soils		0,00200764	NA	NA	0,01	NA	NA	NA	NA
L_AgriOther	3Da2c	Other organic fertilisers applied to soils (including compost)		NE	NA	NA	NE	NA	NA	NA	NA
L_AgriOther	3Da3	Urine and dung deposited by grazing animals		2,308874164	NA	NA	1,11	NA	NA	NA	NA
L_AgriOther	3Da4	Crop residues applied to soils		NE	NA	NA	NE	NA	NA	NA	NA
L_AgriOther	3Db	Indirect emissions from managed soils		NE	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products		NA	NA	NA	NA	0,09	2,33	2,33	NA
L_AgriOther	3Dd	Off-farm storage, handling and transport of bulk agricultural products		NE	NE	NA	NE	NE	NE	NE	NA
L_AgriOther	3De	Cultivated crops	(b)	NA	1,29	NA	NE	NA	NA	NA	NA
L_AgriOther	3Df	Use of pesticides		NA	NA	NA	NO	NA	NA	NA	NA
L_AgriOther	3F	Field burning of agricultural residues		NE	NE	NE	NE	NE	NE	NE	NO
L_AgriOther	3I	Agriculture other (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5A	Biological treatment of waste - Solid waste disposal on land		NA	2,62648	NA	NE	5,56E-05	0,000369	0,00078	NA
J_Waste	5B1	Biological treatment of waste - Composting		NE	NE	NE	0,01	NE	NE	NE	NE
J_Waste	5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities		NA	NA	NA	NA	NA	NA	NA	NA
J_Waste	5C1a	Municipal waste incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bi	Industrial waste incineration	(c)	IE	IE	IE	IE	IE	IE	IE	IE
J_Waste	5C1bii	Hazardous waste incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biii	Clinical waste incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biv	Sewage sludge incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bv	Cremation	(c)	0,0045342	7,1E-05	0,00062	NA	0,000191	0,000191	0,000212	NE

HR: 22.1.2019: 2017	***NFR sectors to be reported***			**Main Pollutants** (from 1990)				**Particulate Matter** (from 2000)			
				NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
J_Waste	5C1bvi	Other waste incineration (please specify in the IIR)	(c)	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C2	Open burning of waste		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5D1	Domestic wastewater handling		NA	4,22E-03	NA	NE	NE	NE	NE	NE
J_Waste	5D2	Industrial wastewater handling		NA	0,00023	NA	NE	NE	NE	NE	NE
J_Waste	5D3	Other wastewater handling		NA	NE	NA	0,5973	NE	NE	NE	NE
J_Waste	5E	Other waste (please specify in IIR)	(d)	NE	NE	NE	NE	0,162548	0,162548	0,162548	NE
M_Other	6A	Other (included in national total for entire territory) (please specify in IIR)		NO	NO	NO	NO	NO	NO	NO	NO
	NATIONAL TOTAL	**National total for the entire territory (based on fuel sold)**		54,852	63,241	12,557	37,642	16,726	25,378	37,935	2,846
	ADJUSTMENTS (Net total)	Sum of adjustments (negative value) from Annex VII									
	NATIONAL TOTAL FOR COMPLIANCE	**National total for compliance assessment (please specify all details in the IIR)**	(e)								
'MEMO' ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS											
O_AviCruise	1A3ai(ii)	International aviation cruise (civil)		1,506878998	0,05884	0,08337	NE	0,023547	0,023547	0,023547	0,01128206
O_AviCruise	1A3aii(ii)	Domestic aviation cruise (civil)		0,072280379	0,0007	0,00497	NE	0,001404	0,001404	0,001404	0,00067252
P_IntShipping	1A3di(i)	International maritime navigation		0,298300478	0,01064	0,0076	2,7E-05	0,00532	0,0057	0,0057	1,6554E-05
z_Memo	1A5c	Multilateral operations		NA	NA	NA	NA	NA	NA	NA	NA
z_Memo	1A3	Transport (fuel used)		NE	NE	NE	NE	NE	NE	NE	NE
z_Memo	6B	Other not included in national total of the entire territory (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
N_Natural	11A	Volcanoes		NO	NO	NO	NO	NO	NO	NO	NO
N_Natural	11B	Forest fires		4,8543	14,5629	0,97086	0,97086	NE	NE	NE	NE
N_Natural	11C	Other natural emissions (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO

(a) For example, fugitive emissions from the production of geothermal power could be reported here.
(b) Does not include emissions from application of fertiliser and manure (reported under 3D). NH_3 emissions from crops should be reported here.
(c) Excludes waste incineration for energy (this is included in 1A1) and in industry (if used as fuel).
(d) Includes accidental fires.

(e) The 'National Total for Compliance' includes any aggregated combination of i) adjustments to national totals; ii) national totals based on transport fuel used; iii) territory declared upon ratification of the relevant Protocol of the Convention.

Member States of the European Union may also use this line for reporting national totals for compliance purposes under the National Emission Ceilings Directive (NECD) if these differ from the main National Total. MS should consult the definitions of geographical coverage in the NECD to determine what should be included within the NECD National Total.

Table A6-2 Emissions data for the CO and heavy metals according to NFR categories

HR: 22.1.2019: 2017	NFR sectors to be reported			Other (from 1990)	Priority Heavy Metals (from 1990)			Additional Heavy Metals (from 1990, voluntary reporting)					
				CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**kt**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**
A_PublicPower	1A1a	Public electricity and heat production		0,95682	0,22665	0,01064	0,11088	0,09488	0,1266	0,16913	0,46084	0,01024	0,93318
B_Industry	1A1b	Petroleum refining		0,33878	0,04041	0,01252	0,00299	0,02611	0,05064	0,0558	2,40782	0,01526	0,66119
B_Industry	1A1c	Manufacture of solid fuels and other energy industries		0,1137	4,3E-05	3,5E-06	0,00039	0,00039	5,1E-05	1E-05	5,1E-05	0,00023	0,00286
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel		0,03212	0,00052	0,00011	0,00043	0,00022	0,00036	0,00026	0,00025	0,00011	0,0068
B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals		0,01295	0,00013	5,1E-05	0,00023	7,2E-05	0,00011	4E-05	4,5E-05	3,8E-05	0,00219
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals		0,03858	0,00049	5E-05	0,00399	0,00062	0,00039	0,00025	0,00049	0,00028	0,002
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print		0,08048	0,00138	0,00066	0,00091	0,00017	0,00119	0,00032	0,00012	0,00013	0,02904
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco		1,07595	0,02957	0,00396	0,00402	0,00513	0,01684	0,01706	0,01291	0,00244	0,28016
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals		6,91679	0,33517	0,03475	0,12298	0,06721	0,13363	0,17281	0,12878	0,06183	1,7424
I_Offroad	1A2gvii	Mobile Combustion in manufacturing industries and construction: (please specify in the IIR)		3,57	0,01	0,00092	NE	NE	0,00	0,16	0,01	0,00	0,09
B_Industry	1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
H_Aviation	1A3ai(i)	International aviation LTO (civil)		0,33002	8,1E-05	6,1E-06	0,00012	3E-05	0,0002	0,00022	8,1E-06	0,00011	0,02942
H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)		0,63694	0,13692	6,8E-06	1,4E-05	3,4E-06	9E-05	0,00138	1,8E-05	1,4E-05	0,00489
F_RoadTransport	1A3bi	Road transport: Passenger cars		22,7965	3,02267	0,01288	0,00839	0,00022	0,03246	0,03948	0,01401	0,00018	2,57761
F_RoadTransport	1A3bii	Road transport: Light duty vehicles		1,52301	0,05985	0,00238	0,00147	0,00003	0,00802	0,00595	0,00243	2,8E-05	0,47636
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses		2,0819	0,00183	0,00327	0,00197	0,00004	0,01119	0,00802	0,00331	3,7E-05	0,65414
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles		4,20868	0,11218	0,00024	0,00020	0,00001	0,00036	0,00094	0,00029	4,5E-06	0,04855
F_RoadTransport	1A3bv	Road transport: Gasoline evaporation		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F_RoadTransport	1A3bvi	Road transport: Automobile tyre and brake wear		NA	0,84803	0,0039	NE	NE	0,31455	6,88974	0,04955	0,00649	2,57793
F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I_Offroad	1A3c	Railways		0,18832	6E-05	0,00017	9E-05	2,3E-05	0,00088	0,02992	0,00123	0,00017	0,0176
G_Shipping	1A3di(ii)	International inland waterways		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
G_Shipping	1A3dii	National navigation (shipping)		0,87714	0,00575	0,00044	0,00132	0,00178	0,00222	0,0412	0,04179	0,00419	0,05262
I_Offroad	1A3ei	Pipeline transport		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
I_Offroad	1A3eii	Other (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_OtherStationaryComb	1A4ai	Commercial/institutional: Stationary		0,62999	0,02515	0,0048	0,00129	0,0019	0,02704	0,00785	0,23712	0,00088	0,2187
I_Offroad	1A4aii	Commercial/institutional: Mobile		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
C_OtherStationaryComb	1A4bi	Residential: Stationary		113,288	1,25053	0,59405	0,04179	0,01172	1,05271	0,27744	0,0931	0,02333	23,416
I_Offroad	1A4bii	Residential: Household and gardening (mobile)		5,74706	0,02775	7,4E-05	NE	NE	0,00037	0,01258	0,00052	7,4E-05	0,0074
C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary		0,07582	0,00416	7,9E-05	0,00015	0,00035	0,0052	0,00156	0,06489	0,00011	0,01004
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery		1,24	NA	0,00	NE	NE	0,01	0,29	0,01	0,00	0,17
I_Offroad	1A4ciii	Agriculture/Forestry/Fishing: National fishing		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
C_OtherStationaryComb	1A5a	Other stationary (including military)		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
I_Offroad	1A5b	Other, Mobile (including military, land based and recreational boats)		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
D_Fugitive	1B1a	Fugitive emission from solid fuels: Coal mining and handling		NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
D_Fugitive	1B1b	Fugitive emission from solid fuels: Solid fuel transformation		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D_Fugitive	1B1c	Other fugitive emissions from solid fuels		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D_Fugitive	1B2aiv	Fugitive emissions oil: Refining / storage		29,0626	0,24302	0,04689	0,05534	0,24785	0,2456	0,10581	0,51551	0,01366	0,09417
D_Fugitive	1B2av	Distribution of oil products		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)		NA	NA	NA	4,1E-05	NA	NA	NA	NA	NA	NA
D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)		0,18975	0,00157	0,00071	0,00011	0,00026	0,00231	0,00154	0,00339	3,7E-06	0,02438
D_Fugitive	1B2d	Other fugitive emissions from energy production	(a)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

HR: 22.1.2019: 2017	NFR sectors to be reported			Other (from 1990)	Priority Heavy Metals (from 1990)			Additional Heavy Metals (from 1990, voluntary reporting)					
				CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**kt**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**
B_Industry	2A1	Cement production		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
B_Industry	2A2	Lime production		IE	IE	IE	IE	NA	NA	NA	NA	NA	NA
B_Industry	2A3	Glass production		IE	0,47317	0,03618	0,00084	0,05288	0,06402	0,00195	0,13639	0,22267	0,10298
B_Industry	2A5a	Quarrying and mining of minerals other than coal		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2A5b	Construction and demolition		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2A5c	Storage, handling and transport of mineral products		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
B_Industry	2A6	Other mineral products (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B1	Ammonia production		0,00281	NA	NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2B2	Nitric acid production		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2B3	Adipic acid production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B5	Carbide production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B6	Titanium dioxide production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B7	Soda ash production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B10a	Chemical industry: Other (please specify in the IIR)		3,5E-05	NO	NO	NO	NE	NE	NE	NE	NE	NE
B_Industry	2B10b	Storage, handling and transport of chemical products (please specify in the IIR)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2C1	Iron and steel production		0,0568	0,08687	0,00668	0,00167	0,0005	0,00334	0,00067	0,02339	IE	0,12028
B_Industry	2C2	Ferroalloys production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C3	Aluminium production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C4	Magnesium production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C5	Lead production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C6	Zinc production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7a	Copper production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7b	Nickel production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7c	Other metal production (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7d	Storage, handling and transport of metal products (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E_Solvents	2D3a	Domestic solvent use including fungicides		NA	NA	NA	0,0231	NA	NA	NA	NA	NA	NA
E_Solvents	2D3b	Road paving with asphalt		NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2D3c	Asphalt roofing		0,00026	NE	NE	NE	NA	NA	NA	NA	NA	NA
B_Industry	2D3d	Coating applications		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3e	Degreasing		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3f	Dry cleaning		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3g	Chemical products		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3h	Printing		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3i	Other solvent use (please specify in the IIR)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E_Solvents	2G	Other product use (please specify in the IIR)		0,51	1,06	0,05	0,00	0,00	0,02	0,65	0,07	NE	0,38
B_Industry	2H1	Pulp and paper industry		NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2H2	Food and beverages industry		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2H3	Other industrial processes (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2I	Wood processing		NE	NA	NA	NA	NE	NA	NE	NA	NA	NA
B_Industry	2J	Production of POPs		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)		NA	NE	NE	0,04125	NE	NE	NE	NE	NE	NE

HR: 22.1.2019: 2017	NFR sectors to be reported			Other (from 1990)	Priority Heavy Metals (from 1990)			Additional Heavy Metals (from 1990, voluntary reporting)					
				CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**kt**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**
B_Industry	2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
K_AgriLivestock	3B1a	Manure management - Dairy cattle		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B1b	Manure management - Non-dairy cattle		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B2	Manure management - Sheep		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B3	Manure management - Swine		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4a	Manure management - Buffalo		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4d	Manure management - Goats		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4e	Manure management - Horses		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4f	Manure management - Mules and asses		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4gi	Manure mangement - Laying hens		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4gii	Manure mangement - Broilers		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4giii	Manure mangement - Turkeys		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4giv	Manure management - Other poultry		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4h	Manure management - Other animals (please specify in IIR)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da1	Inorganic N-fertilizers (includes also urea application)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da2a	Animal manure applied to soils		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da2b	Sewage sludge applied to soils		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da2c	Other organic fertilisers applied to soils (including compost)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da3	Urine and dung deposited by grazing animals		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da4	Crop residues applied to soils		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Db	Indirect emissions from managed soils		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Dd	Off-farm storage, handling and transport of bulk agricultural products		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3De	Cultivated crops	(b)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Df	Use of pesticides		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3F	Field burning of agricultural residues		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
L_AgriOther	3I	Agriculture other (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5A	Biological treatment of waste - Solid waste disposal on land		NE	NA	NA	NE	NA	NA	NA	NA	NA	NA
J_Waste	5B1	Biological treatment of waste - Composting		NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
J_Waste	5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
J_Waste	5C1a	Municipal waste incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bi	Industrial waste incineration	(c)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
J_Waste	5C1bii	Hazardous waste incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biii	Clinical waste incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biv	Sewage sludge incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bv	Cremation	(c)	0,00077	0,00017	2,8E-05	0,00819	7,5E-05	7,5E-05	6,8E-05	9,5E-05	0,00011	0,00088
J_Waste	5C1bvi	Other waste incineration (please specify in the IIR)	(c)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

HR: 22.1.2019: 2017	NFR sectors to be reported			Other (from 1990)	Priority Heavy Metals (from 1990)			Additional Heavy Metals (from 1990, voluntary reporting)					
				CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
NFR Aggregation for Gridding and LPS (GNFR)	NFR Code	Longname	Notes	kt	t	t	t	t	t	t	t	t	t
J_Waste	5C2	Open burning of waste		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5D1	Domestic wastewater handling		NA	NE	NE	NE	NE	NE	NE	NE	NE	NE
J_Waste	5D2	Industrial wastewater handling		NA	NE	NE	NE	NE	NE	NE	NE	NE	NE
J_Waste	5D3	Other wastewater handling		NA	NE	NE	NE	NE	NE	NE	NE	NE	NE
J_Waste	5E	Other waste (please specify in IIR)	(d)	NE	0,00047	0,00095	0,00095	0,00151	0,00144	0,00336	NE	NE	NE
M_Other	6A	Other (included in national total for entire territory) (please specify in IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	NATIONAL TOTAL	**National total for the entire territory (based on fuel sold)**		196,584	8,006	0,830	0,435	0,516	2,136	8,937	4,282	0,365	34,730
	ADJUSTMENTS (Net total)	Sum of adjustments (negative value) from Annex VII											
	NATIONAL TOTAL FOR COMPLIANCE	**National total for compliance assessment (please specify all details in the IIR)**	(e)										
'MEMO' ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS													
O_AviCruise	1A3ai(ii)	International aviation cruise (civil)		0,12948	0,00041	3,1E-05	0,00062	0,00016	0,00104	0,00114	4,1E-05	0,00057	0,15008
O_AviCruise	1A3aii(ii)	Domestic aviation cruise (civil)		0,01404	2,5E-05	1,9E-06	3,7E-05	9,3E-06	6,2E-05	6,8E-05	2,5E-06	3,4E-05	0,00895
P_IntShipping	1A3di(i)	International maritime navigation		0,02812	0,00049	3,8E-05	0,00011	0,00015	0,00019	0,00334	0,0038	0,00038	0,00456
z_Memo	1A5c	Multilateral operations		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
z_Memo	1A3	Transport (fuel used)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
z_Memo	6B	Other not included in national total of the entire territory (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
N_Natural	11A	Volcanoes		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
N_Natural	11B	Forest fires		145,629	NA	NA	NA	NA	NA	NA	NA	NA	NA
N_Natural	11C	Other natural emissions (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

(a) For example, fugitive emissions from the production of geothermal power could be reported here.
(b) Does not include emissions from application of fertiliser and manure (reported under 3D). NH_3 emissions from crops should be reported here.
(c) Excludes waste incineration for energy (this is included in 1A1) and in industry (if used as fuel).
(d) Includes accidental fires.
(e) The 'National Total for Compliance' includes any aggregated combination of i) adjustments to national totals; ii) national totals based on transport fuel used; iii) territory declared upon ratification of the relevant Protocol of the Convention.

Member States of the European Union may also use this line for reporting national totals for compliance purposes under the National Emission Ceilings Directive (NECD) if these differ from the main National Total. MS should consult the definitions of geographical coverage in the NECD to determine what should be included within the NECD National Total.

Table A6-3 Emissions data for POPs according to NFR categories

HR: 22.1.2019: 2017	NFR sectors to be reported			POPs [1] (from 1990)							
				PCDD/ PCDF (dioxins/ furans)	PAHs					HCB	PCBs
					benzo(a) pyrene	benzo(b) fluoranthene	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4		
NFR Aggregation for Gridding and LPS (GNFR)	NFR Code	Longname	Notes	g I-TEQ	t	t	t	t	t	kg	kg
A_PublicPower	1A1a	Public electricity and heat production		0,36258	0,0049	0,00078	0,0002	0,00039	0,00627	0,02947	2,25956
B_Industry	1A1b	Petroleum refining		0,01641	8,2E-06	3,7E-05	2,9E-05	4,2E-05	0,00012	NE	NE
B_Industry	1A1c	Manufacture of solid fuels and other energy industries		0,00204	2,8E-06	1,1E-05	4,3E-06	4,2E-06	2,3E-05	NE	NE
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel		0,00299	0,00093	0,00287	0,00094	0,00086	0,00559	5,3E-05	0,0015
B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals		0,00062	0,00029	0,0011	0,00042	0,00041	0,00221	2,3E-05	2,2E-07
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals		0,00177	0,00072	0,00303	0,00125	0,00119	0,00619	7,6E-05	0
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print		0,00597	0,00181	0,00659	0,00216	0,00206	0,01262	0,00025	3E-06
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco		0,20081	0,04525	0,07156	0,02704	0,02206	0,16591	0,00159	0,14938
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals		0,30175	0,0549	0,08955	0,03303	0,02709	0,20458	0,01697	0,38568
I_Offroad	1A2gvii	Mobile Combustion in manufacturing industries and construction: (please specify in the IIR)		NE	0,00	0,00	NE	NE	0,01	NE	NE
B_Industry	1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)		IE	IE	IE	IE	IE	IE	IE	IE
H_Aviation	1A3ai(i)	International aviation LTO (civil)		0,00142	0,00193	0,01521	0,00172	0,00152	0,02039	NA	NA
H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)		0,00029	0,00022	0,00171	0,0002	0,00018	0,0023	NA	NA
F_RoadTransport	1A3bi	Road transport: Passenger cars		0,78234	0,02803	0,03154	0,02444	0,02703	0,11104	NE	NE
F_RoadTransport	1A3bii	Road transport: Light duty vehicles		0,13936	0,00592	0,00664	0,00521	0,00553	0,02329	NE	NE
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses		0,11897	0,00201	0,01216	0,01359	0,00312	0,03089	NE	NE
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles		0,01053	0,00019	0,00023	0,00015	0,00025	0,00083	NE	NE
F_RoadTransport	1A3bv	Road transport: Gasoline evaporation		NA	NA	NA	NA	NA	NA	NA	NA
F_RoadTransport	1A3bvi	Road transport: Automobile tyre and brake wear		NE	NE	NE	NE	NE	NE	NE	NE
F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion		NE	NE	NE	NE	NE	NE	NE	NE
I_Offroad	1A3c	Railways		0,00105	0,00053	0,00088	1,3E-06	1,1E-06	0,00141	NE	NE
G_Shipping	1A3di(ii)	International inland waterways		IE	IE	IE	IE	IE	IE	IE	IE
G_Shipping	1A3dii	National navigation (shipping)		0,35569	8,1E-05	0,00013	NE	NE	0,00022	0,00354	0,00261
I_Offroad	1A3ei	Pipeline transport		NO	NO	NO	NO	NO	NO	NO	NO
I_Offroad	1A3eii	Other (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
C_OtherStationaryComb	1A4ai	Commercial/institutional: Stationary		0,04286	0,00367	0,00585	0,00185	0,00148	0,01285	0,00215	0,00076
I_Offroad	1A4aii	Commercial/institutional: Mobile		IE	IE	IE	IE	IE	IE	IE	IE
C_OtherStationaryComb	1A4bi	Residential: Stationary		12,1235	1,75803	1,86591	0,68182	0,97381	5,27957	0,22845	0,0213
I_Offroad	1A4bii	Residential: Household and gardening (mobile)		NE	0,0003	0,0003	NE	NE	0,00059	NE	NE
C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary		0,00137	1,7E-06	1,1E-05	1,9E-06	1,8E-06	1,6E-05	0,00011	6,7E-08
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery		NE	0,01	0,01	NE	NE	0,01	NE	NE
I_Offroad	1A4ciii	Agriculture/Forestry/Fishing: National fishing		IE	IE	IE	IE	IE	IE	IE	IE
C_OtherStationaryComb	1A5a	Other stationary (including military)		IE	IE	IE	IE	IE	IE	IE	IE
I_Offroad	1A5b	Other, Mobile (including military, land based and recreational boats)		IE	IE	IE	IE	IE	IE	IE	IE
D_Fugitive	1B1a	Fugitive emission from solid fuels: Coal mining and handling		NA	NA	NA	NA	NA	NA	NA	NA
D_Fugitive	1B1b	Fugitive emission from solid fuels: Solid fuel transformation		NO	NO	NO	NO	NO	NO	NO	NO
D_Fugitive	1B1c	Other fugitive emissions from solid fuels		NO	NO	NO	NO	NO	NO	NO	NO

