REPUBLIC of CROATIA
Ministry of Economy and
Sustainable Development

REPUBLIC OF CROATIA 2021 INFORMATIVE INVENTORY REPORT (1990 – 2019)

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REPUBLIC OF CROATIA 2021 INFORMATIVE INVENTORY REPORT (1990 – 2019)
Submission under the Convention on Long-range Transboundary Air Pollution (CLRTAP)
And National Emission Ceilings Directive (NECD 2016/2284/EU)

Project coordinator:

Hana Mesić, Head of Air Protection and Climate activities Service, Ministry of Economy and Sustainable Development

Inventory team coordinator:

Mirela Poljanac, M. Sc., Ekonerg Ltd

Authors:

Generalist:	Mirela Poljanac, M. Sc., Ekonerg Ltd
Energy:	Iva Švedek, univ. spec. oecoing., Mirela Poljanac, M. Sc., Renata Kos, B. Sc. Min., Borna Glűckselig, mag. ing. agr. all Ekonerg Ltd
IPPU:	Renata Kos, B. Sc. Min., Ekonerg Ltd
Agriculture:	Borna Glűckselig, mag. ing. agr., Berislav Marković, M. Lands. Arch., all Ekonerg Ltd
Waste:	Andrea Hublin, Ph. D., Morana Česnik Katulić Ph. D., all Ekonerg Ltd
QA/QC:	Vladimir Jelavić, Ph. D., Valentina Delija-Ružić, M. Eng. Mech. Eng., Mirela Poljanac, M. Sc., all Ekonerg Ltd, and Hana Mesić, Jasna Kufrin, Andrina Crnjak Thavenet, Martina Beuk, Tatjana Obučina, Tamara Embreuš, all MESD.

Contributors:

Arijan Abrashi, Ph. D., Ekonerg Ltd. – preparation of road vehicle detabase

Author of photo on the cover:

Siniša Predavac

Zagreb, March 2021

Ministry of Economy and Sustainable Development, Institute for Environment and Nature Radnička cesta 80, 10000 Zagreb, Croatia, https://mingor.gov.hr/

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1	2	3

EKONERG – Energy Research and Environmental Protection Institute

Koranska 5, Zagreb, Croatia

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REPUBLIC OF CROATIA 2021 INFORMATIVE INVENTORY REPORT (1990 – 2019)

Phase IV of the public procurement contract for the provision of the service "Fulfilment of obligations of the Republic of Croatia according to the requirements of the LRTAP Convention and the NEC Directive: Preparation of total national emissions-NFR, Emission of large point sources and Informative Inventory Report 2021"

Inventory team coordinator:	Mirela Poljanac, M. Sc.
Authors:	Mirela Poljanac, M. Sc. Iva Švedek, univ. spec. oecoing. Renata Kos, B. Sc. Min. Andrea Hublin, Ph. D. Morana Česnik Katulić Ph. D. Borna Glűckselig, mag. ing. agr. Berislav Marković, M. Lands. Arch.
Associates:	Arijan Abrashi, Ph. D.
QA/QC:	Vladimir Jelavić, Ph. D. Valentina Delija-Ružić, M. Eng. Mech. Eng. Mirela Poljanac, M. Sc.

Atmospheric Protection And Climate Change Department Manager:	General Manager:
Vladimir Jelavić, Ph. D.	Zdravko Mužek, M. Sc.

Zagreb, March 2021

Content

Executive summary

ES1 Annual report and responsible executor

This report is Croatia´s annual Informative Inventory Report 2021 (for period 1990 – 2019) (hereinafter referred to as IIR2021) under the Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe (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).

The air pollutants reported 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 (benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene), HCB and PCBs).

The Croatian air pollution inventory is reported in Nomenclature for Reporting format[1], revised 25.9.2019 (hereinafter referred to as NFR 2019-1). The Republic of Croatia reports emission inventories for all years since 1990 and submits them in digital form.

The Croatian Air Pollution Inventory has been prepared in accordance with standard methods and procedures in accordance with the EMEP / EEA air pollutant emission inventory guidebook 2019 (hereinafter GB2019) and other available technical guidance.

IIR2021 follows recommended structure for the IIR[2] and covers all years in period from 1990 to 2019.

Information contained in this report is available to the public on the Ministry of Economy and Sustainable Development[3] (MESD) website, at the links: https://mzoe.gov.hr/o-ministarstvu-1065/djelokrug-4925/okolis/zrak/emisije-u-zrak/1312 and https://emep.haop.hr/ - Spatial distribution portal, interface of the Croatia air pollutant emission maps.

This report and the NFR tables are available on the Centre on Emission Inventories and Projections (CEIP) website, at the link: https://www.ceip.at/status-of-reporting-and-review-results and on the Eionet central data repository on links: http://cdr.eionet.europa.eu/hr/un/clrtap/ and http://cdr.eionet.europa.eu/hr/eu/nec_revised/.

EKONERG - Energy Research and Environmental Protection Institute Ltd. from Zagreb is under the Public Procurement Contract for the service delivery "Reporting Service in accordance with the requirements of the LRTAP Convention and the NEC Directive" for the MESD[4], the responsible executor for the preparation of IIR2021 and NFR reporting formats and for maintaining the CollectER and COPERT databases. EKONERG experts participate in the meetings of the UNECE Working Group on Emission Inventories and Emission Projections

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[1] Annex I of 2014 Reporting guidelines (ECE/EB.AIR.125)

[2] Annex II of 2014 Reporting guidelines (ECE/EB.AIR.125)

[3] In accordance with the status changes defined in Article 34 and Article 35 of the Act on the Organization and Scope of State Administration Bodies (Official Gazette 85/20), the Ministry of Environmental and Energy will continue to operate as the Ministry of the Economy and Sustainable development.

[4] Contracting authority in the procurement process, responsible for the annual preparation and submission of the annual IIR and NFR tables to the UNECE-LRTAP Convention and the European Commission.

and related expert panels, at which the parties to the CLRTAP prepare guidelines and methodologies for the preparation of inventories.

ES2 Emission trends 1990–2019 and projections for 2020, 2025, 2030, 2040 and 2050

Emissions of almost all relevant air pollutants show a general downward trend in the period 1990 - 2019. The NOx emissions were reduced 51.5%, SO_2 by 95.2%, NH_3 by 34.6%, NMVOC by 55.8%, CO by 60.5%, $PM_{2.5}$ by 26.2%, PM_{10} by 19.1%, BC by 31.8%, heavy metals: Pb by 99%, Cd by 31%, Hg by 65.5%, As by 93.1%, Cr by 63.8%, Ni by 83.6%, Se by 18,8% and Zn by 17.2% while emissions of TSP and Cu increased by 11.6% and 38.2%. PCDD / PCDF emissions decreased by 45.1%, PCBs by 15.1%, HCBs by 91.5% and PAHs by 38.8% (Table 1.1-5).

Figure S2-1 shows the relative emission trends of the main pollutants, their projections for the scenario with measures (WM) and the scenario with additional measures (WAM), the emission ceiling commitments and the emission reduction obligations for the two periods 2020 - 2029 and 2030 - onwards, which are established in the revised Gothenburg Protocol and the NECD and which have been transposed into Croatian legislation by the Regulation on National Emission Ceiling of Certain Pollutants in Air in the Republic of Croatia (OG 78/18).

Details of the projections are presented in Chapter 9. Emissions of the three main pollutants SO_2, NOx, NMVOC in 2019 are below, while NH_3 emissions are above the emission ceiling commitments set for 2010 and for years thereafter (Table 1.1-2). Potentially, (currently) the emission ceiling commitments are will continue after 2020, when, in addition to them, new reduction commitments come into force, which includes the emission of fine particles $PM_{2.5}$.

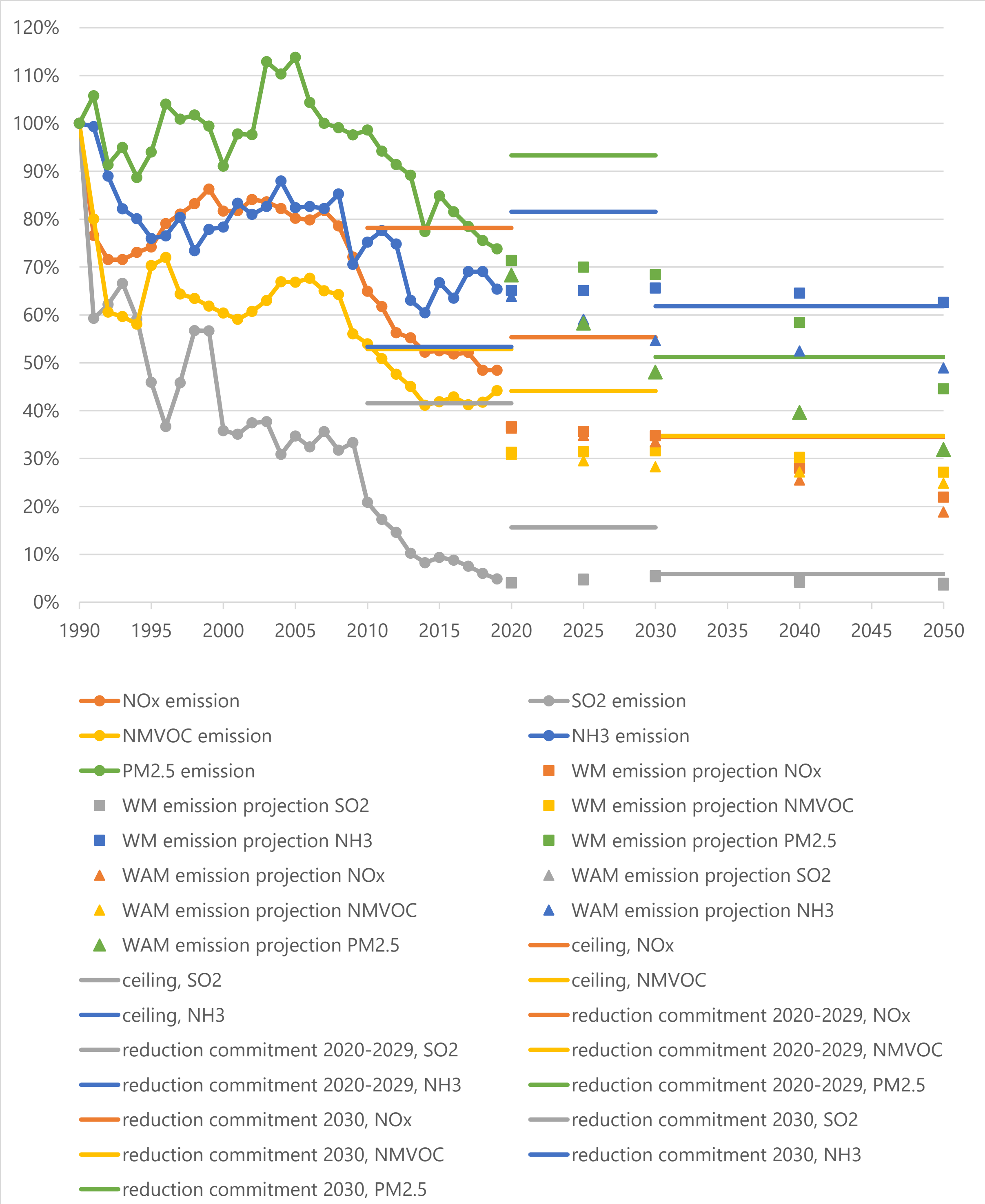

Figure ES2-1 Relative emission trends for main pollutants in the Republic of Croatia for 1990 – 2019, projections for 2020, 2025, 2030, 2040 and 2050 for with measure (WM) and with additional measure (WAM) scenarios, the emission ceiling commitments and the emission reduction commitments for two periods 2020 - 2029 and 2030 - onwards

ES3 Sectoral emissions in 2019

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 97.7%, NOx with 84.9%, NMVOC with 38.5%, NH_3 with 7.9%, TSP with 39.4%, $PM_{2.5}$ with 87.6%, PM_{10} with 65%, BC with 95.3%, CO with 99.6%, Pb with 60.9%, Cd with 84.6%, Hg with 85.7%, As with 90%, Cr with 94.7%, Cu with 91.7 %, Ni with 90.3%, Se with 37.4%, Zn with 97.2%, PCDD/PCDF with 90.5%, PAU with 99.7% and HCB with 48.3%.

Industrial processes and product use is a key emission source for PCB, NMVOC, Pb, Cd, Hg, TSP, PM_{10}, $PM_{2.5}$, Se, As, Cu and Ni. It participates in PCB emissions with 99.3%, in NMVOC emissions with 48.1%, TSP with 53.7%, PM_{10} with 26.9%, Pb with 39.1%, Cd with 15.1%, Hg with 11.5%, Se with 62.6%, $PM_{2.5}$ with 10.9%, As with 9.7%, Ni with 9.7% and Cu with 8.3%.

Agriculture is the main source for emissions of NH_3 (86%), HCB (51.5%), NOx (13.6%), NMVOC (12.4%), PM_{10} (7.7%) and TSP (6.7%).

Waste is the main source only for emission of PCDD/PCDF (5.9 %).

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

Tables ES3-1 - ES3-4 present total national emissions by source of discharges, and total (specific) emissions expressed in dependence of population, area and gross domestic product (GDP) of Croatia in 2019. 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 2019.

Table ES3-1 Emissions of the substances that cause acidification, eutrophication and photochemical pollution in the Republic of Croatia, 2019.

Emissions 2019, t/yr	SO_2	NOx	NMVOC	CO	NH_3
Combustion in energy transformation industry	2,017.1	4,137.2	448.3	1,483.6	9.1
Non-industrial combustion plants	794.1	5,409.2	18,773.1	153,632.4	2,435.2
Combustion in manufacturing industry	2,662.4	4,528.9	1,204.7	8,910.7	49.9
Production processes	2,385.1	851.1	4,916.0	15,440.3	1,629.0
Extraction and distribution of fossil fuels and geothermal energy	0	0	2,208.5	0	0
Solvent and other product use	5	22	32,084.6	663.8	49
Road transport	0.0	23,168.9	4,573.8	24,773.9	362.2
Other mobile source and machinery	46.3	8,439.8	913.3	11,299.0	2.8
Waste treatment and disposal	243.7	39.5	795.0	154.7	602.1
Agriculture	0.8	7,330.6	9,303.3	102.0	31,622.3
TOTAL	8,154.6	53,926.9	75,220.4	216,460.6	36,761.6
Other source and sinks (not included in national total)	454.8	4,306.4	804.3	6,915.1	43.8
Emissions in relation to population, kg/citizen	2.0	13.3	18.5	53.2	9.0
Emissions in relation to area, kg/km^2	0.1	1.0	1.3	3.8	0.6
Emissions in relation to GDP, g/EUR	0.2	1.0	1.4	4.0	0.7
Share, %	**SO_2**	**NOx**	**NMVOC**	**CO**	**NH_3**
Combustion in energy transformation industry	24.7	7.7	0.6	0.7	2.5E-02
Non-industrial combustion plants	9.7	10.0	25.0	71.0	6.6
Combustion in manufacturing industry	32.6	8.4	1.6	4.1	0.1
Production processes	29.2	1.6	6.5	7.1	4.4
Extraction and distribution of fossil fuels and geothermal energy	0	0	2.9	0	0
Solvent and other product use	6.4E-02	4.0E-02	42.7	0.3	0.1
Road transport	0.0	43.0	6.1	11.4	1.0
Other mobile source and machinery	0.6	15.7	1.2	5.2	7.7E-03
Waste treatment and disposal	3.0	7.3E-02	1.1	7.15E-02	1.6
Agriculture	9.4E-03	13.6	12.4	4.7E-02	86.0
TOTAL	100.0	100.0	100.0	100.0	100.0
Other source and sinks (not included in national total)	5.6	8.0	1.1	3.2	0.1

Table ES3-2 Particulate matter emissions in the Republic of Croatia, 2019

Emissions 2019, t/yr	TSP	$PM_{2.5}$	PM_{10}	BC
Combustion in energy transformation industry	1,719.5	1,284.6	1,513.6	47.9
Non-industrial combustion plants	23,317.4	21,654.7	22,208.1	2,595.8
Combustion in manufacturing industry	436.9	366.6	396.1	68.6
Production processes	38,802.0	2,819.2	10,766.2	121.6
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0
Solvent and other product use	559.3	436.4	533.1	143.7
Road transport	2,330.8	1,345.8	1,811.1	615.4
Other mobile source and machinery	251.1	244.0	250.0	101.1
Waste treatment and disposal	191.2	190.4	190.7	7.7
Agriculture	4,865.7	259.0	3,160.4	0.8
TOTAL	72,473.9	28,600.9	40,829.3	3,702.5
Other source and sinks (not included in national total)	93.4	88.5	93.4	16.3
Emissions in relation to population, kg/citizen	17.8	7.0	10.0	0.9
Emissions in relation to area, kg/km^2	1.3	0.5	0.7	0.1
Emissions in relation to GDP, g/EUR	1.3	0.5	0.8	0.1
Share, %	**TSP**	**$PM_{2.5}$**	**PM_{10}**	**BC**
Combustion in energy transformation industry	2.4	4.5	3.7	1.3
Non-industrial combustion plants	32.2	75.7	54.4	70.1
Combustion in manufacturing industry	0.6	1.3	1.0	1.9
Production processes	53.5	9.9	26.4	3.3
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0
Solvent and other product use	0.8	1.5	1.3	3.9
Road transport	3.2	4.7	4.4	16.6
Other mobile source and machinery	0.3	0.9	0.6	2.7
Waste treatment and disposal	0.3	0.7	0.5	0.2
Agriculture	6.7	0.9	7.7	0.0
TOTAL	100.0	100.0	100.0	100.0
Other source and sinks (not included in national total)	0.1	0.3	0.2	0.4

Table ES3-3 Heavy metals emissions in the Republic of Croatia, 2019

Emissions 2019, t/yr	Pb	Hg	Cd	As	Cr	Cu	Ni	Se	Zn
Combustion in energy transformation industry	324.3	109.6	26.6	133.0	136.8	282.4	1,652.7	24.7	2,197.9
Non-industrial combustion	1,178.7	40.3	555.8	12.8	999.7	263.5	281.1	22.5	21,929.4
Combustion in manufacturing industry	362.9	129.2	39.1	71.3	150.0	187.3	139.5	63.2	2,039.2
Production processes	794.6	35.8	75.5	356.0	201.7	60.3	503.4	237.0	407.1
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0	0	0	0	0	0
Solvent and other product use	1354.75	40.8	66.4	2.3	27.0	831.1	83.8	0	481.2
Road transport	966.2	22.5	4.5	11.4	372.4	7,872.8	57.3	7.2	2,837.5
Other mobile source and machinery	183.9	1.7	3.5	2.0	18.0	563.4	67.6	7.8	402.8
Waste treatment and disposal	1.6	11.1	2.5	1.8	5.3	5.2	4.8	1.0	17.2
Agriculture	0	0	1	0	0	0	0	0	1
TOTAL	5,167.2	391.2	775.3	590.5	1,911.0	10,066.1	2,790.2	363.6	30,313.2
Other source and sinks (not included in national total)	4.04	1.58	0.34	4.29	5.94	25.15	173.56	3.82	245.11
Emissions in relation to population, kg/citizen	1.3	0.1	0.2	0.1	0.5	2.5	0.7	0.1	7.5
Emissions in relation to area, kg/km^2	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.5
Emissions in relation to GDP, g/EUR	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.6

Share, %	Pb	Hg	Cd	As	Cr	Cu	Ni	Se	Zn
Combustion in energy transformation industry	6.3	28.0	3.4	22.5	7.2	2.8	59.2	6.8	7.3
Non-industrial combustion	22.8	10.3	71.7	2.2	52.3	2.6	10.1	6.2	72.3
Combustion in manufacturing industry	7.0	33.0	5.0	12.1	7.9	1.9	5.0	17.4	6.7
Production processes	15.4	9.1	9.7	60.3	10.6	0.6	18.0	65.2	1.3
Extraction and distribution of fossil fuels and geothermal	0	0	0	0	0	0	0	0	0
Solvent and other product use	26.2	10.4	8.6	0.4	1.4	8.3	3.0	0	1.6
Road transport	18.7	5.7	0.6	1.9	19.5	78.2	2.1	2.0	9.4
Other mobile source and machinery	3.6	0.4	0.5	0.3	0.9	5.6	2.4	2.2	1.3
Waste treatment and disposal	3.2E-02	2.8	0.3	0.3	0.3	0.1	0.2	0.3	0.1
Agriculture	3.3E-03	0.1	0.2	1.7E-03	6.4E-03	1.1E-03	2.9E-03	8.4E-03	2.8E-03
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)	0.1	0.4	0.0	0.7	0.3	0.2	6.2	1.0	0.8

Table ES3-4 Persistent organic pollutants emissions in the Republic of Croatia, 2019

Emissions 2019, kg/yr for PAH, HCB, PCB; g I-TEQ/yr for PCDD/PCDF	PAH	PCDD/ PCDF	HCB	PCB
Combustion in energy transformation industry	11.2	0.6	5.4E-02	2.5
Non-industrial combustion plants	12529.2	22.0	0.2	0.0
Combustion in manufacturing industry	399.8	0.5	1.9E-02	0.5
Production processes	34.5	0.2	0	0.2
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0
Solvent and other product use	4.0	1.2E-03	0	406.5
Road transport	370.5	0.9	8.8E-04	1.8E-04
Other mobile source and machinery	51.7	0.4	3.9E-03	2.9E-03
Waste treatment and disposal	2.0E-03	1.6	1.0E-03	2.7E-03
Agriculture	3.5	0.8	0.3	0
TOTAL	13404.4	27.0	0.6	409.7
Other source and sinks (not included in national total)	151.3	1.5E-02	2.3E-03	3.5E-03
Emissions in relation to population, kg/citizen	3.3	6.6E-03	1.5E-04	0.1
Emissions in relation to area, kg/km^2	0.2	4.8E-04	1.1E-05	7.2E-03
Emissions in relation to GDP, g/EUR	0.2	5.0E-04	1.1E-05	7.6E-03
Share, %	**PAH**	**PCDD/ PCDF**	**HCB**	**PCB**
Combustion in energy transformation industry	8.3E-02	2.3	8.9	0.6
Non-industrial combustion plants	93.5	81.5	35.5	0.0
Combustion in manufacturing industry	3.0	1.9	3.1	0.1
Production processes	0.3	0.8	0	4.2E-02
Extraction and distribution of fossil fuels and geothermal energy	0	0	0	0
Solvent and other product use	3.0E-02	4.4E-03	0	99.2
Road transport	2.8	3.4	0.1	4.4E-05
Other mobile source and machinery	0.4	1.5	0.7	7.1E-04
Waste treatment and disposal	1.5E-05	5.9	1.7E-01	6.7E-04
Agriculture	2.6E-02	2.8	51.5	0
TOTAL	100.0	100.0	100.0	100.0
Other source and sinks (not included in national total)	1.1	5.6E-02	0.4	8.5E-04

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 1990–2018, for the present submission. In Appendix 8. the influence of emission recalculations made 1990 - 2018 in respect to each of pollutant and by SNAP97 sector are presented. In addition, the overview of changes between total pollutants emissions for 2018 submitted in 2020 and in this year submission with explanations for existing differences, and comparison with national total pollutants emissions in 2019 are presented in Table ES4-1.

Table ES4-1 Recalculations and explanations for changes between submitted total pollutants emissions for year 2018 in IIR 2020 and in IIR 2021

Pollutant	2020 submission IIR 2020	2021 submission IIR 2021		Unit	Explanations for changes between the 2020 and 2021 submissions
	2018	2018	2019		
NOx	50.5	53.9	53,9	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.2.f error due to using the direct emissions for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used. 1.A.3.d.ii Recalculation was performed for the entire period 1990 – 2018 due to correction of EF for marine diesel oil / gas oil (Tier 1). 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018. 3.B Recalculation of emissions were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 -2018. 3.B.4.g.i Emissions were recalculated for the period 1990-2018 due to incorrect activity data. 3.D.a.2.a Recalculation was performed for the years 2015 and 2016 due to incorrect activity data for sows. 3.D.a.2.a Recalculation of emissions were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 -2018. 3.D.a.3 Recalculation of emissions were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 -2018.

<table>
<tr><th rowspan="3">Pollutant</th><th>2020 submission</th><th colspan="2">2021 submission</th><th rowspan="3">Unit</th><th rowspan="3">Explanations for changes between the 2020 and 2021 submissions</th></tr>
<tr><th>IIR 2020</th><th colspan="2">IIR 2021</th></tr>
<tr><th>2018</th><th>2018</th><th>2019</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>3.F Emissions were recalculated for period 1990-2018 due to an error in activity data.</td></tr>
<tr><td>NMVOC</td><td>72.2</td><td>71.1</td><td>75,2</td><td>kt</td><td>Changes stems from methodology improvement and recalculations made in:
1.A.1.a error due to using the amount of fuel for 2017 instead of 2018.
1.A.2.f error due to using the direct emissions for 2017 instead of 2018.
1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
A.3.d.ii Recalculation was performed for the entire period 1990 – 2018 due to correction of EF for marine diesel oil / gas oil (Tier 1).
1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018.
1.B.2.a.v Corrected AD.
2.D.3.b Transition to Tier 2.
3.D.e Emissions were recalculated for 1990 – 2018 due to the change in activity data for cropland and grassland area.
3.F Emissions were recalculated for period 1990-2018 due to an error in activity data.
5.A Biological treatment of waste - solid waste disposal on land: correction of AD for 2018 according to data in the UNFCCC GHG emissions report (NIR). The recalculation was made for 2018.
5.D.1. Domestic wastewater handling and 5.D.2 Industrial wastewater handling: due to the allocation of wastewater from residential/commercial sectors from category 5.D.2 to category 5.D.1, recalculation was made for the period 1990 - 2018.</td></tr>
<tr><td>SO_2</td><td>10.3</td><td>10.2</td><td>8,2</td><td>kt</td><td>Changes stems from methodology improvement and recalculations made in:
1.A.1.a error due to using the amount of fuel for 2017 instead of 2018.
1.A.1.b error due to using the sulphur content for 2017 instead of 2018.
1.A.2.f error due to using the direct emissions for 2017 instead of 2018.
1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
3.F Emissions were recalculated for period 1990-2018 due to an error in activity data.</td></tr>
</table>

Pollutant	2020 submission IIR 2020	2021 submission IIR 2021		Unit	Explanations for changes between the 2020 and 2021 submissions
	2018	2018	2019		
NH_3	35.7	38.8	36,8	kt	Changes stems from methodology improvement and recalculations made in: 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used. 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018. 3.B Recalculation of emissions (for sows, fattening pigs, laying hens and turkeys) was performed for the period 1990-2018 due to an error in ammonia abatement potentials. 3.B Recalculation of emission were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 -2018. 3.D.a.2.a Recalculation was performed for the years 1996, 1997 and 2014 due to incorrect FE for sheep. 3.D.a.2.a Recalculation was performed for the years 2015 and 2016 due to incorrect activity data for sows. 3.D.a.2.a Recalculation of emissions were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 -2018. 3.D.a.3 Recalculation of emissions were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 -2018. 3.F Emissions were recalculated for period 1990-2018 due to an error in activity data.
$PM_{2.5}$	28.7	29.3	28,6	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used. 1.A.3.d.ii Recalculation was performed for the entire period 1990 – 2018 due to correction of EF for marine diesel oil / gas oil (Tier 1). 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018. 2.D.3.b Transition to Tier 2. 3.B Recalculation was performed for the period 1990-2018 (for sows, fattening pigs, laying hens, broilers and turkeys) due to update of Tier 1 EF's to GB 2019. 3.F Emissions were recalculated for period 1990-2018 due to an error in activity data.

Pollutant	2020 submission	2021 submission		Unit	Explanations for changes between the 2020 and 2021 submissions
	IIR 2020	IIR 2021			
	2018	2018	2019		
					5.A Biological treatment of waste - solid waste disposal on land: correction of AD for 2018 according to data in the UNFCCC GHG emissions report (NIR). The recalculation was made for 2018.
PM_{10}	37.8	41.2	40,8	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used. 1.A.3.d.ii Recalculation was performed for the entire period 1990 – 2018 due to correction of EF for marine diesel oil / gas oil (Tier 1). 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018. 2.D.3.b Transition to Tier 2. 3.B Recalculation was performed for the period 1990-2018 (for sows, fattening pigs, laying hens, broilers and turkeys) due to update of Tier 1 EF's to GB 2019. 3.F Emissions were recalculated for period 1990-2018 due to an error in activity data. 5.A Biological treatment of waste - solid waste disposal on land: correction of AD for 2018 according to data in the UNFCCC GHG emissions report (NIR). The recalculation was made for 2018.
TSP	51.6	71.9	72,5	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used. 1.A.3.d.ii Recalculation was performed for the entire period 1990 – 2018 due to correction of EF for marine diesel oil / gas oil (Tier 1). 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018. 2.D.3.b Transition to Tier 2. 3.B Recalculation was performed for the period 1990-2018 (for sows, fattening pigs, laying hens, broilers and turkeys) due to update of Tier 1 EF's to GB 2019. 3.F Emissions were recalculated for period 1990-2018 due to an error in activity data.

Pollutant	2020 submission IIR 2020 2018	2021 submission IIR 2021 2018	2021 submission IIR 2021 2019	Unit	Explanations for changes between the 2020 and 2021 submissions
					5.A Biological treatment of waste - solid waste disposal on land: correction of AD for 2018 according to data in the UNFCCC GHG emissions report (NIR). The recalculation was made for 2018.
BC	3.9	3.8	3,7	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used. 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018. 2.D.3.b Transition to Tier 2. 3.F Emissions were recalculated for period 1990-2018 due to an error in activity data.
CO	234.8	230.8	216,5	kt	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.2.f error due to using the direct emissions for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used. 1.A.3.d.ii Recalculation was performed for the entire period 1990 – 2018 due to correction of EF for marine diesel oil / gas oil (Tier 1). 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018. 3.F Emissions were recalculated for period 1990-2018 due to an error in activity data.
Pb	8.4	8.1	5,2	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
Cd	0.8	0.8	0,8	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018.

Pollutant	2020 submission IIR 2020	2021 submission IIR 2021		Unit	Explanations for changes between the 2020 and 2021 submissions
	2018	2018	2019		
					1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
Hg	0.4	0.4	0,4	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
As	0.6	0.6	0,6	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
Cr	2.0	2.0	1,9	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
Cu	9.5	9.2	10,1	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
Ni	3.5	3.5	2,8	t	Changes stems from methodology improvement and recalculations made in: 1.A.1.a error due to using the amount of fuel for 2017 instead of 2018. 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
Se	0.4	0.4	0,4	t	Changes stems from methodology improvement and recalculations made in:

Pollutant	2020 submission IIR 2020	2021 submission IIR 2021		Unit	Explanations for changes between the 2020 and 2021 submissions
	2018	2018	2019		
					1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
Zn	31.9	30.8	30,3	t	Changes stems from methodology improvement and recalculations made in: 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used.
PCDD / PCDF	27.7	27.9	27,0	g I-Teq	Changes stems from methodology improvement and recalculations made in: 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used. 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018.
Total 4 PAHs	14.0	13.9	13,4	t	Changes stems from methodology improvement and recalculations made in: 1.A.3.b.vi PAH emissions were calculated for the whole period 1990-2019 as recommended by the ERT. 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018.
benzo (a) pyrene	4.8	4.8	4,7	t	Changes stems from methodology improvement and recalculations made in: 1.A.3.b.vi PAH emissions were calculated for the whole period 1990-2019 as recommended by the ERT. 1.A.4.b.i Residential: 2018 due to the error of using amount of fuels by type for 2017 instead for 2018.
benzo (b) fluoranthene	4.6	4.5	4,4	t	Changes stems from methodology improvement and recalculations made in: 1.A.3.b.v.i PAH emissions were calculated for the whole period 1990-2019 as recommended by the ERT. 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018.
benzo (k) fluoranthene	1.7	1.7	1,7	t	Changes stems from methodology improvement and recalculations made in: 1.A.3.b.vi PAH emissions were calculated for the whole period 1990-2019 as recommended by the ERT. 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018.
indeno (1,2,3-cd) pyrene	2.8	2.7	2,6	t	Changes stems from methodology improvement and recalculations made in:

Pollutant	2020 submission	2021 submission		Unit	Explanations for changes between the 2020 and 2021 submissions
	IIR 2020	IIR 2021			
	2018	2018	2019		
					1.A.3.b.vi PAH emissions were calculated for the whole period 1990-2019 as recommended by the ERT 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018.
HCB	0.56	0.6	0,6	kg	Changes stems from methodology improvement and recalculations made in: 1.A.4.b.i Residential: error due to using the amount of wood for 2017 instead of 2018.
PCBs	411.8	411.8	409,7	kg	Changes stems from methodology improvement and recalculations made in: 1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used

ES5 Improvements and other activity

The Croatian IIR 2021 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 2021

NFR sector, Name	NFR sub-sector, Name	Description of improvements and other activity made
1.A Energy – fuel combustion	1.A.1.a Energy Industries	The recalculation of emissions for 2018 was performed due to the correction of the amount of fuel
1.A Energy – fuel combustion	1.A.1.b Refineries	A recalculation of SO2 emissions for 2018 was performed due to the correction of the amount of sulphur in fuels
1.A Energy – fuel combustion	1.A.2.f.1 Combustion in industries-other industries	A recalculation of direct emissions of one LPS plant for 2018 was performed
1.A Energy – fuel combustion	1.A.3.b Road transport	1.A.3.b a new version of the COPERT 5 model was used. The year of fuel quality is set to match the year being calculated. In the last submission for all years quality for 1996 was used 1.A.3.b.vi PAH emissions were calculated for the whole period 1990-2019 as recommended by the ERT
1.A Energy – fuel combustion	1.A.3.d Navigation (shipping)	Recalculation was performed for the period 1990 – 2018 due to the correction of emission factors for National navigation (shipping).
1.B Fugitive emissions from fuels	1.B.2.a.v Distribution of oil products	NMVOC emission recalculation was performed for 1991, 1992 and 2018 due to a minor error in data input for SNAP 0504.
2 Industrial processes and product use	2.A.2 Lime production	Recalculation of all emissions was performed for the period 2005-2010 and for 2012 due to harmonizing AD with NIR.
2 Industrial processes and product use	2.D.3.b Road paving	Transition to Tier 2, and recalculation of NMVOC, TSP, PM and BC emissions, was performed for the whole time-series.
3 Agriculture	3.B Manure management	Recalculation of NH_3 emissions (for sows, fattening pigs, laying hens and turkeys) was performed for the period 1990 - 2018 due to an error in ammonia abatement potentials. Recalculation of NH_3 and NOx emission were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 - 2018. Emissions of NOx were recalculated (for laying hens) for the period 1990-2018 due to incorrect activity data. Recalculation of PM10 and PM2,5 emissions were performed for the period 1990-2018 (for sows, fattening pigs, laying hens, broilers and turkeys) due to update to Tier 1 EF's to GB 2019.
3 Agriculture	3.D.a.2.a Animal manure applied to soils	Recalculation of NH_3 and NOx emissions were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 - 2018.
3 Agriculture	3.D.a.3 Urine and dung deposited by grazing animals	Recalculation of NH_3 and NOx emissions were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 - 2018.
3 Agriculture	3.D.e Cultivated crops	Emissions of NMVOC were recalculated for 1990 – 2018 due to the change in activity data for cropland and grassland area..
3 Agriculture	3.F Field burning of agricultural residues	Emissions of all relevant pollutants were recalculated due to an error in activity data.

NFR sector, Name	NFR sub-sector, Name	Description of improvements and other activity made
5 Waste	5.A Biological treatment of waste - solid waste disposal on land	AD for 2018 was corrected according to data in the UNFCCC GHG emissions report (NIR), in order to harmonize AD used in both reports (IIR and NIR).
5 Waste	5.D Wastewater handling	Allocation of wastewater from residential/commercial sectors from category 5.D.2 to category 5.D.1 has been performed, in accordance with the EMEP/EEA GB2019.

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.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 GB2019 for the aviation, it is necessary to estimate the representative aircraft. For that, it is necessary to collect data that are more detailed on aircrafts and their movements in all airports in Croatia.
1.A Energy – fuel combustion	1.A.3.d Navigation (shipping)	For NOx emission calculation from marine diesel oil / gas oil, Croatia uses Tier 1 EF (GB 2019). Plan is to recalculate emission to recommended Tier 2 EF (GB 2019). It is necessary to obtain more detailed national data for this upgrade and that is included in Data collection program and it is planned to be included in one of the next submissions.
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, 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. In addition, one plant which produces mineral wool is currently included in emissions estimates only for the year 2019, for all emissions that are reported to the EPR for this plant. Additional research is in progress and all information on the operation of this plant before 2019 are currently being collected. These data will be compiled and processed as part of the emissions calculation improvement project, which is being prepared, and its results are expected to be included in the next IIR.
2 Industrial processes and product use	2.A.5.b Construction and demolition	The plan is to recalculate emissions according to Tier 1 EMEP/EEA GB2019 methodology. A comprehensive emissions calculation improvement project is being prepared, which will include the collection and processing of all available data and estimates of any missing data, and its results are expected to be included in the next IIR.
2 Industrial processes and product use	2.D.3.a Domestic solvent use including fungicides	Following TERT's recommendation, a research of the Car care products category was initiated, due to a significant AD increase in the last few years, which resulted in an increase in emissions. The research is ongoing and all relevant data are being analysed in consultation with the competent authorities. Croatia will report its findings on the reasons for these increases in the next IIR, and, if necessary, correct the emissions estimates.
2 Industrial processes and product use	2.D.3.b Road paving	An emissions calculation improvement project is being prepared, which will include collection and processing of all available data on possible use of abatement technologies within

NFR sector, Name	NFR sub-sector, Name	Improvements planned
		asphalt manufacturing plants. Results of this project are expected to be included in the next IIR.
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 a transition to Tier 2 GB2019 methodology. Since trend analysis should be carried out, the recalculations will be included in one of the next submissions, provided the required financial resources are made available.
2 Industrial processes and product use	2.D.3.g Chemical products	Within this category, it is planned to improve emissions calculations for activities Pharmaceutical products manufacturing and Asphalt blowing. An improvement project is being prepared, which will include collection and processing of all available data. For the activity Pharmaceutical products manufacturing, a revision of solvent use data (especially for estimated and not calculated data) is planned, as well as the inclusion of abatement technologies used in plants. Also, for Asphalt blowing, it is planned to analyse the use of abatement technologies in asphalt plants. The results of this project are expected to be included in the next IIR.
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 GB2019 methodology. Since trend analysis should be carried out, the recalculations will be included in one of the next submissions, provided the required financial resources are made available.
3 Agriculture	3.B Manure management	The plan is also to improve emission calculation of NH_3 (Nex and other parameters used in the emission estimates that are taken from the „Improvement of NH_3, CH_4 and N_2O 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 In-country review. As a part of this revised project, updated national emission factors and parameters are expected, as well as incorporation of existing abatement measures for cattle farms. In addition, planned improvement is upgrading methodology to EMEP/EEA GB 2019. The above-mentioned improvement will be carried out in one of the next 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 submissions.
3 Agriculture	3.F. Field burning of agricultural residues	As the current emission estimate is probably overestimated due to, using p_b value of 0.5, long-term planned improvement is getting a better national estimate for the values.
5 Waste	5.B.1 Biological treatment of waste - composting	Activity data on types of composted waste (wet weight) have been used for NH_3 emission calculation for the period 2007 – 2019. 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. Data will be collected from the individual composting plants within the planned project.
5 Waste	5.B.2 Biological treatment of waste - anaerobic digestion at biogas facilities	Potential NH_3 emissions from pre- and post-storage as well as possible leakage during solid-liquid separation are not included in the inventory. This issue should be investigated for the entire activity period and included in the inventory. Data will be

NFR sector, Name	NFR sub-sector, Name	Improvements planned
		collected from the individual biogas plants within the planned project.
5 Waste	5.C.2 Open burning of waste	Although law in Croatia prohibits this activity, the Annual Data Collection Plan includes activity data need to be investigated for the entire reporting period. Data will be collected within the planned project.
5 Waste	5.D.1 Domestic wastewater - Latrine	In order to more accurately estimate NH_3 emission, it is necessary to collect data and provide an expert assessment of the number of inhabitants using latrine, especially for rural and urban areas, for the entire reporting period. Data will be collected within the planned project.
11 Natural sources	11.C Other natural sources - Animals	The inclusion of NH_3 emissions from category 11.C is not a priority activity and the plan is to supplement the inventory with this category in next submission.

1. Introduction

The Ministry of Economy and Sustainable Development[5] (hereinafter MESD) is, in accordance with the Air Protection Act (OG 127/19) and the Regulation on National Emission Ceiling of Certain Pollutants in Air in the Republic of Croatia (OG 76/18)[6] (hereinafter Regulation on NEC), the competent authority for ensuring the preparation of national inventories, annual emission inventories, emission projections, spatially disaggregated inventories, large point sources inventories, if appropriate adjusted emission inventories, and informative inventory reports, carried out by authorized company in accordance with the law governing environmental protection.

EKONERG - Energy Research and Environmental Protection Institute Ltd. from Zagreb is under the Public Procurement Contract for the service delivery "Reporting Service in accordance with the requirements of the LRTAP Convention and the NEC Directive", record number: 800/02-19/36JN, for the MESD[7], authorized company and responsible executor for the preparation of IIR2021 and NFR reporting formats (1990-2019) and for maintaining the CollectER III and COPERT 5 databases.

This report is Croatia´s annual Informative Inventory Report 2021 (for period 1990 – 2019) (hereinafter referred to as IIR2021) under the UNECE - Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe (hereinafter referred to as the 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 referred to as NECD). The report contains information on Croatia´s air pollution emission inventories for all years from 1990 to 2019.

The air pollutants reported 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 (benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene), HCB and PCBs).

The Croatian air pollution inventory is reported in Nomenclature for Reporting format[8], revised 25.9.2019 (hereinafter referred to as NFR19-1). Previously, the annual emission inventory for Croatia was reported in the Nomenclature for Reporting (NFR14) 2014 format. Croatia submits IIR and reporting formats in digital form.

The Croatian Air Pollution Inventory has been prepared in accordance with standard methods and procedures in accordance with the EMEP / EEA air pollutant emission inventory guidebook 2019 (hereinafter referred to as GB2019) and other available technical guidance.

IIR2021 follows recommended structure for the IIR[9], and covers all years in period from 1990 to 2019.

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[5] Ministry of the Environment and Energy, pursuant to Article 73, paragraph 3 of the Law on Amendments to the Environmental Protection Act (OG 118/18 of December 27, 2018) and deletion of the Croatian Agency for Environment and Nature (CAEN) from the court register (January 17, 2019) assumed the Agency's employees, jobs, rights and obligations, as well as assets, equipment, records and other documentation.

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

[7] Contracting authority in the procurement process, responsible for the annual preparation and submission of the annual IIR and NFR tables to the UNECE-LRTAP Convention and the European Commission.

[8] Annex I of 2014 Reporting guidelines (ECE/EB.AIR.125)

[9] Annex II of 2014 Reporting guidelines (ECE/EB.AIR.125)

The information contained in this report is available to the public on MESD website, at the link: https://mzoe.gov.hr/o-ministarstvu-1065/djelokrug-4925/okolis/zrak/emisije-u-zrak/1312 for IIR, annual data collection program, the QA/QC plan and GB2019 and https://emep.haop.hr/ - Spatial distribution portal, interface with air emission maps by pollutants and GNFR/NFR/SNAP sources for the Republic of Croatia.

This report and the NFR tables are available on the Centre on Emission Inventories and Projections (CEIP) website, at the links: https://www.ceip.at/ms/ceip_home1/ceip_home/status_reporting/ and on the Eionet central data repository on links: http://cdr.eionet.europa.eu/hr/un/clrtap/ and http://cdr.eionet.europa.eu/hr/eu/nec_revised/.

1.1. National Inventory Background

1.1.1. National and international reporting requirements: CLRTAP and NECD

According to the Regulation on NEC (Article 16), the informative inventory reports are prepared in accordance with the latest adopted guidelines for reporting emissions and projections data under the LRTAP Convention. The 2014 Reporting guidelines (ECE/EB.AIR.125)[10], prepared by the Task Force on Emission Inventories and Projections and approved by the Executive Body, are adopted for application in 2015 and subsequent years.

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

The CLRTAP (and the NECD) based on 2014 Reporting guidelines prescribes use the methodologies in the latest version of the EMEP/EEA Guidebook, as approved by the Executive Body to estimate emissions and projections for each source category. Parties can use, as an alternative to the EMEP/EEA Guidebook, national or international methodologies that they consider better able to reflect their national situation, provided that the methodologies produce more accurate estimates than the default methods, are scientifically based, are compatible with the EMEP/EEA Guidebook and are documented in their IIRs.

The Republic of Croatia (i.e. MESD) is in accordance with Article 12 of the Regulation on NEC and as a party to the CLRTAP, 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 CLRTAP and to the European Environment Agency (EEA/EIONET) emission inventory and projections, spatially disaggregated emission inventories, large point source inventory and the informative inventory report by deadlines and for certain pollutants as required by Annex I of the Regulation on NEC and other deadlines for reporting purposes under the obligations of the CLRTAP.

One of the obligation of the Parties to the CLRTAP is also the annual verification of submitted reports (estimates/inventories) and emission projections by the Parties to the CLRTAP in parallel with the verification of the report in accordance with the new NECD. The annual review of the emissions in accordance with the CLRTAP is carried out by appointed experts of the

[10] Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution, TFEIP, March 2014, https://www.ceip.at/fileadmin/inhalte/ceip/1_reporting_guidelines2014/ece.eb.air.125_advance_version_reporting_guidelines_2014.pdf

parties (the so-called ROSTER list of all appointed experts who can participate in the review). The expert review teams (ERTs) are established by the EMEP CEIP for every annual review. Croatia has, so far, nominated one national expert for the ROSTER list. Each year, independently of the ERTs review, the European Commission conducts its own review pursuant to the new NECD by a team of technical review experts (TERTs). For this activity, the Member State is required to nominate experts for the national expert team who will respond to all the TERT observations. The experts of the national expert team are also the persons responsible for the preparation of the inventory of pollutant emissions in accordance with the contract between MESD and the responsible executor.

The CLRTAP is a framework agreement and the first international legally binding instrument by which States have committed themselves to combating air pollution. The aim of the CLRTAP is that Parties shall endeavour 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 CLRTAP entered into force in 1983 and currently has a 51 Party. The CLRTAP has been extended by eight protocols (1985 – 1999) that are the key assets/legal instruments for reducing air pollution. The Protocols identify specific measures to be taken by Parties to cut their emissions of air pollutants - sulphur 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 CLRTAP and its seven related protocols (Table 1.1-1). Pursuant to the above, the Republic of Croatia is internationally obliged to observe the obligations stipulated by the CLRTAP 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[11] by Croatia	Official gazette, No.
Convention on Long-range Transboundary Air Pollution (CLRTAP)	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 (GP)	1999	2005	28	2008	OG-IT 07/08

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

Treaty	Signed by the Parties	In force since	Number of Parties	Ratified[11] by Croatia	Official gazette, No.
Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, as amended on 4 May 2012 (amended GP)	2012	2019	23	2019	-

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

The GP was amended in 2012 by Executive Body decisions 2012/1 and 2012/2 to include national emission reduction commitments to be achieved by 2020 and beyond. This amended version entered into force on 7 October 2019. With Amendments to the GP, new emission reduction commitments have been adopted, 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 1.1-3.

At the EU level, an existing policy on air protection has been improved with a view to achieve 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 NECD).

The new NECD foresees new obligations for the reduction of certain pollutants in the air for NMVOC, 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[12] (Tables 1.1-2 and 1.1-3). The NECD pollutants contribute to acidification and eutrophication of ecosystems whilst also playing a major role in the formation of ground-level ozone. The new NECD also assumes the commitments proposed in the revised GP, which were defined for achievement in 2010 and in the following years. The new NECD came into force on 31 December 2016. The existing 2010 emission ceilings for NOx, NMVOC, NH_3 and SOx, as agreed in the old NECD 2001/81/EC and GP, remain in place until 2020 (and beyond), when new national emission reduction commitments are established, which will also include emission reduction commitments for $PM_{2.5}$ and be applicable from 2020 and 2030.

[12] 2005 is a base year in respect of which the compliance with Gothenburg Protocols and the new NEC Directive is checked

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	2010	70 kt	87 kt	30 kt	90 kt
Revised Gothenburg Protocol	2010 and beyond				
NECD (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 new NECD 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 fulfil the prescribed obligations both for SO_2, NOx, NMVOC, NH_3, $PM_{2.5}$, in accordance with the GP and the new NECD, and for persistent organic pollutants: PAU, HCB, PCB and PCDD / PCDF in accordance with the Protocol on Persistent Organic Pollutants (hereinafter: POPs Protocol).

The POPs 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] i.e. 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 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)**	21.9 t
Dioxins and furans (PCDD/PCDF)	49.2 g I-TEQ
Hexachlorobenzene (HCB)	7.1 kg
Polychlorinated biphenyls (PCBs)	482.8 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 and Indeno(1,2,3-cd)pyrene

In accordance with CLRTAP Executive Body's Decision 2002/10[13], on emission data reporting under the CLRTAP and the Protocols in force, Croatia is obliged to report on air emissions in line with Emission Reporting Guidelines[14] and methodology described GB2019. 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 CLRTAP and its Protocols, in 1998, submitted its first national emission calculation and IIR for emissions in 1996.

[13] Decision 2002/10 on emission data reporting under the Convention and the Protocols in force, ECE.EB.AIR/77/Add.1, 2002
[14] Emission Reporting Guidelines, ECE/EB.AIR/80, 2003

The pollutants required for annual reporting under the national Regulation on NEC, the international CLRTAP and European NECD along with required reporting years and reported years in this year's submission for Croatia, are listed in Table 1.1-5 below.

Table 1.1-5 Summary of annual reporting requirements for estimating and reporting emissions under the national Regulation on NEC, international the CLRTAP and European NECD

<table>
<tr><th>Group</th><th colspan="2">Pollutant</th><th>Required reporting years</th><th>Reported years in 2021 Croatia submission</th></tr>
<tr><td rowspan="4">Main Pollutants</td><td colspan="2">Nitrogen Oxides</td><td rowspan="4">1990 – reporting year minus 2</td><td rowspan="4">1990-2019</td></tr>
<tr><td colspan="2">Sulphur Dioxide</td></tr>
<tr><td colspan="2">Non-Methane Volatile Organic Compounds</td></tr>
<tr><td colspan="2">Ammonia</td></tr>
<tr><td>Other</td><td colspan="2">Carbon Monoxide</td><td>1990 – reporting year minus 2</td><td>1990-2019</td></tr>
<tr><td rowspan="4">Particulate Matter</td><td colspan="2">Particulate Matter < 10 µm</td><td rowspan="4">2000 – reporting year minus 2</td><td rowspan="4">1990-2019</td></tr>
<tr><td colspan="2">Particulate Matter < 2.5 µm</td></tr>
<tr><td colspan="2">Total Suspended Particulates (voluntary reporting)</td></tr>
<tr><td colspan="2">Black Carbon (voluntary reporting)</td></tr>
<tr><td rowspan="3">Priority Heavy Metals</td><td colspan="2">Lead</td><td rowspan="3">1990 – reporting year minus 2</td><td rowspan="3">1990-2019</td></tr>
<tr><td colspan="2">Cadmium</td></tr>
<tr><td colspan="2">Mercury</td></tr>
<tr><td rowspan="6">Additional Heavy Metals</td><td colspan="2">Copper (voluntary reporting)</td><td rowspan="6">1990 – reporting year minus 2</td><td rowspan="6">1990-2019</td></tr>
<tr><td colspan="2">Zinc (voluntary reporting)</td></tr>
<tr><td colspan="2">Nickel (voluntary reporting)</td></tr>
<tr><td colspan="2">Chromium (voluntary reporting)</td></tr>
<tr><td colspan="2">Arsenic (voluntary reporting)</td></tr>
<tr><td colspan="2">Selenium (voluntary reporting)</td></tr>
<tr><td rowspan="8">Persistent Organic Pollutants</td><td colspan="2">PCDD/ PCDF (dioxins/ furans)</td><td rowspan="8">1990 – reporting year minus 2</td><td rowspan="8">1990-2019</td></tr>
<tr><td rowspan="5">PAHs</td><td>Benzo[a]pyrene</td></tr>
<tr><td>Benzo[b]fluoranthene</td></tr>
<tr><td>Benzo[k]fluoranthene</td></tr>
<tr><td>Indeno(1,2,3-cd)pyrene</td></tr>
<tr><td>Total 1-4</td></tr>
<tr><td colspan="2">Hexachlorobenzene</td></tr>
<tr><td colspan="2">Polychlorinated Biphenyls</td></tr>
<tr><td rowspan="6">Activity data by NFR source category and by SNAP category in IIR</td><td colspan="2">Liquid Fuels</td><td rowspan="6">1990 – reporting year minus 2</td><td rowspan="6">1990-2019</td></tr>
<tr><td colspan="2">Solid Fuels</td></tr>
<tr><td colspan="2">Gaseous Fuels</td></tr>
<tr><td colspan="2">Biomass</td></tr>
<tr><td colspan="2">Other Fuels</td></tr>
<tr><td colspan="2">Other activity</td></tr>
</table>

Every four years, starting in 2015, under the CLRTAP, Member States must report projected emissions for key pollutants SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$, and BC if available, for the years 2020, 2025 and 2030 and, where available, also for 2040 and 2050. In contrast, projections for the same pollutants and years must be reported to the NECD every two years (starting in 2017) by EU Member States. The Croatia reports the emission projections on as required by the CLRTAP and the NECD. The latest Croatian air pollutant emissions projections are based on the Energy Development Strategy of the Republic of Croatia until 2030 with a view to 2050 (OG 25/20) and take into account the measures considered in the proposal of the Integrated National Energy and Climate Plan of the Republic of Croatia for the period from 2021 to 2030 as well as Low-Carbon Development Strategy of the Republic of Croatia for the period until

2030 with a view to 2050. Projections of the air pollutant emissions use the same assumptions and parameters as the projections of GHG emissions for the Republic of Croatia.