HR: 22.1.2019: 2017	NFR sectors to be reported			POPs (1) (from 1990)							
				PCDD/ PCDF (dioxins/ furans)	PAHs					HCB	PCBs
					benzo(a) pyrene	benzo(b) fluoranthene	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4		
NFR Aggregation for Gridding and LPS (GNFR)	NFR Code	Longname	Notes	g I-TEQ	t	t	t	t	t	kg	kg
D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport		NE	NA	NA	NA	NA	NA	NA	NA
D_Fugitive	1B2aiv	Fugitive emissions oil: Refining / storage		0,01414	0,00053	0,00089	0,00061	0,00046	0,00249	NA	NA
D_Fugitive	1B2av	Distribution of oil products		NE	NA	NA	NA	NA	NA	NA	NA
D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)		NE	NA	NA	NA	NA	NA	NA	NA
D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)		NE	5,1E-07	8,7E-07	4,8E-07	4,8E-07	2,3E-06	NA	NA
D_Fugitive	1B2d	Other fugitive emissions from energy production	(a)	NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2A1	Cement production		IE	IE	IE	IE	IE	IE	IE	IE
B_Industry	2A2	Lime production		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2A3	Glass production		IE	IE	IE	IE	IE	IE	IE	IE
B_Industry	2A5a	Quarrying and mining of minerals other than coal		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2A5b	Construction and demolition		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2A5c	Storage, handling and transport of mineral products		IE	IE	IE	IE	IE	IE	IE	IE
B_Industry	2A6	Other mineral products (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B1	Ammonia production		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2B2	Nitric acid production		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2B3	Adipic acid production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B5	Carbide production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B6	Titanium dioxide production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B7	Soda ash production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2B10a	Chemical industry: Other (please specify in the IIR)		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2B10b	Storage, handling and transport of chemical products (please specify in the IIR)		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2C1	Iron and steel production		0,10024	IE	IE	IE	IE	0,01604	IE	0,08353
B_Industry	2C2	Ferroalloys production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C3	Aluminium production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C4	Magnesium production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C5	Lead production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C6	Zinc production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7a	Copper production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7b	Nickel production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7c	Other metal production (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2C7d	Storage, handling and transport of metal products (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
E_Solvents	2D3a	Domestic solvent use including fungicides		NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3b	Road paving with asphalt		NE	NE	NE	NE	NE	NE	NE	NA
B_Industry	2D3c	Asphalt roofing		NE	NE	NE	NE	NE	NE	NE	NA
B_Industry	2D3d	Coating applications		NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3e	Degreasing		NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3f	Dry cleaning		NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3g	Chemical products		NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3h	Printing		NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3i	Other solvent use (please specify in the IIR)		NE	0,00065	0,00033	0,00033	0,00033	0,00164	NE	NE
E_Solvents	2G	Other product use (please specify in the IIR)		0,00	0,00	0,00	0,00	0,00	0,00	NE	NE

HR: 22.1.2019: 2017	NFR sectors to be reported			POPs [1] (from 1990)							
				PCDD/ PCDF (dioxins/ furans)	PAHs: benzo(a) pyrene	PAHs: benzo(b) fluoranthene	PAHs: benzo(k) fluoranthene	PAHs: Indeno (1,2,3-cd) pyrene	PAHs: Total 1-4	HCB	PCBs
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**g I-TEQ**	**t**	**t**	**t**	**t**	**t**	**kg**	**kg**
B_Industry	2H1	Pulp and paper industry		NA	NA	NE	NE	NE	NE	NE	NA
B_Industry	2H2	Food and beverages industry		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2H3	Other industrial processes (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2I	Wood processing		NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2J	Production of POPs		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)		NA	NA	NA	NA	NA	NA	NE	412,453
B_Industry	2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
K_AgriLivestock	3B1a	Manure management - Dairy cattle		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B1b	Manure management - Non-dairy cattle		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B2	Manure management - Sheep		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B3	Manure management - Swine		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4a	Manure management - Buffalo		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4d	Manure management - Goats		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4e	Manure management - Horses		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4f	Manure management - Mules and asses		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4gi	Manure mangement - Laying hens		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4gii	Manure mangement - Broilers		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4giii	Manure mangement - Turkeys		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4giv	Manure management - Other poultry		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4h	Manure management - Other animals (please specify in IIR)		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da1	Inorganic N-fertilizers (includes also urea application)		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da2a	Animal manure applied to soils		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da2b	Sewage sludge applied to soils		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da2c	Other organic fertilisers applied to soils (including compost)		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da3	Urine and dung deposited by grazing animals		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Da4	Crop residues applied to soils		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Db	Indirect emissions from managed soils		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Dd	Off-farm storage, handling and transport of bulk agricultural products		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3De	Cultivated crops	(b)	NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Df	Use of pesticides		NA	NA	NA	NA	NA	NA	NO	NA
L_AgriOther	3F	Field burning of agricultural residues		NO	NO	NO	NO	NO	NO	NO	NO
L_AgriOther	3I	Agriculture other (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5A	Biological treatment of waste - Solid waste disposal on land		NA	NA	NA	NA	NA	NA	NA	NA
J_Waste	5B1	Biological treatment of waste - Composting		NA	NA	NA	NA	NA	NA	NA	NA
J_Waste	5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities		NA	NA	NA	NA	NA	NA	NA	NA
J_Waste	5C1a	Municipal waste incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bi	Industrial waste incineration	(c)	IE	IE	IE	IE	IE	IE	IE	IE
J_Waste	5C1bii	Hazardous waste incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biii	Clinical waste incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biv	Sewage sludge incineration	(c)	NO	NO	NO	NO	NO	NO	NO	NO

HR: 22.1.2019: 2017	NFR sectors to be reported			POPs (1) (from 1990)							
				PCDD/ PCDF (dioxins/ furans)	PAHs					HCB	PCBs
					benzo(a) pyrene	benzo(b) fluoranth ene	benzo(k) fluoranth ene	Indeno (1,2,3-cd) pyrene	Total 1-4		
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**g I-TEQ**	**t**	**t**	**t**	**t**	**t**	**kg**	**kg**
J_Waste	5C1bv	Cremation	(c)	0,00015	7,25E-08	3,96E-08	3,54E-08	3,84E-08	#######	0,00082	0,00225
J_Waste	5C1bvi	Other waste incineration (please specify in the IIR)	(c)	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C2	Open burning of waste		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5D1	Domestic wastewater handling		NA	NA	NA	NA	NA	NA	NA	NA
J_Waste	5D2	Industrial wastewater handling		NA	NA	NA	NA	NA	NA	NA	NA
J_Waste	5D3	Other wastewater handling		NA	NA	NA	NA	NA	NA	NA	NA
J_Waste	5E	Other waste (please specify in IIR)	(d)	1,63806	NE	NE	NE	NE	NE	NE	NE
M_Other	6A	Other (included in national total for entire territory) (please specify in IIR)		NO	NO	NO	NO	NO	NO	NO	NO
	NATIONAL TOTAL	**National total for the entire territory (based on fuel sold)**		16,226	1,920	2,131	0,795	1,068	5,930	0,284	415,360
	ADJUSTMENTS (Net total)	Sum of adjustments (negative value) from Annex VII									
	NATIONAL TOTAL FOR COMPLIANCE	**National total for compliance assessment (please specify all details in the IIR)**	(e)								
'MEMO' ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS											
O_AviCruise	1A3ai(ii)	International aviation cruise (civil)		0,00725	0,00983	0,07763	0,0088	0,00776	0,10402	NE	NE
O_AviCruise	1A3aii(ii)	Domestic aviation cruise (civil)		0,00043	0,00059	0,00463	0,00052	0,00046	0,0062	NE	NE
P_IntShipping	1A3di(i)	International maritime navigation		0,00049	0,00011	0,00019	NE	NE	0,0003	0,0003	0,00014
z_Memo	1A5c	Multilateral operations		NA	NA	NA	NA	NA	NA	NA	NA
z_Memo	1A3	Transport (fuel used)		NE	NE	NE	NE	NE	NE	NE	NE
z_Memo	6B	Other not included in national total of the entire territory (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
N_Natural	11A	Volcanoes		NO	NO	NO	NO	NO	NO	NO	NO
N_Natural	11B	Forest fires		NA	NA	NA	NA	NA	NA	NA	NA
N_Natural	11C	Other natural emissions (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO

(a) For example, fugitive emissions from the production of geothermal power could be reported here.
(b) Does not include emissions from application of fertiliser and manure (reported under 3D). NH_3 emissions from crops should be reported here.
(c) Excludes waste incineration for energy (this is included in 1A1) and in industry (if used as fuel).
(d) Includes accidental fires.
(e) The 'National Total for Compliance' includes any aggregated combination of i) adjustments to national totals; ii) national totals based on transport fuel used; iii) territory declared upon ratification of the relevant Protocol of the Convention.

Member States of the European Union may also use this line for reporting national totals for compliance purposes under the National Emission Ceilings Directive (NECD) if these differ from the main National Total. MS should consult the definitions of geographical coverage in the NECD to determine what should be included within the NECD National Total.

Table A6-4 Activity data according to NFR categories

HR: 22.1.2019: 2017	NFR sectors to be reported			Activity Data (from 1990)						
				Liquid Fuels	Solid Fuels	Gaseous Fuels	Biomass	Other Fuels	*Other activity (specified)*	*Other Activity Units*
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**TJ NCV**	**TJ NCV**	**TJ NCV**	**TJ NCV**	**TJ NCV**		
A_PublicPower	1A1a	Public electricity and heat production		1487	13204	26764	3	NO	*NA*	*TJ NCV*
B_Industry	1A1b	Petroleum refining		11437	NA	3994	NO	NO	*NA*	*TJ NCV*
B_Industry	1A1c	Manufacture of solid fuels and other energy industries		NO	NO	3893	0	NO	*NA*	*TJ NCV*
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel		59	9	496	6	NO	*NA*	*TJ NCV*
B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals		9	NO	354	4	NO	*NA*	*TJ NCV*
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals		123	NO	5205	NO	NO	*NA*	*TJ NCV*
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print		NO	NO	261	44	NO	*NA*	*TJ NCV*
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco		462	879	1656	105	NO	*NA*	*TJ NCV*
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals		9010	2387	9696	1668	178	*NA*	*TJ NCV*
I_Offroad	1A2gvii	Mobile Combustion in manufacturing industries and construction: (please specify in the IIR)		3915	NA	NO	NO	NA	*NA*	*TJ NCV*
B_Industry	1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)		IE	IE	IE	IE	IE	*NA*	*TJ NCV*
H_Aviation	1A3ai(i)	International aviation LTO (civil)		136	NA	NO	NO	NA	*NA*	*TJ NCV*
H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)		1014	NA	NO	NO	NA	*NA*	*TJ NCV*
F_RoadTransport	1A3bi	Road transport: Passenger cars		58466,87	NO	18,26	14,65	NO	NA	*TJ NCV*
F_RoadTransport	1A3bii	Road transport: Light duty vehicles		11609,25	NO	NO	4,74	NO	NA	*TJ NCV*
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses		15889,89	NO	154,82	6,72	NO	NA	*TJ NCV*
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles		982,08	NO	NO	NO	NO	NA	*TJ NCV*
F_RoadTransport	1A3bv	Road transport: Gasoline evaporation		IE	NA	NA	NA	NA	NA	*TJ NCV*
F_RoadTransport	1A3bvi	Road transport: Automobile tyre and brake wear		NA	NA	NA	NA	NA	27843	*10^6 km*
F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion		NA	NA	NA	NA	NA	27843	*10^6 km*
I_Offroad	1A3c	Railways		752	NO	NO	NO	NA	*NA*	*TJ NCV*
G_Shipping	1A3di(ii)	International inland waterways		IE	NO	NO	NO	NA	*NA*	*TJ NCV*
G_Shipping	1A3dii	National navigation (shipping)		1892	NO	NO	NO	NA	*NA*	*TJ NCV*
I_Offroad	1A3ei	Pipeline transport		NO	NA	NA	NA	NA	*NA*	*TJ NCV*
I_Offroad	1A3eii	Other (please specify in the IIR)		NO	NO	NO	NO	NO	NO	*TJ NCV*
C_OtherStationaryComb	1A4ai	Commercial/institutional: Stationary		2457	4	8026	347	NO	*NA*	*TJ NCV*
I_Offroad	1A4aii	Commercial/institutional: Mobile		IE	IE	IE	IE	IE	IE	*TJ NCV*
C_OtherStationaryComb	1A4bi	Residential: Stationary		5795	120	20060	45674	NO	*NA*	*TJ NCV*
I_Offroad	1A4bii	Residential: Household and gardening (mobile)		330	NA	NO	NO	NA	*NA*	*TJ NCV*
C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary		636	NO	833	NO	NO	*NA*	*TJ NCV*
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery		7239	NA	NO	NO	NA	*NA*	*TJ NCV*
I_Offroad	1A4ciii	Agriculture/Forestry/Fishing: National fishing		IE	IE	IE	IE	IE	*NA*	*TJ NCV*
C_OtherStationaryComb	1A5a	Other stationary (including military)		IE	IE	IE	IE	NA	*NA*	*TJ NCV*
I_Offroad	1A5b	Other, Mobile (including military, land based and recreational boats)		IE	IE	IE	IE	NA	*NA*	*TJ NCV*
D_Fugitive	1B1a	Fugitive emission from solid fuels: Coal mining and handling		NA	NA	NA	NA	NA	*NO*	*Coal produced [Mt]*
D_Fugitive	1B1b	Fugitive emission from solid fuels: Solid fuel transformation		NA	NA	NA	NA	NA	*NO*	*Coal used for transformation [Mt]*
D_Fugitive	1B1c	Other fugitive emissions from solid fuels		NA	NA	NA	NA	NA	*NA*	*Please specify*
D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport		NA	NA	NA	NA	NA	*744,5*	*Crude oil produced [Mt]*
D_Fugitive	1B2aiv	Fugitive emissions oil: Refining / storage		NA	NA	NA	NA	NA	*3562,5*	*Crude oil refined [Mt]*
D_Fugitive	1B2av	Distribution of oil products		NA	NA	NA	NA	NA	*6893,7*	*Oil consumed [Mt]*

HR: 13.11.2018: 2017	NFR sectors to be reported			Activity Data (from 1990)						
				Liquid Fuels	Solid Fuels	Gaseous Fuels	Biomass	Other Fuels	*Other activity (specified)*	*Other Activity Units*
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**TJ NCV**	**TJ NCV**	**TJ NCV**	**TJ NCV**	**TJ NCV**		
D_Fugitive	1B2av	Distribution of oil products		NA	NA	NA	NA	NA	*6297,3*	*Oil consumed [Mt]*
D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)		NA	NA	NA	NA	NA	*1,65E+09*	*Gas throughput [Mn3]*
D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)		NA	NA	NA	NA	NA	*440327,52*	*Gas vented flared [TJ]*
D_Fugitive	1B2d	Other fugitive emissions from energy production	(a)	NA	NA	NA	NA	NA	NO	
B_Industry	2A1	Cement production		NA	NA	NA	NA	NA	*2326,976*	*Clinker produced [kt]*
B_Industry	2A2	Lime production		NA	NA	NA	NA	NA	*142,8288*	*Lime produced [kt]*
B_Industry	2A3	Glass production		NA	NA	NA	NA	NA	*394,98*	*Glass produced [t]*
B_Industry	2A5a	Quarrying and mining of minerals other than coal		NA	NA	NA	NA	NA	*23,74*	*Material quarried [Mt]*
B_Industry	2A5b	Construction and demolition		NA	NA	NA	NA	NA	*2065404*	*floor space constructed/demolished [M3]*
B_Industry	2A5c	Storage, handling and transport of mineral products		NA	NA	NA	NA	NA	IE	*Amount [Mt]*
B_Industry	2A6	Other mineral products (please specify in the IIR)		NA	NA	NA	NA	NA	NO	*Please specify*
B_Industry	2B1	Ammonia production		NA	NA	NA	NA	NA	*468,7951*	*Ammonia produced [kt]*
B_Industry	2B2	Nitric acid production		NA	NA	NA	NA	NA	*322,1851*	*Nitric acid produced [kt]*
B_Industry	2B3	Adipic acid production		NA	NA	NA	NA	NA	*NO*	*Adipic acid produced [kt]*
B_Industry	2B5	Carbide production		NA	NA	NA	NA	NA	*NO*	*Carbide produced [kt]*
B_Industry	2B6	Titanium dioxide production		NA	NA	NA	NA	NA	NO	*Titanium dioxide produced [kt]*
B_Industry	2B7	Soda ash production		NA	NA	NA	NA	NA	NO	*Soda ash produced [kt]*
B_Industry	2B10a	Chemical industry: Other (please specify in the IIR)		NA	NA	NA	NA	NA	*797,71265*	*Please specify*
B_Industry	2B10b	Storage, handling and transport of chemical products (please specify in the IIR)		NA	NA	NA	NA	NA	IE	*Please specify*
B_Industry	2C1	Iron and steel production		NA	NA	NA	NA	NA	*23,620332*	*Steel produced [kt]*
B_Industry	2C2	Ferroalloys production		NA	NA	NA	NA	NA	*NO*	*Ferroalloys produced [kt]*
B_Industry	2C3	Aluminium production		NA	NA	NA	NA	NA	*NO*	*Aluminium produced [kt]*
B_Industry	2C4	Magnesium production		NA	NA	NA	NA	NA	*NO*	*Magnesium produced [kt]*
B_Industry	2C5	Lead production		NA	NA	NA	NA	NA	*NO*	*Lead produced [kt]*
B_Industry	2C6	Zinc production		NA	NA	NA	NA	NA	*NO*	*Zinc produced [kt]*
B_Industry	2C7a	Copper production		NA	NA	NA	NA	NA	*NO*	*Copper produced [kt]*
B_Industry	2C7b	Nickel production		NA	NA	NA	NA	NA	*NO*	*Nickel produced [kt]*
B_Industry	2C7c	Other metal production (please specify in the IIR)		NA	NA	NA	NA	NA	*NO*	*Please specify*
B_Industry	2C7d	Storage, handling and transport of metal products (please specify in the IIR)		NA	NA	NA	NA	NA	*38,91*	*Amount (kt)*
E_Solvents	2D3a	Domestic solvent use including fungicides		NA	NA	NA	NA	NA	NA	
E_Solvents	2D3b	Road paving with asphalt		NA	NA	NA	NA	NA	NA	
B_Industry	2D3c	Asphalt roofing		NA	NA	NA	NA	NA	NA	
B_Industry	2D3d	Coating applications		NA	NA	NA	NA	NA	*36,622*	*Paint applied [kt]*
E_Solvents	2D3e	Degreasing		NA	NA	NA	NA	NA	*NA*	*Solvents used [kt]*
E_Solvents	2D3f	Dry cleaning		NA	NA	NA	NA	NA	*NA*	*Solvents used [kt]*
E_Solvents	2D3g	Chemical products		NA	NA	NA	NA	NA	*NA*	*NA*
E_Solvents	2D3h	Printing		NA	NA	NA	NA	NA	*NA*	*NA*
E_Solvents	2D3i	Other solvent use (please specify in the IIR)		NA	NA	NA	NA	NA	*NA*	
E_Solvents	2G	Other product use (please specify in the IIR)		NA	NA	NA	NA	NA	IE	*Please specify*
B_Industry	2H1	Pulp and paper industry		NA	NA	NA	NA	NA	*38,911719*	*Pulp production [kt]*
B_Industry	2H2	Food and beverages industry		NA	NA	NA	NA	NA	*1782,9602*	*Bread, Wine, Beer, Spirits production [kt]*

HR: 22.1.2019: 2017	NFR sectors to be reported			Activity Data (from 1990)						
				Liquid Fuels	Solid Fuels	Gaseous Fuels	Biomass	Other Fuels	*Other activity (specified)*	*Other Activity Units*
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**TJ NCV**	**TJ NCV**	**TJ NCV**	**TJ NCV**	**TJ NCV**		
B_Industry	2H3	Other industrial processes (please specify in the IIR)		NA	NA	NA	NA	NA	NO	
B_Industry	2I	Wood processing		NA	NA	NA	NA	NA	*117,87*	*Please specify*
B_Industry	2J	Production of POPs		NA	NA	NA	NA	NA	*NA*	*NA*
B_Industry	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)		NA	NA	NA	NA	NA	*NA*	*NA*
B_Industry	2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)		NA	NA	NA	NA	NA	*NA*	*NA*
K_AgriLivestock	3B1a	Manure management - Dairy cattle		NA	NA	NA	NA	NA	*160,56*	*Population size (1000 head)*
K_AgriLivestock	3B1b	Manure management - Non-dairy cattle		NA	NA	NA	NA	NA	*309,51*	*Population size (1000 head)*
K_AgriLivestock	3B2	Manure management - Sheep		NA	NA	NA	NA	NA	*636,81*	*Population size (1000 head)*
K_AgriLivestock	3B3	Manure management - Swine		NA	NA	NA	NA	NA	*1121,03*	*Population size (1000 head)*
K_AgriLivestock	3B4a	Manure management - Buffalo		NA	NA	NA	NA	NA	*NO*	*Population size (1000 head)*
K_AgriLivestock	3B4d	Manure management - Goats		NA	NA	NA	NA	NA	*76,77*	*Population size (1000 head)*
K_AgriLivestock	3B4e	Manure management - Horses		NA	NA	NA	NA	NA	*23,21*	*Population size (1000 head)*
K_AgriLivestock	3B4f	Manure management - Mules and asses		NA	NA	NA	NA	NA	*3,27*	*Population size (1000 head)*
K_AgriLivestock	3B4gi	Manure mangement - Laying hens		NA	NA	NA	NA	NA	*3843,14*	*Population size (1000 head)*
K_AgriLivestock	3B4gii	Manure mangement - Broilers		NA	NA	NA	NA	NA	*5838,08*	*Population size (1000 head)*
K_AgriLivestock	3B4giii	Manure mangement - Turkeys		NA	NA	NA	NA	NA	*493,07*	*Population size (1000 head)*
K_AgriLivestock	3B4giv	Manure management - Other poultry		NA	NA	NA	NA	NA	*255,11*	*Population size (1000 head)*
K_AgriLivestock	3B4h	Manure management - Other animals (please specify in IIR)		NA	NA	NA	NA	NA	*NO*	*Population size (1000 head)*
L_AgriOther	3Da1	Inorganic N-fertilizers (includes also urea application)		NA	NA	NA	NA	NA	*102080193*	*Use of inorganic fertilizers (kg N/yr)*
L_AgriOther	3Da2a	Animal manure applied to soils		NA	NA	NA	NA	NA	NA	
L_AgriOther	3Da2b	Sewage sludge applied to soils		NA	NA	NA	NA	NA	NA	
L_AgriOther	3Da2c	Other organic fertilisers applied to soils (including compost)		NA	NA	NA	NA	NA	NE	
L_AgriOther	3Da3	Urine and dung deposited by grazing animals		NA	NA	NA	NA	NA	NA	
L_AgriOther	3Da4	Crop residues applied to soils		NA	NA	NA	NA	NA	NA	
L_AgriOther	3Db	Indirect emissions from managed soils		NA	NA	NA	NA	NA	NA	
L_AgriOther	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products		NA	NA	NA	NA	NA	NA	
L_AgriOther	3Dd	Off-farm storage, handling and transport of bulk agricultural products		NA	NA	NA	NA	NA	NA	
L_AgriOther	3De	Cultivated crops	(b)	NA	NA	NA	NA	NA	NA	
L_AgriOther	3Df	Use of pesticides		NA	NA	NA	NA	NA	NA	
L_AgriOther	3F	Field burning of agricultural residues		NA	NA	NA	NA	NA	NE	*Area burned [k ha/yr]*
L_AgriOther	3I	Agriculture other (please specify in the IIR)		NA	NA	NA	NA	NA	NO	*NA*
J_Waste	5A	Biological treatment of waste - Solid waste disposal on land		NA	NA	NA	NA	NA	*1683,64*	*Annual deposition of MSW at the SWDS [kt]*
J_Waste	5B1	Biological treatment of waste - Composting		NA	NA	NA	NA	NA	NA	
J_Waste	5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities		NA	NA	NA	NA	NA	NA	
J_Waste	5C1a	Municipal waste incineration	(c)	NA	NA	NA	NA	NA	NO	*MSW incinerated [kt]*
J_Waste	5C1bi	Industrial waste incineration	(c)	NA	NA	NA	NA	NA	*NO*	*Waste incinerated [kt]*
J_Waste	5C1bii	Hazardous waste incineration	(c)	NA	NA	NA	NA	NA	IE	*Waste incinerated [kt]*