Starting in 2017, EU Member States must report spatially allocated emissions (gridded data) and emissions from large point sources every four years as defined in Section A of Annex VI to the CLRTAP Reporting Guidelines. In the Croatia gridded emission, the gridded emissions include emissions from large-point sources, which are reported also separately. These data were reported in 2017 in the new EMEP grid resolution. In 2021 submission, the Croatia will be reporting updated gridded emissions.

A summary of the two yearly and four yearly reporting requirements, is presented in Table 1.1-6 below.

Table 1.1-6 Summary of two yearly and four yearly reporting requirements under the national Regulation on NEC, international the CLRTAP and European NECD

Group	Pollutant	Time series/target years	Reported years in the 2021 Croatia submission
Gridded data in the new EMEP grid (0.1° × 0.1° long-lat) by source category (GNFR)	SO_2, NO_x, NH_3, NMVOC, CO, PM_{10}, $PM_{2.5}$, BC (voluntary reporting), Pb, Cd, Hg, PCDD/PCDFs, PAHs, HCB, PCBs	Every four years for reporting year minus 2 (X-2) as from 2017	1990, 1995, 2000, 2005, 2010, 2015, 2019
Emissions from large-point sources (LPS) by source category (GNFR)	SO_2, NO_x, NH_3, NMVOC, CO, PM_{10}, $PM_{2.5}$, Pb, Cd, Hg, PCDD/PCDFs, PAHs, HCB, PCBs	Every four years for reporting year minus 2 (X-2) as from 2017	2019
Projected emissions by aggregated NFR	SO_2, NO_x, NH_3, NMVOC, $PM_{2.5}$, BC (voluntary reporting)	CLRTAP: report every 4 years from 2015 onwards, for years 2020, 2025, 2030, (2040, 2050 if available) NECD: report every 2 years from 2017 onwards, for years 2020, 2025, 2030, (2040, 2050 if available)	Voluntary reporting of 2020, 2025, 2030 emissions of BC. Voluntary reporting of 2040, 2050 emissions of all pollutants including BC. 2018, 2020, 2025, 2030, 2040, 2050
Projected activity parameters	-	Reported for the projection target year and the historic year chosen as the starting year for the projections	Voluntary reporting of 2040, 2050 activity parameters. 2018, 2020, 2025, 2030, 2040, 2050

The structure of the Croatian IIR follows the proposed content according to Annex II of the Reporting Guidelines 2014. Chapter 1 describes the background of the national inventory, institutional and organizational structure for its preparation, the process of inventory preparation, describes the use of methodologies and data sources, key categories, QA / QC and verification methods, a general uncertainty assessment and a general inventory completeness assessment are given. The Chapter 2 provides information of key trends by pollutant. Chapters 3 to 7 provide an overview of sectoral applied methodologies (details of methodologies for emission calculation, presentation of related categories, presentation of activity data, applied emission factors and their sources, identification of performed recalculations and planned improvements. Chapter 8 provides a summary of recalculations (by sector, year and pollutant) and planned improvements Chapter 9 presents emission projections of the following pollutants NOx, SO_2, NMVOC, NH_3, $PM_{2.5}$ and BC. Chapter 10 provides information on the spatial distribution of emissions and LPS, and in Chapter 11 information on inventory adjustments.

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 CLRTAP and the NECD 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 by pollutant on territory of the Republic of Croatia for years 1990, 1995, 2000, 2005, 2010, 2015, 2016, 2017, 2018 and 2019 are presented in the Table 1.1-7, along with the share of change in period since 1990 and in relation to the earlier historical year.

Table 1.1-7 Time series of total emissions in the Republic of Croatia by pollutant

Pollutant	Unit	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	Share of change from 1990-2019	Share of change fron 2018-2019	Emission ceiling in 2010 and up to 2020
NOx	kt	111.3	82.6	90.9	89.2	72.3	58.4	57.7	58.0	53.9	53.9	-51.5%	0.0%	87
NMVOC	kt	170.2	119.7	102.8	113.8	91.9	71.3	73.0	70.2	71.1	75.2	-55.8%	5.8%	90
SO2	kt	168.5	77.4	60.4	58.5	35.1	15.8	14.8	12.7	10.2	8.2	-95.2%	-19.7%	70
NH3	kt	56.2	42.7	44.1	46.3	42.3	37.5	35.7	38.8	38.8	36.8	-34.6%	-5.3%	30
PM2.5	kt	38.8	36.4	35.3	44.1	38.2	32.9	31.6	30.4	29.3	28.6	-26.2%	-2.3%	-
PM10	kt	50.5	45.7	44.5	59.4	49.5	44.0	42.7	41.5	41.2	40.8	-19.1%	-0.8%	-
TSP	kt	65.0	60.4	65.3	102.9	77.8	71.4	70.3	68.7	71.9	72.5	11.6%	0.8%	-
BC	kt	5.4	5.0	5.2	6.1	5.2	4.3	4.2	4.1	3.8	3.7	-31.8%	-3.4%	-
CO	kt	547.8	441.3	463.0	413.6	325.3	266.2	257.0	251.3	230.8	216.5	-60.5%	-6.2%	-
Pb	t	515.6	260.2	143.4	13.6	8.0	7.9	7.9	8.0	8.1	5.2	-99.0%	-36.3%	-
Cd	t	1.1	0.8	0.9	1.0	0.9	0.9	0.8	0.8	0.8	0.8	-31.0%	-5.3%	-
Hg	t	1.1	0.3	0.5	0.6	0.5	0.5	0.5	0.4	0.4	0.4	-65.5%	-8.5%	-
As	t	8.6	1.2	1.1	1.1	0.8	0.5	0.4	0.5	0.6	0.6	-93.1%	4.7%	-
Cr	t	5.3	3.7	3.2	3.7	2.5	2.2	2.0	2.1	2.0	1.9	-63.8%	-2.8%	-
Cu	t	7.3	6.1	7.4	9.3	8.1	8.3	8.5	9.3	9.2	10.1	38.2%	9.2%	-
Ni	t	17.0	13.8	12.6	13.7	7.7	4.5	4.2	4.3	3.5	2.8	-83.6%	-19.7%	-
Se	t	0.4	0.3	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.4	-18.8%	-0.9%	-
Zn	t	36.6	30.3	28.3	34.6	33.6	32.1	31.0	31.0	30.8	30.3	-17.2%	-1.5%	-
PCDD/ PCDF	g I-Teq	49.2	43.5	41.9	49.8	40.5	34.6	33.1	29.2	27.9	27.0	-45.1%	-3.1%	-
PAHs	t	21.9	16.7	15.0	18.7	17.7	15.9	15.2	14.7	13.9	13.4	-38.8%	-3.3%	-
HCB	kg	7.09	6.43	1.99	0.45	0.85	0.43	0.47	0.46	0.55	0.60	-91.5%	8.7%	-
PCBs	kg	482.8	468.2	441.4	435.7	433.7	424.9	422.1	415.3	411.8	409.7	-15.1%	-0.5%	-

In addition to the reporting under the CLRTAP and the NECD, the Croatia reports GHG emissions to the United Nations Framework Convention on Climate Change (UNFCCC). There are some differences between the scope of emissions that must be reported in national total for each of the CLRTAP, NECD, and UNFCCC, and the major one between the source sector coverage are in different accounting for aviation and maritime transport emissions under the territorial perspective and are highlighted in Table 1.1-8.

Table 1.1-8 Major differences in reporting under the CLRTAP, NECD and UNFCCC in perspective of accounting in the national totals

Source category	CLRTAP and NECD	UNFCCC
Domestic aviation (landing and take-off phases - LTO)	YES	YES
Domestic aviation (cruise phase - cruise)	memo	YES
International aviation (landing and take-off phases - LTO)	YES	memo
International aviation (cruise phase- cruise)	memo	memo
Domestic inland shipping	YES	YES
International inland shipping	YES	memo
International maritime shipping	memo	memo

YES - reported emissions are included in national total reported emissions under different legislative requirements.
memo - reported emissions are not included in national total reported emissions, and are reported as memo items.

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.

1.1.2. Reporting obligations and deadlines for reporting: CLRTAP and NECD

The various reporting obligations and deadlines for reporting are summarised below. As mentioned before, reporting obligations adopted for application in 2015 and subsequent years are prescribed in 2014 Reporting guidelines (ECE/EB.AIR.125) and corresponding annexes (I-VI).

- CLRTAP and NECD: Emission inventories (full time series of emissions and activity data) (Annex I) annually by 15 February
- CLRTAP and NECD: Informative Inventory Report (IIR) (Annex II) annually by 15 March
- CLRTAP: emission projections (Annex IV) 2015 onwards every four years by 15 March
- NECD: emission projections (Annex IV) 2017 onwards every two years by 15 March
- CLRTAP and NECD: Spatially-disaggregated emission inventory (gridded data) (Annex V) 2017 onwards every four years by 1 May
- CLRTAP and NECD: Large point source inventories (LPS information) (Annex VI) 2017 onwards every four years by 1 May
- CLRTAP: notification on new adjustment application (if applicable) by 15 February
- CLRTAP: supporting documentation for new adjustment application by 15 March
- NECD: National air pollution control programmes 2019 onwards every four years by 1 April.

1.1.3. Emission sources reported in the national air pollutant emission inventory

The Croatia national air pollutant emissions inventory, in accordance with international guidelines (ECE/EB.AIR.125) on emissions inventory reporting, there are sources that are excluded from the national inventory emission estimates:

- Natural sources are not included in the national totals but estimates of some sources and pollutants are made (e.g. forest fires) and reported as memo items.
- Secondary emission sources to atmosphere such as, re-suspension of particulate matter is not included in the national totals.
- Secondary pollutants, such as tropospheric ozone, is also not included in the national totals.

- Cruise emissions from civil and international aviation are made and reported as memo items (i.e. excluded from the Croatia national totals).
- Estimates of "International" emissions such as shipping are made and reported as memo items (i.e. excluded from the Croatia national totals).

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.

The MESD[15] is in accordance with the Air Protection Act (OG 127/19) and the Regulation on NEC the competent authority competent authority for ensuring the preparation of national inventories, annual emission inventories, emission projections, spatially disaggregated inventories, large point sources inventories, if appropriate adjusted emission inventories, and informative inventory reports, carried out by authorized company in accordance with the law governing environmental protection.

EKONERG - Energy Research and Environmental Protection Institute Ltd. from Zagreb is, under the Public Procurement Contract for the provision of service "Fulfillment of obligations of the Republic of Croatia according to the requirements of CLRTAP and NEC directive: Preparation of total national emissions - NFR, Emissions from large point sources and Informative Inventory Report for 2021", record number: 800/02-19/36JN, for the MESD[16], authorized company and responsible executor for the preparation of IIR2021 and NFR19 reporting formats (1990-2019).

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

- The Ministry of Economy and Sustainable development[17] with assistance of Energy Institute Hrvoje Požar that prepares the national annual energy balance and is competent for the Environmental Pollution Register (EPR[18]) and for "the Volatile Organic Compounds"[19] web database (hereinafter: HLAP database);

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[15] Ministry of the Environment and Energy, pursuant to Article 73, paragraph 3 of the Law on Amendments to the Environmental Protection Act (OG 118/18 of December 27, 2018) and deletion of the Croatian Agency for Environment and Nature (CAEN) from the court register (January 17, 2019) assumed the Agency's employees, jobs, rights and obligations, as well as assets, equipment, records and other documentation.

[16] Contracting authority in the procurement process, responsible for the annual preparation and submission of the annual IIR and NFR tables to the UNECE-LRTAP Convention and the European Commission.

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

[18] 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)*

[19] The "Volatile Organic Compounds" database consists of two databases: "Volatile Organic Compounds in Paints and Varnishes" and "Emissions of Volatile Organic Compounds". The database "Volatile organic compounds in paints and varnishes" was established in accordance with the Regulation on limit values for the content of volatile organic compounds in certain paints and varnishes used in construction and vehicle finishing products (OG 69/13). The "Emissions of volatile

- 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 Agriculture
- 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 the Croatian national emission inventory system. The figure also illustrates the dataflow from official data providers and datasets, other data provider sources through the inventories compilation system and national databases to the main reporting outputs.

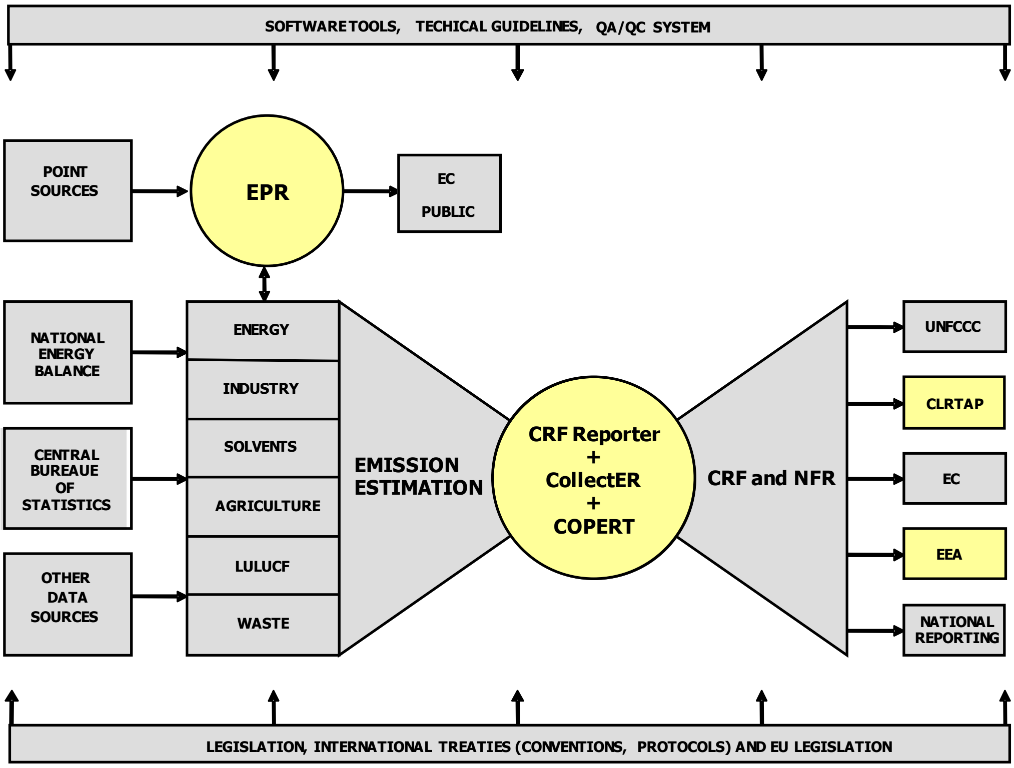

Figure 1.2-1 Croatia National Emission Inventory System

organic compounds" database meets the requirements of the Regulation on limit values for emissions of pollutants into the air from stationary sources (OG 87/17).

1.3. The process of inventory preparation

The process of inventory preparation has three main phases: planning, preparation and reporting and archiving.

1.3.1. Planning

Planning phase includes activities related to organizational, technical and financial aspects of inventory preparation. In the national level management and planning process the MESD has following main roles and responsibilities:

- planning the funds for the activities required for the following reporting year for annual emission inventories, improvement of emission inventories, emission projections, spatially disaggregated inventories, large point sources inventories, if appropriate adjusted emission inventories, and informative inventory reports,
- preparation of tender documentation (inclusion of timetable according to EMEP/EEA reporting programme),
- selection of executive authorized company for annual emission inventories, improvement of emission inventories, emission projections, spatially disaggregated inventories, large point sources inventories, if appropriate adjusted emission inventories, and informative inventory reports,
- procurement and management of contracts which deliver and report for annual emission inventories, improvement of emission inventories emission projections, spatially disaggregated inventories, large point sources inventories, if appropriate adjusted emission inventories, and informative inventory reports,
- nomination of the national experts for the Member State Review Team for respond to observations (comments) from TERT in the annual review by the EC pursuant to the new NECD.
- nomination of the national expert(s) for the ROSTER (a list of appointed experts of the parties who can participate in the annual review of the emissions in accordance with the CLRTAP). The expert review teams (ERTs) are established by the EMEP CEIP for every annual review.
- planning data supply agreements with other data providers.

Executive authorized company in accordance with the law governing environmental protection has the following main roles and responsibilities:

- overview of existing / updated reporting guidelines and guidebooks (reporting requirements, submitting deadlines, latest methodology)
- analysis of recommendations for inventory improvement from previous submissions or gave by expert review teams if such exists,
- assessment of required development actions,
- scheduling of tasks and responsibilities of the personnel involved in emission inventory to ensure timely and accurate delivery of contracted outputs,
- scheduling of activities for data QA/QC (see Appendix 1).

1.3.2. Inventory preparation

Inventory preparation phase is a central phase in the process. The roles and responsibilities are divided between MSDE and contracted authorized company. In inventory preparation process MSDE is responsible for:

- data acquisition which includes requests to data providers by letter, e-mail, telephone, collect data according to annual data collection programme and deliver data to contracted authorized company,

Contracted authorized company is responsible as follows:

- management of inventory QA/QC plans, data collection programme, and activities across all aspects of the inventory preparation process,
- identification and updating of emission sources according to last NFR format (NFR19),
- analysing and processing of raw activity data,
- updating the whole timeseries to take account of improved data and any advances in the methodology used to estimate the emissions,
- emission calculation and recalculations (if necessary),
- maintaining the databases (CollectER III and COPERT V),
- preparation and delivery of the contracted tasks (IIR, associated datasets and formats, and other contracting reports) to time and quality.

1.3.3. Reporting and archiving

The inventory preparation phase is followed by the reporting and archiving phase in which the MESD has following roles and responsibilities:

- submission of the annual emission inventories, emission projections, spatially disaggregated inventories, large point sources inventories, if appropriate adjusted emission inventories, and informative inventory reports,
- information dissemination,
- information archiving.

Contracted authorized company is responsible for:

- archiving of historic datasets (and ensuring the security of historic electronic data), activity data and emission factors are archived and stored in the CollectER III and COPERT V databases and are owned by MESD.
- documented QA/QC procedures and activities in the IIR,
- maintaining a reference literature.

The MESD is insuring the air emission inventory information dissemination to the public through the following websites:

- https://mzoe.gov.hr/o-ministarstvu-1065/djelokrug-4925/okolis/zrak/emisije-u-zrak/1312 for IIR, annual data collection programme, QA/QC plan and GB2019,
- https://emep.haop.hr/ - Croatia spatial distribution portal for spatially disaggregated emissions.

IIR and required reporting formats are available on CEIP website: https://www.ceip.at/status-of-reporting-and-review-results and in Eionet central data repository on links:

http://cdr.eionet.europa.eu/hr/un/clrtap/ and http://cdr.eionet.europa.eu/hr/eu/nec_revised/.

Submission of IIR and requested formats is carried out in accordance with the Guidelines for Reporting Emissions and Projections Data under the CLRTAP[20] within the deadlines and scope presented in subchapter 1.1.2. Detailed and updated information related to deadlines and scope of reporting are available on official EMEP[21] /CEIP[22] web page – www.ceip.at/, and on official EEA webpage: https://www.eea.europa.eu/themes/air/air-pollution-sources-1/national-emission-ceilings.

The Republic of Croatia electronically submits its data to the EMEP Centre for Emission Inventories and Projections (CEIP) (emep.emissions@,umweltbundesamt.at)) or alternatively to the EIONET Central Data Repository, maintained by EEA. Inform the UNECE secretariat of LRTAP Convention (krzysztof.olendrzynski@,iu'i.org) of the contents of its data submission by means of the enclosed notification form (but without sending the data files to the secretariat).

Reporting under the new NECD is fully consistent with reporting under the CLRTAP.

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, MESD 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

NFR Sector	Activity data	Source
1 Energy 1 A 1 Energy Industries	Fuel sold, fuel consumption and fuel characteristic data for thermal power plants	Energy balance - MESD with assistance of Energy Institute Hrvoje Požar
		EPR - MESD
		National electricity producer
	Sulphur content in fuel	Major national fuel producer
1 A 2 Manufacturing Industries and Construction	Fuel sold Fuel consumption	Energy balance and Industry analysis balance - MESD with assistance of Energy Institute Hrvoje Požar
		EPR - MESD
		Major national industry companies
	Sulphur content in fuel	Major national fuel producer
1 A 3 Transport	Fuel sold	Energy balance - MESD with assistance of Energy Institute Hrvoje Požar

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

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

[22] CEIP: The EMEP Centre on Emission Inventories and Projections hosted by the Umweltbundesamt, the Austrian Environment Agency, which became operational on 15 January 2008.

NFR Sector	Activity data	Source
	Number of vehicles	Vehicle data base – the Ministry of Interior
	Annual mileage	Statistical yearbook – CBS
	Min. and max temperature for big towns	Statistical yearbook – CBS
	Sulphur content in fuel	Major national fuel producer
	Vapor pressure for petrol fuels	National regulations
	Number of flights and fuel amount by cycle and routes	EUROCONTROL data (2005 – 2019)
	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 - MESD with assistance of Energy Institute Hrvoje Požar
	Sulphur content in fuel	Major national fuel producer
1 B Fugitive Emissions from fuel	Amount of fuel treated, stored, distributed	Energy balance - MESD with assistance of Energy Institute Hrvoje Požar, Plinacro Ltd.
	Data on production and used inputs	MESD (survey request: oil refineries)
	Emission data	EPR - MESD
2 Industrial Processes and Product Use	Production/consumption data	Annual Report on Industrial Production – PRODCOM - CBS
		EPR - MESD
		MESD (survey requests to manufacturers)
		HLAP database - MESD
	Import and export data	EUROSTAT database (2001 – 2019)
	Fuel sold for non-energy consumption	Energy balance - MESD with assistance of Energy Institute Hrvoje Požar
	Population data	Statistical yearbooks – CBS
3 Agriculture	Number of animals	Statistical yearbook – CBS, The Single Register of Domestic Animals – Ministry of Agriculture, FAO
	Amount of N-fertilizers sold	MESD (survey requests to manufacturers)
	Nitrogen from a sewage sludge when used in agriculture	MESD
	Crop yield and harvested area	Statistical yearbook – CBS
5 Waste	Amount of waste	EPR, Waste Management Information System - MESD
	Statistical data related to living conditions in households	Censuses for 1981, 1991, 2001, 2011 - CBS
	The amount of treated wastewater	Statistical Reports and Releases - CBS
	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 - CBS

1.4.2. 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 5 (v3) that contains activity data on vehicle fleet and procedures for emissions calculation from road transport. For the calculation of emissions from non-road transport (1.A.2.gvii and 1.A.4.ii), agriculture (3.B and 3.D), use of pesticides (3.D.f), field burning of agricultural residues (3.F), small combustion - residential (NFR 1.A.4.b.i), Waste and the IPPU sectors, engineering-mathematical models are used.

Pollutant emissions are reporting in defined NFR19 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[23] Air Pollutant Emission Inventory Guidebook “Technical Guidance to Prepare National Emission Inventories” (2013, 2016, 2019);
- 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),

[23] 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

- Bundesamt für Umwelt, Wald und Landschaft (BUWAL): Emissionsfaktoren für stationäre Quallen – HANDBUCH (1995);
- 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 GB2019 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 the national EPR database) and country specific emission factors. Croatia uses country specific emission factor for SO_2 emission calculation. Details on methodology 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 GB2019.
- 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 GB2019.
- 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, 1.A.3.b.vii: COPERT 5 (v 4.36) model
- 1.A.3.b.vii Road transport: Road abrasion: Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2019.
- 1.A.3.c: Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2019
- 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 GB2019
- 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 GB2019

- 1.B.1.a, 1.B.1.b, 1.B.2.c.i – SO_2 and NMVOC, 1.B.2.c.ii: Tier 1 EMEP/EEA, along with the recommended Tier 1 emission factors from GB2019.
- 1.B.2.a.i, 1.B.2.a.iv, 1.B.2.a.v (except SNAP 0504), 1.B.2.b, 1.B.2.c.i (not including SO_2 and NMVOC): Tier 2 EMEP/EEA, along with the recommended Tier 1 emission factors from GB2019. For SNAP 0504 EFs are taken from Corinair (vol. 2, p. 57).

2 INDUSTRIAL PROCESSES AND PRODUCT USE

- 2.A.1 (not including one factory, for which Tier 1 is used), 2.A.2: Tier 2 EMEP/EEA, along with the abated Tier 2 emission factors from GB2019.
- 2.A.3 (glass production only): Tier 1 EMEP/EEA, along with the recommended Tier 1 emission factors from GB2019; for rock wool production: Tier 3.
- 2.A.5.a, 2.A.5.b: Tier 1 EMEP/EEA, along with the recommended Tier 1 emission factors from GB2019 (except 2.A.5.b - emission factors from GB2013).
- 2.B.1, 2.B.2, 2.B.10.a (sulphuric acid, NPK fertilizers and urea): Tier 2. Emission factors: plant specific (DE – direct emissions from EPR) and/or EMEP/EEA emission factors from GB2019.
- 2.C.1: Tier 2 EMEP/EEA, along with Tier 2 emission factors from GB2019.
- 2.C.2: Tier 1 EMEP/EEA, along with Tier 1 emission factors from GB2019.
- 2.C.3: Tier 2 EMEP/EEA, along with Tier 2 emission factors from GB2019.
- 2.D.3.a: Tier 2 EMEP/EEA, along with Tier 2 emission factors from GB2019.
- 2.D.3.b: Tier 2 EMEP/EEA, along with Tier 2 emission factors from GB2019.
- 2.D.3.c, 2.D.3.d: Tier 1 EMEP/EEA, along with Tier 1 emission factors from GB2019.
- 2.D.3.e: Tier 2 EMEP/EEA, along with Tier 2 emission factors from GB2019.
- 2.D.3.f: other (methodology suggested by the TERT; see Chapter 5.4).
- 2.D.3.g (not including polyester and PVC processing, for which Tier 1 approach and EFs from GB2019 are used): Tier 2 EMEP/EEA, along with Tier 2 emission factors from GB2019.
- 2.D.3.h: Tier 1 EMEP/EEA, along with Tier 1 emission factors from GB2019.
- 2.D.3.i (not including application of glues), 2.G: Tier 2 EMEP/EEA, along with Tier 2 emission factors from GB2019.
- 2.D.3.i (application of glues): other (IIASA GAINS model; see Chapter 5.4).
- 2.H: Tier 2 EMEP/EEA, along with Tier 2 emission factors from GB2019.
- 2.K, 2.I: Tier 1 EMEP/EEA, along with Tier 1 emission factors from GB2019.

3 AGRICULTURE

- 3.B: Tier 2 EMEP/EEA methodology and Tier 2 emission factors from GB2016 with national specifics for all animals except swine, broilers and laying hens, which were calculated using Tier 3 EMEP/EEA methodology with emission factors from GB2016 with national specifics and abatement measures.
- 3.D.1.a: Tier 1 EMEP/EEA methodology and Tier 1 emission factors from GB2019 for NOx, NMVOC, and PMs emission calculation, and Tier 2 EMEP/EEA methodology, along with Tier 2 emission factors from GB2019 for NH_3 emission calculation.

- 3.D.a.2.a: Tier 2 EMEP/EEA methodology and Tier 2 emission factors from GB2019 with national specifics.
- 3.D.a.2.b: Tier 1 EMEP/EEA methodology and Tier 1 emission factors from GB2019
- 3.D.a.3: Tier 2 EMEP/EEA methodology and Tier 2 emission factors from GB2019
- 3.D.c: Tier 1 EMEP/EEA methodology and Tier 1 emission factors from GB2019
- 3.D.e: Tier 2 EMEP/EEA methodology from GB2019
- 3.D.f: Tier 1 EMEP/EEA methodology and Tier 1 emission factors from GB2019
- 3.F: Tier 1 EMEP/EEA methodology and emission factors from GB2019

5 WASTE

- 5.A: CS methodology was developed to estimate a NMVOC EF based on the CH_4 emissions estimated in the framework of the NIR report; $PM_{2,5}$, PM_{10} and TSP Tier 1 EMEP/EEA methodology, along with Tier 1 emission factors from GB2019.
- 5.B.1: Tier 2 EMEP/EEA methodology for NH_3 from GB2019.
- 5.C.1.b.i: Tier 1 EMEP/EEA methodology, along with Tier 1 emission factors from GB2019 and GB2009 (for emission factors not estimated in GB2019).
- 5.C.1.b.iii, 5.C.1.b.v: Tier 1 EMEP/EEA methodology, along with Tier 1 emission factors from GB2019.
- 5.D.1, 5.D.2: Tier 2 EMEP/EEA methodology, along with Tier 2 emission factors from GB2019.
- 5.E: Tier 2 EMEP/EEA methodology, along with Tier 2 emission factors from GB2019.

11 NATURAL SOURCES

- 11.B Forest fires: EMEP/EEA methodology, along with Tier 1 emission factors from GB2019.

1.5. Key categories

The categories that make the largest contribution to overall inventory calculations are key categories. By identifying key categories in the national inventory, inventory makers can prioritize their efforts and improve their overall estimates. NFR categories used for emission reporting according to UNECE CLRTAP reporting guidelines, were used.

The key category is the one that has priority in the national inventory system because it is significantly important for one or more air pollutants in the national inventory in terms of absolute level, trend or uncertainty in emissions.

It is good practice to systematically and objectively use the analysis of key categories as a basis for selecting emission calculation methods. Such a procedure will lead to improved inventory quality as well as greater confidence in the resulting estimates.

Key category analysis helps to identify priority categories for which methods, activity data, emission factors and other parameters should be considered for regular updating, more rigorously checked and reviewed, and, where necessary or possible, improved.

This chapter provides an explanation of the method used to determine the key categories and a list of key categories by pollutant. In addition, a list of large point sources (hereinafter: LPS) in Croatia for 2019 was presented. LPS emissions from all sectors except agriculture were taken from existing databases (ROO and HLAP databases), while emissions for farms from the agricultural sector were calculated.

1.5.1. The method for key category analysis (KCA)

The method used to determine the key categories of each 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 that, when summed in descending order of magnitude, cumulatively add up to 80 % of the total level[24].

For Approach 1, the analysis is performed at the level of all NFR categories for which different methods are applied in the inventory.

The contribution of each NFR category to the assessment of the level of national inventory is made.

1.5.2. List of key categories by pollutant

The list of key categories by pollutant for 2019 is presented in Tables 1.5-1 and 1.5-1 (continued). The last column of the tables presents the cumulative percentage contribution for the categories identified as key in 2019.

Table 1.5-2 shows the emission values for 2019 for each key source by pollutant, together with the percentage of total emissions and the percentage of change from 1990 to 2019 as an indicator of its contribution to the national total ("-" decrease and "+" increase). The table also shows the total emission and cumulative percentage contribution for all categories identified as key in 2019.

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[24] *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.

Table 1.5-1 Key source categories in 2019 for the Croatian Emission Inventory

Pollutant	Key categories (Sorted from high to low from left to right)										Total (%)
SOx	1B2aiv	1A2f	1A1b	1A4bi							86.0
	27.0%	24.2%	18.3%	8.9%							
NOx	1A3bi	1A3biii	1A4bi	1A3dii	1A2f	1A3bii	3Da3	1A1a	3Da1	1A4cii	82.4
	19.0%	18.2%	7.6%	7.1%	6.2%	5.6%	5.1%	4.8%	4.7%	4.1%	
NH3	3Da1	3Da2a	3B3	1A4bi	3B1a	3B1b					82.9
	29.9%	24.2%	13.0%	6.6%	5.1%	4.0%					
NMVOC	1A4bi	2D3d	2D3a	2D3i	2H2	3B1b	3B1a	2D3h	2D3g	1B2av	80.9
	24.4%	18.6%	10.5%	5.9%	5.3%	4.0%	3.2%	3.1%	3.1%	2.6%	
CO	1A4bi	1A3bi	1B2aiv								85.8
	70.6%	8.1%	7.1%								
TSP	2D3b	1A4bi	2A5a								82.7
	47.0%	32.0%	3.7%								
PM10	1A4bi	2D3b	3Dc	1A1a							82.6
	54.1%	19.3%	5.7%	3.5%							
PM2.5	1A4bi	2D3b									81.7
	75.3%	6.4%									
Pb	2G	1A4bi	1A3bvi	2A3	1A2f						83.1
	26.2%	22.3%	18.7%	9.4%	6.5%						
Hg	1A2f	1A1a	2K	1A4bi	1B2aiv						86.4
	30.7%	27.4%	10.4%	9.9%	8.0%						
Cd	1A4bi	2G	2A3								84.1
	70.8%	8.6%	4.8%								
PCDD/ PCDF	1A4bi										81.2
	81.2%										
PAH	1A4bi										93.3
	93.3%										
HCB	3Df	1A4bi									86.5
	51.5%	35.0%									

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

Table 1.5-1 (cont.) Key source categories in 2019 for the Croatian Emission Inventory

Pollutant	Key categories (Sorted from high to low from left to right)										Total (%)
As	1B2aiv	1A1a	1A2f								81.9
	51.0%	19.7%	11.3%								
Cr	1A4bi	1A3bvi	1A2f	1B2aiv							83.4
	50.9%	18.8%	6.9%	6.8%							
Cu	1A3bvi	2G									86.4
	78.1%	8.3%									
Ni	1A1b	1B2aiv	1A1a	1A4ai	2A3						80.7
	49.1%	11.3%	10.2%	5.2%	5.0%						
Se	2A3	1A2f	1A4bi								85.2
	62.6%	16.7%	5.9%								
Zn	1A4bi	1A3bvi									80.6
	71.4%	9.2%									
benzo(a) pyrene	1A4bi										92.9
	92.9%										
benzo(b) fluoranthene	1A4bi										93.3
	93.3%										
benzo(k) fluoranthene	1A4bi										91.6
	91.6%										
Indeno (1,2,3-cd) pyrene	1A4bi										96.4
	96.4%										
PCBs	2K										99.2
	99.2%										
BC	1A4bi	1A3bi	2G								82.7
	69.0%	9.8%	3.9%								

Data source: EKONERG Ltd

Table 1.5-2 Summary of key categories in 2019

Pollutant	NFR Code	Key source during 2019 NFR name	Emission in 2019	% of total emission in 2019	% change from 1990 to 2019
NO_x	1A3bi	Road transport: Passenger cars	10.22	18.95%	-57.04%
	1A3biii	Road transport: Heavy duty vehicles and buses	9.80	18.17%	-4.30%
	1A4bi	Residential: Stationary	4.11	7.62%	-4.64%
	1A3dii	National navigation (shipping)	3.85	7.15%	20.24%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	3.34	6.19%	-64.43%
	1A3bii	Road transport: Light duty vehicles	3.02	5.59%	-6.71%
	3Da3	Urine and dung deposited by grazing animals	2.74	5.07%	-44.42%
	1A1a	Public electricity and heat production	2.61	4.83%	-77.32%
	3Da1	Inorganic N-fertilizers (includes also urea application)	2.54	4.70%	-9.21%
	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	2.20	4.08%	-71.74%
		Total for key sources	44.41	82.4%	
NMVOC	1A4bi	Residential: Stationary	18.35	24.39%	-22.41%
	2D3d	Coating applications	14.01	18.63%	-35.16%
	2D3a	Domestic solvent use including fungicides	7.92	10.52%	-28.53%
	2D3i	Other solvent use	4.47	5.94%	-61.25%

Pollutant	NFR Code	Key source during 2019 NFR name	Emission in 2019	% of total emission in 2019	% change from 1990 to 2019
	2H2	Food and beverages industry	4.01	5.33%	-82.08%
	3B1b	Manure management - Non-dairy cattle	3.01	4.00%	77.46%
	3B1a	Manure management - Dairy cattle	2.43	3.23%	-44.08%
	2D3h	Printing	2.33	3.10%	-28.49%
	2D3g	Chemical products	2.32	3.08%	12.09%
	1B2av	Distribution of oil products	1.98	2.63%	-45.04%
		Total for key sources	56.52	80.9%	
SO_2	1B2aiv	Fugitive emissions oil: Refining / storage	2.20	27.0%	22.3%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	1.97	24.2%	-81.9%
	1A1b	Petroleum refining	1.49	18.3%	-93.4%
	1A4bi	Residential: Stationary	0.72	8.9%	-95.1%
	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	0.62	7.6%	-90.7%
		Total for key sources	7.01	86.0%	
NH_3	3Da1	Inorganic N-fertilizers (includes also urea application)	11.00	29.91%	7.14%
	3Da2a	Animal manure applied to soils	8.90	24.20%	-42.54%
	3B3	Manure management - Swine	4.79	13.04%	-32.54%
	1A4bi	Residential: Stationary	2.41	6.57%	-20.14%
	3B1a	Manure management - Dairy cattle	1.88	5.12%	-71.13%
	3B1b	Manure management - Non-dairy cattle	1.48	4.02%	-20.44%
		Total for key sources	30.46	82.9%	
$PM_{2.5}$	1A4bi	Residential: Stationary	21.55	75.33%	-26.36%
	2D3b	Road paving with asphalt	1.83	6.41%	340.97%
		Total for key sources	23.38	81.7%	
PM_{10}	1A4bi	Residential: Stationary	22.09	54.11%	-26.38%
	2D3b	Road paving with asphalt	7.86	19.25%	340.97%
	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	2.35	5.75%	-50.83%
	1A1a	Public electricity and heat production	1.42	3.48%	20.17%
		Total for key sources	33.72	82.6%	
TSP	2D3b	Road paving with asphalt	34.06	47.00%	340.97%
	1A4bi	Residential: Stationary	23.20	32.01%	-26.62%
	2A5a	Quarrying and mining of minerals other than coal	2.71	3.74%	-1.61%
		Total for key sources	59.97	82.7%	
CO	1A4bi	Residential: Stationary	152.89	70.6%	-20.1%
	1A3bi	Road transport: Passenger cars	17.49	8.1%	-91.7%
	1B2aiv	Fugitive emissions oil: Refining / storage	15.32	7.1%	-69.4%
		Total for key sources	185.69	85.8%	
Pb	2G	Other product use	1.35	26.2%	143.7%
	1A4bi	Residential: Stationary	1.15	22.3%	-35.5%

Pollutant	NFR Code	Key source during 2019 NFR name	Emission in 2019	% of total emission in 2019	% change from 1990 to 2019
	1A3bvi	Road transport: Automobile tyre and brake wear	0.96	18.7%	84.8%
	2A3	Glass production	0.48	9.4%	3.2%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.34	6.5%	4.0%
		Total for key sources	4.29	83.1%	
Cd	1A4bi	Residential: Stationary	0.55	70.8%	-1.8%
	2G	Other product use	0.07	8.6%	0.1%
	2A3	Glass production	0.04	4.8%	3.2%
		Total for key sources	0.65	84.1%	
Hg	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.12	30.7%	17.4%
	1A1a	Public electricity and heat production	0.11	27.4%	95.5%
	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	0.04	10.4%	-14.9%
	1A4bi	Residential: Stationary	0.04	9.9%	-32.8%
	1B2aiv	Fugitive emissions oil: Refining / storage	0.03	8.0%	-64.9%
		Total for key sources	0.34	86.4%	
PCDD/ PCDF	1A4bi	Residential: Stationary	21.9	81.2%	-35.0%
		Total for key sources	21.9	81.2%	
PAH	1A4bi	Residential: Stationary	12.51	93.3%	-31.4%
		Total for key sources	12.51	93.3%	
As	1B2aiv	Fugitive emissions oil: Refining / storage	0.30	51.0%	1577.4%
	1A1a	Public electricity and heat production	0.12	19.7%	-83.5%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.07	11.3%	13.9%
		Total for key sources	0.48	81.9%	
Cr	1A4bi	Residential: Stationary	0.97	50.87%	-5.31%
	1A3bvi	Road transport: Automobile tyre and brake wear	0.36	18.77%	84.81%
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.13	6.95%	-26.78%
	1B2aiv	Fugitive emissions oil: Refining / storage	0.13	6.77%	-69.40%
		Total for key sources	1.59	83.4%	
Cu	1A3bvi	Road transport: Automobile tyre and brake wear	7.86	78.1%	84.8%
	2G	Other product use	0.83	8.3%	118.7%
		Total for key sources	8.69	86.4%	
Ni	1A1b	Petroleum refining	1.37	49.1%	-74.3%
	1B2aiv	Fugitive emissions oil: Refining / storage	0.32	11.3%	-59.6%
	1A1a	Public electricity and heat production	0.28	10.2%	-95.3%
	1A4ai	Commercial/institutional: Stationary	0.15	5.2%	-83.3%
	2A3	Glass production	0.14	5.0%	3.2%
		Total for key sources	2.25	80.7%	
Se	2A3	Glass production	0.23	62.6%	3.2%

Pollutant	NFR Code	Key source during 2019 NFR name	Emission in 2019	% of total emission in 2019	% change from 1990 to 2019
	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.06	16.7%	12.9%
	1A4bi	Residential: Stationary	0.02	5.9%	-28.5%
		Total for key sources	0.31	85.2%	
Zn	1A4bi	Residential: Stationary	21.63	71.4%	-4.7%
	1A3bvi	Road transport: Automobile tyre and brake wear	2.80	9.2%	85.6%
		Total for key sources	24.43	80.6%	
benzo(a) pyrene	1A4bi	Residential: Stationary	4.36	92.9%	-30.4%
		Total for key sources	4.36	92.9%	
benzo(b) fluoranthene	1A4bi	Residential: Stationary	4.06	93.3%	-34.0%
		Total for key sources	4.06	93.3%	
benzo(k) fluoranthene	1A4bi	Residential: Stationary	1.54	91.6%	-34.3%
		Total for key sources	1.54	91.6%	
Indeno (1,2,3-cd) pyrene	1A4bi	Residential: Stationary	2.55	96.4%	-26.6%
		Total for key sources	2.55	96.4%	
PCBs	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	406.53	99.2%	-14.9%
		Total for key sources	406.53	99.2%	
HCB	3Df	Use of pesticides	0.31	51.5%	-95.4%
	1A4bi	Residential: Stationary	0.21	35.0%	-1.2%
		Total for key sources	0.52	86.5%	
BC	1A4bi	Residential: Stationary	2.56	69.00%	-19.40%
	1A3bi	Road transport: Passenger cars	0.36	9.82%	346.95%
	2G	Other product use	0.14	3.87%	-2.21%
		Total for key sources	3.07	82.70%	

1.5.3. The LPS determination method

The method used to determine which LPS plant is described in the definition of LPS in the 2014 Reporting Guidelines “Large Point Sources” (LPS) are defined as installations[25] whose combined emissions, within a limited identifiable area of the site area, exceed the pollutant emission thresholds set out in Figure 1.5-1.

[25] s defined in Article 2 (4) and (5) of the E-PRTR Regulation cited later in paragraph 9 above, “facility” means one or more installations at the same location operated by the same natural or legal person and “location ”Indicates the geographical location of the facility.

List of pollutants to be reported for an LPS if the applicable threshold value is exceeded, based on thresholds specified in annex II to the E-PRTR Regulation

Pollutants/substances	*Thresholds in kilograms per year (kg/year)*
SO_X	150 000
NO_x	100 000
CO	500 000
NMVOCs	100 000
NH_3	10 000
$PM_{2.5}$	50 000
PM_{10}	50 000
Pb	200
Cd	10
Hg	10
PAHs (Sum of the four indicator PAHs)	50
PCDD/F	0.0001
HCB	10
PCBs	0.1

Figure 1.5-1 List of pollutants to be reported for LPS if the applicable threshold value is exceeded, based on the thresholds listed in Annex II. E-PRTR Regulation

1.5.4. List of the LPS and their emissions in 2019

An overview of total emissions by individual LPS is shown in Table 1.5-3. Emissions of LPS from all sectors except agriculture were taken from existing databases (ROO and HLAP databases), while emissions for farms from the agricultural sector were calculated. Emissions are shown only for pollutants reported in ROO and HLAP databases and for farms those that are specific to the NFR category to which the farm belongs.

The table also presents total LPS emissions, total national emissions and the percentage contribution of LPS to total national emissions for 2019.

Table 1.5-3 List of LPS and their emissions for 2019

Emission	NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	CO	Cd	Hg	PAHs
LPS	kt	kt	kt	kt	kt	kt	kt	t	t	t
EPR database										
DS Smith Belišće Croatia d.o.o. za proizvodnju papira i kartonske ambalaže - Tvornica papira, ambalaže i energetika	0.1283153	0	0.00361	0	0	0.002477	0	0	0	0
Vetropack Straža d.d.	0.35057476	0	0.216721	0	0	0.0015075	0.0045144	0	0	0
Calucem d.o.o., za proizvodnju specijalnih cemenata	0.4199257	0	0.2870069	0	0	0.0060244	0.6659208	0	0	0
Tvornica Šećera Osijek d.o.o	0.05733158	0	0.337896	0	0	0.0393836	0.0156718	0	0	0
Petrokemija d.d. tvornica gnojiva	0.95960058	0	0.1792392	1.418302	0	0.1232243	0.0047468	0	0	0
Našicecement Tvornica cementa d.d.	0.79949843	0.2799401	0.49839	0.026621	0	0.0173517	3.3339496	0.01323	0.03161	0
CEMEX HRVATSKA D.D. - 1 TVORNICA CEMENTA "SVETI JURAJ"	0.74110344	0	0.0109792	0.0663	0	0.0239009	1.7464802	0	0.01	0.03122
CEMEX HRVATSKA D.D. - 1 TVORNICA CEMENTA "SVETI KAJO"	0.18289869	0	0.006018	0.02541	0	0.0094671	0.3704901	0	0	0.00717
Holcim (Hrvatska) d.o.o. - 101 Proizvodnja cementa Koromačno	0.36499	0	0.0382004	0.059926	0	0.0098753	0.5875922	0	0.002	0
Kronospan CRO d.o.o - 01 Proizvodnja iverice	0.0224405	0	0	0	0	0.0753724	0.0271541	0	0	0
Ceste d.d. - Asfaltna baza	0.001321	0	0	0	0	0.0013408	0.0142688	0	0	0
CALCIT LIKA d.o.o. - 02 Mlinica	0	0	0	0	0	0.0196	0.000313	0	0	0
Knaufinsulation d.o.o. Novi Marof - Dimnjak spalionice grotlenih plinova kupolne peći	0.01608607	0	0.1138396	0.0371733	0	0.0155915	0.0096359	0.0225	0	0
Rockwool Adriatic d.o.o.	0.08963961	0	0.3710525	0.086806	0	0.0214413	0.0015082	0	0	0

Emission	NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	CO	Cd	Hg	PAHs
LPS	kt	kt	kt	kt	kt	kt	kt	t	t	t
INA-Industrija nafte D.D. Rafinerija nafte Rijeka	1.19255619	0	1.1436989	0	0	0.0977567	0.1146998	0	0	0
INA-Industrija nafte D.D. Rafinerija nafte Sisak	0.448114	0	1.57148	0	0	0.008472	0.0578038	0	0	0
Hrvatska industrija šećera- pogon Županja	0.02317902	0.22016	0	0	0	0.0013952	0	0	0	0
DRVNI CENTAR GLINA d.o.o, DCG ĐURO ĐAKOVIĆ	0.14256733	0	0.0500909	0	0	0.0450818	0.1358496	0	0	0
UNI VIRIDAS d.o.o. za energetiku - 1 Kogeneracijsko postrojenje Viridas Biomass	0.13100263	0	0.0229626	0	0	0.0040185	0.3825569	0	0	0
HEP-PROIZVODNJA d.o.o. - TE Plomin	0.57719	0	0.22924	0	0	0.06924	0.08299	0	0	0
HEP-PROIZVODNJA d.o.o. - TE-TO Zagreb	0.20555	0	0.0094	0	0	0.002598	0.05702	0	0	0
HEP-PROIZVODNJA d.o.o. - EL-TO Zagreb	0.46227641	0	0	0	0	0.0013097	0.0258394	0	0	0
HEP-PROIZVODNJA d.o.o. - TE-TO Sisak	0.177957	0	0.004338	0	0	0.001201	0.016897	0	0	0
HLAP database										
DRAVA INTERNATIONAL d.o.o.	0	0.17594	0	0	0	0	0	0	0	0
ROTOPLAST d.o.o.	0	0.28657	0	0	0	0	0	0	0	0
ALUFLEXPACK NOVI d.o.o. Drniš	0	0.12328	0	0	0	0	0	0	0	0
ALUFLEXPACK NOVI d.o.o. Umag	0	0.50015	0	0	0	0	0	0	0	0
BAKROTISAK d.d.	0	0.33962	0	0	0	0	0	0	0	0
SIPRO d.o.o.	0	0.21454	0	0	0	0	0	0	0	0
FARMS										
ZITO D.O.O. LUZANI	0.0001036	0.0052463	0	0.0364183	7.075E-05	0.0016509	0	0	0	0

Emission	NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	CO	Cd	Hg	PAHs
LPS	kt	kt	kt	kt	kt	kt	kt	t	t	t
ZITO D.O.O. SLASCAK	7.9981E-05	0.0040504	0	0.0281167	5.462E-05	0.0012746	0	0	0	0
VUPIK D.D. BOBOTA	7.2636E-05	0.0036784	0	0.0255348	4.961E-05	0.0011575	0	0	0	0
BELJE D.D. DARDA 1	6.9966E-05	0.0035432	0	0.024596	4.778E-05	0.001115	0	0	0	0
ZITO D.O.O. MAGDENOVAC	0.00018374	0.0101824	0	0.0374153	5.569E-05	0.0011406	0	0	0	0
PIK VINKOVCI D.D. CERETINCI 1	6.6482E-05	0.0037867	0	0.0103676	1.201E-05	0.0002042	0	0	0	0
PIK VINKOVCI D.D. ANDRIJASEVCI 1	6.4434E-05	0.00367	0	0.0100482	1.164E-05	0.0001979	0	0	0	0
BELJE D.D. FARMA GRADEC	0.00020409	0.0109286	0	0.0533846	9.223E-05	0.0020446	0	0	0	0
BELJE D.D. FARMA KOZARAC	8.7554E-05	0.0044339	0	0.0307789	5.98E-05	0.0013952	0	0	0	0
VUPIK D.D. PACETIN	6.9131E-05	0.0035009	0	0.0243026	4.721E-05	0.0011017	0	0	0	0
BELJE D.D. FARMA SOKOLOVAC	7.5087E-05	0.0038026	0	0.0263965	5.128E-05	0.0011966	0	0	0	0
ZITO D.O.O. FORKUSEVCI	0.00010136	0.005773	0	0.0158061	1.831E-05	0.0003113	0	0	0	0
BELJE PLUS D.O.O. HALJEVO	7.0744E-05	0.0040295	0	0.0110323	1.278E-05	0.0002173	0	0	0	0
BELJE PLUS D.O.O. GAJ	0.0001256	0.007154	0	0.0195872	2.269E-05	0.0003857	0	0	0	0
ZITO D.O.O. VUKA	3.1317E-05	0.0127344	0	0.0285126	0.0004829	0.0064383	0	0	0	0
LUKAC D.O.O. IVANIC GRAD	1.3523E-05	0.0054989	0	0.012312	0.0002085	0.0027801	0	0	0	0
PERFA BIO D.O.O.	3.7964E-05	0.0154374	0	0.0345647	0.0005854	0.0078049	0	0	0	0
LUNETA D.O.O. SVETI DURD	2.6751E-05	0.0108779	0	0.0243557	0.0004125	0.0054996	0	0	0	0
KOKA D.D. FARMA 1 JELKOVEC	0.00056369	0.0140507	0	0.0178395	0.0003358	0.0033578	0	0	0	0
KOKA D.D. FARMA 13 PETRIJANEC	0.00063001	0.0157036	0	0.0199382	0.0003753	0.0037528	0	0	0	0
KOKA D.D. FARMA 8 GORNJI KUCAN	0.00077972	0.0194352	0	0.024676	0.0004645	0.0046446	0	0	0	0
KOKA D.D. FARMA 21 CAKOVEC	0.00075891	0.0189166	0	0.0240175	0.0004521	0.0045206	0	0	0	0
KOKA D.D. FARMA 9 GORNJI KUCAN	0.00075875	0.0189126	0	0.0240125	0.000452	0.0045197	0	0	0	0

Emission	NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	CO	Cd	Hg	PAHs
LPS	kt	kt	kt	kt	kt	kt	kt	t	t	t
KOKA D.D. FARMA 17 PETRIJANEC	0.00075729	0.0188761	0	0.0239662	0.0004511	0.004511	0	0	0	0
KOKA D.D. FARMA 19 OPCINA MARTIJANEC	0.00069468	0.0173157	0	0.0219849	0.0004138	0.004138	0	0	0	0
KOKA D.D. FARMA 18 CAKOVEC	0.00063538	0.0158376	0	0.0201083	0.0003785	0.0037848	0	0	0	0
KOKA D.D. FARMA 20 PETRIJANEC	0.00061367	0.0152965	0	0.0194213	0.0003656	0.0036555	0	0	0	0
VINDON D.O.O. BRODSKI STUPNIK	0.0009772	0.0230037	0	0.0450596	0.0016255	0.0089403	0	0	0	0
VINDON D.O.O. DELOVI	0.00073229	0.0172385	0	0.0337668	0.0012181	0.0066997	0	0	0	0
KOKA D.D. FARMA 11 VINICA	0.00051407	0.0121014	0	0.0237043	0.0008551	0.0047032	0	0	0	0
VINDON D.O.O. ZADUBRAVLJE	0.00058537	0.0137798	0	0.0269919	0.0009737	0.0053555	0	0	0	0
VINDON D.O.O. KLOKOCEVIK	0.00029841	0.0070246	0	0.0137599	0.0004964	0.0027301	0	0	0	0
VINDON D.O.O. BANOVCI	0.00057426	0.0135183	0	0.0264797	0.0009552	0.0052538	0	0	0	0
KOKA D.D. FARMA 14 PETRIJANEC	0.00035037	0.0082479	0	0.016156	0.0005828	0.0032055	0	0	0	0
BOVIS D.O.O. IVANKOVO	0.0002132	0.0867408	0	0.0684659	0.0018733	0.0028785	0	0	0	0
SIRJAN D.O.O. IVANIC GRAD - ZUTICKA 46	0.00020779	0.0845386	0	0.0667277	0.0018257	0.0028054	0	0	0	0
FARMA TOMASANCI D.O.O.	0.00017736	0.0721606	0	0.0569575	0.0015584	0.0023946	0	0	0	0
SIRJAN D.O.O. IVANIC GRAD - ZUTICKA 44	0.00015735	0.0640162	0	0.050529	0.0013825	0.0021244	0	0	0	0
BELJE PLUS D.O.O. KARANAC	0.00010606	0.0431521	0	0.0340606	0.0009319	0.001432	0	0	0	0
SIRJAN D.O.O. KUSIJEVEC	9.9671E-05	0.0405512	0	0.0320077	0.0008758	0.0013457	0	0	0	0
BELJE PLUS D.O.O. MITROVAC	8.8239E-05	0.0358999	0	0.0283364	0.0007753	0.0011913	0	0	0	0
SIMENTAL COMMERCE D.O.O.	8.5206E-05	0.0346659	0	0.0273624	0.0007487	0.0011504	0	0	0	0