HR: 22.1.2019: 2017	*NFR sectors to be reported*			**Activity Data** (from 1990)						
				Liquid Fuels	Solid Fuels	Gaseous Fuels	Biomass	Other Fuels	*Other activity (specified)*	*Other Activity Units*
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Longname**	**Notes**	**TJ NCV**	**TJ NCV**	**TJ NCV**	**TJ NCV**	**TJ NCV**		
J_Waste	5C1biii	Clinical waste incineration	(c)	NA	NA	NA	NA	NA	*NO*	*Waste incinerated [kt]*
J_Waste	5C1biv	Sewage sludge incineration	(c)	NA	NA	NA	NA	NA	NO	
J_Waste	5C1bv	Cremation	(c)	NA	NA	NA	NA	NA	*5496*	*Incineration of corpses [Number]*
J_Waste	5C1bvi	Other waste incineration (please specify in the IIR)	(c)	NA	NA	NA	NA	NA	NO	
J_Waste	5C2	Open burning of waste		NA	NA	NA	NA	NA	NO	
J_Waste	5D1	Domestic wastewater handling		NA	NA	NA	NA	NA	*NE*	*Total organic product [Gg DC/yr]*
J_Waste	5D2	Industrial wastewater handling		NA	NA	NA	NA	NA	*NE*	*Total organic product [Gg DC/yr]*
J_Waste	5D3	Other wastewater handling		NA	NA	NA	NA	NA	*NE*	*Total organic product [Gg DC/yr]*
J_Waste	5E	Other waste (please specify in IIR)	(d)	NA	NA	NA	NA	NA	NA	*Please specify*
M_Other	6A	Other (included in national total for entire territory) (please specify in IIR)		NA	NA	NA	NA	NA	NO	*NA*
	NATIONAL TOTAL	**National total for the entire territory (based on fuel sold)**		#######	16603,01	81411,80	47877,30	177,82	NA	*NA*
	ADJUSTMENTS (Net total)	Sum of adjustments (negative value) from Annex VII								*NA*
	NATIONAL TOTAL FOR COMPLIANCE	**National total for compliance assessment (please specify all details in the IIR)**	(e)							*NA*
'MEMO' ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS										
O_AviCruise	1A3ai(ii)	International aviation cruise (civil)		4123	NA	NO	NO	NA	NA	*TJ NCV*
O_AviCruise	1A3aii(ii)	Domestic aviation cruise (civil)		308	NA	NO	NO	NA	NA	*TJ NCV*
P_IntShipping	1A3di(i)	International maritime navigation		72	NO	NO	NO	NA	NA	*TJ NCV*
z_Memo	1A5c	Multilateral operations		NA	NA	NA	NA	NA	NA	
z_Memo	1A3	Transport (fuel used)		NE	NE	NE	NE	NE	NA	
z_Memo	6B	Other not included in national total of the entire territory (please specify in the IIR)		NA	NA	NA	NA	NA	NO	*NA*
N_Natural	11A	Volcanoes		NA	NA	NA	NA	NA	NO	*Please specify*
N_Natural	11B	Forest fires		NA	NA	NA	NA	NA	*48543*	*Area of forest burned [ha]*
N_Natural	11C	Other natural emissions (please specify in the IIR)		NA	NA	NA	NA	NA	NO	

(a) For example, fugitive emissions from the production of geothermal power could be reported here.
(b) Does not include emissions from application of fertiliser and manure (reported under 3D). NH_3 emissions from crops should be reported here.
(c) Excludes waste incineration for energy (this is included in 1A1) and in industry (if used as fuel).
(d) Includes accidental fires.
(e) The 'National Total for Compliance' includes any aggregated combination of i) adjustments to national totals; ii) national totals based on transport fuel used; iii) territory declared upon ratification of the relevant Protocol of the Convention.

Member States of the European Union may also use this line for reporting national totals for compliance purposes under the National Emission Ceilings Directive (NECD) if these differ from the main National Total. MS should consult the definitions of geographical coverage in the NECD to determine what should be included within the NECD National Total.

12.7. Apendix 7. Uncertainty analysis

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	SO2	99.3234264	4.31719305	3.0	10.0	10.44	3.58958	-0.01752	0.02534	-0.17525	0.10751	0.20559
1 A 2 Manufacturing Industries and Construction	SO2	37.0194778	2.20926429	3.0	10.0	10.44	1.83692	-0.00304	0.01297	-0.03040	0.05502	0.06286
1 A 3 b Road Transport	SO2	4.41942987	0.03435386	3.0	20.0	20.22	0.05533	-0.00171	0.00020	-0.03419	0.00086	0.03421
1 A 3 Other mobile source and machinery	SO2	1.27455525	0.01896851	3.0	20.0	20.22	0.03055	-0.00044	0.00011	-0.00880	0.00047	0.00881
1 A 4 a Commercial, institutional combustion	SO2	6.89342072	0.10725996	5.0	20.0	20.62	0.17610	-0.00235	0.00063	-0.04703	0.00445	0.04724
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	SO2	17.8215901	0.94036526	3.0	20.0	20.22	1.51456	-0.00219	0.00552	-0.04375	0.02342	0.04963
1 B Extraction and distribution of fossil fuels	SO2	0.61496454	0.31909864	10.0	50.0	50.99	1.29581	0.00161	0.00187	0.08034	0.02649	0.08460
1 B 2 a iv Refining / storage	SO2	1.80036063	4.42896659	3.0	50.0	50.09	17.66775	0.02521	0.02600	1.26073	0.11029	1.26554
2 B 10 a, 2 H Chemical industry: Other, Pulp and Paper industry	SO2	0.74568753	0.1744151	3.0	20.0	20.22	0.28091	0.00070	0.00102	0.01402	0.00434	0.01468
2 C Metal production	SO2	0.45575628	0.0020047	7.5	20.0	21.36	0.00341	-0.00019	0.00001	-0.00371	0.00012	0.00371
2 G Other product use	SO2	0.00214118	0.00407398	10.0	20.0	22.36	0.00725	0.00002	0.00002	0.00046	0.00034	0.00057
5 C Waste incineration	SO2	0.00008735	0	5.0	20.0	20.62	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5 C 1 b v Cremation	SO2	0.00016543	0.00062105	5.0	20.0	20.62	0.00102	0.00000	0.00000	0.00007	0.00003	0.00008
TOTAL		170.37	12.56	% Uncertainty in total inventory			18.23			Trend uncertainty:		1.29

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	NO2	16.6402352	5.44720276	3.0	20.0	20.22	2.00836	-0.02624	0.04970	-0.52486	0.21086	0.56563
1 A 2 Manufacturing Industries and Construction	NO2	23.5246237	5.49980758	3.0	20.0	20.22	2.02776	-0.05712	0.05018	-1.14232	0.21289	1.16199
1 A 3 b Road Transport	NO2	37.1322827	23.520066	3.0	20.0	20.22	8.67176	0.04489	0.21460	0.89779	0.91045	1.27865
1 A 3 Other mobile source and machinery	NO2	3.92945961	2.88348258	3.0	100.0	100.04	5.25920	0.00836	0.02631	0.83629	0.11162	0.84371
1 A 4 a Commercial, institutional combustion	NO2	2.48002058	1.2552987	5.0	50.0	50.25	1.14997	0.00013	0.01145	0.00645	0.08099	0.08124
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	NO2	12.7711042	8.04612588	3.0	50.0	50.09	7.34758	0.01508	0.07341	0.75395	0.31146	0.81575
1 B Extraction and distribution of fossil fuels	NO2	0.07566167	0.03670884	10.0	50.0	50.99	0.03412	-0.00001	0.00033	-0.00053	0.00474	0.00477
1 B 2 a iv Refining / storage	NO2	0.25627738	0.1488514	3.0	50.0	50.09	0.13593	0.00019	0.00136	0.00939	0.00576	0.01102
2 B 10 a, 2 H Chemical industry: Other, Pulp and Paper industry	NO2	0.52730198	0.02871072	3.0	50.0	50.09	0.02622	-0.00215	0.00026	-0.10729	0.00111	0.10729
2 B 1, 2 B 2 Ammonia and Nitric acid production	NO2	2.09103104	1.16216571	3.0	50.0	50.09	1.06127	0.00106	0.01060	0.05276	0.04499	0.06934
2 C Metal production	NO2	0.09649594	0.00434352	7.5	50.0	50.56	0.00400	-0.00040	0.00004	-0.02005	0.00042	0.02005
2 G Other product use	NO2	0.02194814	0.01672519	10.0	30.0	31.62	0.00964	0.00005	0.00015	0.00157	0.00216	0.00267
3 D	NO2	9.83	6.72	5.0	100.0	100.12	12.27189	0.01646	0.06134	1.64613	0.43374	1.70232
3B1, 3B2, 3B4d, 3B4e, 3B4f,	NO2	0.0777798	0.03	10.0	100.0	100.50	0.05893	-0.00006	0.00029	-0.00617	0.00415	0.00744
3B3, 3B4g	NO2	0.15086578	0.04290624	50.0	100.0	111.80	0.08745	-0.00030	0.00039	-0.02974	0.02768	0.04063
5 C 1 b v Cremation	NO2	0.0012078	0.0045342	5.0	20.0	20.62	0.00170	0.00004	0.00004	0.00072	0.00029	0.00077
5 C Waste incineration	NO2	0.00054	0.0000	30.0	20.0	36.06	0.00000	0.00000	0.00000	-0.00005	0.00000	0.00005
TOTAL		109.60	54.85	% Uncertainty in total inventory			17.83			Trend uncertainty:		2.76

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	NMVOC	0.96	0.42	3.0	50.0	50.09	0.32875	0.00041	0.00234	0.02054	0.00992	0.02281
1 A 2 Manufacturing Industries and Construction	NMVOC	4.59	1.27	3.0	50.0	50.09	1.00525	-0.00206	0.00715	-0.10309	0.03032	0.10745
1 A 3 b Road Transport	NMVOC	34.64	5.48	3.0	20.0	20.22	1.75381	-0.03852	0.03088	-0.77035	0.13103	0.78141
1 A 3 Other mobile source and machinery	NMVOC	0.54	0.44	3.0	100.0	100.04	0.69119	0.00137	0.00246	0.13723	0.01044	0.13762
1 A 4 a Commercial, institutional combustion	NMVOC	0.29	0.34	5.0	50.0	50.25	0.27216	0.00135	0.00193	0.06765	0.01364	0.06901
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	NMVOC	24.70	15.23	3.0	50.0	50.09	12.06189	0.03618	0.08576	1.80893	0.36385	1.84516
1 B Extraction and distribution of fossil fuels	NMVOC	4.27	2.45	10.0	50.0	50.99	1.97474	0.00523	0.01379	0.26164	0.19506	0.32635
1 B 2 a iv Refining / storage	NMVOC	2.18	1.19	3.0	50.0	50.09	0.93964	0.00231	0.00668	0.11548	0.02834	0.11891
2 B 1, 2 B 10 a, 2 H 1, 2 H 2 Ammonia production, Chemical industry: Other, Pulp and Paper industry, Food and beverages industry	NMVOC	23.4	5.43	3.0	50.0	50.09	4.29822	-0.01635	0.03056	-0.81745	0.12966	0.82767
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	NMVOC	0.00	0.02	3.0	20.0	20.22	0.00772	0.00014	0.00014	0.00272	0.00058	0.00278
2 C Metal production	NMVOC	9.6E-03	0.00	7.5	50.0	50.56	0.00130	-0.00001	0.00001	-0.00051	0.00010	0.00052
2D3b, 2D3c, 2D3g, 2D3h	NMVOC	7.18	3.52	30	20.0	36.06	2.00622	0.00541	0.01982	0.10822	0.84075	0.84769
2D3a, 2D3i, 2G, 2D3e, 2D3f, 2D3d	NMVOC	58.44	15.99	10	20.0	22.36	5.65424	-0.02706	0.09006	-0.54122	1.27359	1.38382
3B	NMVOC	12.10	7.55	10.0	100	100.50	11.99448	0.01822	0.04251	1.82225	0.60112	1.91884
3D	NMVOC	2.63	1.29	5	100.0	100.12	2.03782	0.00197	0.00725	0.19707	0.05125	0.20362
5 A Biological treatment of waste - Solid waste disposal on land	NMVOC	1.64	2.63	5	50	50.25	2.08692	0.01150	0.01479	0.57517	0.10459	0.58460
5 C 1 b v Cremation	NMVOC	1.9E-05	7.14E-05	5.0	50	50.25	0.00006	0.00000	0.00000	0.00002	0.00000	0.00002
5 C Waste incineration	NMVOC	0.00195	0.00000	30.0	50	58.31	0.00000	0.00000	0.00000	-0.00020	0.00000	0.00020
5D1, 5D2	NMVOC	2.4E-03	4.44E-03	30.0	50	58.31	0.00410	0.00002	0.00003	0.00101	0.00106	0.00147
TOTAL		177.57	63.24	% Uncertainty in total inventory			19.02			Trend uncertainty:		3.40

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	CO	2.67	1.41	3.0	20.0	20.22	0.14498	0.00084	0.00253	0.01681	0.01073	0.01994
1 A 2 Manufacturing Industries and Construction	CO	23.60	11.73	3.0	20.0	20.22	1.20664	0.00610	0.02105	0.12206	0.08930	0.15124
1 A 3 b Road Transport	CO	236.59	30.61	3.0	20.0	20.22	3.14903	-0.09445	0.05493	-1.88891	0.23305	1.90324
1 A 3 Other mobile source and machinery	CO	3.22	2.03	3.0	100.0	100.04	1.03433	0.00161	0.00365	0.16083	0.01547	0.16158
1 A 4 a Commercial, institutional combustion	CO	1.56	0.63	5.0	50.0	50.25	0.16103	0.00014	0.00113	0.00716	0.00799	0.01073
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	CO	198.34	120.35	3.0	50.0	50.09	30.66520	0.09009	0.21597	4.50432	0.91629	4.59657
1 B Extraction and distribution of fossil fuels	CO	0.65	1.9E-01	10.0	50.0	50.99	0.04922	-0.00007	0.00034	-0.00343	0.00482	0.00591
1 B 2 a iv Refining / storage	CO	50.04	29.06	3.0	50.0	50.09	7.40519	0.02046	0.05215	1.02279	0.22127	1.04645
2 B 10 a, 2 H Chemical industry: Other, Pulp and Paper industry, 2 B 1 Ammonia production	CO	30.71	2.8E-03	3.0	50.0	50.09	0.00073	-0.01942	0.00001	-0.97118	0.00002	0.97118
2 C Metal production	CO	9.20	0.06	7.5	50.0	50.56	0.01461	-0.00572	0.00010	-0.28609	0.00108	0.28609
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	CO	2.3E-04	2.6E-04	30	100.0	104.40	0.00014	0.00000	0.00000	0.00003	0.00002	0.00004
2 G Other product use	CO	0.67	0.51	5	100.0	100.12	0.26021	0.00049	0.00092	0.04918	0.00648	0.04961
5 C Waste incineration	CO	0.00004	0.00000	5.0	100.0	100.12	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5 C 1 b v Cremation	CO	2.0E-04	7.7E-04	5.0	50.0	50.25	0.00020	0.00000	0.00000	0.00006	0.00001	0.00006
TOTAL		557.25	196.58	% Uncertainty in total inventory			31.75			Trend uncertainty:		5.19

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	NH3	0.00893257	0.00908593	3.0	1000.00	1000.00	0.24138	0.00006	0.00016	0.05515	0.00069	0.05516
1 A 2 Manufacturing Industries and Construction	NH3	0.13420051	0.05057566	3.0	1000.00	1000.00	1.34360	-0.00070	0.00090	-0.70220	0.00382	0.70221
1 A 3 b Road Transport	NH3	0.03025101	0.48422432	3.0	400	400.01	5.14569	0.00826	0.00863	3.30597	0.03660	3.30617
1 A 3 Other mobile source and machinery	NH3	0.00098152	0.00058751	3.0	1000.00	1000.00	0.01561	0.00000	0.00001	-0.00126	0.00004	0.00126
1 A 4 a Commercial, institutional combustion	NH3	0.00073058	0.01413224	5.0	1000.00	1000.01	0.37544	0.00024	0.00025	0.24304	0.00178	0.24304
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	NH3	3.02902408	2.05473525	3.0	1000.00	1000.00	54.58619	0.00042	0.03660	0.41853	0.15530	0.44642
1 B Extraction and distribution of fossil fuels	NH3	0.0020572	0	10.0	1000.00	1000.05	0.00000	-0.00002	0.00000	-0.02458	0.00000	0.02458
1 B 2 a iv Refining / storage	NH3	0.2050219	0.11908112	3.0	1000.00	1000.00	3.16351	-0.00033	0.00212	-0.32786	0.00900	0.32798
2 B 10 a Chemical industry: Other, 2 H 1 Pulp and Paper industry, 2 H 2 Food and beverages industry	NH3	3.48320198	2.34025907	3.0	400	400.01	24.86916	0.00008	0.04169	0.03179	0.17688	0.17971
2 A 3 Glass production, 2 B 1 Ammonia production	NH3	0.01724735	0.10129276	3.0	400	400.01	1.07640	0.00160	0.00180	0.63938	0.00766	0.63943
2D3a, 2D3i, 2G	NH3	0.05017765	0.0377522	10	400	400.12	0.40129	0.00007	0.00067	0.02924	0.00951	0.03075
3B1, 3B2, 3B4d, 3B4e, 3B4f	NH3	9.38394287	4.79906672	10.0	100	100.50	12.81275	-0.02657	0.08549	-2.65655	1.20907	2.91876
3B3, 3B4g	NH3	11.7553985	6.20962945	50.0	100	111.80	18.44360	-0.02975	0.11062	-2.97491	7.82225	8.36885
3D	NH3	27.34	20.82	5	100	100.12	55.37375	0.04405	0.37087	4.40539	2.62242	5.12685
5B1	NH3	0.00	0.00658464	5	400	400.03	0.06998	0.00012	0.00012	0.04692	0.00083	0.04693
5D3 Other wastewater handling	NH3	0.693288	0.597304	30.0	1000.00	1000.45	15.87507	0.00236	0.01064	2.35826	0.45145	2.40109
TOTAL		56.13	37.64	% Uncertainty in total inventory			86.37			Trend uncertainty:		11.08

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	BC	0.11611067	0.0308397	3.0	50.0	50.09	0.54281	-0.00545	0.00565	-0.27240	0.02398	0.27345
1 A 2 Manufacturing Industries and Construction	BC	0.77991775	0.12124115	3.0	50.0	50.09	2.13397	-0.05227	0.02222	-2.61371	0.09429	2.61541
1 A 3 b Road Transport	BC	0.57530125	0.7707404	3.0	100.0	100.04	27.09514	0.08618	0.14128	8.61767	0.59938	8.63849
1 A 3 Other mobile source and machinery	BC	0.00407704	0.00233518	3.0	500.0	500.01	0.41029	0.00004	0.00043	0.01910	0.00182	0.01919
1 A 4 a Commercial, institutional combustion	BC	0.07563552	0.03293996	5.0	78.0	78.16	0.90468	-0.00119	0.00604	-0.09313	0.04269	0.10245
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	BC	3.69820048	1.73578112	3.0	76.0	76.06	46.39109	-0.03520	0.31817	-2.67529	1.34986	2.99655
1 B Extraction and distribution of fossil fuels	BC	0.0267969	0.005382	10.0	50.0	50.99	0.09643	-0.00158	0.00099	-0.07878	0.01395	0.08001
1 B 2 a iv Refining / storage	BC	0.00039979	0.00023221	3.0	50.0	50.09	0.00409	0.00000	0.00004	0.00022	0.00018	0.00028
2 B 10 a, 2 H 1, 2 H 2 Chemical industry: Other, Pulp and Paper industry, Food and beverages industry	BC	0.00621899	0.00752275	3.0	50.0	50.09	0.13241	0.00078	0.00138	0.03921	0.00585	0.03965
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	BC	0.00811471	0.00974406	3.0	50.0	50.09	0.17151	0.00101	0.00179	0.05051	0.00758	0.05107
2 C Metal production	BC	0.01328905	2.5259E-06	7.5	50.0	50.56	0.00004	-0.00127	0.00000	-0.06351	0.00000	0.06351
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	BC	0.00456985	0.01856193	30	50.0	58.31	0.38032	0.00297	0.00340	0.14827	0.14435	0.20693
2D3a, 2D3i, 2G	BC	0.14690565	0.11052752	10	100.0	100.50	3.90318	0.00621	0.02026	0.62114	0.28651	0.68403
5 C Waste incineration	BC	0.000055	0.000000	30.0	50.0	58.31	0.00000	-0.00001	0.00000	-0.00026	0.00000	0.00026
TOTAL		5.46	2.85	% Uncertainty in total inventory			53.92			Trend uncertainty:		9.54

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	PM2.5	1.0440582	0.75829217	3.0	50.0	50.09	2.27092	0.00788	0.01986	0.39400	0.08425	0.40291
1 A 2 Manufacturing Industries and Construction	PM2.5	2.94198227	0.44878422	3.0	50.0	50.09	1.34401	-0.02198	0.01175	-1.09877	0.04986	1.09991
1 A 3 b Road Transport	PM2.5	1.29706172	1.46030401	3.0	100.0	100.04	8.73482	0.02336	0.03824	2.33561	0.16225	2.34124
1 A 3 Other mobile source and machinery	PM2.5	0.26755789	0.23014608	3.0	500.0	500.01	6.88013	0.00296	0.00603	1.47890	0.02557	1.47912
1 A 4 a Commercial, institutional combustion	PM2.5	0.2224452	0.08980628	5.0	78.0	78.16	0.41967	-0.00020	0.00235	-0.01557	0.01663	0.02278
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	PM2.5	29.294229	11.3661821	3.0	76.0	76.06	51.68706	-0.03807	0.29765	-2.89302	1.26282	3.15663
1 B Extraction and distribution of fossil fuels	PM2.5	0.07863937	0.02310587	10.0	50.0	50.99	0.07044	-0.00030	0.00061	-0.01485	0.00856	0.01714
1 B 2 a iv Refining / storage	PM2.5	0.30753285	0.2142366	3.0	50.0	50.09	0.64159	0.00208	0.00561	0.10413	0.02380	0.10682
2 B 10 a, 2 H 1, 2 H 2 Chemical industry: Other, Pulp and Paper industry, Food and beverages industry	PM2.5	0.28536899	0.41793039	3.0	50.0	50.09	1.25161	0.00767	0.01094	0.38354	0.04643	0.38634
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	PM2.5	0.23356499	0.27320205	3.0	50.0	50.09	0.81818	0.00448	0.00715	0.22376	0.03035	0.22581
2 A 5 a, 2 A 5 b Quarrying and mining of mineral products, Construction and demolition	PM2.5	0.1580463	0.13547431	5.0	50.0	50.25	0.40701	0.00173	0.00355	0.08674	0.02509	0.09030
2 C Metal production	PM2.5	0.3129442	0.00070165	7.5	50.0	50.56	0.00212	-0.00357	0.00002	-0.17854	0.00019	0.17854
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	PM2.5	0.0821296	0.32784892	30	50.0	58.31	1.14295	0.00764	0.00859	0.38216	0.36425	0.52795
2D3a, 2D3i, 2G	PM2.5	0.43597726	0.35281117	10	100.0	100.50	2.11992	0.00424	0.00924	0.42380	0.13066	0.44348
3B1, 3B2, 3B4d, 3B4e, 3B4f,	PM2.5	0.26256691	0.11702887	10.0	100.0	100.50	0.70318	0.00005	0.00306	0.00530	0.04334	0.04366
3B3, 3B4g	PM2.5	0.50505199	0.2572585	50.0	100.0	111.80	1.71965	0.00094	0.00674	0.09438	0.47637	0.48563
3D	PM2.5	0.18358398	0.08979978	5	50.0	50.25	0.26979	0.00025	0.00235	0.01229	0.01663	0.02068
5 A Biological treatment of waste - Solid waste disposal on land	PM2.5	3.4664E-05	5.556E-05	5	100.0	100.12	0.00033	0.00000	0.00000	0.00011	0.00001	0.00011
5 C 1 b v Cremation	PM2.5	5.0801E-05	0.00019071	5.0	80.0	80.16	0.00091	0.00000	0.00000	0.00035	0.00004	0.00035
5 C Waste incineration	PM2.5	0.000001	0	30.0	50.0	58.31	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5 E Other waste (Building and car fires)	PM2.5	0.2735262	0.1625475	10.0	700.0	700.07	6.80359	0.00112	0.00426	0.78346	0.06020	0.78577
TOTAL		38.19	16.73	% Uncertainty in total inventory			53.49			Trend uncertainty:		4.54

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	PM10	1.63595337	0.9590896	3.0	50.0	50.09	1.89301	0.00267	0.01905	0.13343	0.08083	0.15600
1 A 2 Manufacturing Industries and Construction	PM10	3.07233597	0.4837383	3.0	50.0	50.09	0.95478	-0.02114	0.00961	-1.05718	0.04077	1.05797
1 A 3 b Road Transport	PM10	1.53743633	1.85964434	3.0	100.0	100.04	7.33109	0.02154	0.03694	2.15382	0.15672	2.15951
1 A 3 Other mobile source and machinery	PM10	0.27350848	0.23143399	3.0	500.0	500.01	4.55983	0.00186	0.00460	0.92915	0.01950	0.92935
1 A 4 a Commercial, institutional combustion	PM10	0.25106859	0.09655508	5.0	78.0	78.16	0.29737	-0.00060	0.00192	-0.04650	0.01356	0.04843
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	PM10	30.0256763	11.6409159	3.0	76.0	76.06	34.88849	-0.06902	0.23124	-5.24556	0.98105	5.33652
1 B Extraction and distribution of fossil fuels	PM10	0.13232627	0.02310587	10.0	50.0	50.99	0.04643	-0.00087	0.00046	-0.04330	0.00649	0.04379
1 B 2 a iv Refining / storage	PM10	0.70476278	0.49244283	3.0	50.0	50.09	0.97196	0.00272	0.00978	0.13621	0.04150	0.14240
2 B 10 a, 2 H 1, 2 H 2 Chemical industry: Other, Pulp and Paper industry, Food and beverages industry	PM10	0.38872364	0.55724052	3.0	50.0	50.09	1.09986	0.00718	0.01107	0.35880	0.04696	0.36186
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	PM10	0.43675818	0.49250625	3.0	50.0	50.09	0.97209	0.00541	0.00978	0.27046	0.04151	0.27362
2 A 5 a, 2 A 5 b Quarrying and mining of mineral products, Construction and demolition	PM10	1.58046303	1.35474305	5.0	50.0	50.25	2.68245	0.01108	0.02691	0.55405	0.19029	0.58582
2 C Metal production	PM10	0.47396618	0.00080188	7.5	50.0	50.56	0.00160	-0.00473	0.00002	-0.23649	0.00017	0.23649
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	PM10	0.611069	2.45335162	30	50.0	58.31	5.63693	0.04261	0.04873	2.13047	2.06760	2.96882
2D3a, 2D3i, 2G	PM10	0.50634248	0.43609989	10	100.0	100.50	1.72699	0.00359	0.00866	0.35920	0.12251	0.37952
3B1, 3B2, 3B4d, 3B4e, 3B4f,	PM10	0.43307872	0.20260695	10.0	100.0	100.50	0.80234	-0.00031	0.00402	-0.03121	0.05692	0.06491
3B3, 3B4g	PM10	3.23153926	1.59577802	50.0	100.0	111.80	7.03025	-0.00066	0.03170	-0.06606	2.24144	2.24241
3D	PM10	4.77318348	2.33479428	5	50.0	50.25	4.62299	-0.00142	0.04638	-0.07087	0.32795	0.33552
5 A Biological treatment of waste - Solid waste disposal on land	PM10	0.00023005	0.00036872	5	100.0	100.12	0.00145	0.00001	0.00001	0.00050	0.00005	0.00050
5 C 1 b v Cremation	PM10	5.0801E-05	0.00019071	5.0	80.0	80.16	0.00060	0.00000	0.00000	0.00026	0.00003	0.00026
5 C Waste incineration	PM10	0.00000175	0	30.0	50.0	58.31	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5 E Other waste (Building and car fires)	PM10	0.2735262	0.1625475	10.0	700.0	700.07	4.48400	0.00049	0.00323	0.34288	0.04566	0.34590
TOTAL		50.34	25.38	% Uncertainty in total inventory			**37.85**			Trend uncertainty:		**7.07**

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	TSP	2.73881435	1.22852625	3.0	50.0	50.09	1.62216	-0.00890	0.02076	-0.44515	0.08807	0.45378
1 A 2 Manufacturing Industries and Construction	TSP	3.19052218	0.53333783	3.0	50.0	50.09	0.70422	-0.02553	0.00901	-1.27667	0.03824	1.27724
1 A 3 b Road Transport	TSP	1.7126797	2.11207119	3.0	100.0	100.04	5.57009	0.01713	0.03569	1.71329	0.15142	1.71997
1 A 3 Other mobile source and machinery	TSP	0.27797141	0.23283966	3.0	500.0	500.01	3.06897	0.00092	0.00393	0.46174	0.01669	0.46205
1 A 4 a Commercial, institutional combustion	TSP	0.25047422	0.09712148	5.0	78.0	78.16	0.20011	-0.00107	0.00164	-0.08361	0.01160	0.08441
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	TSP	31.5716188	12.2250514	3.0	76.0	76.06	24.51098	-0.13468	0.20658	-10.23606	0.87643	10.27351
1 B Extraction and distribution of fossil fuels	TSP	0.25224617	0.02310587	10.0	50.0	50.99	0.03106	-0.00234	0.00039	-0.11709	0.00552	0.11722
1 B 2 a iv Refining / storage	TSP	0.89697081	0.6828659	3.0	50.0	50.09	0.90166	0.00182	0.01154	0.09114	0.04896	0.10346
2 B 10 a, 2 H 1, 2 H 2, 2 I Chemical industry: Other, Pulp and Paper industry, Food and beverages industry, Wood processing	TSP	0.8354831	0.87364271	3.0	50.0	50.09	1.15357	0.00571	0.01476	0.28560	0.06263	0.29239
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	TSP	0.20789305	0.20366998	3.0	50.0	50.09	0.26893	0.00119	0.00344	0.05948	0.01460	0.06125
2 A 5 a, 2 A 5 b Quarrying and mining of mineral products, Construction and demolition	TSP	3.21383302	2.75614124	5.0	50.0	50.25	3.65082	0.01175	0.04657	0.58773	0.32932	0.67370
2 C Metal production	TSP	0.66112238	0.00112071	7.5	50.0	50.56	0.00149	-0.00714	0.00002	-0.35707	0.00020	0.35707
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	TSP	2.845118	11.4416205	30	50.0	58.31	17.58674	0.16244	0.19334	8.12213	8.20267	11.54352
2D3a, 2D3i, 2G	TSP	0.53760027	0.4618443	10	100.0	100.50	1.22353	0.00198	0.00780	0.19808	0.11037	0.22675
3B1, 3B2, 3B4d, 3B4e, 3B4f	TSP	0.96090449	0.4532449	10.0	100.0	100.50	1.20075	-0.00275	0.00766	-0.27491	0.10831	0.29548
3B3, 3B4g	TSP	3.97622926	2.11059766	50.0	100.0	111.80	6.22041	-0.00740	0.03566	-0.74006	2.52187	2.62821
3D	TSP	4.77318348	2.33479428	5	50.0	50.25	3.09270	-0.01224	0.03945	-0.61199	0.27897	0.67257
5 A Biological treatment of waste - Solid waste disposal on land	TSP	0.00048635	0.00077953	5	100.0	100.12	0.00206	0.00001	0.00001	0.00079	0.00009	0.00080
5 C 1 b v Cremation	TSP	5.6452E-05	0.00021193	5.0	80.0	80.16	0.00045	0.00000	0.00000	0.00024	0.00003	0.00024
5 C Waste incineration	TSP	0.0023825	0	30.0	50.0	58.31	0.00000	-0.00003	0.00000	-0.00129	0.00000	0.00129
5 E Other waste (Building and car fires)	TSP	0.2735262	0.1625475	10.0	700.0	700.07	2.99972	-0.00022	0.00275	-0.15127	0.03884	0.15617
TOTAL		59.179	37.94	% Uncertainty in total inventory			32.08			Trend uncertainty:		15.88

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	PAH	0.02584755	0.00641266	3.0	100.0	100.04	0.10818	0.00000	0.00027	-0.00029	0.00115	0.00119
1 A 2 Manufacturing Industries and Construction	PAH	2.65296931	0.40442732	3.0	100.0	100.04	6.82285	-0.01102	0.01710	-1.10168	0.07255	1.10407
1 A 3 b Road Transport	PAH	0.06131321	0.16605109	3.0	400.0	400.01	11.20067	0.00637	0.00702	2.54847	0.02979	2.54865
1 A 3 Other mobile source and machinery	PAH	0.05749444	0.02430937	3.0	400.0	400.01	1.63974	0.00042	0.00103	0.16731	0.00436	0.16737
1 A 4 a Commercial, institutional combustion	PAH	0.13126364	0.01285283	5.0	400.0	400.03	0.86701	-0.00085	0.00054	-0.33932	0.00384	0.33934
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	PAH	18.2501386	5.29374057	3.0	400.0	400.01	357.07944	0.03010	0.22385	12.04037	0.94970	12.07777
1 B Extraction and distribution of fossil fuels	PAH	0.29468499	2.3486E-06	10.0	400.0	400.12	0.00016	-0.00312	0.00000	-1.24967	0.00000	1.24967
1 B 2 a iv Refining / storage	PAH	0.00429265	0.00249326	3.0	400.0	400.01	0.16818	0.00006	0.00011	0.02396	0.00045	0.02397
2 C Metal production	PAH	2.16715585	0.01603762	7.5	400.0	400.07	1.08195	-0.02228	0.00068	-8.91223	0.00719	8.91223
2 D 3 i, 2G	PAH	0.00385834	0.00388197	10.0	400.0	400.12	0.26193	0.00012	0.00016	0.04930	0.00232	0.04935
5 C Waste incineration	PAH	0.000005	0	5.0	100.0	100.12	0.00000	0.00000	0.00000	-0.00001	0.00000	0.00001
5 C 1 b v Cremation	PAH	4.9542E-08	1.8598E-07	5	100.0	100.12	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
TOTAL		23.65	5.93	% Uncertainty in total inventory			357.33			Trend uncertainty:		15.32

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kg	kg	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	HCB	0.00499383	0.02947304	3.0	100.0	100.04	10.40055	0.08865	0.10751	8.86547	0.45612	8.87720
1 A 2 Manufacturing Industries and Construction	HCB	0.03492122	0.01896057	3.0	100.0	100.04	6.69087	-0.06249	0.06916	-6.24903	0.29343	6.25591
1 A 3 Other mobile source and machinery	HCB	0.0035192	0.00353814	3.0	400.0	400.01	4.99210	-0.00037	0.01291	-0.14771	0.05476	0.15753
1 A 4 a Commercial, institutional combustion	HCB	0.00201686	0.00215149	5.0	400.0	400.03	3.03577	0.00024	0.00785	0.09594	0.05549	0.11083
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	HCB	0.21397433	0.22855949	3.0	400.0	400.01	322.48349	0.02634	0.83372	10.53682	3.53716	11.11468
5 C Waste incineration	HCB	0.01	0.00	5.0	100.0	100.12	0.00000	-0.05467	0.00000	-5.46691	0.00000	5.46691
5 C 1 b v Cremation	HCB	0.0002196	0.0008244	5.0	100.0	100.12	0.29115	0.00218	0.00301	0.21788	0.02126	0.21891
TOTAL		0.27	0.28	% Uncertainty in total inventory			322.77			Trend uncertainty:		16.48

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		g I-TEQ	g I-TEQ	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	PCDD/PCDF	0.2129213	0.38103025	3.0	100.0	100.04	2.34935	0.00638	0.00784	0.63795	0.03328	0.63882
1 A 2 Manufacturing Industries and Construction	PCDD/PCDF	3.10744129	0.51391819	3.0	100.0	100.04	3.16871	-0.01078	0.01058	-1.07809	0.04488	1.07902
1 A 3 b Road Transport	PCDD/PCDF	0.57172086	1.0512099	3.0	400.0	400.01	25.91523	0.01771	0.02164	7.08270	0.09181	7.08330
1 A 3 Other mobile source and machinery	PCDD/PCDF	0.35938016	0.3584537	3.0	400.0	400.01	8.83687	0.00491	0.00738	1.96303	0.03131	1.96328
1 A 4 a Commercial, institutional combustion	PCDD/PCDF	0.21185927	0.04286095	5.0	400.0	400.03	1.05669	-0.00057	0.00088	-0.22977	0.00624	0.22985
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	PCDD/PCDF	33.0854893	12.1248478	3.0	400.0	400.01	298.91099	0.02195	0.24960	8.78012	1.05897	8.84375
1 B Extraction and distribution of fossil fuels	PCDD/PCDF	1.668	0	10.0	400.0	400.12	0.00000	-0.01147	0.00000	-4.58619	0.00000	4.58619
1 B 2 a iv Refining / storage	PCDD/PCDF	0.02434635	0.01414088	3.0	400.0	400.01	0.34861	0.00012	0.00029	0.04948	0.00124	0.04949
2 C Metal production	PCDD/PCDF	0.9020344	0.10023514	7.5	400.0	400.07	2.47144	-0.00414	0.00206	-1.65533	0.02189	1.65548
2 G Other product use	PCDD/PCDF	0.0012091	0.00090969	10.0	400.0	400.12	0.02243	0.00001	0.00002	0.00417	0.00026	0.00417
5 C Waste incineration	PCDD/PCDF	5.69	0.00	5.0	100.0	100.12	0.00000	-0.03906	0.00000	-3.90624	0.00000	3.90624
5 C 1 b v Cremation	PCDD/PCDF	3.9528E-05	0.00014839	5.0	100.0	100.12	0.00092	0.00000	0.00000	0.00028	0.00002	0.00028
5 E Other waste (Building and car fires)	PCDD/PCDF	2.745048	1.638064	5.0	100.0	100.12	10.10803	0.01484	0.03372	1.48372	0.23844	1.50276
TOTAL		48.58	16.23	% Uncertainty in total inventory			**300.37**			Trend uncertainty:		**13.23**

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	Pb	0.62418557	0.26709716	3.0	100.0	100.04	3.33751	0.00048	0.00049	0.04778	0.00210	0.04783
1 A 2 Manufacturing Industries and Construction	Pb	0.77081964	0.38151794	3.0	100.0	100.04	4.76726	0.00069	0.00071	0.06858	0.00300	0.06865
1 A 3 b Road Transport	Pb	456.128315	4.04456253	3.0	200.0	200.02	101.04365	-0.00500	0.00750	-1.00077	0.03180	1.00128
1 A 3 Other mobile source and machinery	Pb	0.36298604	0.14281355	3.0	400.0	400.01	7.13510	0.00025	0.00026	0.10187	0.00112	0.10187
1 A 4 a Commercial, institutional combustion	Pb	0.17477713	0.0251532	5.0	400.0	400.03	1.25674	0.00004	0.00005	0.01672	0.00033	0.01673
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	Pb	3.5135867	1.28244453	3.0	400.0	400.01	64.07216	0.00228	0.00238	0.91191	0.01008	0.91197
1 B Extraction and distribution of fossil fuels	Pb	0.21460998	0.001572	10.0	400.0	400.12	0.07858	0.00000	0.00000	-0.00119	0.00004	0.00120
1 B 2 a iv Refining / storage	Pb	0.4100438	0.24301882	3.0	400.0	400.01	12.14145	0.00044	0.00045	0.17563	0.00191	0.17564
2 A 3 Glass production	Pb	0.468333	0.47317246	3.0								
2 C Metal production	Pb	76.3933844	0.08687046	7.5	400.0	400.07	4.34077	-0.00194	0.00016	-0.77469	0.00171	0.77469
2 G Other product use	Pb	0.555856	1.057616	10.0	400.0	400.12	52.85454	0.00194	0.00196	0.77784	0.02772	0.77833
5 C Waste incineration	Pb	0.009005	0	5.0	100.0	100.12	0.00000	0.00000	0.00000	-0.00002	0.00000	0.00002
5 C 1 b v Cremation	Pb	4.3964E-05	0.00016504	5.0	700.0	700.02	0.01443	0.00000	0.00000	0.00021	0.00000	0.00021
5 E Other waste (Building and car fires)	Pb	0.00079725	0.00047183	5.0	700.0	700.02	0.04125	0.00000	0.00000	0.00060	0.00001	0.00060
TOTAL		539.63	8.01	% Uncertainty in total inventory			131.76			Trend uncertainty:		1.76

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	Cd	0.0398587	0.02316282	3.0	100.0	100.04	2.79121	-0.00532	0.02043	-0.53176	0.08669	0.53878
1 A 2 Manufacturing Industries and Construction	Cd	0.08733356	0.04048209	3.0	100.0	100.04	4.87824	-0.02070	0.03571	-2.06989	0.15152	2.07543
1 A 3 b Road Transport	Cd	0.01359596	0.02268297	3.0	200.0	200.02	5.46492	0.01122	0.02001	2.24491	0.08490	2.24652
1 A 3 Other mobile source and machinery	Cd	0.00120389	0.00062855	3.0	400.0	400.01	0.30284	-0.00022	0.00055	-0.08934	0.00235	0.08937
1 A 4 a Commercial, institutional combustion	Cd	0.00264174	0.00480492	5.0	400.0	400.03	2.31518	0.00253	0.00424	1.01275	0.02997	1.01319
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	Cd	0.56116569	0.59589935	3.0	400.0	400.01	287.11119	0.16231	0.52569	64.92400	2.23031	64.96229
1 B Extraction and distribution of fossil fuels	Cd	0.00535574	0.00070802	10.0	400.0	400.12	0.34123	-0.00284	0.00062	-1.13427	0.00883	1.13431
1 B 2 a iv Refining / storage	Cd	0.08072737	0.04688819	3.0	400.0	400.01	22.59127	-0.01079	0.04136	-4.31501	0.17549	4.31858
2 A 3 Glass production	Cd	0.0358137	0.03618378	3.0	400.0	400.01	17.43376	0.00878	0.03192	3.51124	0.13543	3.51385
2 C Metal production	Cd	0.2367564	0.00668234	7.5	400.0	400.07	3.22011	-0.14677	0.00590	-58.70791	0.06253	58.70795
2 G Other product use	Cd	0.06634072	0.05111986	10.0	400.0	400.12	24.63714	0.00223	0.04510	0.89279	0.63777	1.09718
5 C Waste incineration	Cd	0.001145	0.000000	5.0	100.0	100.12	0.00000	-0.00074	0.00000	-0.07398	0.00000	0.07398
5 C 1 b v Cremation	Cd	7.3639E-06	2.7645E-05	5.0	100.0	100.12	0.00333	0.00002	0.00002	0.00196	0.00017	0.00197
5 E Other waste (Building and car fires)	Cd	0.00161105	0.00095292	5.0	700.0	700.02	0.80347	-0.00020	0.00084	-0.14019	0.00594	0.14032
TOTAL		1.13	0.83	% Uncertainty in total inventory			289.71			Trend uncertainty:		87.81