Emission	NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	CO	Cd	Hg	PAHs
LPS	kt	kt	kt	kt	kt	kt	kt	t	t	t
FARMA MUZNIH KRAVA ANTUNOVAC	8.1939E-05	0.033337	0	0.0263134	0.00072	0.0011063	0	0	0	0
SIMENTAL COMMERCE D.O.O. TENJA	8.1193E-05	0.0330333	0	0.0260737	0.0007134	0.0010962	0	0	0	0
VUPIK PLUS D.O.O. EKONOMIJA	7.9793E-05	0.0324637	0	0.0256241	0.0007011	0.0010773	0	0	0	0
SLASCAK D.O.O. VISKOVCI	6.822E-05	0.0277555	0	0.0219079	0.0005994	0.0009211	0	0	0	0
BELJE PLUS D.O.O. DUGE MEDE	6.4114E-05	0.0260849	0	0.0205892	0.0005633	0.0008656	0	0	0	0
OSATINA GRUPA D.O.O. PODGORAC	6.2154E-05	0.0252875	0	0.0199599	0.0005461	0.0008392	0	0	0	0
BELJE PLUS D.D. KNEZEVI VINOGRADI	6.1828E-05	0.0251546	0	0.019855	0.0005433	0.0008348	0	0	0	0
KRNDIJA D.O.O.	5.9028E-05	0.0240156	0	0.0189559	0.0005187	0.000797	0	0	0	0
AGRO-VET D.O.O. PETRINJA	5.2075E-05	0.0211869	0	0.0167231	0.0004576	0.0007031	0	0	0	0
BIO ADRIA D.O.O. KRSAN	4.8716E-05	0.01982	0	0.0156442	0.000428	0.0006577	0	0	0	0
ZDENACKA FARMA D.O.O. VELIKI ZDENCI	4.7829E-05	0.0194593	0	0.0153595	0.0004203	0.0006458	0	0	0	0
PRO MILK D.O.O. SADILOVAC	4.7456E-05	0.0193074	0	0.0152396	0.000417	0.0006407	0	0	0	0
JOSIP SIRJAN, BRINJE	4.7409E-05	0.0192884	0	0.0152246	0.0004166	0.0006401	0	0	0	0
VUPIK PLUS D.O.O. BOBOTA	4.5916E-05	0.0186809	0	0.0147451	0.0004034	0.0006199	0	0	0	0
ZITAR D.O.O.	4.5496E-05	0.01851	0	0.0146103	0.0003998	0.0006143	0	0	0	0
KRAJCINE D.O.O.	4.4236E-05	0.0179974	0	0.0142057	0.0003887	0.0005972	0	0	0	0
AGRO-VET D.O.O. VELIKI POTOCEC	4.4143E-05	0.0179595	0	0.0141757	0.0003879	0.000596	0	0	0	0
VUPIK PLUS D.O.O. EKONOMIJA DUBRAVA	4.2229E-05	0.0171811	0	0.0135613	0.0003711	0.0005702	0	0	0	0
OSILOVAC D.O.O. FERICANCI	4.181E-05	0.0170102	0	0.0134265	0.0003674	0.0005645	0	0	0	0
VUPIK PLUS D.O.O. DALJ	4.0736E-05	0.0165736	0	0.0130818	0.0003579	0.00055	0	0	0	0

Emission	NOx (as NO_2)	NMVOC	SOx (as SO_2)	NH_3	$PM_{2.5}$	PM_{10}	CO	Cd	Hg	PAHs
LPS	kt	kt	kt	kt	kt	kt	kt	t	t	t
AGRO-VET D.O.O.	4.0596E-05	0.0165166	0	0.0130368	0.0003567	0.0005481	0	0	0	0
FARMA SALAS D.O.O. MARIJANCI	3.8403E-05	0.0156244	0	0.0123326	0.0003374	0.0005185	0	0	0	0
JOZIPOVIC-OBRT U POLJOPRIVREDI I TRGOVINI	3.7563E-05	0.0152826	0	0.0120628	0.0003301	0.0005072	0	0	0	0
KRNJAK D.O.O. KUCANCI	3.355E-05	0.01365	0	0.0107741	0.0002948	0.000453	0	0	0	0
JOSIP SIRJAN, MALA HRASTILNICA	3.1917E-05	0.0129855	0	0.0102497	0.0002804	0.0004309	0	0	0	0
HANA D.O.O. NASICE	3.187E-05	0.0129665	0	0.0102347	0.00028	0.0004303	0	0	0	0
STOCARSTVO RAIC, VUKOVINA	0.00018591	0.0253927	0	0.0187259	0.0004595	0.0006893	0	0	0	0
BELJE PLUS D.O.O. POLJANSKI LUG	0.00016596	0.0226674	0	0.0167161	0.0004102	0.0006153	0	0	0	0
PPK KARLOVACKA MESNA INDUSTRIJA	0.0001511	0.0206384	0	0.0152198	0.0003735	0.0005603	0	0	0	0
NOVI AGRAR D.O.O. BIJELO BRDO	0.00014586	0.0199222	0	0.0146917	0.0003605	0.0005408	0	0	0	0
MESNA INDUSTRIJA BRACA PIVAC D.O.O.	0.00014477	0.0197731	0	0.0145817	0.0003578	0.0005368	0	0	0	0
STOCARSTVO RAIC, GUDOVAC	0.00014193	0.0193852	0	0.0142956	0.0003508	0.0005262	0	0	0	0
TOTAL LPS	**7.51**	**3.63**	**5.09**	**3.44**	**0.037**	**0.744**	**7.66**	**0.036**	**0.044**	**0.038**
TORAL RH	**53.93**	**75.22**	**8.15**	**36.76**	**28.60**	**40.83**	**216.46**	**0.78**	**0.39**	**13.40**
SHARE OF LPS IN TOTAL RH	**13.92%**	**4.83%**	**62.47%**	**9.35%**	**0.13%**	**1.82%**	**3.54%**	**4.61%**	**11.15%**	**0.29%**

1.6. 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 MESD 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, filling of emission reporting templates - NFR tables for 1990 - 2019 (for 2019 in Appendix I), preparation of IIR.

The compiled national inventory is tested with the electronic RepDab-tool which check format, consistency and completeness before submitting it to UNECE/CEIP. RepDab is on-line available at the CEIP website (https://www.ceip.at/repdab). If needed, data is revised. When all formats passed all RepDab tests, then formats are submitted.

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

1.6.1. 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 National Environmental Pollution Register (EPR database) and data from the "Volatile Organic Compounds" database (HLAP database) is performed. The EPR is based on the Ordinance on the Environmental Pollution Register (OG 80/13, 87/15). According to that Ordinance the competent authorities, 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 MESD responsible for air pollutant emission inventory work, who then informs the person responsible for databases EPR and HLAP. Further, person responsible for the 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.

1.6.2. 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.

The MESD[26] is in accordance with the Air Protection Act (OG 127/19) and the Regulation on NEC the competent authority competent authority for ensuring the preparation of national inventories, annual emission inventories, emission projections, spatially disaggregated inventories, large point sources inventories, if appropriate adjusted emission inventories, and informative inventory reports, carried out by authorized company in accordance with the law governing environmental protection.

EKONERG - Energy Research and Environmental Protection Institute Ltd. from Zagreb is under the Public Procurement Contract for the provision of service "Fulfilment of obligations of the Republic of Croatia according to the requirements of CLRTAP and NEC directive: Preparation of total national emissions - NFR, Emissions from large point sources and Informative Inventory Report for 2021", record number: 800/02-19/36JN, for the MESD[27], authorized company and responsible executor for the preparation of IIR2021 and NFR reporting formats (1990-2019).

In the view of the aforementioned, it follows that MESD and EKONERG Ltd. are responsible for carry out quality assurance and quality control of activity data, calculated emissions and the prepared annual report before electronic submission to EMEP/CEIP or alternatively to EIONET.

In accordance with the NEC Regulation, data providers are responsible for the information they submit to the MESD.

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 (e.g. Environmental Pollution Register, direct communication with operators). Application of quality control procedures have resulted in recalculations of emissions which is presented in Chapter 8.

In the framework of the CLRTAP and NECD a review and check in detail the inventories of each Party (so-called "*Stage 3 in depth reviews*") has been initiated since 2008, in accordance

[26] Ministry of the Environment and Energy, pursuant to Article 73, paragraph 3 of the Law on Amendments to the Environmental Protection Act (OG 118/18 of December 27, 2018) and deletion of the Croatian Agency for Environment and Nature (CAEN) from the court register (January 17, 2019) assumed the Agency's employees, jobs, rights and obligations, as well as assets, equipment, records and other documentation.

[27] Contracting authority in the procurement process, responsible for the annual preparation and submission of the annual IIR and NFR tables to the UNECE-LRTAP Convention and the European Commission.

with the model established under the 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 2020 -2021 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 (2020 -2021)

2021	Bosnia and Herzegovina, Kazakhstan, Liechtenstein, Monaco and Montenegro. - Bosnia and Herzegovina did not provide any emission data to EMEP/CEIP yet.
2020	European Union, North Macedonia, Iceland, Kyrgyzstan, Switzerland. Kazakhstan, Liechtenstein and Monaco did not submit data on time, review postponed to 2021.

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

The first comprehensive technical review of National Emission Inventories for EU member states, pursuant new NECD (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 NECD 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 CLRTAP and the EU Greenhouse Gas Monitoring Mechanism (MMR)/UNFCCC.

1.7. 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 2019, and on uncertainties for activity rates and emission factors for NFR sectors. Estimated emissions for 1990 and 2019, the uncertainty introduced into the trend 1990-2019, and the uncertainty in total national emissions 2019 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.

1.7.1. 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)[28]. 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 2019 are equal.

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

The Guidebook recommends that inputs (direct emissions[29], 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.

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

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

1.7.2. 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).

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 GB2019
1B1, 1B2ai	10	Expert judgment in combination with comparisons with other datasets and other countries
1B2aiv, 1B2av, 1B2b,1B2c	3	Facilities - specific data in combination with Tier 2 methodology from GB2019
2A1, 2A2, 2A3	3	Facilities - specific data in comparison with national statistical data
2A5a, 2A5b	5	National data and comparison with other datasets and other countries
2B1, 2B2	3	Facilities - specific 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 specific data in comparison with national statistical data

NFR SECTOR AGGREGATION	%	DATA SOURCE
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 GB2019
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 - specific data in combination with Tier 2 methodology from GB2019
3Df	3	National statistical sale data
3F	50	The default values are combined with national statistics
5A, 5B1, 5C	5	National data from the EPR and Waste Management Information System under MESD
5D1, 5D2	30	National statistical data from Statistical Reports and Releases and from Census 1981, Census 1991, Census 2001 and Census 2011 (in combination with extrapolation method) under CBS
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	20	20	20	20	100	100	100	100	400	400	400
1.A.3.a, c, d	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
3.D.f	-	-	-	-	-	-	-	-	-	30	-
3.F	50	50	50	17	25	25	25	25	100	100	50
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	400	400	400	400	400	400	400	400	400	400	400
1.A.3.a, c, d	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
3.D.f	-	-	-	-	-	-	-	-	-	-	-
3.F	100	100	100	100	100	100	100	100	100	100	-
5.D.1	400	400	400	400	400	400	400	400	400	400	400

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	78.0	78.0	78.0	78.0
1.A.4.b.i	76.0	76.0	76.0	76.0
1.A.4.b.ii	50.0*	50.0*	50.0*	50.0
1.A.4.c.i	39.0	39.0	39.0	39.0
1.A.4.c.ii	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

1.7.3. Results of Tier 1 uncertainty evaluation

Table 1.7.3-1 shows a summary of the uncertainty evaluation of Croatia total emissions 2019 and the trend uncertainties 1990-2019 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 2019

Pollutant	Total emission in 2019	Unit	Emission uncertainty %	Trend %	Trend uncertainty %
SO_2	8.15	kt	14.39	-95.16%	0.66
NOx	53.93	kt	19.47	-51.54%	3.34
NMVOC	75.22	kt	18.72	-55.82%	4.71
CO	216.46	kt	37.24	-60.49%	7.98
TSP	72.47	kt	37.20	11.57%	33.85
PM_{10}	40.83	kt	43.42	-19.10%	10.78
$PM_{2.5}$	28.60	kt	58.10	-26.22%	4.62
BC	3.71	kt	56.42	-31.77%	6.39
PAH	13.40	kt	373.97	-38.82%	26.64
HCB	0.60	kg	141.22	-91.49%	10.97
PCDD/PCDF	27.01	g I-TEQ	325.44	-45.13%	30.01
NH_3	36.76	kt	92.99	-34.63%	15.26
As	0.59	kt	205.84	-93.13%	27.80
Cd	0.78	kt	287.29	-30.95%	79.91
Cr	1.91	kt	212.50	-63.76%	56.58
Cu	10.07	kt	161.59	38.25%	64.63
Hg	0.39	kt	80.12	-65.49%	87.11
Ni	2.79	kt	84.44	-83.57%	11.01
Pb	5.17	kt	146.01	-99.00%	1.95

Pollutant	Total emission in 2019	Unit	Emission uncertainty	Trend	Trend uncertainty
			%	%	%
Se	0.36	kt	252.61	-18.84%	45.11
Zn	30.31	kt	288.85	-17.20%	39.40
PCBs	409.75	kg	399.94	-15.13%	59.55

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 2019 varies between [53,93*(1-p/100), 53,93*(1+p/100)], where "p" is emission uncertainty (19,47%). With the same approach the 95% probability range for trend is between [-51,54%-t, -51,54%+t], where "t" is trend uncertainty (3,34%).

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 GB2019. 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 GB2019 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.

1.8. 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

Notation key	Meaning	Purpose
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

1.8.1. 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 GB2019
1.A.1.c	PCB, HCB	FEs are not available in GB2019
1.A.2.g.vii	PCB, HCB, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, PCDD/PCDF, Hg, As	FEs are not available in GB2019
1.A.3.b.v	PCDD/PCDF, PCB	FEs are not available in GB2019, neither in COPERT 5 model
1.A.3.b.vi	PCDD/PCDF, PAUs, PCBs	FEs are not available in GB2019, neither in COPERT 5 model
1.A.3.b.vii	BC, PCDD/PCDF, PAHs, PCBs	FEs are not available in GB2019, neither in COPERT 5 model
1.A.3.d.ii	benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene	FEs are not available in GB2019
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 GB2019
1.A.4.c.i	HCB, PCBs	FEs are not available in GB2019
1.B.2.a.i	SO_2, PCDD/PCDF	FEs are not available in GB2019
1.B.2.c	NH3, PCDD/PCDF	FEs are not available in GB2019
2.B.1	SO_2, $PM_{2.5}$	FEs are not available in GB2019
2.B.2	NH_3, $PM_{2.5}$	FEs are not available in GB2019
2.C.3	HCB	FEs are not available in GB2019
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 GB2019
3.D.b	All relevant	There is no methodology.
3.D.d	All relevant	There is no methodology.
3.F	HCB, PCB	FEs are not available in GB2019
5.A	NH_3, CO, Hg	FEs are not available in GB2019
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 GB2019
5.C.1.b.i	NH_3, Se	FEs are not available in GB2019
5.C.1.b.iii	NH_3, PM_{10}, $PM_{2.5}$, Se, Zn	FEs are not available in GB2019
5.C.1.b.v	BC	FEs are not available in GB2019
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 GB2019
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 GB2019
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 GB2019

1.8.2. 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	
1A2gviii	All relevant	1.A.2.f	1990 - 2019
1.A.3.d.i.(ii)	All relevant	1.A.3.d.i(i)	1990 - 2019
1.A.4.a.ii	All relevant	1.A.4.b.ii and 1.A.4.c.ii	1990 - 2019

NFR14 code	Substance(s)	Included in NFR code	
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 - 2019
1.A.5.a	All relevant	1.A.4.a.i	1990 - 2019
1.A.5.b	All relevant	1.A.3.a, 1.A.3.b (i-iv), 1.A.3.d	1990 - 2019
2.A.1	All relevant for fuel combustion except for PMs	1.A.2.f	1990 - 2019
2.A.2	All relevant for fuel combustion except for PMs	1.A.2.f	1990 - 2019
2.A.3	All relevant for fuel combustion except for PMs	1.A.2.f	1990 - 2019
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 - 2019
2.B.10.b	TSP, PM_{10}, $PM_{2.5}$	2.B.10.a	1990 - 2019
2.C.1	NH_3	1.A.2.f	1990 - 2000
		1.A.2.a	2001 - 2019
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 - 2019
3.D.a	NOx, NH_3, and other relevant	3.B source categories	1990 – 2019
3.D.b	PMs	3.D.a.1	1990 – 2019
3.D.c	PMs	3.B source categories, 3.D.a.1	1990 – 2019
3.D.e	PMs	3.D.a.1	1990 – 2019
5.B.2	All relevant for fuel combustion	1.A.1, 1.A.4	2009 – 2019
5.C.1.b.i	All relevant for fuel combustion	1.A.2.f	2009 – 2019
5.C.1.b.ii	All relevant	5.C.1.b.i	1997 – 2002

1.8.3. 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.5.a	All relevant	(C) - military, (IE) Combustion in commercial and institutional plants (NFR 1 A 4 a and SNAP 020100)	1990 - 2019
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 - 2019
1.B.1.c	NO	-	1990 - 2019
1.B.3	NO	-	1990 - 2019
2.B.10.a	NOx, CO, NMVOC, SO_2, NH_3, PM_{10}, TSP, $PM_{2.5}$	Processes in inorganic chemical industry - production of: sulphuric 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: sulphuric 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	1991

NFR14 code	Substance(s) reported	Sub-source description	
		(SNAP 040508), Polystyrene (SNAP 040511) and Ethyl benzene (SNAP 040518)	
		Processes in inorganic chemical industry - production of: sulphuric 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: sulphuric 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: sulphuric 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)	1994 and 1997 - 2000
		Processes in inorganic chemical industry - production of: sulphuric 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: sulphuric 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

NFR14 code	Substance(s) reported	Sub-source description	
		Processes in inorganic chemical industry - production of: sulphuric acid (SNAP 040401), NPK fertilizers (SNAP 040407), urea (SNAP 040408), and processes in organic chemical industry - production of: Formaldehyde (SNAP 040517)	2012 – 2019
2.C.7.c	NO	-	1990 - 2019
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 - 2019
2.H.3	NO	-	1990 - 2019
2.G	NMVOC	Use of pesticide, including fungicide	1990 – 2019
3.D.a.2.c	NO	-	1990 - 2019
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 - 2019

2. Explanation of key trends

This chapter presents an explanation of key trends with a line chart for the pollutant trend, a pie chart for the percentage of aggregated NFR categories in 1990 and 2019, a bar chart for the variation of aggregate NFR categories and a tabular overview of aggregate emissions for each pollutant on SNAP level (01-10) for the period 1990-2019.

The considered NFR categories aggregated by emission are as follows:

- 1.A.1 Energy industries,
- 1.A.2 Industry and construction,
- 1.A.3.b Road transport,
- 1.A.3.a, c, d Non-road transport (LTO air, rail and domestic maritime)
- 1.A.4 Small combustion plants and Non-road mobile sources and machines,
- 1B Fugitive emissions,
- 2 Industrial processes and product use,
- 3 Agriculture
- 5 Waste.

Trends of all pollutants within the inventory of air pollutants in Croatia, as well as the acidification index, are considered, and are presented in Chapters 2.1 - 2.9. A description of time series inconsistencies is given if such exist in trend. Explain significant changes in the time trend for key categories (i.e. dips and jumps) and explain constant / permanent reductions or increases in emissions. The changes are mainly the result of changes in the activity / reduction / source process (e.g. shutdown or start-up of the plant) or in a specific situation in the country and world (e.g. the 1991-1995 war for Croatian independence, the world economic crisis, etc.). If the reason for the trend fluctuation is the result of different methods or source data used for different years, this is explained in Chapters 3 - 7 where sectoral methodologies are explained.

Before explaining the trends, the following is a summary of significant and minor improvements and other changes made to the inventory of air pollutants in Croatia that have affected the trends.

Methodology improvement (move to higher tier, more complete activity data), harmonization of so far used EFs with new propose ones in the EMEP/EEA guidebook, harmonization of activity data 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 3 - 7 in the part *Recalculations and other changes* and in the Chapter 8.

Significant changes in emission trends in this year's inventory are the result of recalculations in the following categories:

- for 1.A.3.b.v.i. PAHs emissions were calculated for the whole period 1990-2018 as recommended by the expert review team
- for NFR 1.A.3.d Navigation (shipping) for the entire period 1990 – 2018 Tier 2 EF's for small recreational boats (Table 3-5, GB 2019) were used to calculate emissions from total amount of marine diesel oil / gas oil. This error is corrected and Tier 1 EF's (Table 3-2, GB 2019) are now in use, which led to significant increase of NOx emissions from this source category.

- for NFR 2.D.3.b Road paving with asphalt, Croatia moved to a higher tier (Tier 2, GB2019) and revised all activity data. This improvement had a significant effect on the increase of NMVOC, TSP, PM and BC emissions for the whole time-series (see sub-chapter 4.4 for details).
- for NFR 3.B Manure management due to the harmonization of N exrection rate (Nex) in this Report with the Nex values from CRF, emissions were recalculated for the entire period 1990 – 2018, which led to an increase of NH3 and NOx emissions from this sector.
- for NFR 3.F Field burning of agricultural residues, emissions of all relevant pollutants were recalculated for the entire period 1990 – 2018 due to an error in activity data, which led to significant increase of emissions from this source category.
- 5.D.1 and 5.D.2 - allocation of wastewater from residential/commercial sectors from category 5.D.2 to category 5.D.1 has been performed. Accordingly, recalculations of NMVOC emissions for category 5.D.1 and category 5.D.2 were performed for the period 1990 - 2018.

2.1. Sulphur dioxide (SO_2)

The total sulphur dioxide (SO_2) emission in 2019 was amounted to 8.2 kt that is 18.7 % lower than in 2018 (Table 3.1-1). Moreover, the SO_2 emission in 2019 was decrease by 95.2 % compared with 1990 (Figure 2.1-1).

Of the total SO_2 emission in 2019, 97.7% is generated from Energy sector, from Energy Industries 24.7 %, Manufacturing industry and construction 32.7%, Fugitive emissions from fuels 30 % and Small combustion (stationary and mobile) 9.8 %.

Since 1990, emissions from the Energy Industries have declined by 98 %, from the Manufacturing industry and construction by 92.4 % and from Small combustion by 95.7 % while emission from sector Fugitive emissions from fuels increased by 1.2 %. Sulphur emissions from industrial processes and product use sector, have also decreased, by 83.3 % 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. In addition, 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 2019 was lower than the commitment quota of 70 kt (Figure 2.1-1).

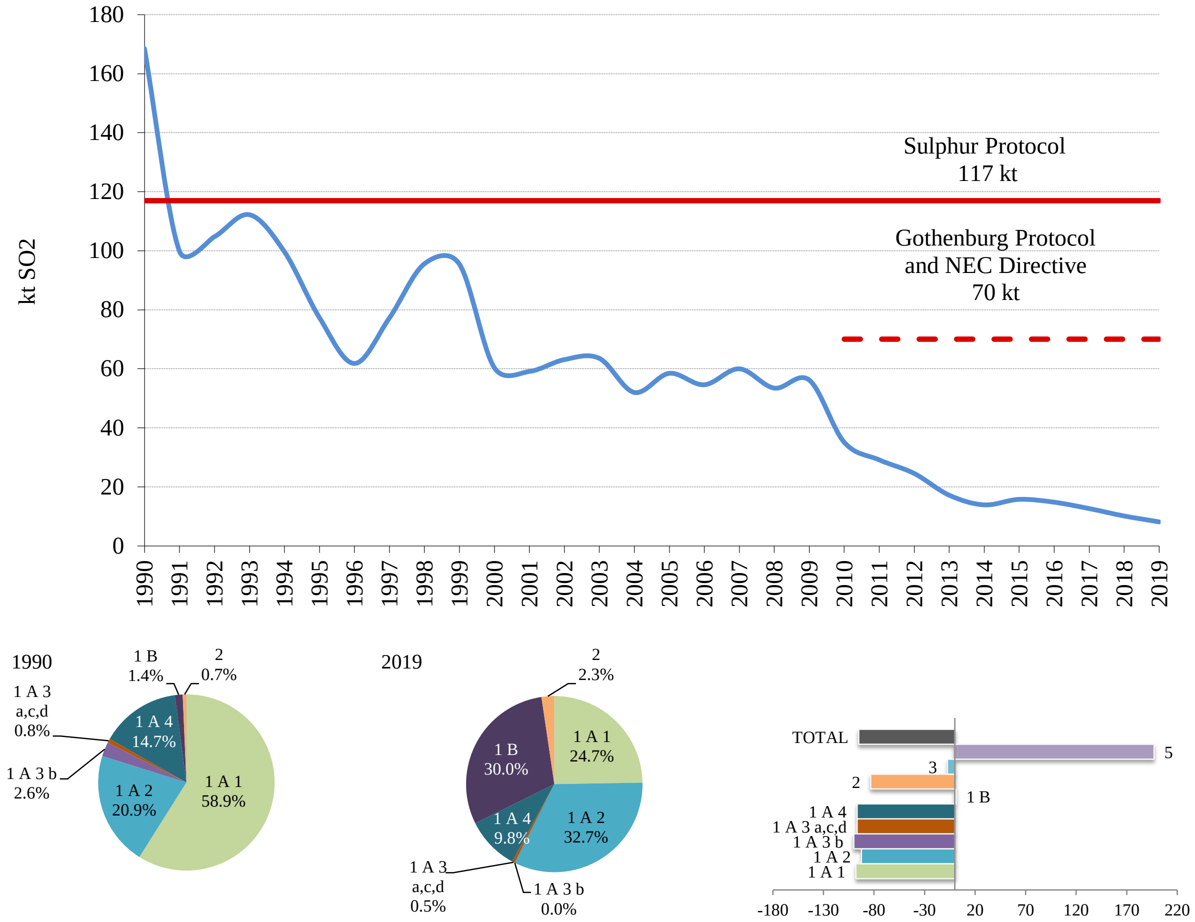


Figure 2.1-1 The SO_2 emissions (kt/yr.) and percentage share by sector and variation in SO_2 emissions

Table 2.1-1 The SO_2 emissions by SNAP nomenclature in the period 1990-2019

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	33.9	2.9	NA	NA	4.4	4.7	0.61	8.25E-04	168.5
1991	59.9	13.3	18.2	2.0	NA	NA	3.0	3.1	0.40	8.70E-04	99.9
1992	73.3	7.7	15.2	1.6	NA	NA	4.4	2.1	0.35	4.57E-04	104.8
1993	75.1	10.1	17.5	1.8	NA	NA	4.8	2.5	0.44	5.73E-04	112.2
1994	66.4	7.4	18.1	1.8	NA	NA	3.6	2.0	0.45	5.37E-04	99.7
1995	53.2	4.6	12.7	1.9	NA	NA	2.9	1.6	0.48	5.71E-04	77.4
1996	39.2	4.3	8.6	1.6	NA	NA	5.1	2.6	0.46	5.59E-04	61.8
1997	52.9	6.1	10.1	1.9	NA	NA	4.1	1.8	0.46	6.41E-04	77.2
1998	69.2	4.9	12.4	2.5	NA	NA	4.1	2.0	0.45	6.79E-04	95.6
1999	69.5	6.5	9.6	2.8	NA	NA	4.6	2.0	0.49	6.02E-04	95.5
2000	32.9	6.2	9.2	3.9	NA	NA	5.1	2.7	0.46	5.04E-04	60.4
2001	33.6	5.2	10.5	3.4	NA	NA	3.8	2.2	0.43	6.01E-04	59.1
2002	33.5	7.0	11.7	3.6	NA	NA	4.3	2.7	0.43	6.60E-04	63.1
2003	35.3	6.5	9.5	3.4	NA	NA	5.6	2.9	0.44	4.31E-04	63.6
2004	25.3	5.9	9.0	3.8	NA	NA	5.0	2.6	0.46	6.45E-04	52.0
2005	32.5	5.7	9.5	3.8	NA	NA	4.1	2.5	0.44	6.27E-04	58.5
2006	29.3	4.9	9.8	3.4	NA	NA	4.1	2.7	0.42	6.68E-04	54.6
2007	38.3	3.7	8.5	4.0	NA	NA	3.0	2.0	0.46	5.49E-04	60.0
2008	32.0	3.4	8.1	3.6	NA	NA	2.7	3.3	0.39	7.66E-04	53.5
2009	36.7	3.8	6.5	3.5	NA	NA	2.3	3.0	0.43	7.24E-04	56.2
2010	19.7	3.6	5.6	2.3	NA	NA	1.8	1.7	0.38	6.36E-04	35.1

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
2011	17.2	3.1	3.8	3.5	NA	NA	0.5	0.8	0.31	6.14E-04	29.2
2012	13.9	2.9	3.4	3.7	NA	NA	0.0	0.4	0.26	5.87E-04	24.6
2013	8.9	1.5	3.0	3.3	NA	NA	0.0	0.2	0.27	6.74E-04	17.2
2014	6.1	1.1	2.8	3.6	NA	NA	0.0	0.1	0.22	6.18E-04	13.9
2015	7.8	1.1	3.0	3.5	NA	NA	0.0	0.1	0.27	6.22E-04	15.8
2016	6.2	1.1	3.0	4.2	NA	NA	0.0	0.1	0.29	7.85E-04	14.8
2017	4.3	1.0	2.3	4.6	NA	NA	0.0	0.0	0.32	5.96E-04	12.7
2018	2.6	0.8	2.2	4.2	NA	NA	0.0	0.0	0.33	7.12E-04	10.2
2019	2.0	0.8	2.7	2.4	NA	NA	0.0	0.0	0.24	7.65E-04	8.2
2019 vs 1990	-98.0%	-96.5%	-92.1%	-18.5%	NA	NA	-100.0%	-99.0%	-60.4%	-7.4%	-95.2%
2019 vs 2018	-21.3%	-4.8%	21.9%	-43.0%	NA	NA	-100.0%	141.4%	-26.6%	7.3%	-19.7%

2.2. 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 2019 amounted to 53.9 kt, which is a decline by 51.5 % since 1990 and remained at the same level compared to 2018 (Table 2.2-1). Emissions from the energy sector in 2019 were about 44.8 kt and account for about 84.9 % of the total NOx emission. The main source in the energy sector in 2019 was Road transport with a contribution of 43% to total NOx emissions.