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	Hg	0.06344416	0.11426999	3.0	100.0	100.04	26.26926	0.07826	0.09905	7.82618	0.42023	7.83745
1 A 2 Manufacturing Industries and Construction	Hg	0.1208622	0.13256777	3.0	100.0	100.04	30.47569	0.07531	0.11491	7.53119	0.48752	7.54695
1 A 3 b Road Transport	Hg	0.00854661	0.01202791	3.0	200.0	200.02	5.52827	0.00763	0.01043	1.52614	0.04423	1.52678
1 A 3 Other mobile source and machinery	Hg	0.00322001	0.00154998	3.0	400.0	400.01	1.42468	0.00029	0.00134	0.11626	0.00570	0.11640
1 A 4 a Commercial, institutional combustion	Hg	0.00806037	0.00128839	5.0	400.0	400.03	1.18430	-0.00152	0.00112	-0.60748	0.00790	0.60753
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	Hg	0.05808745	0.04193356	3.0	400.0	400.01	38.54377	0.01735	0.03635	6.93839	0.15421	6.94011
1 B Extraction and distribution of fossil fuels	Hg	0.70793491	0.00015039	10.0	400.0	400.12	0.13827	-0.22994	0.00013	-91.97617	0.00184	91.97617
1 B 2 a iv Refining / storage	Hg	0.08969708	0.05533571	3.0	400.0	400.01	50.86253	0.01862	0.04797	7.44861	0.20350	7.45139
2 A 3 Glass production	Hg	0.00082647	0.00083501	3.0	400.0	400.01	0.76751	0.00045	0.00072	0.18142	0.00307	0.18145
2 C Metal production	Hg	0.00857783	0.00167059	7.5	400.0	400.07	1.53577	-0.00136	0.00145	-0.54265	0.01536	0.54287
2 G Other product use	Hg	4.0413E-05	7.6893E-05	10.0	400.0	400.12	0.07070	0.00005	0.00007	0.02137	0.00094	0.02140
2K	Hg	0.04778	0.04124531	50.0	400.0	403.11	38.20512	0.02012	0.03575	8.04806	2.52803	8.43577
2D3a	Hg	0.0267568	0.02309737	10.0	400.0	400.12	21.23628	0.01127	0.02002	4.50774	0.28314	4.51662
5 C Waste incineration	Hg	0.006034	0.000000	5.0	100.0	100.12	0.00000	-0.00197	0.00000	-0.19729	0.00000	0.19729
5 C 1 b v Cremation	Hg	0.00218136	0.00818904	5.0	100.0	100.12	1.88406	0.00638	0.00710	0.63849	0.05019	0.64046
5 E Other waste (Building and car fires)	Hg	0.00161105	0.00095292	5.0	700.0	700.02	1.53280	0.00030	0.00083	0.20945	0.00584	0.20953
TOTAL		1.15	0.44	% Uncertainty in total inventory			87.44			Trend uncertainty:		93.68

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	As	0.77941468	0.12137986	3.0	100.0	100.04	23.54426	0.00867	0.01411	0.86701	0.05987	0.86907
1 A 2 Manufacturing Industries and Construction	As	0.10750284	0.07340902	3.0	100.0	100.04	14.23927	0.00778	0.00853	0.77839	0.03621	0.77923
1 A 3 b Road Transport	As	0.00026442	0.00029514	3.0	200.0	200.02	0.11446	0.00003	0.00003	0.00649	0.00015	0.00650
1 A 3 Other mobile source and machinery	As	0.00392465	0.00183492	3.0	400.0	400.01	1.42309	0.00019	0.00021	0.07438	0.00091	0.07439
1 A 4 a Commercial, institutional combustion	As	0.00731397	0.00189931	5.0	400.0	400.03	1.47310	0.00017	0.00022	0.06793	0.00156	0.06795
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	As	0.024281	0.01207283	3.0	400.0	400.01	9.36320	0.00123	0.00140	0.49370	0.00595	0.49373
1 B Extraction and distribution of fossil fuels	As	0.00777749	0.00026228	10.0	400.0	400.12	0.20347	-0.00002	0.00003	-0.00949	0.00043	0.00950
1 B 2 a iv Refining / storage	As	0.01793942	0.2478524	3.0	400.0	400.01	192.22433	0.02869	0.02881	11.47547	0.12225	11.47612
2 A 3 Glass production	As	0.0523431	0.05288398	3.0	100.0	100.04	10.25800	0.00578	0.00615	0.57828	0.02608	0.57887
2 C Metal production	As	7.59739707	0.00050118	7.5	400.0	400.07	0.38875	-0.05244	0.00006	-20.97563	0.00062	20.97563
2 G Other product use	As	0.00094297	0.00179417	10.0	400.0	400.12	1.39188	0.00020	0.00021	0.08080	0.00295	0.08086
5 C Waste incineration	As	0.000032	0.000000	5.0	100.0	100.12	0.00000	0.00000	0.00000	-0.00002	0.00000	0.00002
5 C 1 b v Cremation	As	1.9925E-05	7.4801E-05	5.0	100.0	100.12	0.01452	0.00001	0.00001	0.00086	0.00006	0.00086
5 E Other waste (Building and car fires)	As	0.00255698	0.00151117	5.0	700.0	700.02	2.05100	0.00016	0.00018	0.11050	0.00124	0.11051
TOTAL		8.60	0.52	% Uncertainty in total inventory			194.71			Trend uncertainty:		23.95

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	Cr	1.91682979	0.17729373	3.0	100.0	100.04	8.30401	-0.11214	0.03348	-11.21442	0.14206	11.21532
1 A 2 Manufacturing Industries and Construction	Cr	0.35069035	0.15710363	3.0	100.0	100.04	7.35836	0.00295	0.02967	0.29509	0.12588	0.32082
1 A 3 b Road Transport	Cr	0.20416634	0.36657989	3.0	200.0	200.02	34.32786	0.05366	0.06923	10.73125	0.29372	10.73527
1 A 3 Other mobile source and machinery	Cr	0.00867266	0.00338771	3.0	400.0	400.01	0.63442	-0.00002	0.00064	-0.00837	0.00271	0.00880
1 A 4 a Commercial, institutional combustion	Cr	0.08068901	0.02704374	5.0	400.0	400.03	5.06477	-0.00104	0.00511	-0.41588	0.03611	0.41745
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	Cr	1.05364526	1.06675594	3.0	400.0	400.01	199.77287	0.12095	0.20146	48.38089	0.85474	48.38844
1 B Extraction and distribution of fossil fuels	Cr	0.09941629	0.00230629	10.0	400.0	400.12	0.43203	-0.00714	0.00044	-2.85485	0.00616	2.85485
1 B 2 a iv Refining / storage	Cr	0.42285767	0.24560481	3.0	400.0	400.01	45.99475	0.01416	0.04638	5.66305	0.19679	5.66647
2 A 3 Glass production	Cr	0.0633627	0.06401745	3.0	400.0	400.01	11.98864	0.00726	0.01209	2.90481	0.05129	2.90526
2 C Metal production	Cr	1.0807925	0.00334117	7.5	400.0	400.07	0.62580	-0.08154	0.00063	-32.61703	0.00669	32.61703
2 G Other product use	As	0.0110604	0.0210444	10.0	400.0	400.12	3.94213	0.00313	0.00397	1.25268	0.05621	1.25394
5 C Waste incineration	Cr	0.000355	0.000000	5.0	100.0	100.12	0.00000	-0.00003	0.00000	-0.00270	0.00000	0.00270
5 C 1 b v Cremation	Cr	1.9852E-05	7.4526E-05	5.0	100.0	100.12	0.00349	0.00001	0.00001	0.00126	0.00010	0.00126
5 E Other waste (Building and car fires)	Cr	0.00244325	0.00144435	5.0	700.0	700.02	0.47335	0.00009	0.00027	0.06065	0.00193	0.06068
TOTAL		5.30	2.14	% Uncertainty in total inventory			208.56			Trend uncertainty:		60.79

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	Cu	0.874229739	0.224936565	3.0	100.0	100.04	2.51801	-0.07261	0.02517	-7.26108	0.10680	7.26187
1 A 2 Manufacturing Industries and Construction	Cu	0.614150054	0.346283339	3.0	100.0	100.04	3.87640	-0.02997	0.03875	-2.99695	0.16442	3.00146
1 A 3 b Road Transport	Cu	5.882953875	6.944136352	3.0	200.0	200.02	155.41722	0.11787	0.77714	23.57312	3.29712	23.80258
1 A 3 Other mobile source and machinery	Cu	0.109282553	0.072711782	3.0	400.0	400.01	3.25446	-0.00409	0.00814	-1.63778	0.03452	1.63814
1 A 4 a Commercial, institutional combustion	Cu	0.036236108	0.007847961	5.0	400.0	400.03	0.35128	-0.00318	0.00088	-1.27104	0.00621	1.27106
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	Cu	0.724620507	0.57972991	3.0	400.0	400.01	25.94776	-0.01622	0.06488	-6.48662	0.27526	6.49246
1 B Extraction and distribution of fossil fuels	Cu	0.029964152	0.001543852	10.0	400.0	400.12	0.06912	-0.00318	0.00017	-1.27244	0.00244	1.27244
1 B 2 a iv Refining / storage	Cu	0.179394163	0.10581484	3.0	400.0	400.01	4.73610	-0.00824	0.01184	-3.29457	0.05024	3.29496
2 A 3 Glass production	Cu	0.00192843	0.001948357	3.0	400.0	400.01	0.08721	0.00000	0.00022	0.00088	0.00093	0.00127
2 C Metal production	Cu	0.08251068	0.000668234	7.5	400.0	400.07	0.02991	-0.00916	0.00007	-3.66402	0.00079	3.66402
2 G Other product use	Cu	0.3800874	0.648079342	10.0	400.0	400.12	29.01522	0.02997	0.07253	11.98854	1.02571	12.03234
5 C Waste incineration	Cu	0.014470	0.000000	5.0	100.0	100.12	0.00000	-0.00162	0.00000	-0.16196	0.00000	0.16196
5 C 1 b v Cremation	Cu	1.81975E-05	6.83153E-05	5.0	100.0	100.12	0.00077	0.00001	0.00001	0.00056	0.00005	0.00056
5 E Other waste (Building and car fires)	Cu	0.00567462	0.00335883	5.0	700.0	700.02	0.26309	-0.00026	0.00038	-0.18150	0.00266	0.18152
TOTAL		8.94	8.94	% Uncertainty in total inventory			160.39			Trend uncertainty:		29.08

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	Ni	11.6433713	2.86871302	3.0	100.0	100.04	67.03025	-0.00293	0.16798	-0.29338	0.71267	0.77070
1 A 2 Manufacturing Industries and Construction	Ni	0.28257779	0.14899872	3.0	100.0	100.04	3.48150	0.00458	0.00872	0.45755	0.03702	0.45904
1 A 3 b Road Transport	Ni	0.1071046	0.06959464	3.0	200.0	200.02	3.25120	0.00250	0.00408	0.50052	0.01729	0.50082
1 A 3 Other mobile source and machinery	Ni	0.11016182	0.04305045	3.0	400.0	400.01	4.02197	0.00090	0.00252	0.36141	0.01070	0.36157
1 A 4 a Commercial, institutional combustion	Ni	0.86880829	0.23711724	5.0	400.0	400.03	22.15366	0.00113	0.01388	0.45169	0.09818	0.46224
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	Ni	0.36966944	0.17037907	3.0	400.0	400.01	15.91757	0.00455	0.00998	1.81946	0.04233	1.81995
1 B Extraction and distribution of fossil fuels	Ni	0.07383993	0.00338785	10.0	400.0	400.12	0.31660	-0.00089	0.00020	-0.35424	0.00281	0.35425
1 B 2 a iv Refining / storage	Ni	0.78164599	0.51551345	3.0	400.0	400.01	48.16156	0.01870	0.03019	7.48099	0.12807	7.48208
2 A 3 Glass production	Ni	0.1349901	0.136385	3.0	400.0	400.01	12.74169	0.00600	0.00799	2.40155	0.03388	2.40178
2 C Metal production	Ni	2.6514066	0.0233882	7.5	400.0	400.07	2.18535	-0.03750	0.00137	-14.99869	0.01453	14.99870
2 G Other product use	Ni	0.0539157	0.06503167	10.0	400.0	400.12	6.07728	0.00302	0.00381	1.20654	0.05385	1.20774
5 C Waste incineration	Ni	0.000315	0.000000	5.0	100.0	100.12	0.00000	0.00000	0.00000	-0.00046	0.00000	0.00046
5 C 1 b v Cremation	Ni	2.5371E-05	9.5246E-05	5.0	100.0	100.12	0.00223	0.00001	0.00001	0.00052	0.00004	0.00052
TOTAL		17.08	4.28	% Uncertainty in total inventory			88.32			Trend uncertainty:		17.12

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	Se	0.07919249	0.02572958	3.0	100.0	100.04	7.04858	0.08064	0.05594	8.06366	0.23734	8.06715
1 A 2 Manufacturing Industries and Construction	Se	0.07876611	0.06573013	3.0	100.0	100.04	18.00668	0.00692	0.14291	0.69196	0.60633	0.92002
1 A 3 b Road Transport	Se	0.01483534	0.00673219	3.0	200.0	200.02	3.68731	0.01097	0.01464	2.19415	0.06210	2.19503
1 A 3 Other mobile source and machinery	Se	0.00498067	0.00448507	3.0	400.0	400.01	4.91265	0.00115	0.00975	0.46115	0.04137	0.46300
1 A 4 a Commercial, institutional combustion	Se	0.00247402	0.00087535	5.0	400.0	400.03	0.95885	0.00237	0.00190	0.94712	0.01346	0.94721
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	Se	0.03241907	0.02520466	3.0	400.0	400.01	27.60749	0.00117	0.05480	0.46656	0.23250	0.52128
1 B Extraction and distribution of fossil fuels	Se	0.00890301	3.7088E-06	10.0	400.0	400.12	0.00406	0.01536	0.00001	6.14364	0.00011	6.14364
1 B 2 a iv Refining / storage	Se	0.01793942	0.01365732	3.0	400.0	400.01	14.95931	0.00128	0.02969	0.51031	0.12598	0.52563
2 A 3 Glass production	Se	0.220392	0.22266939	3.0	400.0	400.01	243.89707	0.10316	0.48414	41.26323	2.05402	41.31432
5 C 1 b v Cremation	Se	2.8958E-05	0.00010871	5.0	100.0	100.12	0.02980	0.00019	0.00024	0.01864	0.00167	0.01871
TOTAL		0.46	0.37	% Uncertainty in total inventory			246.75			Trend uncertainty:		42.63

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	Zn	2.73092892	1.59723764	3.0	100.0	100.04	4.60108	0.02099	0.04076	2.09928	0.17293	2.10639
1 A 2 Manufacturing Industries and Construction	Zn	6.02270309	2.15408474	3.0	100.0	100.04	6.20516	0.08113	0.05497	8.11259	0.23322	8.11594
1 A 3 b Road Transport	Zn	3.70665916	6.33459052	3.0	200.0	200.02	36.48313	0.07775	0.16166	15.54913	0.68585	15.56425
1 A 3 Other mobile source and machinery	Zn	0.16562434	0.10452036	3.0	400.0	400.01	1.20384	0.00108	0.00267	0.43149	0.01132	0.43164
1 A 4 a Commercial, institutional combustion	Zn	0.30460203	0.21870334	5.0	400.0	400.03	2.51909	0.00131	0.00558	0.52327	0.03947	0.52476
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	Zn	22.9264254	23.6029137	3.0	400.0	400.01	271.85199	0.08330	0.60234	33.31976	2.55551	33.41762
1 B Extraction and distribution of fossil fuels	Zn	0.17305242	0.02437568	10.0	400.0	400.12	0.28083	0.00329	0.00062	1.31677	0.00880	1.31679
1 B 2 a iv Refining / storage	Zn	0.15376643	0.09416742	3.0	400.0	400.01	1.08459	0.00107	0.00240	0.42990	0.01020	0.43002
2 A 3 Glass production	Zn	0.1019313	0.10298459	3.0	400.0	400.01	1.18615	0.00032	0.00263	0.12905	0.01115	0.12953
2 C Metal production	Zn	2.68198038	0.12028217	7.5	400.0	400.07	1.38558	0.05755	0.00307	23.02095	0.03256	23.02097
2 G Other product use	Zn	0.2169857	0.37530167	10.0	400.0	400.12	4.32385	0.00467	0.00958	1.86781	0.13545	1.87271
5 C Waste incineration	Zn	0.000525	0.000000	5.0	100.0	100.12	0.00000	0.00001	0.00000	0.00119	0.00000	0.00119
5 C 1 b v Cremation	Zn	0.00023442	0.00088002	5.0	100.0	100.12	0.00254	0.00002	0.00002	0.00172	0.00016	0.00172
TOTAL		39.19	34.73	% Uncertainty in total inventory			**274.45**			Trend uncertainty:		**44.33**

A	B	C	D	E	F	G	H	I	J	K	L	M
NFR Source	Pollutant	Emissions 1990	Emissions 2017	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total emissions in year 2013	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kg	kg	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	PCB	1.083	2.26	3.0	100.0	100.04	0.54425	0.00275	0.00468	0.27493	0.01984	0.27565
1 A 2 Manufacturing Industries and Construction	PCB	2.45	0.54	3.0	100.0	100.04	0.12924	-0.00325	0.00111	-0.32542	0.00471	0.32545
1 A 3 Other mobile source and machinery	PCB	4.0E-02	2.6E-03	3.0	400.0	400.01	0.00251	-0.00007	0.00001	-0.02624	0.00002	0.02624
1 A 4 a Commercial, institutional combustion	PCB	0.15	7.6E-04	5.0	400.0	400.03	0.00073	-0.00027	0.00000	-0.10763	0.00001	0.10763
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	PCB	0.75	0.02	3.0	400.0	400.01	0.02051	-0.00130	0.00004	-0.51929	0.00019	0.51929
2 C Metal production	PCB	0.85	0.08	7.5	400	400.07	0.08045	-0.00133	0.00017	-0.53334	0.00183	0.53334
2 K	PCB	477.80	412.45	50	400	403.11	400.29203	0.00344	0.85371	1.37546	60.36615	60.38182
5 C Waste incineration	PCB	0.002800	0.000000	5.0	100	100.12	0.00000	0.00000	0.00000	-0.00050	0.00000	0.00050
5 C 1 b v Cremation	PCB	6.0E-04	2.3E-03	5.0	100	100.12	0.00054	0.00000	0.00000	0.00036	0.00003	0.00036
TOTAL		483.13	415.36	% Uncertainty in total inventory			400.29			Trend uncertainty:		60.39

12.8. Appendix 8. Influence of recalculations 1990 – 2016 in respect to pollutant and SNAP97 sector

Pollutant	SO_2											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,1%
1991	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,1%
1992	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,1%
1993	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,1%
1994	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
1995	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
1996	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
1997	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
1998	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
1999	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2000	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2001	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2002	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2003	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2004	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2005	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2006	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2007	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2008	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2009	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2010	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2011	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2012	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0,0%
2013	0%	0%	0%	9%	-	0%	0%	0%	0%	-	0%	1,6%
2014	0%	0%	0%	3%	-	0%	32%	-1%	0%	-	0%	0,9%
2015	-3%	0%	0%	6%	-	0%	-1%	-1%	0%	-	0%	-0,2%
2016	-2%	0%	3%	5%	-	0%	-57%	-1%	0%	-	0%	0,6%

Pollutant	NOx											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-8%	-19%	0%	0%	-	0%	0%	0%	0%	224%	0%	3.6%
1991	-10%	-14%	0%	0%	-	0%	0%	0%	0%	214%	0%	5.3%
1992	-9%	-20%	0%	0%	-	0%	0%	0%	0%	157%	0%	3.2%
1993	-9%	-20%	0%	0%	-	0%	0%	0%	0%	211%	0%	2.9%
1994	-17%	-19%	0%	0%	-	0%	0%	0%	0%	189%	0%	1.3%
1995	-17%	-19%	0%	0%	-	0%	0%	0%	0%	187%	0%	0.2%
1996	-15%	-21%	0%	0%	-	0%	0%	0%	0%	174%	0%	0.2%
1997	-11%	-20%	0%	0%	-	0%	0%	0%	0%	138%	0%	1.1%
1998	-11%	-17%	0%	0%	-	0%	0%	0%	0%	172%	0%	1.2%
1999	-11%	-20%	0%	0%	-	0%	0%	0%	0%	163%	0%	0.6%
2000	-7%	-20%	0%	0%	-	0%	0%	0%	0%	142%	0%	2.2%
2001	-4%	-17%	0%	0%	-	0%	0%	0%	0%	132%	0%	3.2%
2002	-3%	-18%	0%	0%	-	0%	0%	-1%	0%	142%	0%	3.0%
2003	-3%	-17%	0%	0%	-	0%	0%	-1%	0%	152%	0%	3.0%
2004	-4%	-17%	0%	0%	-	0%	0%	-1%	0%	163%	0%	3.7%
2005	-4%	-16%	0%	0%	-	0%	0%	0%	0%	148%	0%	3.6%
2006	-3%	-15%	0%	0%	-	0%	0%	0%	0%	163%	0%	4.0%
2007	-2%	-14%	0%	0%	-	0%	0%	0%	0%	138%	0%	3.9%
2008	-1%	-13%	0%	0%	-	0%	0%	0%	0%	132%	0%	3.9%
2009	-2%	-12%	0%	0%	-	0%	0%	0%	0%	152%	0%	4.4%
2010	-2%	-11%	0%	0%	-	0%	0%	0%	0%	164%	0%	5.0%
2011	-2%	-11%	0%	0%	-	0%	0%	0%	0%	138%	0%	5.1%
2012	-1%	-9%	0%	0%	-	0%	0%	0%	0%	147%	0%	5.9%
2013	1%	-8%	0%	3%	-	0%	0%	0%	0%	169%	0%	6.2%
2014	2%	-7%	0%	1%	-	0%	0%	0%	0%	185%	0%	7.2%
2015	2%	-7%	0%	2%	-	0%	-1%	0%	0%	176%	0%	6.9%

Pollutant	NMVOC										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-3%	0%	0%	0%	0%	1%	0%	0%	74%	12%	0%	1.5%
1991	-4%	0%	0%	0%	0%	-4%	0%	0%	74%	12%	0%	0.5%
1992	-4%	0%	0%	0%	0%	-9%	0%	0%	74%	10%	0%	-0.8%
1993	-4%	0%	0%	0%	0%	-10%	0%	0%	70%	10%	0%	-1.0%
1994	-7%	0%	0%	0%	0%	-9%	0%	0%	67%	11%	0%	-0.7%
1995	-9%	0%	0%	0%	0%	9%	0%	0%	63%	11%	0%	4.6%
1996	-7%	0%	0%	0%	0%	5%	0%	0%	59%	16%	0%	3.2%
1997	-5%	0%	0%	0%	0%	-8%	0%	0%	55%	16%	0%	-0.3%
1998	-6%	0%	0%	0%	0%	-9%	0%	0%	51%	17%	0%	-0.2%
1999	-6%	0%	0%	0%	0%	-10%	0%	0%	48%	16%	0%	-0.4%
2000	-3%	0%	0%	0%	0%	-9%	0%	0%	50%	4%	0%	-1.2%
2001	-2%	0%	0%	0%	0%	-9%	0%	0%	47%	4%	0%	-1.3%
2002	-2%	0%	0%	0%	0%	-7%	0%	1%	44%	4%	0%	-1.2%
2003	-2%	0%	0%	0%	0%	-7%	0%	1%	42%	4%	0%	-1.1%
2004	-2%	0%	0%	0%	0%	-6%	0%	0%	40%	4%	0%	-0.9%
2005	-2%	0%	0%	0%	0%	-6%	0%	0%	38%	4%	0%	-1.0%
2006	-2%	0%	0%	0%	0%	-5%	0%	0%	34%	4%	0%	-0.8%
2007	-1%	0%	0%	0%	0%	-4%	0%	0%	31%	4%	0%	-0.7%
2008	-1%	0%	0%	1%	0%	-4%	0%	0%	29%	5%	0%	-0.7%
2009	-1%	0%	0%	0%	0%	-6%	0%	0%	28%	5%	0%	-0.9%
2010	0%	0%	0%	1%	0%	-7%	0%	0%	25%	6%	0%	-1.0%
2011	0%	0%	0%	1%	0%	-8%	0%	0%	28%	6%	0%	-1.2%
2012	1%	0%	0%	1%	0%	-8%	0%	0%	39%	6%	0%	-1.1%
2013	3%	0%	0%	3%	0%	-11%	0%	0%	37%	9%	0%	-1.7%
2014	6%	0%	0%	1.40%	0%	-12%	0%	0%	35%	9%	0%	-2.0%
2015	8%	0%	0%	2.40%	0%	-12%	-5%	0%	40%	9%	0%	-2.1%

Pollutant	CO										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-12%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
1991	-5%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
1992	1%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.1%
1993	-3%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
1994	3%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.1%
1995	5%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.1%
1996	2%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.1%
1997	-1%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
1998	-2%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
1999	-1%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2000	-10%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2001	-13%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2002	-16%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2003	-14%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2004	-15%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2005	-18%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2006	-13%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2007	-10%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2008	-10%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2009	-16%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2010	-13%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0.0%
2011	-21%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	-0.1%
2012	-25%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	-0.1%
2013	-15%	0%	0%	34%	-	0%	0%	0%	0%	-	0%	3.1%
2014	-24%	0%	0%	14%	-	0%	0%	0%	0%	-	0%	1.4%
2015	-16%	0%	0%	26%	-	0%	-8%	0%	0%	-	0%	1.2%

Pollutant	NH_3											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-1%	0%	0%	0%	-	0%	0%	0%	0%	5%	0%	4.6%
1991	-1%	0%	0%	0%	-	0%	0%	0%	0%	6%	0%	5.2%
1992	-1%	0%	0%	0%	-	0%	0%	0%	0%	10%	0%	8.0%
1993	-1%	0%	0%	0%	-	0%	0%	0%	0%	7%	0%	5.8%
1994	-2%	0%	0%	0%	-	0%	0%	0%	0%	7%	0%	5.6%
1995	-4%	0%	0%	0%	-	0%	0%	0%	0%	8%	0%	6.2%
1996	-2%	0%	0%	0%	-	0%	0%	0%	0%	9%	0%	7.2%
1997	-1%	0%	0%	0%	-	0%	0%	0%	0%	11%	0%	8.9%
1998	-2%	0%	0%	0%	-	0%	0%	0%	0%	9%	0%	6.8%
1999	-2%	0%	0%	0%	-	0%	0%	0%	0%	10%	0%	8.5%
2000	0%	0%	0%	0%	-	0%	0%	0%	0%	13%	0%	10.6%
2001	0%	0%	0%	0%	-	0%	0%	0%	0%	11%	0%	9.0%
2002	0%	0%	0%	0%	-	0%	0%	0%	0%	11%	0%	8.8%
2003	0%	0%	0%	0%	-	0%	0%	0%	0%	10%	0%	8.3%
2004	0%	0%	0%	0%	-	0%	0%	0%	0%	10%	0%	8.1%
2005	0%	0%	0%	0%	-	0%	0%	0%	0%	16%	0%	12.7%
2006	0%	0%	0%	1%	-	0%	0%	0%	0%	10%	0%	8.4%
2007	0%	0%	0%	1%	-	0%	0%	0%	0%	12%	0%	9.9%
2008	0%	0%	0%	1%	-	0%	0%	0%	0%	12%	0%	10.0%
2009	0%	0%	0%	1%	-	0%	0%	0%	0%	10%	0%	8.9%
2010	0%	0%	0%	1%	-	0%	0%	0%	0%	9%	0%	7.5%
2011	0%	0%	0%	1%	-	0%	-1%	0%	0%	11%	0%	8.9%
2012	0%	0%	0%	1%	-	0%	-2%	0%	0%	10%	0%	8.5%
2013	1%	0%	0%	2%	-	0%	-2%	0%	0%	9%	0%	7.4%
2014	1%	0%	0%	2%	-	0%	0%	0%	0%	8%	0%	7.2%
2015	2%	0%	0%	2%	-	0%	0%	0%	0%	14%	0%	12.0%
2016	2%	0%	0%	2%	-	0%	0%	0%	0%	7%	0%	6.1%

Pollutant	TSP										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	9%	0%	0%	0%	0%	0%	0%	0%	0%	42%	-	5.5%
1991	10%	0%	0%	0%	0%	0%	0%	0%	0%	43%	-	5.4%
1992	8%	0%	0%	0%	0%	0%	0%	0%	0%	40%	-	4.6%
1993	7%	0%	0%	0%	0%	0%	0%	0%	0%	38%	-	4.4%
1994	7%	0%	0%	0%	0%	0%	0%	0%	0%	40%	-	4.5%
1995	10%	0%	0%	0%	0%	0%	0%	0%	0%	42%	-	4.4%
1996	13%	0%	0%	0%	0%	0%	0%	0%	0%	59%	-	5.2%
1997	7%	0%	0%	0%	0%	0%	0%	0%	0%	61%	-	5.3%
1998	5%	0%	0%	0%	0%	0%	0%	0%	0%	63%	-	5.3%
1999	5%	0%	0%	0%	0%	0%	0%	0%	0%	58%	-	5.2%
2000	12%	0%	0%	0%	-	0%	0%	0%	0%	15%	-	1.6%
2001	8%	0%	0%	0%	-	0%	0%	0%	0%	15%	-	1.5%
2002	11%	0%	0%	0%	-	0%	0%	3%	0%	15%	-	1.5%
2003	11%	0%	0%	0%	-	0%	0%	3%	0%	16%	-	1.3%
2004	20%	0%	0%	0%	-	0%	0%	2%	0%	15%	-	1.2%
2005	14%	0%	0%	0%	-	0%	0%	2%	0%	16%	-	1.2%
2006	16%	0%	0%	0%	-	0%	0%	1%	0%	16%	-	1%
2007	11%	0%	0%	0%	-	0%	0%	1%	0%	16%	-	1%
2008	13%	0%	0%	0%	-	0%	0%	1%	0%	20%	-	1.5%
2009	11%	0%	0%	0%	-	0%	25%	0%	0%	20%	-	2.6%
2010	17%	0%	0%	0%	-	0%	0%	0%	0%	23%	-	2.0%
2011	15%	0%	0%	0%	-	0%	0%	0%	0%	24%	-	2.0%
2012	12%	0%	0%	0%	-	0%	0%	0%	0%	23%	-	2.1%
2013	13%	0%	0%	1%	-	0%	0%	0%	0%	34%	-	3.5%
2014	10%	0%	0%	0%	-	0%	0%	0%	0%	37%	-	3.7%
2015	10%	0%	0%	1%	-	0%	-5%	0%	0%	36%	-	3.5%

Pollutant	$PM_{2.5}$										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	15%	0%	0%	1%	0%	0%	0%	0%	0%	13%	-	0.6%
1991	16%	0%	0%	1%	0%	0%	0%	0%	0%	13%	-	0.5%
1992	13%	0%	0%	2%	0%	0%	0%	0%	0%	12%	-	0.5%
1993	11%	0%	0%	1%	0%	0%	0%	0%	0%	12%	-	0.4%
1994	10%	0%	0%	0%	0%	0%	0%	0%	0%	12%	-	0.4%
1995	11%	0%	0%	0%	0%	0%	0%	0%	0%	13%	-	0.4%
1996	18%	0%	0%	0%	0%	0%	0%	0%	0%	18%	-	0.6%
1997	7%	0%	0%	0%	0%	0%	0%	0%	0%	19%	-	0.5%
1998	6%	0%	0%	0%	0%	0%	0%	0%	0%	20%	-	0.5%
1999	8%	0%	0%	0%	0%	0%	0%	0%	0%	19%	-	0.5%
2000	17%	0%	0%	0%	-	0%	0%	0%	0%	5%	-	0.3%
2001	12%	0%	0%	0%	-	0%	0%	0%	0%	5%	-	0.3%
2002	17%	0%	0%	0%	-	0%	0%	3%	0%	5%	-	0.4%
2003	18%	0%	0%	0%	-	0%	0%	3%	0%	5%	-	0.3%
2004	28%	0%	0%	0%	-	0%	0%	2%	0%	5%	-	0.3%
2005	28%	0%	0%	0%	-	0%	0%	2%	0%	5%	-	0.3%
2006	23%	0%	0%	0%	-	0%	0%	2%	0%	5%	-	0.3%
2007	20%	0%	0%	0%	-	0%	0%	1%	0%	5%	-	0.4%
2008	17%	0%	0%	0%	-	0%	0%	1%	0%	7%	-	0.3%
2009	23%	0%	0%	0%	-	0%	0%	0%	0%	6%	-	0.4%
2010	33%	0%	0%	0%	-	0%	0%	0%	0%	8%	-	0.4%
2011	23%	0%	0%	0%	-	0%	0%	0%	0%	8%	-	0.4%
2012	18%	0%	0%	0%	-	0%	0%	0%	0%	8%	-	0.4%
2013	16%	0%	0%	4%	-	0%	0%	0%	0%	12%	-	0.6%
2014	14%	0%	0%	2%	-	0%	0%	0%	0%	12%	-	0.6%
2015	12%	0%	0%	3%	-	0%	-7%	0%	0%	12%	-	0.2%
2016	8%	0%	0%	3%	-	0%	-5%	0%	1%	12%	-	0.3%

Pollutant	PM_{10}										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	10%	0%	0%	1%	0%	0%	0%	0%	0%	51%	-	6.4%
1991	12%	0%	0%	1%	0%	0%	0%	0%	0%	53%	-	6.2%
1992	9%	0%	0%	1%	0%	0%	0%	0%	0%	49%	-	5.2%
1993	8%	0%	0%	1%	0%	0%	0%	0%	0%	48%	-	4.9%
1994	9%	0%	0%	0%	0%	0%	0%	0%	0%	50%	-	5.3%
1995	11%	0%	0%	0%	0%	0%	0%	0%	0%	53%	-	5.1%
1996	15%	0%	0%	0%	0%	0%	0%	0%	0%	74%	-	6.2%
1997	7%	0%	0%	0%	0%	0%	0%	0%	0%	76%	-	6.5%
1998	5%	0%	0%	0%	0%	0%	0%	0%	0%	78%	-	6.5%
1999	7%	0%	0%	0%	0%	0%	0%	0%	0%	73%	-	6.5%
2000	13%	0%	0%	0%	-	0%	0%	0%	0%	19%	-	1.9%
2001	9%	0%	0%	0%	-	0%	0%	0%	0%	18%	-	1.7%
2002	12%	0%	0%	0%	-	0%	0%	3%	0%	18%	-	1.8%
2003	12%	0%	0%	0%	-	0%	0%	3%	0%	20%	-	1.6%
2004	20%	0%	0%	0%	-	0%	0%	2%	0%	19%	-	1.6%
2005	17%	0%	0%	0%	-	0%	0%	2%	0%	20%	-	1.6%
2006	16%	0%	0%	0%	-	0%	0%	2%	0%	20%	-	1.8%
2007	12%	0%	0%	0%	-	0%	0%	1%	0%	20%	-	1.9%
2008	13%	0%	0%	0%	-	0%	0%	1%	0%	25%	-	2.1%
2009	13%	0%	0%	0%	-	0%	0%	0%	0%	25%	-	2.3%
2010	20%	0%	0%	0%	-	0%	0%	0%	0%	29%	-	2.7%
2011	15%	0%	0%	0%	-	0%	0%	0%	0%	31%	-	2.8%
2012	12%	0%	0%	0%	-	0%	0%	0%	0%	29%	-	2.8%
2013	12%	0%	0%	2%	-	0%	0%	0%	0%	43%	-	4.6%
2014	10%	0%	0%	1%	-	0%	0%	0%	0%	47%	-	5.3%
2015	9%	0%	0%	2%	-	0%	-5%	0%	0%	46%	-	4.9%
2016	6%	0%	0%	2%	-	0%	-4%	0%	1%	43%	-	5.2%

Pollutant	Cd										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-52%	-1%	0%	0%	-	0%	0%	0%	0%	-	-	-4.2%
1991	-54%	4%	0%	0%	-	0%	0%	0%	0%	-	-	-0.7%
1992	-56%	-1%	0%	0%	-	0%	0%	0%	0%	-	-	-4.8%
1993	-61%	-1%	0%	0%	-	0%	0%	0%	0%	-	-	-5.6%
1994	-46%	-1%	0%	0%	-	0%	0%	0%	0%	-	-	-3.8%
1995	-38%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-3.3%
1996	-43%	-1%	0%	0%	-	0%	0%	0%	0%	-	-	-3.6%
1997	-52%	-1%	0%	0%	-	0%	0%	0%	0%	-	-	-4.6%
1998	-46%	-1%	0%	0%	-	0%	0%	0%	0%	-	-	-3.8%
1999	-47%	-1%	0%	0%	-	0%	0%	0%	0%	-	-	-4.0%
2000	-53%	-1%	0%	0%	-	0%	0%	0%	0%	-	-	-4.5%
2001	-32%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.4%
2002	-30%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.5%
2003	-28%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.2%
2004	-28%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.2%
2005	-32%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.5%
2006	-31%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.4%
2007	-33%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.7%
2008	-33%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.6%
2009	-37%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-3.0%
2010	-44%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-3.5%
2011	-33%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.9%
2012	-30%	-2%	0%	0%	-	0%	0%	0%	0%	-	-	-2.6%
2013	-38%	-2%	0%	15%	-	0%	0%	0%	0%	-	-	-1.5%
2014	-32%	-2%	0%	5%	-	0%	0%	0%	0%	-	-	-2.1%
2015	-34%	-2%	0%	9%	-	0%	0%	0%	0%	-	-	-2.1%
2016	-31%	-3%	0%	12%	-	0%	0%	0%	0%	-	-	-2.2%

Pollutant	Hg										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-14%	-3%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.1%
1991	-16%	-4%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.0%
1992	-13%	-5%	0%	0%	0%	0%	0%	0%	0%	-	-	-0.9%
1993	-17%	-5%	0%	0%	0%	0%	0%	0%	0%	-	-	-3.6%
1994	-24%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-2.5%
1995	-15%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-2.4%
1996	-21%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-2.8%
1997	-12%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-2.9%
1998	-10%	-5%	0%	0%	0%	0%	0%	0%	0%	-	-	-2.4%
1999	-12%	-5%	0%	0%	0%	0%	0%	0%	0%	-	-	-2.4%
2000	-6%	-5%	0%	0%	0%	0%	0%	0%	0%	-	-	-2.0%
2001	-2%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.1%
2002	-2%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.1%
2003	-2%	-5%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.0%
2004	-1%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.0%
2005	-2%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.1%
2006	-2%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.0%
2007	-2%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.0%
2008	-1%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.0%
2009	-3%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.3%
2010	-2%	-7%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.5%
2011	-2%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.2%
2012	-1%	-6%	0%	0%	0%	0%	0%	0%	0%	-	-	-1.1%
2013	-1%	-7%	0%	29%	0%	0%	0%	0%	0%	-	-	1.5%
2014	-1%	-7%	0%	11%	0%	0%	0%	0%	0%	-	-	0.0%
2015	-1%	-8%	0%	21%	0%	0%	0%	0%	0%	-	-	0.7%
2016	-1%	-9%	0%	24%	0%	0%	0%	0%	0%	-	-	0.7%

Pollutant	Pb											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	9%	4%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
1991	11%	2%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
1992	9%	5%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
1993	12%	5%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
1994	29%	5%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
1995	31%	5%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
1996	23%	6%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
1997	13%	6%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
1998	12%	4%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
1999	13%	6%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
2000	9%	5%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
2001	3%	4%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
2002	3%	5%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
2003	2%	4%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
2004	4%	4%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
2005	3%	4%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
2006	2%	4%	0%	0%	-	0%	0%	0%	0%	-	-	0.6%
2007	2%	3%	0%	0%	-	0%	0%	0%	0%	-	-	0.5%
2008	1%	3%	0%	0%	-	0%	0%	0%	0%	-	-	0.5%
2009	2%	3%	0%	0%	-	0%	0%	0%	0%	-	-	0.5%
2010	3%	2%	0%	0%	-	0%	0%	0%	0%	-	-	0.5%
2011	2%	2%	0%	0%	-	0%	0%	0%	0%	-	-	0.5%
2012	2%	2%	0%	0%	-	0%	0%	0%	0%	-	-	0.4%
2013	1%	2%	0%	8%	-	0%	0%	0%	0%	-	-	1.0%
2014	1%	2%	0%	2%	-	0%	0%	0%	0%	-	-	0.6%
2015	1%	2%	0%	5%	-	0%	0%	0%	0%	-	-	0.9%
2016	1%	2%	0%	6%	-	0%	0%	0%	0%	-	-	0.7%

Pollutant	PCDD/PCDF											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	4%	0%	0%	0%	-	0%	39%	0%	0%	-	-	0.4%
1991	5%	0%	0%	0%	-	0%	44%	0%	0%	-	-	0.3%
1992	17%	0%	0%	0%	-	0%	61%	0%	0%	-	-	0.5%
1993	5%	0%	0%	0%	-	0%	75%	0%	0%	-	-	0.6%
1994	30%	0%	0%	0%	-	0%	71%	0%	0%	-	-	0.7%
1995	45%	0%	0%	0%	-	0%	85%	0%	0%	-	-	0.9%
1996	0%	0%	0%	0%	-	0%	79%	0%	0%	-	-	0.6%
1997	20%	0%	0%	0%	-	0%	85%	0%	0%	-	-	0.8%
1998	0%	0%	0%	0%	-	0%	83%	0%	0%	-	-	0.7%
1999	0%	0%	0%	0%	-	0%	82%	0%	0%	-	-	0.8%
2000	0%	0%	0%	0%	-	0%	88%	0%	0%	-	-	0.9%
2001	3%	0%	0%	0%	-	0%	99%	0%	0%	-	-	0.9%
2002	0%	0%	0%	0%	-	0%	101%	0%	0%	-	-	1.0%
2003	2%	0%	0%	0%	-	0%	124%	0%	0%	-	-	1.1%
2004	3%	0%	0%	0%	-	0%	142%	0%	0%	-	-	1.3%
2005	3%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
2006	0%	0%	0%	0%	-	0%	178%	0%	0%	-	-	1.7%
2007	0%	0%	0%	0%	-	0%	196%	0%	0%	-	-	2.0%
2008	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
2009	2%	0%	0%	0%	-	0%	193%	0%	0%	-	-	2.1%
2010	2%	0%	0%	0%	-	0%	187%	0%	0%	-	-	2.2%
2011	0%	0%	0%	0%	-	0%	182%	0%	0%	-	-	2.2%
2012	1%	0%	0%	0%	-	0%	198%	0%	0%	-	-	2.4%
2013	0%	0%	0%	2%	-	0%	183%	0%	0%	-	-	2.5%
2014	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
2015	0%	0%	0%	1%	-	0%	0%	0%	0%	-	-	0.0%
2016	0%	0%	0%	3%	-	0%	2%	0%	0%	-	-	0.1%

Pollutant	PCB										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
1991	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
1992	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
1993	0%	1%	0%	0%	-	0%	-	0%	0%	-	-	0%
1994	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
1995	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
1996	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
1997	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
1998	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
1999	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2000	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2001	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2002	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2003	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2004	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2005	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2006	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2007	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2008	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2009	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2010	0%	0%	0%	0%	-	0%	-	0%	0%	-	-	0%
2011	0%	0%	0%	0%	-	0.0%	-	0%	0%	-	-	0.0000%
2012	0%	0%	0%	0%	-	0.0%	-	0%	0%	-	-	0.0000%
2013	0%	0%	0%	0%	-	0.0%	-	0%	0%	-	-	0.0000%
2014	0%	0%	0%	0%	-	0.0%	-	0%	0%	-	0%	0.0000%
2015	0%	0%	-26%	0%	-	0.0%	-	0%	0%	-	0%	-0.041%
2016	0%	0%	-21%	0%	-	0.0%	-	0%	0%	-	0%	-0.032%

Pollutant	PAHs										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	1%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
1991	1%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
1992	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
1993	0%	0%	0%	0%	-	0%	0%	-1%	0%	-	-	0.00%
1994	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
1995	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
1996	1%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
1997	1%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
1998	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
1999	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2000	1%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2001	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2002	1%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2003	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2004	1%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2005	1%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2006	1%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2007	1%	0%	0.0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2008	0%	0%	0.0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2009	1%	0%	0.0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2010	2%	0%	0.0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2011	1%	0%	0.0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2012	1%	0%	0.0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2013	1%	0%	0.0%	2%	-	0%	0%	0%	0%	-	-	0.01%
2014	2%	0%	0.0%	0%	-	0%	0%	0%	0%	-	-	0.00%
2015	1%	0%	0.0%	1%	-	0%	0%	0%	0%	-	-	0.01%
2016	-5%	0%	0.0%	4%	-	0%	0%	0%	0%	-	-	-0.01%

Pollutant	As											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	14%	0%	0%	-	0%	0%	0%	0%	-	-	0.1%
1991	1%	12%	0%	0%	-	0%	0%	1%	0%	-	-	0.2%
1992	0%	28%	0%	0%	-	0%	0%	0%	0%	-	-	0.8%
1993	0%	27%	0%	0%	-	0%	0%	0%	0%	-	-	0.9%
1994	0%	27%	0%	0%	-	0%	0%	2%	0%	-	-	0.5%
1995	1%	27%	0%	0%	-	0%	0%	1%	0%	-	-	0.9%
1996	1%	32%	0%	0%	-	0%	0%	0%	0%	-	-	1.0%
1997	1%	33%	0%	0%	-	0%	0%	0%	0%	-	-	0.7%
1998	1%	22%	0%	0%	-	0%	0%	0%	0%	-	-	0.6%
1999	1%	30%	0%	0%	-	0%	0%	0%	0%	-	-	0.6%
2000	0%	30%	0%	0%	-	0%	0%	0%	0%	-	-	0.6%
2001	0%	25%	0%	0%	-	0%	0%	0%	0%	-	-	0.4%
2002	0%	26%	0%	0%	-	0%	0%	0%	0%	-	-	0.3%
2003	0%	24%	0%	0%	-	0%	0%	0%	0%	-	-	0.3%
2004	0%	24%	0%	0%	-	0%	0%	0%	0%	-	-	0.4%
2005	0%	21%	0%	0%	-	0%	0%	0%	0%	-	-	0.4%
2006	0%	20%	0%	0%	-	0%	0%	0%	0%	-	-	0.3%
2007	0%	18%	0%	0%	-	0%	0%	0%	0%	-	-	0.2%
2008	0%	17%	0%	0%	-	0%	0%	0%	0%	-	-	0.3%
2009	0%	15%	0%	0%	-	0%	0%	0%	0%	-	-	0.3%
2010	0%	14%	0%	0%	-	0%	0%	0%	0%	-	-	0.3%
2011	0%	13%	0%	0%	-	0%	0%	0%	0%	-	-	0.4%
2012	0%	11%	0%	0%	-	0%	0%	0%	0%	-	-	0.3%
2013	0%	10%	0%	1%	-	0%	0%	0%	0%	-	-	0.9%
2014	0%	9%	0%	1%	-	0%	0%	0%	0%	-	-	0.7%
2015	0%	9%	0%	1%	-	0%	0%	0%	0%	-	-	0.7%
2016	-7%	9%	0%	1%	-	0%	0%	0%	0%	-	-	-1.2%