In relation to the 1990 the NOx emission from Road transport sector has declined by 37.9%, 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 71 %, 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 31.4% in the 1990s, mainly due to the decrease in the use of N-fertilizers in crop production. In addition, 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 that still exists in Croatia (Figure 2.2-1).

The NOx emission in 2019 was lower than the commitment quota of 87 kt (Figure 2.2-1).

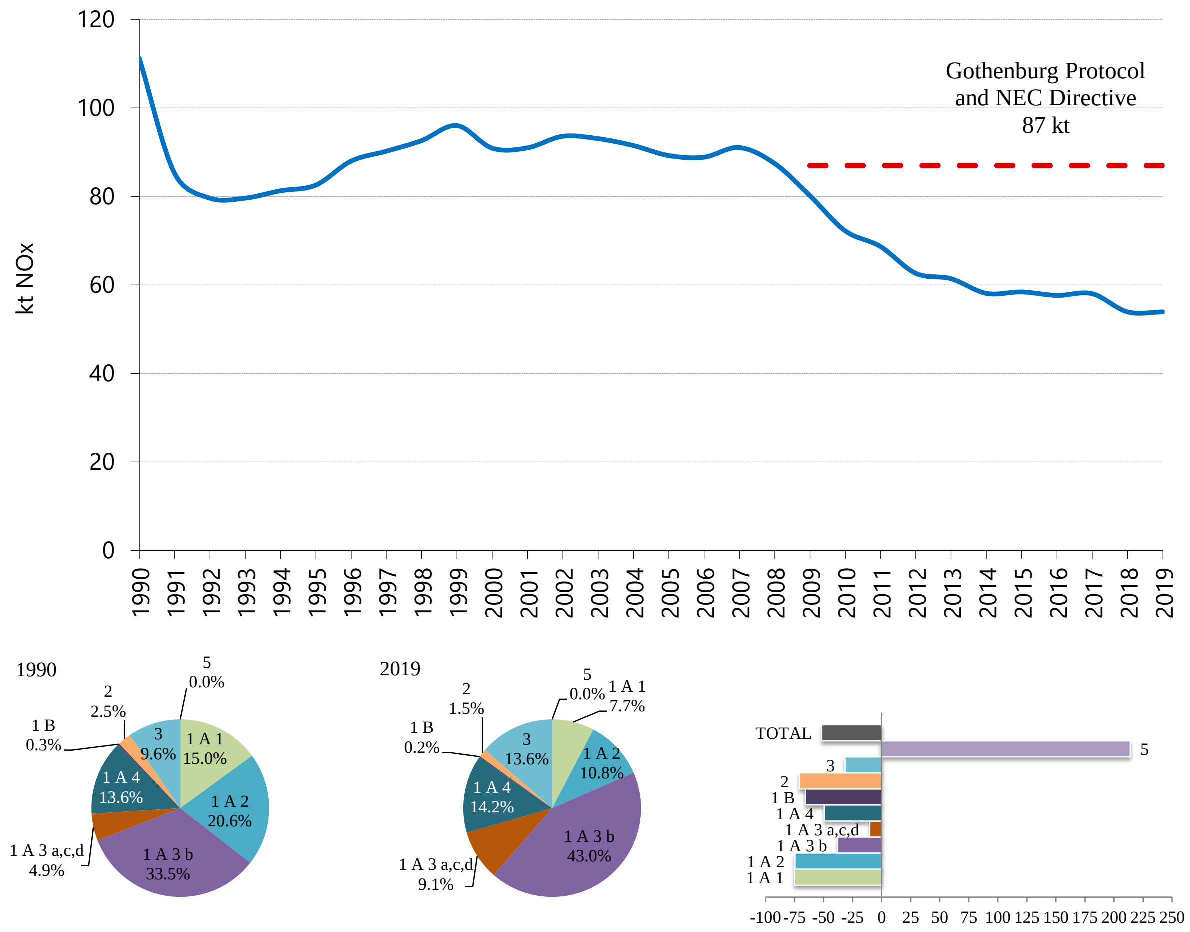


Figure 2.2-1 The NO_X emissions (kt/yr.) and percentage share by sector and variation in NO_X emissions

Table 2.2-1 The NO_X emissions by SNAP nomenclature in the period 1990-2019

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	7.4	18.3	3.0	NA	2.19E-02	37.3	17.9	7.2E-02	10.7	111.3
1991	12.1	6.6	12.9	2.6	NA	2.04E-02	26.9	13.6	5.6E-02	10.5	85.3
1992	14.4	6.6	11.5	2.9	NA	2.26E-02	25.7	9.3	4.8E-02	9.1	79.6
1993	14.9	7.1	10.9	2.5	NA	2.05E-02	27.8	8.2	5.7E-02	8.2	79.7
1994	12.9	6.1	11.3	2.6	NA	8.93E-03	29.9	10.4	5.4E-02	8.1	81.3
1995	15.0	6.7	10.8	2.8	NA	2.16E-02	29.4	10.1	5.9E-02	7.7	82.6
1996	14.7	7.9	11.0	2.6	NA	2.09E-02	32.1	11.9	5.4E-02	7.6	88.0
1997	14.4	7.6	11.8	2.7	NA	2.06E-02	34.4	11.0	5.6E-02	8.2	90.2
1998	17.0	6.7	12.0	2.4	NA	2.18E-02	34.3	12.7	5.7E-02	7.3	92.6
1999	18.2	7.6	11.4	2.7	NA	2.52E-02	35.6	12.6	6.3E-02	7.9	96.0
2000	13.1	6.7	11.0	2.9	NA	2.45E-02	34.3	14.7	6.2E-02	8.1	90.9
2001	12.7	6.8	12.2	2.3	NA	3.22E-02	32.9	15.5	6.2E-02	8.5	91.0
2002	14.3	6.9	12.0	2.4	NA	3.52E-02	34.5	15.0	5.8E-02	8.4	93.6
2003	13.2	7.6	11.1	2.6	NA	3.73E-02	34.7	15.4	5.9E-02	8.3	93.1
2004	10.8	7.3	12.5	3.0	NA	2.73E-02	34.4	14.4	5.7E-02	9.0	91.5
2005	11.4	7.4	12.5	2.6	NA	2.71E-02	31.5	14.9	5.7E-02	8.9	89.2
2006	10.5	6.8	13.1	2.5	NA	2.65E-02	31.8	15.2	6.0E-02	9.0	88.9
2007	12.6	6.2	14.1	2.7	NA	2.67E-02	31.5	15.0	6.6E-02	8.8	91.1
2008	10.8	6.4	13.0	2.6	NA	2.80E-02	28.7	16.4	6.1E-02	9.5	87.5
2009	10.5	6.5	11.8	1.6	NA	2.05E-02	27.7	14.5	6.2E-02	7.5	80.2

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
2010	8.5	6.8	8.1	1.8	NA	2.39E-02	26.4	12.6	3.5E-02	7.9	72.3
2011	9.0	6.5	6.8	1.3	NA	2.10E-02	25.0	11.9	4.3E-02	8.2	68.7
2012	7.9	6.1	6.9	1.2	NA	2.01E-02	22.0	10.7	4.3E-02	7.8	62.6
2013	7.9	5.9	5.8	1.1	NA	1.77E-02	23.5	10.3	4.1E-02	6.8	61.4
2014	7.3	5.2	5.6	1.2	NA	1.53E-02	22.2	9.9	4.7E-02	6.7	58.1
2015	7.2	5.9	5.2	1.2	NA	1.49E-02	22.6	9.1	5.1E-02	7.1	58.4
2016	7.2	5.9	5.2	1.1	NA	1.50E-02	22.6	8.8	5.7E-02	6.8	57.7
2017	5.5	5.9	4.5	1.3	NA	1.67E-02	24.7	8.6	3.9E-02	7.5	58.0
2018	4.3	5.7	4.4	1.0	NA	2.21E-02	22.5	8.6	5.0E-02	7.3	53.9
2019	4.1	5.4	4.5	0.9	NA	2.17E-02	23.2	8.4	3.9E-02	7.3	53.9
2019 vs 1990	-75.1%	-26.6%	-75.2%	-71.4%	NA	-1.0%	-37.9%	-52.9%	-45.2%	-31.4%	-51.5%
2019 vs 2018	-4.3%	-4.5%	2.1%	-17.2%	NA	-1.7%	2.8%	-1.5%	-21.7%	0.5%	0.0%

2.3. 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 often-inefficient conversion of feed nitrogen into animal product (N rich meat, milk or eggs).

The NH_3 emission in 2019 amounted to 36.8 kt. Emission has decrease by 34.6 % since 1990 and by 5.3 % since year before (Table 3.3-1). About 86 % of NH_3 emissions in Croatia in 2019 originate from the Agriculture sector. Sectors with a smaller share in NH_3 total emissions in 2018 were the Industrial processes sector (about 4.4 %) with emission domination from production of ammonia, nitric acid and mineral N-fertilizers; the Small combustion sector and mobile machinery (6.6 %) with dominance of emission from Residential; Waste sector (1.6 %) with dominance of emissions from Latrines and Road transport (1 %).

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 combustion and Waste. The decrease in the Agricultural sector is 34.9 % as a result of the continuous decrease in the number of animals for most types and more recently the introduction of farm-based emission reduction technologies (see Tables 5.1-4 and 5.1-5). Decrease in the sector Industrial processes and product use is 54.5 % 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 5.9 times compared to 1990 was recorded in the Road transport as a result of the introduction of a three-way catalytic control system in diesel vehicles (Euro 5 and 6) using selective catalytic reduction (SCR) with urea injection into the exhaust intended to control NOx emissions, which is converted to NH_3.

The ammonia emission in 2019 (Figure 2.3-1) was above the quota value of 30 kt.

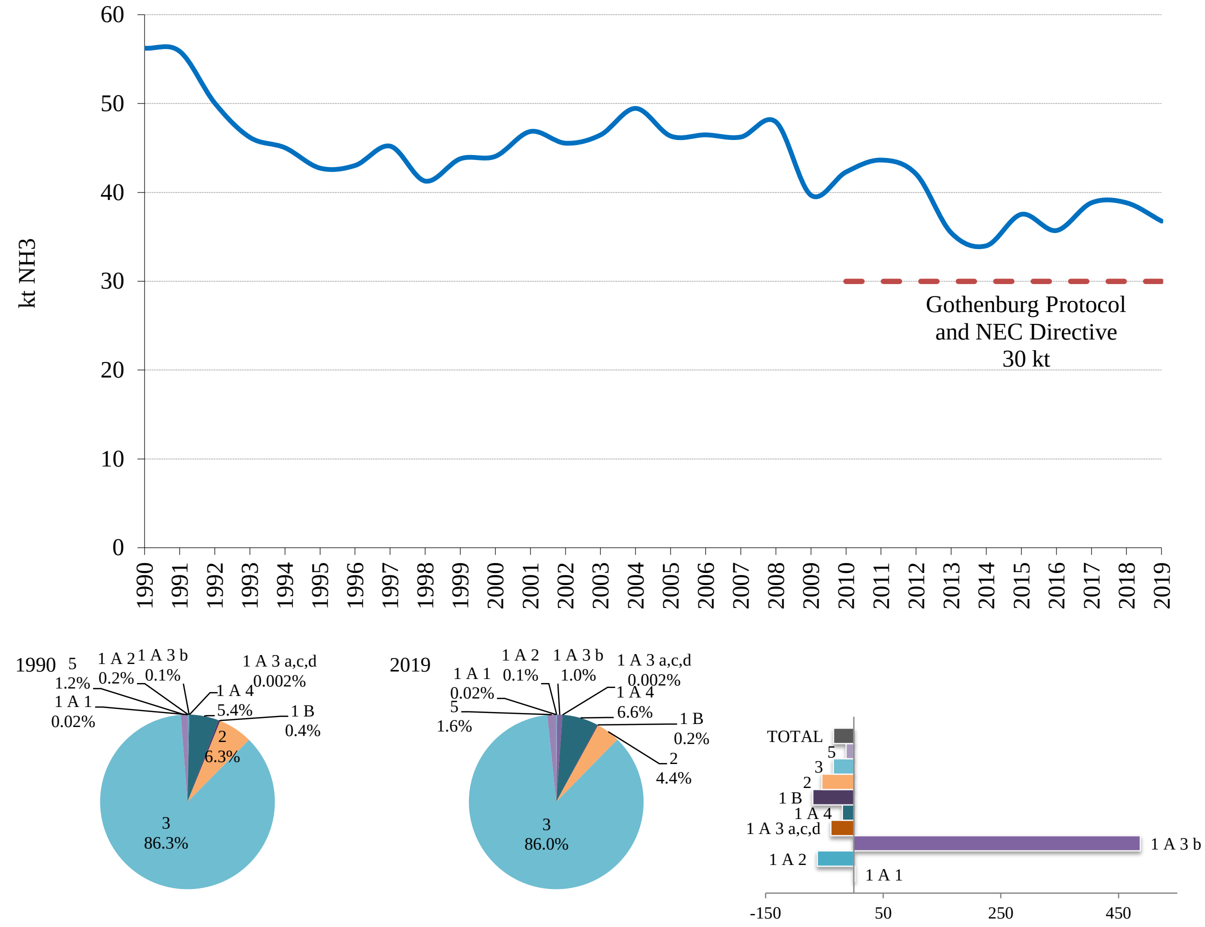


Figure 2.3-1 The NH_3 emissions (kt/yr.) and percentage share by sector and variation in NH_3 emissions

Table 2.3-1 The NH_3 emission by SNAP nomenclature in the period 1990-2019

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	3.02	0.13	3.71	NA	5.0E-02	0.06	3.5E-03	0.69	48.5	56.2
1991	5.4E-03	3.59	0.13	3.63	NA	4.7E-02	0.04	2.5E-03	0.69	47.7	55.9
1992	6.3E-03	3.13	0.11	4.61	NA	5.2E-02	0.04	1.4E-03	0.69	41.4	50.0
1993	9.0E-03	3.30	0.11	3.26	NA	4.7E-02	0.04	1.7E-03	0.69	38.7	46.2
1994	5.5E-03	2.99	0.08	3.62	NA	2.0E-02	0.05	1.8E-03	0.68	37.6	45.0
1995	4.0E-03	3.16	0.09	3.68	NA	4.9E-02	0.06	1.7E-03	0.68	35.0	42.7
1996	4.8E-03	3.53	0.09	3.65	NA	4.7E-02	0.09	1.8E-03	0.67	34.9	43.0
1997	7.0E-03	3.24	0.12	3.71	NA	4.6E-02	0.15	1.7E-03	0.67	37.3	45.2
1998	6.6E-03	3.25	0.11	4.16	NA	5.0E-02	0.23	2.0E-03	0.66	32.8	41.3
1999	6.4E-03	3.19	0.08	3.05	NA	5.7E-02	0.30	2.4E-03	0.66	36.4	43.8
2000	1.0E-02	2.84	0.09	3.57	NA	5.6E-02	0.33	2.4E-03	0.66	36.5	44.1
2001	9.4E-03	3.13	0.07	2.77	NA	7.3E-02	0.30	2.6E-03	0.65	39.8	46.9
2002	1.2E-02	2.99	0.08	2.92	NA	7.6E-02	0.34	2.5E-03	0.65	38.5	45.5
2003	1.1E-02	3.44	0.09	3.61	NA	7.9E-02	0.36	3.0E-03	0.65	38.2	46.5
2004	1.1E-02	3.36	0.10	4.60	NA	5.9E-02	0.36	2.9E-03	0.64	40.3	49.5
2005	1.1E-02	3.55	0.08	3.79	NA	6.1E-02	0.38	3.1E-03	0.64	37.8	46.3
2006	1.0E-02	3.22	0.10	2.57	NA	6.0E-02	0.41	3.3E-03	0.64	39.5	46.5
2007	1.2E-02	3.06	0.09	2.74	NA	6.1E-02	0.54	3.4E-03	0.64	39.1	46.2
2008	1.2E-02	3.02	0.08	2.18	NA	6.4E-02	0.51	3.8E-03	0.63	41.4	47.9
2009	9.5E-03	3.11	0.09	1.70	NA	4.7E-02	0.53	3.4E-03	0.63	33.6	39.7

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	3.29	0.09	2.63	NA	5.5E-02	0.51	3.1E-03	0.63	35.1	42.3
2011	1.3E-02	3.16	0.08	2.63	NA	4.8E-02	0.49	3.0E-03	0.62	36.6	43.6
2012	1.1E-02	3.10	0.09	2.82	NA	4.6E-02	0.48	2.8E-03	0.62	34.9	42.1
2013	1.1E-02	3.03	0.08	1.95	NA	4.0E-02	0.47	2.7E-03	0.62	29.2	35.4
2014	1.0E-02	2.63	0.06	1.58	NA	3.5E-02	0.43	2.7E-03	0.62	28.6	34.0
2015	1.0E-02	2.96	0.05	2.58	NA	3.4E-02	0.43	2.6E-03	0.62	30.8	37.5
2016	1.1E-02	2.83	0.03	2.27	NA	3.4E-02	0.43	2.6E-03	0.61	29.5	35.7
2017	9.1E-03	2.69	0.05	2.56	NA	3.8E-02	0.41	2.7E-03	0.61	32.5	38.8
2018	8.0E-03	2.54	0.05	2.85	NA	5.0E-02	0.39	2.8E-03	0.61	32.3	38.8
2019	9.1E-03	2.44	0.05	1.63	NA	4.9E-02	0.36	2.8E-03	0.60	31.6	36.8
2019 vs 1990	1.8%	-19.5%	-62.5%	-56.1%	NA	-2.2%	487.0%	-18.9%	-13.2%	-34.9%	-34.6%
2019 vs 2018	13.1%	-4.0%	-5.2%	-42.8%	NA	-1.8%	-6.4%	2.6%	-0.5%	-2.2%	-5.3%

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 met the requirements of the GP under the LRTAP Convention.

This year's inventory includes technical measures for the reduction of ammonia emissions that are being implemented on Croatian farms with regard to pigs (sows, fatteners), poultry (broilers, turkeys, and laying hens) and dairy and other cattle. The remain plan is to implement activities based on the guidelines given for reducing NH_3 emissions from mineral fertilizers based on urea: 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. It is also necessary to implement the measures (MAG-7) set out in the Croatian Air Pollution Control Programme for the period from 2020 to 2029 (OG 90/19): improved livestock management, improved manure management systems, reduction of mineral fertilizers and manure on agricultural land and education.

2.4. 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 22 % in 1990 to 32.6% in 2019 and for NH_3 from 30.1% in 1990 to 60.3 % in 2019 (Table 2.4-1). In addition, their absolute emissions are slightly decreased during the observed period (Figure 2.4-1). This is mainly due to the significant decrease of SO_2 emission during the same period (from 48 % in 1990 to 7.1 % in 2019). 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 2.4-1 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	48.0	22.0	30.1	11.0
1991	37.8	22.4	39.8	8.3
1992	41.3	21.7	37.0	7.9
1993	44.1	21.7	34.1	8.0
1994	41.4	23.4	35.2	7.5
1995	36.0	26.6	37.4	6.7
1996	30.4	29.9	39.7	6.4
1997	34.4	27.8	37.8	7.0
1998	40.3	27.1	32.7	7.4
1999	39.1	27.2	33.7	7.6
2000	29.3	30.6	40.1	6.5
2001	28.1	30.0	41.9	6.6
2002	29.6	30.4	40.1	6.7
2003	29.5	30.0	40.5	6.7
2004	25.0	30.4	44.6	6.5
2005	28.2	29.8	42.0	6.5
2006	26.8	30.3	42.9	6.4
2007	28.6	30.1	41.4	6.6
2008	26.2	29.7	44.1	6.4
2009	30.2	29.8	40.0	5.8
2010	21.3	30.4	48.2	5.2
2011	18.4	30.0	51.6	5.0
2012	16.7	29.5	53.7	4.6
2013	13.6	33.7	52.7	4.0
2014	11.8	34.1	54.1	3.7
2015	12.4	32.0	55.6	4.0
2016	12.2	32.8	55.0	3.8
2017	10.1	32.0	58.0	3.9
2018	8.4	31.0	60.5	3.8
2019	7.1	32.6	60.3	3.6

(*) 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

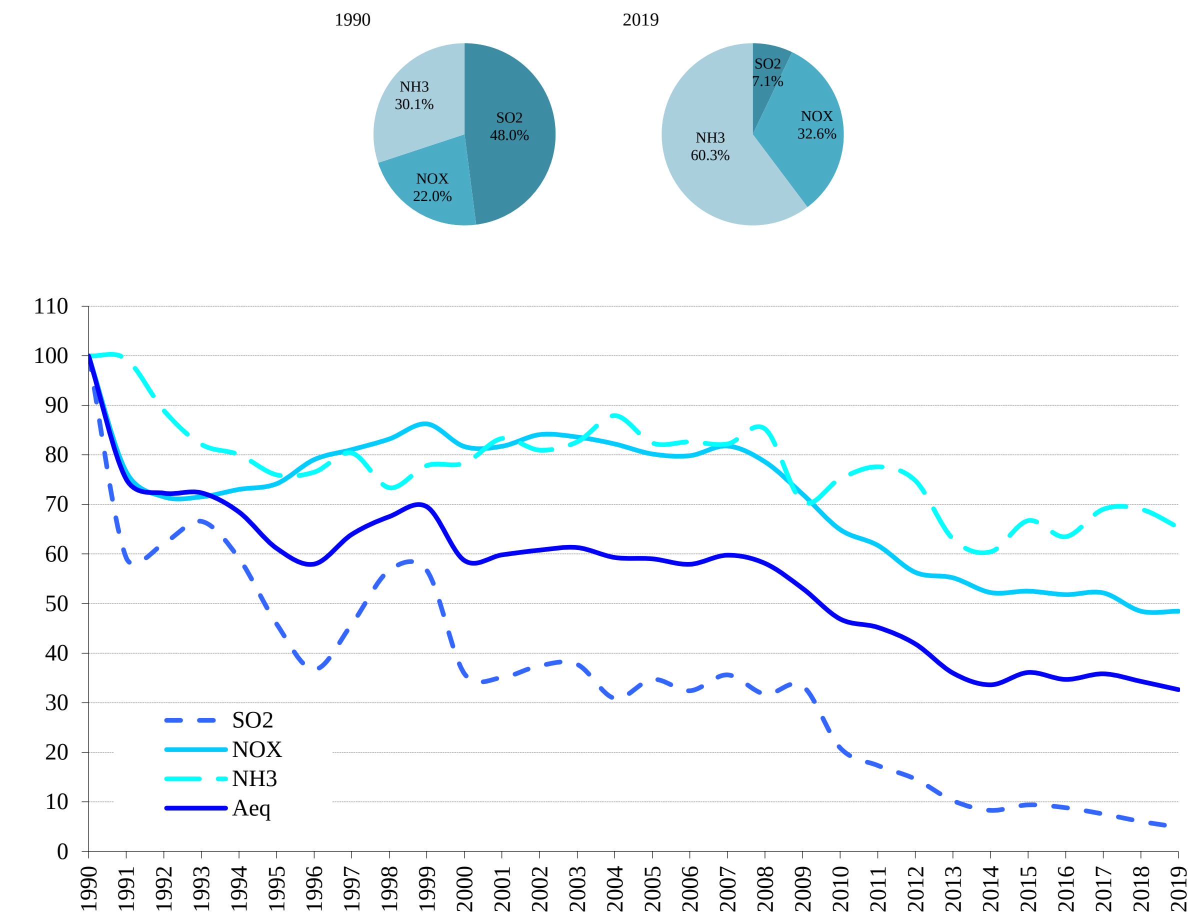


Figure 2.4-1 Relative emission of substances (without nature) that contribute to acidification and eutrophication for 1990-2017 (1990 = 100%)

2.5. 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 2019 amounted to 216.5 kt and decreased by 60.5% compared to 1990 and by 6.2 % compared with year before (Figure 2.5-1 and Table 2.5-1). The Energy Sector is 99.6 % of the total CO emission in 2019, of which 74.1% comes from Small combustion sources (with domination of Residential), 11.4% from the Road transport, 7.1% from the Refining / storage sector, and 5.5% from fuel combustion in Manufacturing 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 89.2 %) 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 98.1 % 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 69.4 % 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 2.2-1). In addition, 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 3.5-1 and Figure 3.5-2). In addition, emission dips can be seen in the years 1994, 2000, 2002 and 2014 when, due to the warmer winter, the consumption of biomass for heating was lower (Figure 3.5-3).