Pollutant	Cr											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-5%	8%	0%	0%	-	0%	0%	0%	0%	-	-	-0,5%
1991	-5%	1%	0%	0%	-	0%	0%	2%	0%	-	-	-1,5%
1992	-4%	8%	0%	0%	-	0%	0%	2%	0%	-	-	0,2%
1993	-3%	8%	0%	0%	-	0%	0%	4%	0%	-	-	0,7%
1994	0%	7%	0%	0%	-	0%	0%	3%	0%	-	-	1,4%
1995	0%	7%	0%	0%	-	0%	0%	4%	0%	-	-	2,1%
1996	-4%	9%	0%	0%	-	0%	0%	0%	0%	-	-	0,9%
1997	-4%	9%	0%	0%	-	0%	0%	0%	0%	-	-	0,6%
1998	-2%	6%	0%	0%	-	0%	0%	0%	0%	-	-	0,6%
1999	-1%	9%	0%	0%	-	0%	0%	0%	0%	-	-	1,4%
2000	-6%	9%	0%	0%	-	0%	0%	0%	0%	-	-	0,2%
2001	-6%	7%	0%	0%	-	0%	0%	0%	0%	-	-	-0,5%
2002	-7%	7%	0%	0%	-	0%	0%	0%	0%	-	-	-1,1%
2003	-5%	7%	0%	0%	-	0%	0%	0%	0%	-	-	-0,7%
2004	-9%	6%	0%	0%	-	0%	0%	0%	0%	-	-	-1,0%
2005	-8%	6%	0%	0%	-	0%	0%	0%	0%	-	-	-1,0%
2006	-8%	5%	0%	0%	-	0%	0%	0%	0%	-	-	-1,3%
2007	-9%	5%	0%	0%	-	0%	0%	0%	0%	-	-	-2,2%
2008	-6%	5%	0%	0%	-	0%	0%	0%	0%	-	-	-1,2%
2009	-8%	4%	0%	0%	-	0%	0%	0%	0%	-	-	-2,0%
2010	-20%	4%	0%	0%	-	0%	0%	0%	0%	-	-	-2,6%
2011	-14%	3%	0%	0%	-	0%	0%	0%	0%	-	-	-1,8%
2012	-15%	3%	0%	0%	-	0%	0%	0%	0%	-	-	-1,5%
2013	-19%	2%	0%	25%	-	0%	0%	0%	0%	-	-	1,8%
2014	-21%	2%	0%	10%	-	0%	0%	0%	0%	-	-	0,1%
2015	-21%	2%	0%	19%	-	0%	0%	0%	0%	-	-	0,4%
2016	-40%	2%	0%	20%	-	0%	-1%	0%	0%	-	-	-0,8%

Pollutant	Cu										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-8%	6%	0%	0%	-	0%	0%	0%	0%	-	-	-0.6%
1991	-8%	4%	0%	0%	-	0%	0%	0%	0%	-	-	-0.8%
1992	-6%	8%	0%	0%	-	0%	0%	0%	0%	-	-	-0.7%
1993	-6%	8%	0%	0%	-	0%	0%	0%	0%	-	-	-0.5%
1994	-2%	7%	0%	0%	-	0%	0%	0%	0%	-	-	-0.2%
1995	-4%	7%	0%	0%	-	0%	0%	0%	0%	-	-	-0.3%
1996	-9%	9%	0%	0%	-	0%	0%	0%	0%	-	-	-0.6%
1997	-7%	9%	0%	0%	-	0%	0%	0%	0%	-	-	-0.5%
1998	-4%	6%	0%	0%	-	0%	0%	0%	0%	-	-	-0.4%
1999	-4%	9%	0%	0%	-	0%	0%	0%	0%	-	-	-0.2%
2000	-8%	9%	0%	0%	-	0%	0%	0%	0%	-	-	-0.4%
2001	-7%	7%	0%	0%	-	0%	0%	0%	0%	-	-	-0.5%
2002	-8%	8%	0%	0%	-	0%	0%	0%	0%	-	-	-0.4%
2003	-6%	7%	0%	0%	-	0%	0%	0%	0%	-	-	-0.3%
2004	-10%	7%	0%	0%	-	0%	0%	0%	0%	-	-	-0.4%
2005	-9%	6%	0%	0%	-	0%	0%	0%	0%	-	-	-0.5%
2006	-9%	6%	0%	0%	-	0%	0%	0%	0%	-	-	-0.5%
2007	-10%	5%	0%	0%	-	0%	0%	0%	0%	-	-	-0.6%
2008	-7%	5%	0%	0%	-	0%	0%	0%	0%	-	-	-0.4%
2009	-9%	4%	0%	0%	-	0%	0%	0%	0%	-	-	-0.6%
2010	-17%	4%	0%	0%	-	0%	0%	0%	0%	-	-	-0.6%
2011	-12%	4%	0%	0%	-	0%	0%	0%	0%	-	-	-0.5%
2012	-11%	3%	0%	0%	-	0%	0%	0%	0%	-	-	-0.4%
2013	-11%	3%	0%	32%	-	0%	0%	0%	0%	-	-	0.1%
2014	-11%	2%	0%	13%	-	0%	0%	0%	0%	-	-	0.0%
2015	-12%	2%	0%	25%	-	0%	0%	0%	0%	-	-	0.0%
2016	-15%	2%	0%	26%	-	0%	-1%	0%	0%	-	-	-1.1%

Pollutant	Ni											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-47%	661%	0%	0%	-	0%	0%	1%	0%	-	-	-34.9%
1991	-45%	481%	0%	0%	-	0%	0%	4%	0%	-	-	-36.8%
1992	-42%	991%	0%	0%	-	0%	0%	2%	0%	-	-	-34.3%
1993	-43%	1013%	0%	0%	-	0%	0%	2%	0%	-	-	-34.0%
1994	-41%	951%	0%	0%	-	0%	0%	10%	0%	-	-	-32.6%
1995	-39%	966%	0%	0%	-	0%	0%	3%	0%	-	-	-32.0%
1996	-49%	1165%	0%	0%	-	0%	0%	0%	0%	-	-	-40.4%
1997	-48%	1206%	0%	0%	-	0%	0%	0%	0%	-	-	-38.6%
1998	-40%	821%	0%	0%	-	0%	0%	0%	0%	-	-	-32.1%
1999	-35%	1165%	0%	0%	-	0%	0%	0%	0%	-	-	-26.8%
2000	-45%	1138%	0%	0%	-	0%	0%	0%	0%	-	-	-31.9%
2001	-44%	928%	0%	0%	-	0%	0%	0%	0%	-	-	-31.5%
2002	-47%	1015%	0%	0%	-	0%	0%	0%	0%	-	-	-34.7%
2003	-42%	919%	0%	0%	-	0%	0%	0%	0%	-	-	-31.0%
2004	-48%	905%	0%	0%	-	0%	0%	0%	0%	-	-	-35.1%
2005	-46%	785%	0%	0%	-	0%	0%	0%	0%	-	-	-33.3%
2006	-47%	745%	0%	0%	-	0%	0%	0%	0%	-	-	-32.8%
2007	-48%	663%	0%	0%	-	0%	0%	0%	0%	-	-	-40.7%
2008	-43%	644%	0%	0%	-	0%	0%	0%	0%	-	-	-34.0%
2009	-46%	588%	0%	0%	-	0%	0%	0%	0%	-	-	-38.4%
2010	-57%	513%	0%	0%	-	0%	0%	0%	0%	-	-	-47.4%
2011	-54%	488%	0%	0%	-	0%	0%	0%	0%	-	-	-44.8%
2012	-51%	404%	0%	0%	-	0%	0%	0%	0%	-	-	-41.0%
2013	-52%	349%	0%	21%	-	0%	0%	0%	0%	-	-	-38.2%
2014	-56%	318%	0%	8%	-	0%	0%	0%	0%	-	0%	-41.9%
2015	-57%	324%	0%	14%	-	0%	0%	0%	0%	-	0%	-45.2%
2016	-59%	322%	0%	17%	-	0%	-1%	0%	0%	-	0%	-46.7%

Pollutant	Se										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
1991	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
1992	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
1993	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
1994	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
1995	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
1996	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.3%
1997	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.3%
1998	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
1999	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
2000	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
2001	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2002	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.2%
2003	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2004	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2005	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2006	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2007	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2008	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2009	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2010	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2011	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2012	-1%	0%	0%	0%	-	-	0%	0%	0%	-	-	-0.1%
2013	-1%	0%	0%	1%	-	-	0%	0%	0%	-	-	0.7%
2014	0%	0%	0%	0%	-	-	0%	0%	0%	-	-	0.3%
2015	0%	0%	0%	1%	-	-	0%	0%	0%	-	-	0.5%
2016	-2%	0%	0%	1%	-	-	0%	0%	0%	-	-	0.4%

Pollutant	Zn										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	21%	0%	0%	0%	-	0%	0%	0%	0%	-	-	1.0%
1991	22%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.8%
1992	21%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.9%
1993	19%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.7%
1994	10%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.5%
1995	14%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.7%
1996	23%	0%	0%	0%	-	0%	0%	0%	0%	-	-	1.0%
1997	21%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.9%
1998	15%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.7%
1999	13%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.6%
2000	20%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.8%
2001	21%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.7%
2002	23%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.9%
2003	20%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.8%
2004	24%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.8%
2005	23%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.8%
2006	23%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.9%
2007	25%	0%	0%	0%	-	0%	0%	0%	0%	-	-	1.1%
2008	21%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.7%
2009	25%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.9%
2010	32%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.9%
2011	21%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.7%
2012	18%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.6%
2013	17%	0%	0%	6%	-	0%	0%	0%	0%	-	-	0.4%
2014	15%	0%	0%	1%	-	0%	0%	0%	0%	-	-	0.4%
2015	17%	0%	0%	2%	-	0%	0%	0%	0%	-	-	0.6%
2016	14%	0%	0%	7%	-	0%	0%	0%	1%	-	-	0.5%

Pollutant	HCB										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	27%	1%	0%	-	-	-	-	0%	0%	-	-	1.1%
1991	40%	0%	0%	-	-	-	-	0%	0%	-	-	0.8%
1992	30%	1%	0%	-	-	-	-	0%	0%	-	-	1.1%
1993	40%	1%	0%	-	-	-	-	0%	0%	-	-	1.1%
1994	433%	1%	0%	-	-	-	-	1%	0%	-	-	1.7%
1995	221%	1%	0%	-	-	-	-	0%	0%	-	-	1.9%
1996	309%	1%	0%	-	-	-	-	0%	0%	-	-	1.7%
1997	53%	1%	0%	-	-	-	-	0%	0%	-	-	1.5%
1998	62%	1%	0%	-	-	-	-	0%	0%	-	-	1.3%
1999	76%	1%	0%	-	-	-	-	0%	0%	-	-	1.6%
2000	12%	1%	0%	-	-	-	-	0%	0%	-	-	1.1%
2001	5%	1%	0%	-	-	-	-	0%	0%	-	-	0.7%
2002	3%	1%	0%	-	-	-	-	0%	0%	-	-	0.8%
2003	3%	1%	0%	-	-	-	-	0%	0%	-	-	0.7%
2004	4%	1%	0%	-	-	-	-	0%	0%	-	-	0.7%
2005	1%	1%	0%	-	-	-	-	0%	0%	-	-	0.5%
2006	3%	1%	0%	-	-	-	-	0%	0%	-	-	0.6%
2007	2%	0%	0%	-	-	-	-	0%	0%	-	-	0.5%
2008	2%	0%	0%	-	-	-	-	0%	0%	-	-	0.5%
2009	2%	0%	0%	-	-	-	-	0%	0%	-	-	0.4%
2010	2%	0%	0%	-	-	-	-	0%	0%	-	-	0.4%
2011	1%	0%	0%	-	-	-	-	0%	0%	-	-	0.4%
2012	1%	0%	0%	-	-	-	-	0%	0%	-	-	0.3%
2013	0%	0%	0%	-	-	-	-	0%	0%	-	-	0.2%
2014	0%	0%	0%	-	-	-	-	0%	0%	-	-	0.2%
2015	0%	0%	0%	-	-	-	-	0%	0%	-	-	0.2%
2016	0%	0%	0%	-	-	-	-	0%	0%	-	-	0.2%

Pollutant	BC										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	total
1990	3%	0%	0%	1%	-	0%	0%	0%	0%	-	-	-0.1%
1991	1%	0%	0%	2%	-	0%	0%	0%	0%	-	-	-0.1%
1992	0%	0%	0%	2%	-	0%	0%	0%	0%	-	-	-0.2%
1993	0%	0%	0%	1%	-	0%	0%	0%	0%	-	-	-0.2%
1994	-4%	0%	0%	1%	-	0%	0%	0%	0%	-	-	-0.3%
1995	-5%	0%	0%	0%	-	0%	0%	0%	0%	-	-	-0.4%
1996	-3%	0%	0%	0%	-	0%	0%	0%	0%	-	-	-0.3%
1997	-2%	0%	0%	0%	-	0%	0%	0%	0%	-	-	-0.3%
1998	-3%	0%	0%	0%	-	0%	0%	0%	0%	-	-	-0.2%
1999	-4%	0%	0%	0%	-	0%	0%	0%	0%	-	-	-0.3%
2000	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	-0.2%
2001	5%	0%	0%	0%	-	0%	0%	0%	0%	-	-	-0.1%
2002	9%	0%	0%	0%	-	0%	0%	4%	0%	-	-	0.2%
2003	8%	0%	0%	0%	-	0%	0%	3%	0%	-	-	0.1%
2004	8%	0%	0%	0%	-	0%	0%	3%	0%	-	-	0.1%
2005	9%	0%	0%	0%	-	0%	0%	2%	0%	-	-	0.1%
2006	11%	0%	0%	0%	-	0%	0%	2%	0%	-	-	0.1%
2007	13%	0%	0%	0%	-	0%	0%	1%	0%	-	-	0.1%
2008	12%	0%	0%	0%	-	0%	0%	1%	0%	-	-	0.0%
2009	15%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
2010	18%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
2011	12%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
2012	13%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
2013	14%	0%	0%	0%	-	0%	0%	0%	0%	-	-	0.0%
2014	14%	0%	0%	1%	-	0%	0%	0%	0%	-	-	0.0%
2015	14%	0%	0%	0%	-	0%	4%	0%	1%	-	-	0.9%
2016	10%	0%	0%	0%	-	0%	8%	0%	5%	-	-	1.8%

12.9. Appendix 9. Inclusion/exclusion of the condensable component from PM10 and PM2.5 emission factors

Table A9-1 Inclusion/exclusion of the condensable component from PM10 and PM2.5 emission factors by NFR source category

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
1A1a	Public electricity and heat production	no	yes	The emission factors used for TSP, PM10 and PM2.5, that are calculating from direct emission for large point sources (LPS) and yearly taken from EPR base, exclude the condensable component. Method used for PM10 emission measurement is gravimetric method and samples for it, need to be dry. Gravimetric method is in Croatian law, reference method for determination of mass concentration of floating particles, described with HRN EN 12341 standard for PM10 fraction. For non LCP sources, the emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these PM factors represent filterable PM emissions and are based on an defined ash content.
1A1b	Petroleum refining	no	yes	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these PM factors represent filterable PM emissions only (excluding any condensable fraction)
1A1c	Manufacture of solid fuels and other energy industries	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and the basis of these emission factors could not be determined in the reference.
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.
1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.
1A2c	Stationary combustion in manufacturing industries and construction: Chemicals	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.
1A2d	Stationary combustion in manufacturing industries and construction: Pulp,	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
	Paper and Print			
1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.
1A2gvii	Mobile Combustion in manufacturing industries and construction: (please specify in the IIR)	yes	no	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors represent total PM emissions (filterable and condensable fractions).
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.
1A3ai(i)	International aviation LTO (civil)	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2013 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1A3aii(i)	Domestic aviation LTO (civil)	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2013 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1A3bi	Road transport: Passenger cars	yes	no	The emission factors used for TSP, PM10 and PM2.5 are default ones from COPERT IV that is Tier 3 approach accordin to GB2016. According to GB2016, PM mass emission factors are considered to include both filterable and condensable material. The mass of particles collected on a filter kept below 52°C during diluted exhaust sampling. This corresponds to total (filterable and condensable) PM2.5. Coarse exhaust PM (i.e. >2.5μm diameter) is considered to be negligible, hence PM=PM2.5.
1A3bii	Road transport: Light duty vehicles	yes	no	
1A3biii	Road transport: Heavy duty vehicles and buses	yes	no	
1A3biv	Road transport: Mopeds & motorcycles	yes	no	
1A3bv	Road transport: Gasoline evaporation	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
1A3bvi	Road transport: Automobile tyre and brake wear	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
				the condensable component in PM emission factors.
1A3bvii	Road transport: Automobile road abrasion	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1A3c	Railways	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1A3di(ii)	International inland waterways	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1A3dii	National navigation (shipping)	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1A3ei	Pipeline transport	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
1A3eii	Other (please specify in the IIR)	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
1A4ai	Commercial/institutional: Stationary	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.
1A4aii	Commercial/institutional: Mobile	IE	IE	IE: 1A4aii
1A4bi	Residential: Stationary	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.
1A4bii	Residential: Household and gardening (mobile)	yes	no	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors represent total PM emissions (filterable and condensable fractions).
1A4ci	Agriculture/Forestry/ Fishing: Stationary	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors have been reviewed and it is unclear whether they represent filterable PM or total PM (filterable and condensable) emissions.
1A4cii	Agriculture/Forestry/ Fishing: Off-road vehicles and other machinery	yes	no	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these emission factors represent total PM emissions (filterable and condensable fractions).

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
1A4ciii	Agriculture/Forestry/ Fishing: National fishing	IE	IE	IE: 1A3dii
1A5a	Other stationary (including military)	IE	IE	IE: 1A4a
1A5b	Other, Mobile (including military, land based and recreational boats)	IE	IE	IE: 1A4a, 1A3b(i-iv)
1B1a	Fugitive emission from solid fuels: Coal mining and handling	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1B1c	Other fugitive emissions from solid fuels	NO	NO	This activity does not exist in Croatia.
1B2ai	Fugitive emissions oil: Exploration, production, transport	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1B2aiv	Fugitive emissions oil: Refining / storage	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1B2av	Distribution of oil products	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
1B2c	Venting and flaring (oil, gas, combined oil and gas)	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
1B2d	Other fugitive emissions from energy production	NO	NO	This activity does not exist in Croatia.
2A1	Cement production	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
				the condensable component in PM emission factors.
2A2	Lime production	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
2A3	Glass production	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
2A5a	Quarrying and mining of minerals other than coal	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
2A5b	Construction and demolition	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
2A5c	Storage, handling and transport of mineral products	IE	IE	IE: 2A1, 2A2, 2A3, 2A5a, 2A5b
2A6	Other mineral products (please specify in the IIR)	NO	NO	This activity does not exist in Croatia.
2B1	Ammonia production	NA/NE	NA/NE	There is no emission factor for PM2.5 in the GB2016, and this activity does not result with TSP and PM10 emissions.
2B2	Nitric acid production	NA/NE	NA/NE	There is no emission factor for PM2.5 in the GB2016, and this activity does not result with TSP and PM10 emissions.
2B3	Adipic acid production	NO	NO	This activity does not exist in Croatia.
2B5	Carbide production	NO	NO	This activity does not exist in Croatia.
2B6	Titanium dioxide production	NO	NO	This activity does not exist in Croatia.
2B7	Soda ash production	NO	NO	This activity does not exist in Croatia.
2B10a	Chemical industry: Other (please specify in the IIR)	NE	NE	There is no emission factor for TSP, PM10 and PM2.5 in the GB2016.
2B10b	Storage, handling and transport of chemical products (please specify in the IIR)	IE	IE	IE: 2B10a
2C1	Iron and steel production	no	yes	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these PM factors represent filterable PM emissions only (excluding any condensable fraction

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
				(European Commission, 2001)).
2C2	Ferroalloys production	no	yes	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these PM factors represent filterable PM emissions only (excluding any condensable fraction).
2C3	Aluminium production	no	yes	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these PM factors represent filterable PM emissions only (excluding any condensable fraction).
2C4	Magnesium production	NO	NO	This activity does not exist in Croatia.
2C5	Lead production	NO	NO	This activity does not exist in Croatia.
2C6	Zinc production	NO	NO	This activity does not exist in Croatia.
2C7a	Copper production	NO	NO	This activity does not exist in Croatia.
2C7b	Nickel production	NO	NO	This activity does not exist in Croatia.
2C7c	Other metal production (please specify in the IIR)	NO	NO	This activity does not exist in Croatia.
2C7d	Storage, handling and transport of metal products (please specify in the IIR)	NO	NO	This activity does not exist in Croatia.
2D3a	Domestic solvent use including fungicides	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
2D3b	Road paving with asphalt	yes	no	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and these PM factors represent filterable PM emissions with Nnote that US EPA (2004) includes condensable PM emission factors and factors for controlled plant.
2D3c	Asphalt roofing	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
2D3d	Coating applications	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
2D3e	Degreasing	NE	NE	There is no emission factor for PM2.5 in the GB2016.
2D3f	Dry cleaning	NE	NE	There is no emission factor for PM2.5 in the GB2016.
2D3g	Chemical products	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
2D3h	Printing	NE	NE	There is no emission factor for PM2.5 in the GB2016.
2D3i	Other solvent use (please specify in the IIR)	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
				factors.
2G	Other product use (please specify in the IIR)	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
2H1	Pulp and paper industry	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
2H2	Food and beverages industry	NE	NE	There is no emission factor for TSP, PM10 and PM2.5 in the GB2016.
2H3	Other industrial processes (please specify in the IIR)	NO	NO	This activity does not exist in Croatia.
2I	Wood processing			There is no emission factor for PM10 and PM2.5 in the GB2016.
2J	Production of POPs	NO	NO	This activity does not exist in Croatia.
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)	NO	NO	This activity does not exist in Croatia.
3B1a	Manure management - Dairy cattle	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B1b	Manure management - Non-dairy cattle	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B2	Manure management - Sheep	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B3	Manure management - Swine	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
3B4a	Manure management - Buffalo	NO	NO	This activity does not exist in Croatia.
3B4d	Manure management - Goats	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B4e	Manure management - Horses	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B4f	Manure management - Mules and asses	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B4gi	Manure mangement - Laying hens	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B4gii	Manure mangement - Broilers	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B4giii	Manure mangement - Turkeys	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B4giv	Manure management - Other poultry	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
3B4h	Manure management - Other animals (please specify in IIR)	NO	NO	This activity does not exist in Croatia.
3Da1	Inorganic N-fertilizers (includes also urea application)	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
3Da2a	Animal manure applied to soils	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
3Da2b	Sewage sludge applied to soils	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
3Da2c	Other organic fertilisers applied to soils (including compost)	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
3Da3	Urine and dung deposited by grazing	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
	animals			
3Da4	Crop residues applied to soils	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
3Db	Indirect emissions from managed soils	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	yes	no	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information that the processes which result in particulate emissions are largely low-temperature mechanical activities, and emissions are unlikely to include substantial quantities of condensable particulate material.
3Dd	Off-farm storage, handling and transport of bulk agricultural products	NE	NE	There is no emission factor for PM10 and PM2.5 in the GB2016.
3De	Cultivated crops	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
3Df	Use of pesticides	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
3F	Field burning of agricultural residues	NE	NE	Activity data is not available for now.
3I	Agriculture other (please specify in the IIR)	NO	NO	This activity does not exist in Croatia.
5A	Biological treatment of waste - Solid waste disposal on land	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
5B1	Biological treatment of waste - Composting	NE	NE	There is no emission factor for PM10 and PM2.5 in the GB2016.
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
5C1a	Municipal waste incineration	NO	NO	This activity does not exist in Croatia.
5C1bi	Industrial waste incineration	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
5C1bii	Hazardous waste incineration	NO	NO	This activity does not exist in Croatia.
5C1biii	Clinical waste incineration	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
5C1biv	Sewage sludge	NO	NO	This activity does not exist in Croatia.

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
	incineration			
5C1bv	Cremation	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2016 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
5C1bvi	Other waste incineration (please specify in the IIR)	NO	NO	This activity does not exist in Croatia.
5C2	Open burning of waste	NO	NO	This activity does not exist in Croatia.
5D1	Domestic wastewater handling	NE	NE	There is no emission factor for PM10 and PM2.5 in the GB2016.
5D2	Industrial wastewater handling	NE	NE	There is no emission factor for PM10 and PM2.5 in the GB2016.
5D3	Other wastewater handling	NE	NE	There is no emission factor for PM10 and PM2.5 in the GB2016.
5E	Other waste (please specify in IIR)	NE	NE	There is no emission factor for PM10 and PM2.5 in the GB2016.
6A	Other (included in national total for entire territory) (please specify in IIR)	NO	NO	This activity does not exist in Croatia.

13. List of abbrevations

CAEN	- Croatian Agency for Environment and Nature
CLRTAP	- Convention on Long-Range Transboundary Air Pollution
CollectER	- Collect Emission Register
COPERT	- Computer Programme to Calculate Emissions from Road Transport
CORINAIR	- Core Inventory of Air Emissions in Europe
CRF	- Common Reporting Format (UNFCCC)
EEA	- European Environmental Agency
EMEP	- Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
ETC/ACC	- European Topic Centre on Air and Climate Change
GHG	- Greenhouse gas
IPCC	- Intergovernmental Panel on Climate Change
MEE	- Ministry of Environment and Energy
MPMEP	- Multi-Polluant Multi-Effect Protocol
NFR	- Nomenclature for Reporting
OG-IT	- Official Gazette – International Treaties
AE-DEM	- Air Emission – Data Exchange Mode
Report*ER*	- AE-DEM module for reporting
SNAP	- Selected Nomenclature for Air Pollution
UNECE	- United Nations Economic Commission for Europe
UNFCCC	- United Nations Framework Convention on Climate Change
EPR	- Environmental Pollution Register
IIR	- Informative Inventory Report (CLRTAP)
NEC Directive	- National Emission Ceiling Directive
LULUCF	- Land Use, Land-Use Change and Forestry
CBS	- Croatian Bureau of Statistics
St.Y.	- Statistical Yearbook
MI	- Ministry of Interior
MEE	- Ministry of Environment and Energy
MA	- Ministry of Agriculture
EIHP	- Energy Institute Hrvoje Požar
SO_2	- Sulphur oxides reported as SO_2
NOx	- Nitrogen oxides reported as NO_2
NH_3	- Ammonia
NMVOC	- Non-methane volatile organic compounds

VOC	- Volatile organic compounds
CO	- Carbon monoxide
TSP	- Total suspended particulate matter
PM_{10}	- Particulate matter with diameter less than 10 µm
$PM_{2.5}$	- Particulate matter with diameter less than 2.5 µm
As	- Arsenic
Cd	- Cadmium
Cr	- Chromium
Cu	- Copper
Hg	- Mercury
Ni	- Nickel
Pb	- Lead
Se	- Selenium
Zn	- Zinc
HCH	- Hexachlorocyclohexane
PAH	- Polyaromatic hydrocarbons
PCDD/PCDF	- Dioxins and furans
DE	- Direct emission – emission from stationary sources submitted in EPR
GDP	- gross domestic product

I-TEQ - International Toxic Equivalent; The older International Toxic Equivalent (I-TEQ) scheme by the North Atlantic Treaty Organisation (NATO) initially set up in 1989 and later extended and updated

DIY	- do-it-yourself
GO	- Gas oil
HFO	- Heavy fuel oil
KER	- Kerosene
LPG	- Liquefied petroleum gas
LF	- Liquid fuel
NG	- Natural gas
SHB	- Single house boiler

14. List of tables

Table ES3-1 Emissions of the substances which cause acidification, eutrophication and photochemical pollution in the Republic of Croatia, 2017. - 11 -

Table ES3-2 Particulate matter emissions in the Republic of Croatia, 2017 - 12 -

Table ES3-3 Heavy metals emissions in the Republic of Croatia, 2017 - 13 -

Table ES3-4 Persistent organic pollutants emissions in the Republic of Croatia, 2017 - 14 -

Table ES4-1 Recalculations and explanations for changes between submitted total pollutants emissions for year 2016 in IIR 2018 and in IIR 2019 - 15 -

Table ES5-1 Improvements and other activity made in IIR 2019 - 19 -

Table ES6-1 Improvements planned for the next or one of the next inventory - 21 -

Table 1.1-1 Status of ratification of international treaties under the CLRTAP - 25 -

Table 1.1-2 Emission quotas for certain pollutants for Croatia and deadlines achieving them - 26 -

Table 1.1-3 Emission reduction commitments for SO_2, NOx, NH_3, NMVOC and $PM_{2.5}$ in accordance to NEC Directive for Croatia - 26 -

Table 1.1-4 Emission levels for certain POPs according to Protocol on POPs - 27 -

Table 1.1-5 Time series of total emissions in the Republic of Croatia by pollutant - 28 -

Table 1.4-2 Official and other activity data sources for NFR sectors - 31 -

Table 1.5-1 Key source categories in 2017 for the Croatian Emission Inventory - 36 -

Table 1.5-1 (cont.) Key source categories in 2017 for the Croatian Emission Inventory - 36 -

Table 1.6-1 Approved plan of Stage 3 (in depth) reviews of Emission inventories under CLRTAP (2018 - 2020) - 38 -

Table 1.7.2-1 Applied uncertainty levels for activity data and data sources by NFR sector aggregation - 41 -

Table 1.7.2-2 Applied uncertainty levels for SO_2, NO_2, NMVOC, CO, TSP, PM_{10}, $PM_{2.5}$, PAH, HCB, PCDD/PCDF emission factors by NFR sectors - 42 -

Table 1.7.2-3 Applied uncertainty levels for heavy metals, HCH and PCBs emission factors by NFR sectors - 42 -

Table 1.7.2-4 Applied uncertainty levels for $PM_{2.5}$, PM_{10} and TSP emission factors for NFR 1.A.4 - 42 -

Table 1.7.3-1 The summary of the uncertainty evaluation for Croatia and total emissions by pollutant in 2017 - 43 -

Table 1.8-1 Definition of Notation keys - 44 -

Table 1.8.1-1 Explanation to the Notation key NE - 44 -

Table 1.8.2-1 Explanation to the Notation key IE - 45 -

Table 1.8.3-1 Sub-sources accounted for in reporting codes "Other" - 46 -

Table 2.2-1 Summary of key and main sources and their contributions to overall pollutants emission and percentage of emission change ("-" decrease and "+" increase) from 1990 to 2017 - 48 -

Table 2.3-1 Pollutant emissions from large point source (LPS) and LPS share in the Republic of Croatia national total emissions, 2017 - 53 -

Table 3.1-1 The SO_2 emissions by SNAP nomenclature in the period 1990-2017 - 55 -

Table 3.2-1 The NO_X emissions by SNAP nomenclature in the period 1990-2017 - 57 -

Table 3.3-1 The NH_3 emission by SNAP nomenclature in the period 1990-2017 - 59 -

Table 3.4-1 Emission of acidifying substances that contribute to the acidification expressed in Aeq (*) .... - 61 -
Table 3.5-1 The CO emissions by SNAP nomenclature in the period 1990-2017........ - 63 -
Table 3.6-1 The NMVOC emissions by SNAP nomenclature in the period 1990-2017........ - 65 -
Table 3.7.1-1 The TSP emissions by SNAP nomenclature in the period 1990-2017........ - 67 -
Table 3.7.2-1 The PM_{10} emissions by SNAP nomenclature in the period 1990-2017 .... - 69 -
Table 3.7.3-1 The $PM_{2.5}$ emissions by SNAP nomenclature in the period 1990-2017 .... - 71 -
Table 3.7.4-1 The BC emissions by SNAP nomenclature in the period 1990-2017 .... - 73 -
Table 3.8.1-1 The Pb emissions by SNAP nomenclature in the period 1990-2017........ - 75 -
Table 3.8.2-1 The Cd emissions by SNAP nomenclature in the period 1990-2017........ - 77 -
Table 3.8.3-1 The Hg emissions by SNAP nomenclature in the period 1990-2017 .... - 79 -
Table 3.9.1-1 The As emissions by SNAP nomenclature in the period 1990-2017 .... - 81 -
Table 3.9.2-1 The Cr emissions by SNAP nomenclature in the period 1990-2017........ - 82 -
Table 3.9.3-1 The Cu emissions by SNAP nomenclature in the period 1990-2017........ - 84 -
Table 3.9.4-1 The Ni emissions by SNAP nomenclature in the period 1990-2017........ - 85 -
Table 3.9.5-1 The Se emissions by SNAP nomenclature in the period 1990-2017 .... - 87 -
Table 3.9.6-1 The Zn emissions by SNAP nomenclature in the period 1990-2017........ - 88 -
Table 3.10-1 Persistent organic pollutants (POPs) .... - 89 -
Table 3.10.1-1 The PCDD/PCDF emissions by SNAP nomenclature in the period 1990-2017 .... - 91 -
Table 3.10.2-1 PAHs emissions by SNAP nomenclature in the period 1990-2017........ - 92 -
Table 3.10.3-1 The HCB emission by SNAP nomenclature in the period 1990-2017........ - 94 -
Table 3.10.4-1 The PCBs emissions by SNAP nomenclature in the period 1990-2017........ - 96 -
Table 4.2-1 Generating capacities of HPPs, TPPs and NPP Krško........ - 102 -
Table 4.2-2 Processing Capacities of Oil and Lube Refineries .... - 102 -
Table 4.4-1 Activity data for NFR 1.A.3.b.vii .... - 112 -
Table 4.4-2 Number of road motor vehicles by type ('000)........ - 114 -
Table 4.4-3 Type and class of vehicle, their speed and driving share on each type of road .... - 114 -
Figure 4.4-5 Activity data on fuel consumption for NFR codes 1.A.3.d.ii, and 1.A.3.d.i(i) .... - 117 -
Table 4.5-1 Technology structure for solid fuel and biomass distribution in residential sector .... - 119 -
Table 4.5-2 Technology structure for liquid and gaseous fuel distribution in residential sector .... - 120 -
Table 4.7-1 Military emissions specification........ - 124 -
Table 4.8-1 Basic data on the natural gas transport system of the Republic of Croatia .... - 126 -
Table 4.8-2 Activity data for NFR code 1.B.1.a, 1.B.1.b, 1.B.1.c, 1.B.2.i and 1.B.3........ - 129 -
Table 4.8-3 Activity data for NFR code 1.B.2.a.iv, represented by the relevant SNAP codes .... - 130 -
Table 4.8-4 Activity data for NFR code 1.B.2.a.v, represented by the relevant SNAP codes .... - 131 -
Table 4.8-5 Activity data for NFR 1.B.2.c Venting and Flaring, SNAP 090203 Flaring in oil refinery and SNAP 090206 Flaring in gas and oil extraction........ - 133 -
Table 4.8-6 Activity data for NMVOC emission estimation for sector NFR 1.B.2.b.2 Transmission of natural gas........ - 134 -
Table 4.8-7 Tier 2 emission factor for NMVOC emission calculation for sector NFR 1.B.2.b........ - 135 -
Table 4.8-8 Tier 2 emission factor for NMVOC emission calculation for sector NFR 1.B.2.b.2 .... - 135 -

Table 4.8-9 Activity data for NFR code 1.B.2.b, represented by the relevant SNAP codes .... - 135 -
Table 5.1-1 Activity data for NFR codes 2.A.1, 2.A.2, 2.A.3, 2.A.5.a and 2.A.5.b .... - 142 -
Table 5.2-1 Activity data for NFR codes 2.B.1, 2.B.2 and 2.B.10.a, represented by the relevant SNAP codes .... - 145 -
Table 5.2-2 Activity data for NFR code 2.B.10.a, represented by the relevant SNAP codes .... - 146 -
Table 5.3-1 Activity data for NFR codes 2.C.1, 2.C.2 and 2.C.3, represented by the relevant SNAP codes.. .... - 148 -
Table 5.4-1 Activity data for NFR code 2.D.3.a, represented by the relevant SNAP code .... - 152 -
Table 5.4-2 Activity data for NFR codes 2.D.3.b, 2.D.3.c, 2.D.3.d, 2.D.3.e and 2.D.3.f, represented by the relevant SNAP code .... - 155 -
Table 5.4-3 Activity data for NFR code 2.D.3.g, represented by the relevant SNAP codes.................. - 156 -
Table 5.4-4 Activity data for NFR codes 2.D.3.h, 2.D.3.i, 2G, represented by the relevant SNAP codes .... - 158 -
Table 5.4-5 Activity data for NFR code 2.D.3.i, 2.G, represented by the relevant SNAP code .... - 158 -
Table 5.4-6 Activity data for NFR codes 2.H.1, 2.I and 2.K, represented by the relevant SNAP codes - 159 -
Table 5.4-7 Activity data for NFR code 2.H.2, represented by the relevant SNAP codes .... - 160 -
Table 6.1-1 Animal categories N rate, Nex and percentage of slurry % for the year 2017.................. - 165 -
Table 6.1-2 Percentage (%) of animal categories on sillage feeding for selected years and year 2017 .... - 165 -
Table 6.1-3 Sources for activity data for NFR code 4.B Animal husbandry and manure management .... - 166 -
Table 6.1-4 Activity data for NFR codes 3.B.1.a, 3.B.1.b, 3.B.2, 3.B.3, 3.B.4.d, 3.B.4.e and 3.B.4.f .... - 166 -
Table 6.1-5 Activity data for NFR codes 3.B.4.g.i, 3.B.4.g.ii, 3.B.4.g.iii, and 3.B.4.g.iv .... - 167 -
Table 6.2-1 Activity data for NFR code 3.D.1.a............ - 169 -
Table 6.2-2 Activity data for NFR code 3.D.a.2.b............ - 170 -
Table 6.2-3 Activity data for NFR code 3.D.c .... - 171 -
Table 7.1-1 Activity data for NFR codes 5.A, 5.B.1, 5.C.1.b.i, 5.C.1.b.iii, 5.C.1.b.v, 5.D.1, 5.D.2 and 5.D.3, represented by the relevant SNAP codes .... - 176 -
Table 7.5-1 Activity data for NFR code 5.E, represented by the relevant SNAP codes.......................... - 181 -
Table 8.1-1 Activity data of the sector 11.B............ - 183 -
Table 10.2-1 Parameters and their sources used to produce projections by sectors .... - 195 -
Table 10.3-1 Assumptions for projections – Energy (stationary and mobile combustion) .... - 196 -
Table 10.3-2 Assumptions for projections – Industrial Proceses and Product Use................................ - 198 -
Table 10.3-3 Assumptions for projections - Agriculture............ - 199 -
Table 10.3-4 Assumptions for projections – Waste............ - 199 -
Table A1-1 QA/QC activities............ - 211 -
Table A3-1 NFR and correspond SNAP codes .... - 215 -
Table A4-1 Emission factors for the year 2017 .... - 218 -
Table A5-1: National Energy balance for 2017, natural units............ - 271 -
Table A5-1: National Energy balance for 2017, natural units, cont. .... - 272 -
Table A5-1: National Energy balance for 2017, natural units, cont. .... - 273 -

Table A5-1: National Energy balance for 2017, natural units, cont. .... - 274 -
Table A5-1: National Energy balance for 2017, natural units, cont. .... - 275 -
Table A5-2: National Energy balance for 2017, energy units .... - 276 -
Table A5-2: National Energy balance for 2017, energy units, cont. .... - 277 -
Table A5-2: National Energy balance for 2017, energy units, cont. .... - 278 -
Table A5-2: National Energy balance for 2017, energy units, cont. .... - 279 -
Table A6-1 Emissions data for the Main pollutants and particulate matter according to NFR categories . ... - 281 -
Table A6-2 Emissions data for the CO and heavy metals according to NFR categories .... - 285 -
Table A6-3 Emissions data for POPs according to NFR categories .... - 289 -
Table A6-4 Activity data according to NFR categories .... - 293 -
Table A9-1 Inclusion/exclusion of the condensable component from PM10 and PM2.5 emission factors by NFR source category .... - 342 -

15. List od figures

Figure ES2-1 Relative total emission for main pollutants in the Republic of Croatia for 1990 - 2017 and projections for 2020, 2025 and 2030 for with measure scenario (WM) and for with additional measure scenario (WAM), prescribed quotas and the reduction commitment from 2020 to 2029 and for the period of 2030 ..... - 9 -

Figure 1.2-1 National emission inventory system ..... - 29 -

Figure 3.1-1 The SO_2 emissions (kt/yr.) and percentage share by sector and variation in SO_2 emission... s ..... - 55 -

Figure 3.2-1 The NO_X emissions (kt/yr.) and percentage share by sector and variation in NO_X emissions ..... - 57 -

Figure 3.3-1 The NH_3 emissions (kt/yr.) and percentage share by sector and variation in NH_3 emissions. ..... - 59 -

Figure 3.4-1 Relative emission of substances (without nature) that contribute to acidification and eutrophication for 1990-2017 (1990 = 100%) ..... - 62 -

Figure 3.5-1 The CO emissions (kt/yr.) and percentage share by sector and variation in CO emissions ..... - 63 -

Figure 3.6-1 The NMVOCs emissions (kt/yr.) and percentage share by sector and variation in NMVOCs . ..... - 65 -

Figure 3.7.1-1: The TSP emissions (kt/yr.) and percentage share by sector and variation in TSP emissions ..... - 67 -

Figure 3.7.2-1 The PM_{10} emissions (kt/yr.) and percentage share by sector and variation in PM_{10} emissions ..... - 69 -

Figure 3.7.3-1 The $PM_{2.5}$ emissions (kt/yr.) and percentage share by sector and variation in $PM_{2.5}$ emissions ..... - 71 -

Figure 3.7.4-1 The BC emissions (kt/yr.) and percentage share by sector and variation in BC emissions ..... - 73 -

Figure 3.8.1-1 The Pb emissions (t/yr.) and percentage share by sector and variation in Pb emissions ..... - 75 -

Figure 3.8.2-1 The Cd emissions (t/yr.) and percentage share by sector and variation in Cd emissions ..... - 77 -

Figure 3.8.3-1 The Hg emissions (t/yr.) and percentage share by sector and variation in Hg emissions ..... - 79 -

Figure 3.9.1-1 The As emissions (t/yr.) and percentage share by sector and variation in As emissions ..... - 80 -

Figure 3.9.2-1 The Cr emissions (t/yr.) and percentage share by sector and variation in Cr emissions ..... - 82 -

Figure 3.9.3-1 The Cu emissions (t/yr.) and percentage share by sector and variation in Cu emissions ..... - 84 -

Figure 3.9.4-1The Ni emissions (t/yr.) and percentage share by sector and variation in Ni emissions ..... - 85 -

Figure 3.9.5-1 The Se emissions (t/yr.) and percentage share by sector and variation in Se emissions ..... - 87 -

Figure 3.9.6-1 The Zn emissions (t/yr.) and percentage share by sector and variation in Zn emissions ..... - 88 -

Figure 3.10.1-1 The PCDD/PCDF emissions (g I-TEQ/yr.) and percentage share by sector and variation in PCDD/PCDF emissions - 90 -
Figure 3.10.2-1 The PAHs emissions (kg/yr.), percentage share by sector and variation in PAHs emissions - 92 -
Figure 3.10.3-1 The HCB emission (kg/yr.), percentage share by sector and variation in HCB emissions - 94 -
Figure 3.10.4-1 The PCBs emission (kg/yr.), percentage share by sector and variation in PCBs emissions - 96 -
Figure 4.1-1 Activity data on fuel consumption for NFR codes 1.A.1, 1.A.2, 1.A.4 - 99 -
Figure 4.1-2 Activity data on fuel consumption by type for NFR codes 1.A.1, 1.A.2, 1.A.4 - 100 -
Figure 4.1-3 Consumption and percentage share for fossil fuel by types in 1.A.3 Transport - 100 -
Figure 4.2-1 Activity data on fuel consumption by type for NFR 1.A.1.a - 104 -
Figure 4.2-2 Activity data on fuel consumption by type for NFR 1.A.1.b - 105 -
Figure 4.2-3 Activity data on fuel consumption by type for NFR 1.A.1.c - 105 -
Figure 4.3-1 Activity data on fuel consumption by type for NFR codes 1.A.2.a, 1.A.2.b, 1.A.2.c, 1.A.2.d, 1.A.2.e, 1.A.2.f - 107 -
Figure 4.4-1 Activity data on fuel consumption for NFR codes 1.A.3.a.i(i), 1.A.3.a.ii(i), 1.A.3.a.i(ii), 1.A.3.a.ii(ii) - 111 -
Figure 4.4-2 Fuel consumption by each type of vehicle in the road transportation - 113 -
Figure 4.4-3 Number of each type of vehicle in the road transportation - 113 -
Figure 4.4-4 Activity data on fuel consumption for NFR 1.A.3.c - 116 -
Figure 4.5-1 Activity data on fuel consumption by fuel type for NFR 1.A.4.a - 119 -
Figure 4.5-2 Model of entering of certain technologies into usage in Residential sector regarding biomass and solid fuels - 120 -
Figure 4.5-3 Activity data on fuel consumption by fuel type for NFR 1.A.4.b.i - 120 -
Figure 4.5-4 Activity data on fuel consumption by fuel type for NFR 1.A.4.c.i - 121 -
Figure 4.6-1 Activity data on fuel consumption for NFR codes 1.A.2.g.iv, 1.A.4.b.ii and 1.A.4.c.ii - 124 -
Figure 10.1-1 Overview of the strategical and planning framework for reduction of GHG emissions in the energy sector - 191 -
Figure 10.4-1 Trend and projections of NOx emissions - 201 -
Figure 10.4-2 Trend and projections of SO_2 emissions - 201 -
Figure 10.4-3 Trend and projections of NMVOC emissions - 202 -
Figure 10.4-4 Trend and projections of NH_3 emissions - 202 -
Figure 10.4-5 Trend and projections of $PM_{2.5}$ emissions - 203 -
Figure 10.5-1 Sensitivity analysis of total emissions for some of the input parameters in power sector - 205 -