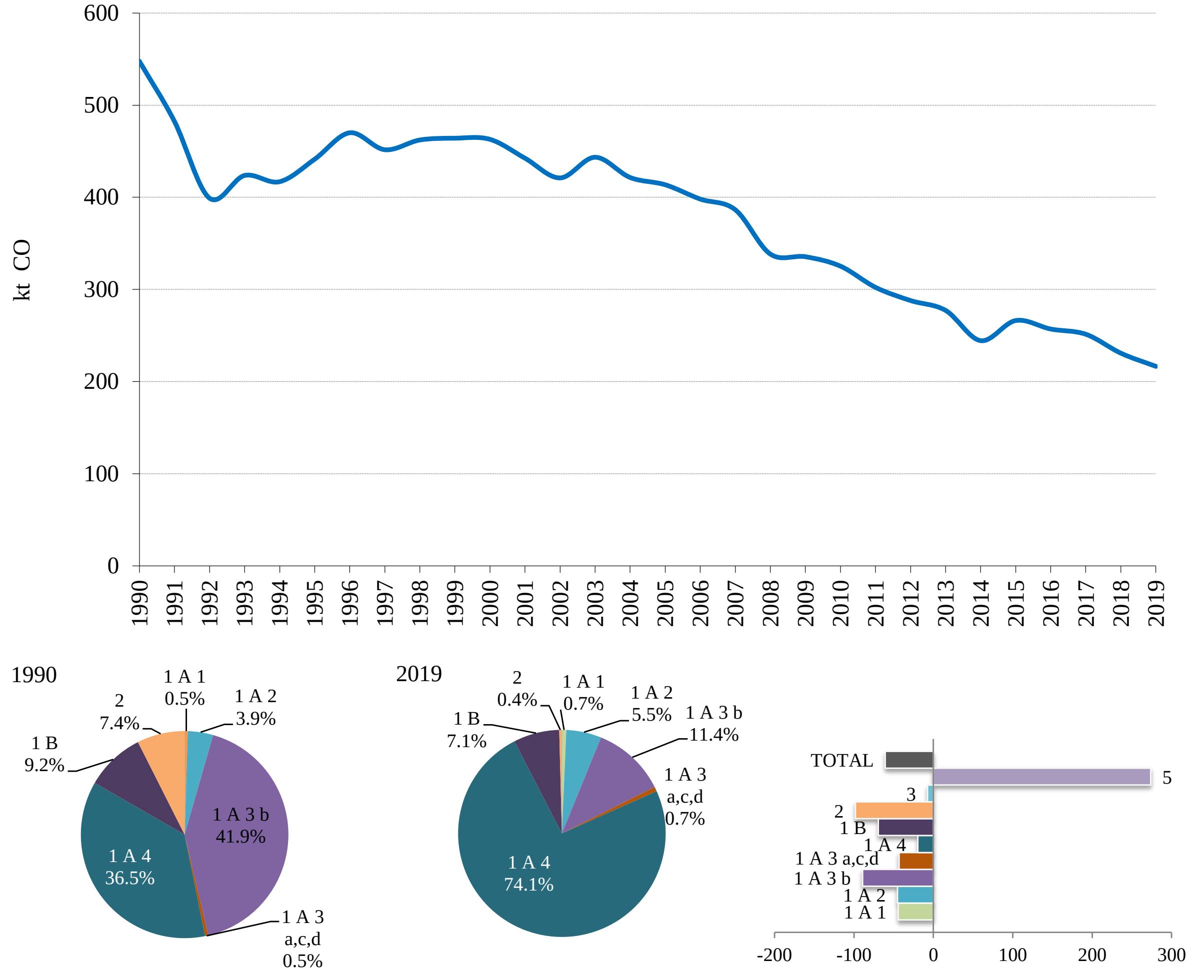


Figure 2.5-1 The CO emissions (kt/yr.) and percentage share by sector and variation in CO emissions

Table 2.5-1 The CO emissions by SNAP nomenclature in the period 1990-2019

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	18.9	90.2	NA	0.67	229.6	12.3	0.32	1.1E-01	547.8
1991	2.09	213.4	13.4	60.3	NA	0.62	173.6	18.7	0.24	1.2E-01	482.6
1992	2.30	180.1	10.6	41.1	NA	0.69	151.0	13.1	0.21	6.1E-02	399.1
1993	2.57	189.6	9.5	54.4	NA	0.63	151.5	15.3	0.25	7.6E-02	423.8
1994	2.62	170.6	9.6	54.6	NA	0.27	163.9	15.1	0.23	7.2E-02	416.9
1995	2.75	179.8	9.2	61.8	NA	0.66	170.7	16.1	0.26	7.6E-02	441.3
1996	2.56	201.3	9.0	54.3	NA	0.64	184.0	18.0	0.23	7.5E-02	470.1
1997	2.34	185.0	10.0	51.7	NA	0.63	185.1	16.7	0.24	8.5E-02	451.7
1998	2.51	186.1	9.6	59.4	NA	0.67	187.5	16.2	0.24	9.1E-02	462.2
1999	2.60	183.3	9.2	61.3	NA	0.77	186.1	20.6	0.26	8.0E-02	464.2

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
2000	1.97	162.8	9.8	84.2	NA	0.75	183.9	19.2	0.26	6.7E-02	463.0
2001	1.48	178.2	10.4	71.6	NA	0.99	160.9	18.5	0.25	8.0E-02	442.5
2002	1.39	171.0	9.9	75.6	NA	1.07	145.7	16.1	0.24	8.8E-02	421.1
2003	1.68	197.1	9.4	77.0	NA	1.13	138.4	18.5	0.25	5.7E-02	443.5
2004	1.58	191.7	10.7	70.6	NA	0.83	127.7	18.1	0.24	8.6E-02	421.5
2005	1.22	203.4	10.9	71.8	NA	0.83	108.7	16.5	0.24	8.4E-02	413.6
2006	1.59	185.1	11.4	83.7	NA	0.81	98.2	17.1	0.26	8.9E-02	398.1
2007	2.15	176.5	12.2	88.5	NA	0.81	88.8	17.3	0.28	7.3E-02	386.5
2008	1.50	175.9	11.8	50.9	NA	0.86	78.8	18.2	0.26	1.0E-01	338.4
2009	1.22	182.0	10.1	52.0	NA	0.63	72.4	16.8	0.27	9.7E-02	335.5
2010	1.18	194.5	10.1	40.3	NA	0.73	63.9	14.3	0.14	8.5E-02	325.3
2011	1.21	188.0	8.8	32.8	NA	0.64	56.6	14.0	0.18	8.2E-02	302.3
2012	1.08	186.0	9.0	35.4	NA	0.61	42.8	12.8	0.18	7.8E-02	287.9
2013	1.11	183.5	9.2	29.6	NA	0.54	40.6	12.4	0.17	9.0E-02	277.2
2014	0.90	160.3	9.0	25.0	NA	0.47	35.7	12.7	0.20	8.2E-02	244.4
2015	1.04	182.2	9.6	26.2	NA	0.46	34.2	12.2	0.21	8.3E-02	266.2
2016	1.15	175.7	8.3	26.0	NA	0.46	32.8	12.2	0.24	1.0E-01	257.0
2017	1.43	168.9	8.3	29.1	NA	0.51	30.9	12.0	0.16	8.0E-02	251.3
2018	1.43	159.2	7.4	22.4	NA	0.68	27.5	11.8	0.20	9.5E-02	230.8
2019	1.48	153.6	8.9	15.4	NA	0.66	24.8	11.3	0.15	1.0E-01	216.5
2019 vs 1990	-44.4%	-20.4%	-52.8%	-82.9%	NA	-1.1%	-89.2%	-8.2%	-51.5%	-7.4%	-60.5%
2019 vs 2018	3.8%	-3.5%	20.7%	-31.1%	NA	-1.7%	-10.0%	-4.5%	-24.5%	7.3%	-6.2%

2.6. Non-methane volatile organic compounds (NMVOC)

The NMVOCs play a significant role in the formation of ozone and fine particulates in the atmosphere. Under sunlight, NMVOCs 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 2019, NMVOC emissions amounted to 75.2 kt, and compared to the previous year has increased by 5.8 % and in comparison to 1990 has reduced by 55.8% (Figure 2.6-1). Sectors Industrial processes and product use, Small combustion and mobile machinery, Agriculture, Road transport and Refining are dominant in NMVOC emissions, and in 2019 these sectors contribute to NMVOC total emissions as follows: 48.1 %, 25.6 %, 12.4 %, 6.1 % and 4 % respectively.

The NMVOC emission reduction in the historical trend since 1990 has been recorded in all sectors. In the Industrial processes and product use, 58.5 % decrease was recorded as a result of the introduction of environmental protection requirements for the reduction of NMVOC emissions from organic solvent containing products i.e. 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 Road transport sector the NMVOC emission has decreased by 86.6% since 1990, due to the increased use of energy-efficient vehicles and the introduction of new exhaust emission requirements (e.g. three-way catalytic converters in automobiles). Fugitive emissions of NMVOC from petroleum products (gasoline) and natural gas have also decreased by 52.9% since 1990. In addition, 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 2.6-1). 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, high efficiency stoves and boilers and pellet stoves and boilers (see Table 3.5-1 and Figure 3.5-2). The Waste sector is the only one with an increasing trend in NMVOC emissions since 1990, for about 3.6 times due to increased activities related to the solid waste disposal on land.

The NMVOC emission in 2019 (Figure 2.6-1) was below the quota value of 90 kt.

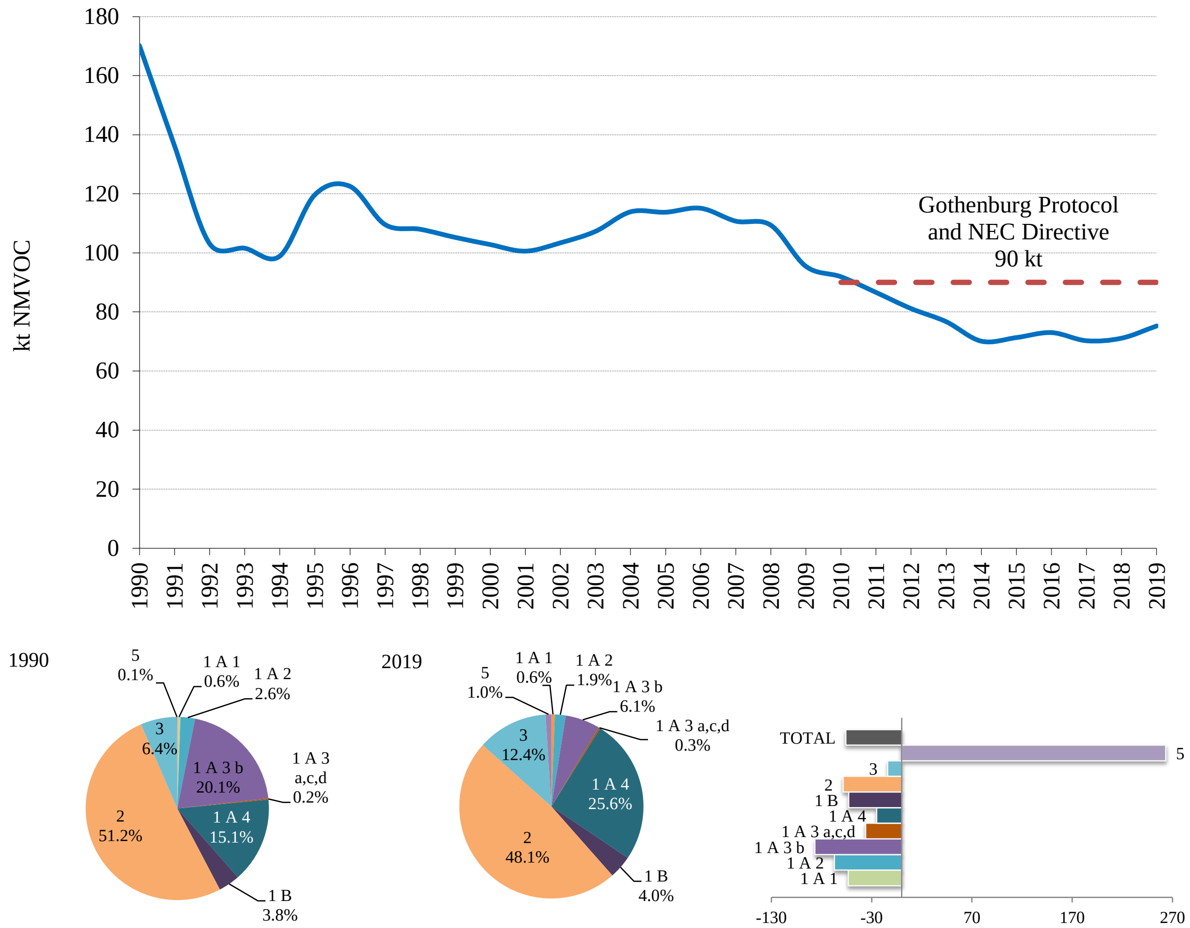


Figure 2.6-1 The NMVOCs emissions (kt/yr.) and percentage share by sector and variation in NMVOCs

Table 2.6-1 The NMVOC emissions by SNAP nomenclature in the period 1990-2019

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	24.0	3.4	25.6	4.2	63.8	34.3	3.0	0.26	10.8	170.2
1991	0.7	27.2	2.7	21.9	2.4	40.5	26.7	3.2	0.26	10.8	136.3
1992	0.8	23.4	2.2	13.8	2.8	24.7	23.3	3.0	0.26	9.1	103.4
1993	0.9	24.7	2.1	13.0	2.8	23.9	22.6	2.0	0.28	9.3	101.6
1994	0.8	22.3	2.0	9.9	3.1	24.8	24.4	2.4	0.29	8.9	98.9
1995	0.8	23.6	1.9	10.4	3.4	42.8	25.4	2.4	0.30	8.7	119.7
1996	0.8	26.5	1.9	11.7	3.4	39.0	27.8	2.7	0.31	8.5	122.6

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
1997	0.8	24.5	2.2	10.1	3.5	28.0	29.3	2.5	0.33	8.5	109.6
1998	0.8	24.6	2.0	9.7	3.6	26.7	29.2	2.6	0.36	8.4	108.0
1999	0.8	24.3	1.7	9.8	3.9	23.3	29.3	2.9	0.39	8.8	105.2
2000	0.8	21.7	1.7	9.3	3.7	23.5	30.0	3.0	0.41	8.7	102.8
2001	0.5	23.9	1.7	8.6	3.7	24.1	25.9	3.0	0.44	8.9	100.6
2002	0.5	22.9	1.7	9.2	3.7	29.7	23.8	2.6	0.45	8.9	103.4
2003	0.5	26.5	1.7	8.8	3.7	30.9	22.7	2.7	0.47	9.3	107.3
2004	0.5	25.9	1.9	9.5	3.7	38.6	21.1	2.6	0.49	9.6	113.9
2005	0.5	27.5	1.8	10.5	3.5	39.6	18.1	2.4	0.49	9.4	113.8
2006	0.5	24.9	1.9	9.9	3.5	45.2	16.7	2.5	0.54	9.6	115.1
2007	0.5	23.6	2.0	8.0	3.8	45.1	15.5	2.4	0.58	9.4	110.7
2008	0.4	23.3	1.8	7.5	3.4	46.5	14.1	2.5	0.63	9.2	109.4
2009	0.5	23.9	1.7	7.0	3.6	33.4	12.9	2.1	0.68	9.6	95.4
2010	0.5	25.3	1.7	6.8	3.3	30.9	11.4	1.7	0.69	9.6	91.9
2011	0.5	24.3	1.5	7.1	3.0	28.3	10.3	1.5	0.71	9.4	86.6
2012	0.4	23.8	1.6	6.3	2.7	26.5	8.4	1.3	0.72	9.4	81.1
2013	0.4	23.3	1.4	6.1	2.6	24.2	7.6	1.2	0.72	9.1	76.7
2014	0.3	20.2	1.2	6.6	2.4	21.4	6.9	1.2	0.75	9.1	70.1
2015	0.4	22.7	1.0	5.5	2.5	21.3	6.5	1.1	0.78	9.3	71.3
2016	0.4	21.7	1.0	6.6	2.5	23.4	6.2	1.1	0.79	9.3	73.0
2017	0.4	20.7	1.0	6.7	2.4	21.9	5.9	1.0	0.82	9.3	70.2
2018	0.4	19.5	1.1	4.6	2.6	26.5	5.6	1.0	0.83	9.0	71.1
2019	0.4	18.8	1.2	4.9	2.2	32.1	4.6	0.9	0.79	9.3	75.2
2019 vs 1990	-53.3%	-21.7%	-64.3%	-80.8%	-47.5%	-49.7%	-86.6%	-69.6%	210.3%	-14.1%	-55.8%
2019 vs 2018	9.4%	-3.7%	12.5%	6.5%	-13.6%	21.1%	-18.2%	-9.6%	-4.0%	3.3%	5.8%

2.7. 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[30]. 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 CLRTAP 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 calculated for all NFR emission sources with available FE in accordance with GB2019.

The TSP emission trend for the 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.

[30] 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

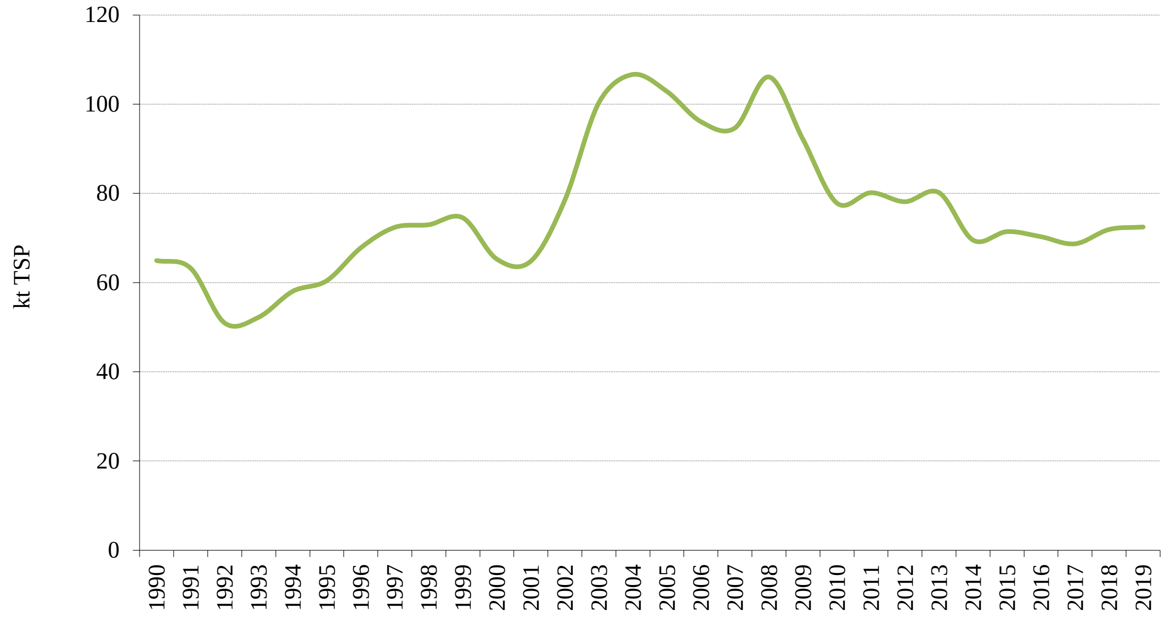
2.7.1. Total suspended particles (TSP)

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

In 2019, total TSP emissions were 72.5 kt, which is 0.8 % higher than in the previous year and 11.6% compared to 1990 (Figure 2.7.1-1 and Table 2.7.1-1). In 2019, the key sectors of the TSP emissions were Energy with 39.4 %, Industrial processes and product use with 53.7 % and Agriculture with 6.7 %.

Since 1990, the TSP emission has a downward trend, the largest contributing factor to the energy sector with the reduction of TSP emissions by 33.4 % due to the reduction of the consumption of solid fuels and at the same time the increase in the consumption of gaseous and liquid fuels and the Agriculture sector, with a reduction of 51.1 % due to decrease 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 23.4 %) due to a larger number of vehicles and Industrial processes and product use sector (by two times) due to increase 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, high efficiency stoves and boilers and boilers and pellet stoves and boilers (see Table 4.5-1 and Figure 4.5-2).



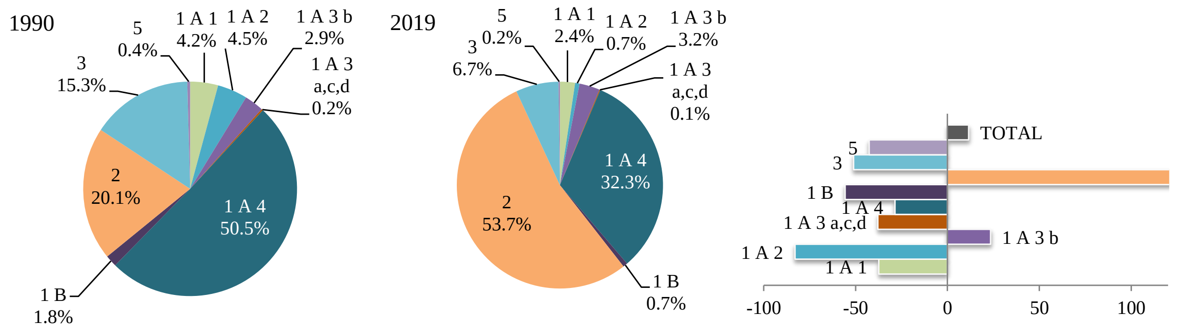


Figure 2.7.1-1: The TSP emissions (kt/yr.) and percentage share by sector and variation in TSP emissions

Table 2.7.1-1 The TSP emissions by SNAP nomenclature in the period 1990-2019

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	31.9	2.4	13.6	1.5E-02	0.5	1.9	1.6	0.3	9.9	65.0
1991	1.9	36.6	1.7	9.9	1.4E-02	0.4	1.5	1.1	0.2	9.8	63.2
1992	2.4	31.6	1.2	5.4	1.1E-02	0.5	1.6	0.7	0.4	7.2	51.0
1993	2.7	33.4	1.1	4.8	1.0E-02	0.4	1.8	0.5	0.2	7.2	52.3
1994	2.3	30.2	1.0	14.0	9.2E-03	0.3	1.9	0.8	0.3	7.3	58.1
1995	2.1	32.0	1.0	14.7	7.3E-03	0.5	2.1	0.7	0.3	7.0	60.4
1996	2.0	35.9	1.0	17.6	5.9E-03	0.6	2.2	0.7	0.3	7.4	67.8
1997	2.9	33.1	1.1	23.6	4.3E-03	0.6	2.5	0.7	0.3	7.5	72.4
1998	3.6	33.3	1.0	23.3	4.5E-03	0.6	2.5	0.8	0.3	7.5	73.0
1999	3.3	32.9	0.7	25.5	1.4E-03	0.6	2.6	0.7	0.3	7.9	74.5
2000	1.4	29.3	0.9	23.5	NA	0.5	3.4	0.9	0.3	5.2	65.3
2001	1.8	32.3	0.8	19.6	NA	0.7	3.1	0.9	0.3	5.3	64.8
2002	1.6	31.0	0.8	33.8	NA	1.6	3.3	0.8	0.3	5.3	78.5
2003	1.7	35.8	0.7	49.9	NA	1.9	3.8	0.8	0.3	5.4	100.3
2004	0.9	35.0	0.8	58.4	NA	1.2	3.7	0.7	0.3	5.6	106.6
2005	1.2	37.2	0.7	53.0	NA	0.9	3.6	0.7	0.3	5.3	102.9
2006	1.1	33.4	0.7	49.8	NA	0.8	3.6	0.7	0.3	5.6	96.1
2007	1.9	31.6	0.8	49.9	NA	0.7	3.5	0.7	0.3	5.3	94.7
2008	1.1	31.0	0.6	63.3	NA	0.7	3.2	0.7	0.3	5.2	106.1
2009	1.6	31.7	0.7	48.3	NA	0.5	3.1	0.6	0.3	5.4	92.1
2010	1.0	33.4	0.7	33.5	NA	0.5	2.9	0.5	0.2	5.1	77.8
2011	0.9	31.8	0.6	38.1	NA	0.4	2.6	0.5	0.3	4.9	80.2
2012	0.9	31.1	0.6	37.3	NA	0.3	2.4	0.4	0.2	4.9	78.1
2013	0.6	30.2	0.6	40.4	NA	0.5	2.3	0.4	0.2	5.1	80.2
2014	0.7	26.0	0.4	34.2	NA	0.4	2.2	0.4	0.2	5.1	69.5
2015	1.0	29.1	0.5	32.7	NA	0.4	2.3	0.3	0.2	5.0	71.4
2016	1.2	27.5	0.4	32.9	NA	0.4	2.3	0.3	0.2	5.1	70.3
2017	1.2	26.0	0.5	32.6	NA	0.5	2.4	0.3	0.2	5.0	68.7
2018	1.5	24.4	0.5	37.5	NA	0.6	2.2	0.3	0.2	4.8	71.9
2019	1.7	23.3	0.4	38.8	NA	0.6	2.3	0.3	0.2	4.9	72.5
2019 vs 1990	-37.4%	-26.9%	-81.4%	184.7%	NA	4.0%	23.4%	-84.5%	-40.3%	-51.1%	11.6%
2019 vs 2018	11.9%	-4.4%	-6.2%	3.6%	NA	-3.2%	4.3%	-6.6%	7.6%	0.8%	0.8%

2.7.2. Particulate matter (PM_{10})

The total PM_{10} emission in 2019 was 40.8 kt. The emission decreased by 19.1% compared to 1990 and by 0.8% compared to the previous year (Figure 2.7.2-1). Energy Sector is the largest source of PM_{10} emissions and contributes 65 % of the total emissions in 2019 (Table 2.7.2-1). Small combustion dominated by biomass combustion in residential are the key sources of PM_{10} emissions and contribute to 54.6 % of total emissions in 2019. Sector Industrial processes and product use are the second largest source of PM_{10} emissions (26.9 % in 2019). The third key sector in the PM_{10} emission is Agriculture, which contributes to the overall emissions in 2019 with 7.7 %.

Since 1990, PM_{10} emissions have a downward trend, which was the most contributed by the stationary energy sector with the reduction of the PM_{10} emissions by 31.9 % 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 53.9 % due to decreasing the number of animals and crop production. Sectors that note the PM_{10} emission growth trend since 1990 is the Transport sector (11.6 % increase) due to the greater number of vehicles and sectors Industrial processes and product use (by 2.2 times) due to increase the use and productivity of some products.

The trend of PM_{10} emissions has several dips and peak between 1990 and 2019. 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 2.7.2-1). 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, high efficiency stoves and boilers and pellet stoves and boilers (see Table 3.5-1 and Figure 3.5-2). In addition, emission dips can be seen in the years 1994, 2000, 2002 and 2014 when, due to the warmer winter, the consumption of biomass for heating was lower (Figure 3.5-3).

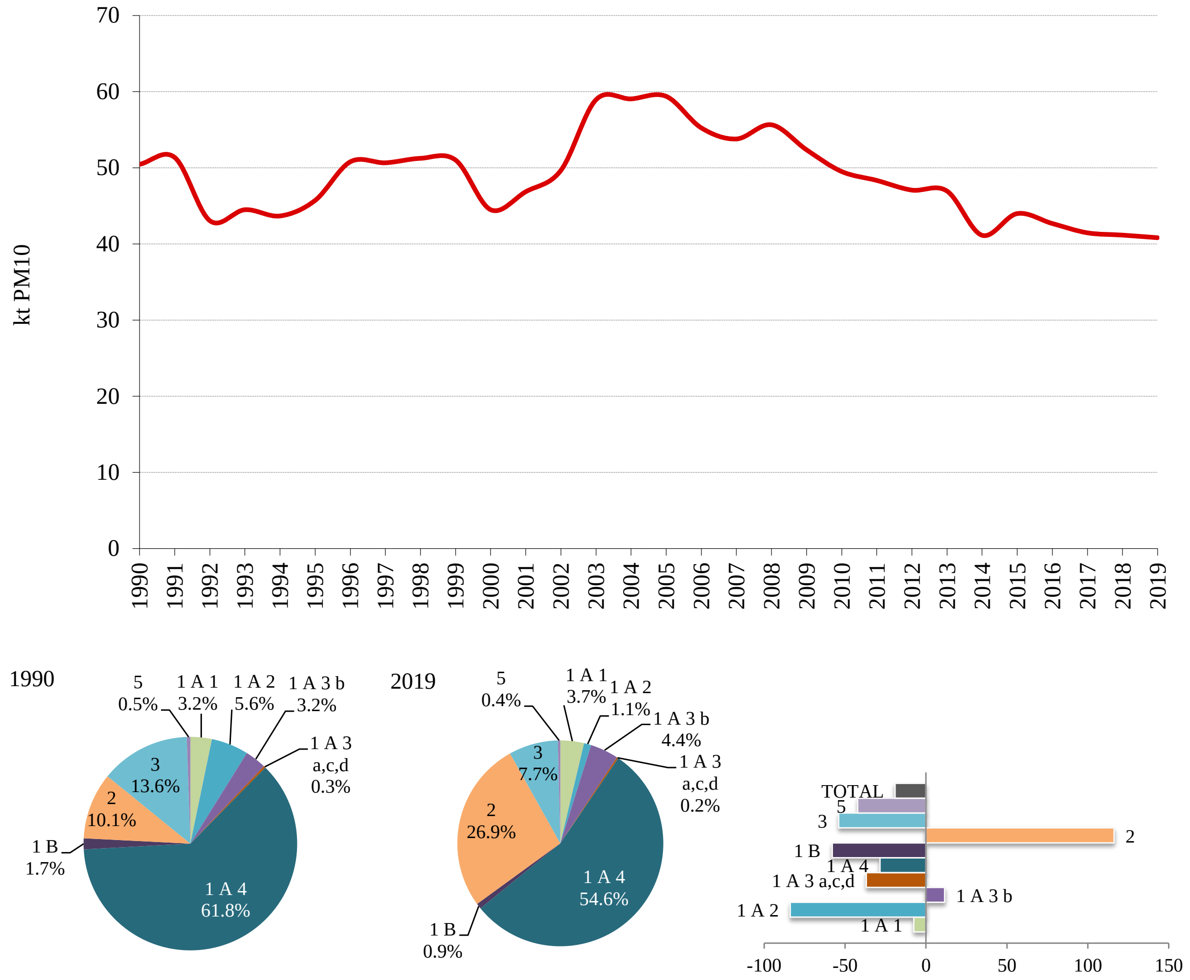


Figure 2.7.2-1 The PM_{10} emissions (kt/yr.) and percentage share by sector and variation in PM_{10} emissions

Table 2.7.2-1 The PM_{10} emissions by SNAP nomenclature in the period 1990-2019

PM10											
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	30.3	2.2	5.4	7.3E-03	0.5	1.6	1.6	0.3	6.9	50.5
1991	1.2	34.8	1.7	3.9	6.5E-03	0.4	1.3	1.1	0.2	6.7	51.4
1992	1.4	30.1	1.2	2.7	5.1E-03	0.5	1.4	0.7	0.4	4.8	43.1
1993	1.6	31.9	1.1	2.4	4.8E-03	0.4	1.6	0.5	0.2	4.8	44.5
1994	1.4	28.8	1.0	4.7	4.3E-03	0.3	1.7	0.7	0.3	4.8	43.7
1995	1.4	30.5	1.0	4.9	3.5E-03	0.5	1.9	0.7	0.3	4.6	45.7
1996	1.3	34.2	0.9	5.6	2.8E-03	0.5	2.0	0.7	0.3	5.1	50.8
1997	2.1	31.5	1.0	6.9	2.0E-03	0.6	2.3	0.7	0.3	5.3	50.7
1998	2.4	31.7	0.9	6.9	2.1E-03	0.6	2.2	0.8	0.3	5.3	51.3
1999	1.9	31.3	0.7	7.6	6.4E-04	0.6	2.3	0.7	0.3	5.5	51.0
2000	0.9	27.9	0.8	7.3	NA	0.5	3.0	0.9	0.3	2.9	44.5
2001	1.2	30.7	0.7	6.5	NA	0.7	2.8	0.9	0.3	3.1	46.9
2002	1.0	29.5	0.7	9.8	NA	1.5	3.0	0.8	0.3	3.0	49.7
2003	1.0	34.1	0.7	13.8	NA	1.8	3.4	0.8	0.3	3.1	58.9
2004	0.7	33.3	0.8	15.9	NA	1.1	3.3	0.7	0.3	3.0	59.1
2005	0.7	35.4	0.6	14.6	NA	0.8	3.2	0.7	0.3	3.0	59.4
2006	0.8	31.8	0.7	14.0	NA	0.7	3.2	0.7	0.3	3.1	55.3
2007	1.1	30.1	0.7	14.2	NA	0.6	3.0	0.7	0.3	3.0	53.8
2008	0.7	29.5	0.6	17.3	NA	0.6	2.8	0.7	0.3	3.1	55.7

PM10											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2009	0.9	30.2	0.6	13.6	NA	0.4	2.6	0.6	0.3	3.1	52.4
2010	0.6	31.8	0.7	9.7	NA	0.5	2.4	0.5	0.2	3.0	49.5
2011	0.6	30.3	0.5	10.7	NA	0.4	2.2	0.5	0.3	2.9	48.4
2012	0.6	29.6	0.6	10.4	NA	0.3	2.0	0.4	0.2	3.0	47.1
2013	0.4	28.7	0.6	11.1	NA	0.4	1.9	0.4	0.2	3.2	47.0
2014	0.5	24.7	0.4	9.6	NA	0.4	1.8	0.4	0.2	3.2	41.1
2015	0.7	27.7	0.4	9.3	NA	0.4	1.9	0.3	0.2	3.2	44.0
2016	0.9	26.2	0.4	9.3	NA	0.4	1.9	0.3	0.2	3.2	42.7
2017	1.0	24.8	0.4	9.4	NA	0.4	1.9	0.3	0.2	3.1	41.5
2018	1.3	23.2	0.4	10.4	NA	0.5	1.8	0.3	0.2	3.1	41.2
2019	1.5	22.2	0.4	10.8	NA	0.5	1.8	0.2	0.2	3.2	40.8
2019 vs 1990	-7.5%	-26.7%	-82.4%	100.9%	NA	5.3%	11.6%	-84.5%	-40.0%	-53.9%	-19.1%
2019 vs 2018	16.7%	-4.4%	-3.2%	3.9%	NA	-2.8%	2.8%	-6.6%	7.6%	1.1%	-0.8%

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

The $PM_{2.5}$ emission in the year 2019 was 28.6 kt. Emissions decreased by 25.8 % compared to 1990 and by 3 % compared to the previous year (Figure 2.7.3-1). Energy Sector is the largest source of $PM_{2.5}$ emissions and contributes with 92.6 % of total emissions in 2019 (Table 2.7.3-1). The key sources of emissions are the Energy sector (87.6% in 2019) with the dominance of Small combustion and mobile machinery (biomass combustion in the Residential) which contribute with 76 % to the total emission in 2019 and IPPU sector (10.9 % in 2019). Road transport and Energy industries contribute to emissions to a lesser extent with 4.7 % and 4.5 % in 2019, respectively.

Since 1990, $PM_{2.5}$ emissions have had a downward trend, driven most by the stationary energy sector, with a 31.3 % reduction in $PM_{2.5}$ emissions due to a reduction in the consumption of solid fuels while increasing the consumption of gaseous and liquid fuels. The sector that has been recording a trend of increasing $PM_{2.5}$ emissions since 1990 is the IPPU sector by 72.5 %, due to the increase in the use and productivity of certain products.

The trend of $PM_{2.5}$ emissions has several dips and peak between 1990 and 2019. 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 2.7.3-1). 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, high efficiency stoves and boilers and pellet stoves and boilers (see Table 3.5-1 and Figure 3.5-2). In addition, emission dips can be seen in the years 1994, 2000, 2002 and 2014 when, due to the warmer winter, the consumption of biomass for heating was lower (Figure 3.5-3).

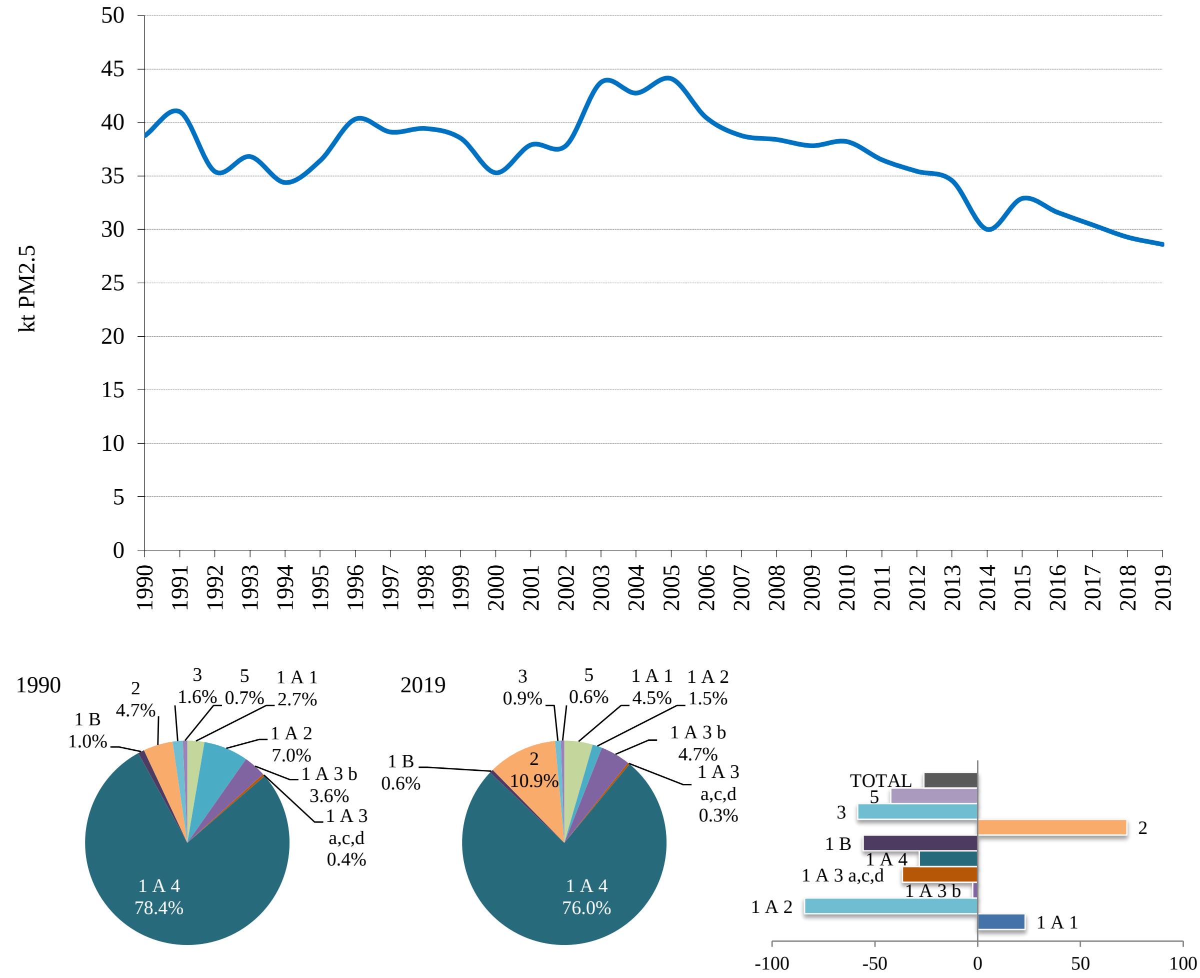


Figure 2.7.3-1 The $PM_{2.5}$ emissions (kt/yr.) and percentage share by sector and variation in $PM_{2.5}$ emissions

Table 2.7.3-1 The $PM_{2.5}$ emissions by SNAP nomenclature in the period 1990-2019

$PM_{2.5}$											
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	29.5	2.1	1.7	8.7E-04	0.4	1.4	1.6	0.32	0.6	38.8
1990	0.8	34.0	1.6	1.3	7.7E-04	0.4	1.1	1.1	0.23	0.6	41.0
1991	0.9	29.3	1.1	0.9	6.0E-04	0.4	1.2	0.6	0.37	0.4	35.4
1992	1.0	31.0	1.0	0.8	5.8E-04	0.4	1.4	0.5	0.22	0.4	36.8
1993	0.9	28.1	0.9	1.4	5.2E-04	0.2	1.5	0.7	0.27	0.4	34.4
1994	0.9	29.7	1.0	1.4	4.1E-04	0.4	1.6	0.7	0.31	0.4	36.4
1995	0.9	33.4	0.9	1.6	3.3E-04	0.4	1.8	0.7	0.31	0.4	40.3
1996	1.7	30.7	1.0	1.9	2.4E-04	0.5	2.0	0.7	0.30	0.4	39.1
1997	1.8	30.9	0.9	1.9	2.5E-04	0.5	2.0	0.8	0.31	0.4	39.4
1998	1.2	30.5	0.7	2.1	7.7E-05	0.5	2.0	0.7	0.32	0.4	38.5
1999	0.6	27.2	0.8	2.1	NA	0.4	2.8	0.9	0.32	0.3	35.3
2000	0.8	30.0	0.7	1.8	NA	0.6	2.6	0.9	0.30	0.3	37.9
2001	0.7	28.7	0.7	2.6	NA	1.0	2.7	0.8	0.29	0.3	37.8
2002	0.7	33.2	0.7	3.5	NA	1.2	3.1	0.8	0.33	0.3	43.8
2003	0.5	32.5	0.8	4.0	NA	0.8	3.0	0.7	0.28	0.3	42.8
2004	0.5	34.5	0.6	3.7	NA	0.6	2.9	0.7	0.29	0.3	44.1
2005	0.5	31.0	0.7	3.5	NA	0.6	2.8	0.7	0.29	0.3	40.4
2006	0.7	29.3	0.7	3.6	NA	0.5	2.6	0.7	0.29	0.3	38.8
2007	0.5	28.8	0.6	4.2	NA	0.5	2.4	0.7	0.28	0.3	38.4

$PM_{2.5}$											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2008	0.5	29.4	0.6	3.5	NA	0.4	2.2	0.6	0.26	0.3	37.8
2009	0.4	31.0	0.7	2.6	NA	0.4	2.1	0.5	0.23	0.3	38.2
2010	0.4	29.6	0.5	2.8	NA	0.4	1.8	0.5	0.26	0.3	36.5
2011	0.4	28.8	0.6	2.8	NA	0.3	1.6	0.4	0.24	0.3	35.4
2012	0.3	28.0	0.5	2.9	NA	0.4	1.5	0.4	0.22	0.3	34.6
2013	0.3	24.1	0.4	2.6	NA	0.3	1.4	0.4	0.16	0.3	30.0
2014	0.5	27.0	0.4	2.5	NA	0.3	1.5	0.3	0.17	0.3	32.9
2015	0.7	25.6	0.3	2.5	NA	0.3	1.5	0.3	0.18	0.3	31.6
2016	0.8	24.2	0.4	2.6	NA	0.4	1.5	0.3	0.19	0.3	30.4
2017	1.1	22.6	0.4	2.7	NA	0.4	1.3	0.3	0.18	0.3	29.3
2019	1.3	21.7	0.4	2.8	NA	0.4	1.3	0.2	0.19	0.3	28.6
2019 vs 1990	23.0%	-26.6%	-82.8%	64.7%	NA	0.1%	-2.4%	-84.8%	-40.0%	-58.4%	-26.2%
2019 vs 2018	19.3%	-4.4%	-1.2%	4.3%	NA	-3.0%	0.4%	-6.9%	7.6%	0.8%	-2.3%

2.7.4. Black carbon (BC)

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

In 2019, BC emission was 3.7 kt (Figure 2.7.4-1) and was down by 31.8 % compared to 1990 and by 3.4 % compared to the previous year. The Energy sector is the sector with the highest contribution to the total BC emission in 2019 (96.2 %). The remaining emissions in 2019 (3.7%) come from the IPPU sector. The key category in the Energy sector is Small combustion and mobile machinery that contributes to the total BC emission in 2019 with 71.4 % and Road transport with a contribution of 16.8 %.

Since 1990, the BC emission has a downward trend, and the largest contributing sector was the stationary Energy with the reduction of the BC emission by 39.2 % due to the reduction of the consumption of solid fuels and at the same time increasing the consumption of gaseous and liquid fuels. The sectors that recorded the increase of BC emissions since 1990 were: IPPU sector by 30.4 % due to increased use and productivity of certain products and Road transport by 7.6 % 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 2.7.4-1). 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 3.5-1 and Figure 3.5-2). In addition, emission dips can be seen in the years 1994, 2000, 2002 and 2014 when, due to the warmer winter, the consumption of biomass for heating was lower.

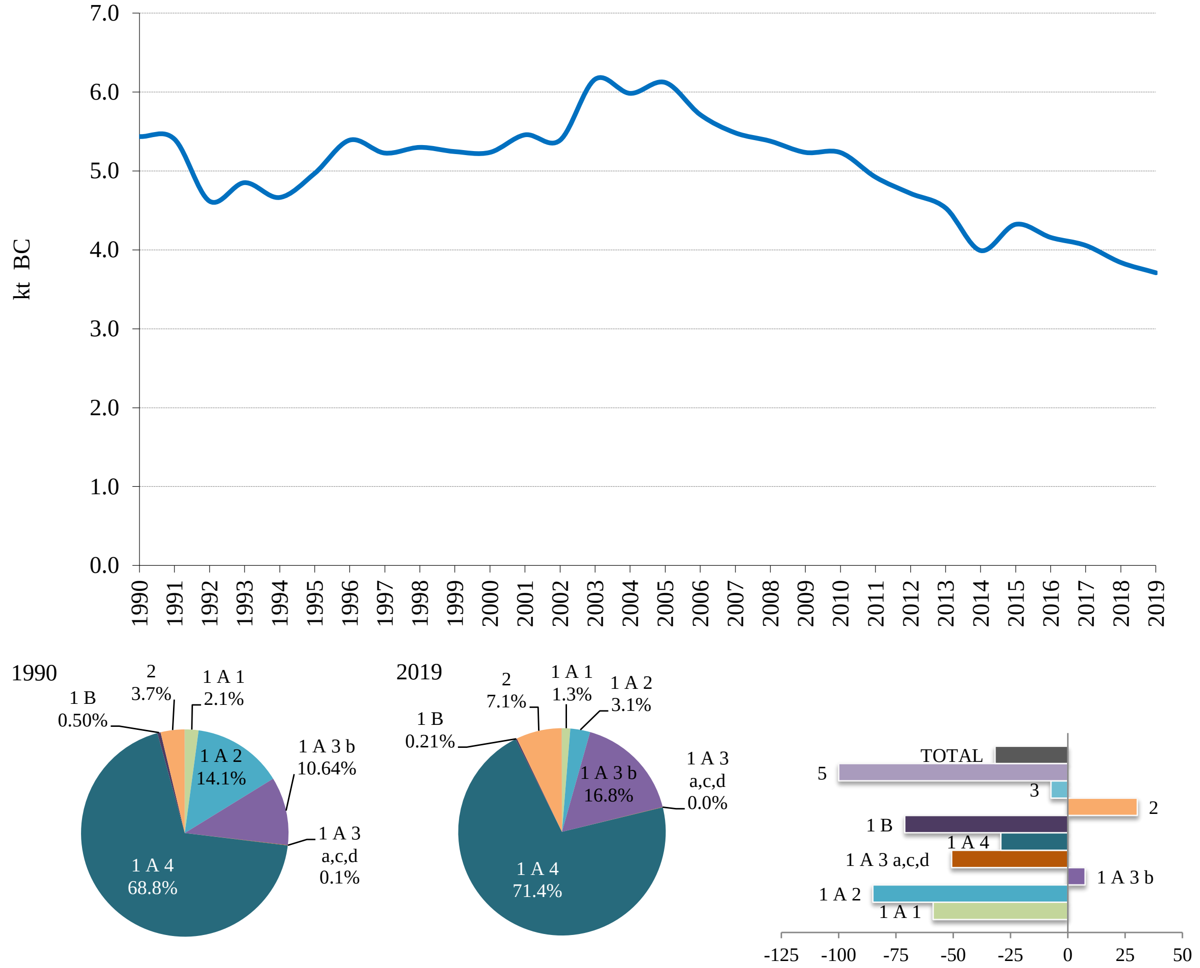


Figure 2.7.4-1 The BC emissions (kt/yr.) and percentage share by sector and variation in BC emissions

Table 2.7.4-1 The BC emissions by SNAP nomenclature in the period 1990-2019

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	3.27	0.44	0.073	NA	0.15	0.58	0.81	0.0102	8.3E-04	5.43
1991	0.10	3.76	0.34	0.056	NA	0.14	0.48	0.52	0.0091	8.7E-04	5.40
1992	0.11	3.29	0.27	0.034	NA	0.15	0.53	0.23	0.0065	4.6E-04	4.62
1993	0.11	3.47	0.26	0.029	NA	0.14	0.64	0.19	0.0083	5.7E-04	4.86
1994	0.16	3.13	0.23	0.054	NA	0.06	0.66	0.36	0.0068	5.4E-04	4.66
1995	0.19	3.30	0.24	0.045	NA	0.14	0.75	0.29	0.0056	5.7E-04	4.97
1996	0.16	3.71	0.24	0.053	NA	0.14	0.79	0.29	0.0052	5.6E-04	5.39
1997	0.14	3.40	0.27	0.075	NA	0.14	0.90	0.29	0.0062	6.4E-04	5.22
1998	0.16	3.39	0.26	0.072	NA	0.15	0.89	0.36	0.0057	6.8E-04	5.30
1999	0.16	3.36	0.20	0.081	NA	0.17	0.92	0.34	0.0069	6.0E-04	5.24
2000	0.075	2.98	0.18	0.075	NA	0.16	1.33	0.42	0.0060	5.0E-04	5.23
2001	0.054	3.26	0.18	0.062	NA	0.21	1.25	0.42	0.0073	6.0E-04	5.45
2002	0.049	3.13	0.18	0.104	NA	0.22	1.31	0.38	0.0077	6.6E-04	5.38
2003	0.052	3.59	0.18	0.152	NA	0.23	1.55	0.39	0.0079	4.3E-04	6.16
2004	0.045	3.50	0.20	0.179	NA	0.17	1.51	0.36	0.0080	6.4E-04	5.98
2005	0.043	3.70	0.18	0.162	NA	0.18	1.49	0.36	0.0083	6.3E-04	6.12

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
2006	0.040	3.35	0.19	0.152	NA	0.18	1.43	0.36	0.0098	6.7E-04	5.71
2007	0.044	3.19	0.19	0.152	NA	0.18	1.36	0.35	0.0105	5.5E-04	5.48
2008	0.031	3.15	0.18	0.191	NA	0.19	1.24	0.38	0.0099	7.7E-04	5.37
2009	0.036	3.25	0.19	0.146	NA	0.14	1.16	0.31	0.0088	7.2E-04	5.23
2010	0.029	3.44	0.15	0.104	NA	0.16	1.07	0.27	0.0055	6.4E-04	5.23
2011	0.031	3.31	0.13	0.118	NA	0.14	0.93	0.25	0.0068	6.1E-04	4.92
2012	0.024	3.25	0.13	0.115	NA	0.14	0.83	0.21	0.0051	5.9E-04	4.71
2013	0.017	3.19	0.12	0.127	NA	0.12	0.77	0.19	0.0050	6.7E-04	4.53
2014	0.017	2.77	0.09	0.109	NA	0.10	0.72	0.17	0.0069	6.2E-04	3.99
2015	0.023	3.13	0.07	0.102	NA	0.10	0.74	0.15	0.0057	6.2E-04	4.32
2016	0.029	3.00	0.05	0.103	NA	0.10	0.73	0.13	0.0059	7.9E-04	4.15
2017	0.031	2.87	0.07	0.104	NA	0.11	0.74	0.12	0.0054	6.0E-04	4.05
2018	0.041	2.70	0.07	0.117	NA	0.15	0.64	0.11	9.2E-03	7.1E-04	3.83
2019	0.048	2.60	0.07	0.122	NA	0.14	0.62	0.10	7.7E-03	7.6E-04	3.70
2019 vs 1990	-58.8%	-20.6%	-84.3%	65.5%	NA	-2.2%	7.0%	-87.5%	-24.5%	-7.4%	-31.9%
2019 vs 2018	15.8%	-3.8%	-1.3%	3.9%	NA	-1.8%	-3.4%	-10.1%	-16.4%	7.3%	-3.4%

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

Heavy metals (HM) emissions from anthropogenic sources became of importance to UNECE/CLRTAP, after various studies showed that HM 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, HM 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 CLRTAP. 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.

2.8.1. Lead (Pb)

The lead emission (Figure 2.8.1-1 and Table 2.8.1-1) in 2019 has amounted to 5.2 t. The Pb emission has decrease by 99 % since 1990 and by 36.3% comparing to previous year. Key sources in Pb emission in 2019 were: IPPU sector (39.1 %) with the domination of glass production and production of steel in electric arc furnaces, Small combustion and mobile machinery sector (23.4 %) and Road transport (18.7 %). The lead emission from these activities originates from the lead content in the raw material for production processes, respectively in the fuel.

The lead emission in the historical trend shows several major reductions, which are the result of decreases in sectors: Road transport and IPPU. Road transport notes a 99.8 % decrease in lead emission since 1990, because 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 removed from use. IPPU sector records a 97.4% reduction in Pb emissions since 1990 as a result of stopping the process of steel production in Siemens-Martin furnaces in 1992. Stopping this process was a result of the war for Croatian independence (1991 - 1995). In addition, the war for Croatian independence caused a reduction in fuel consumption and reduction in overall production in the IPPU sector (Figure 2.8.1-1).

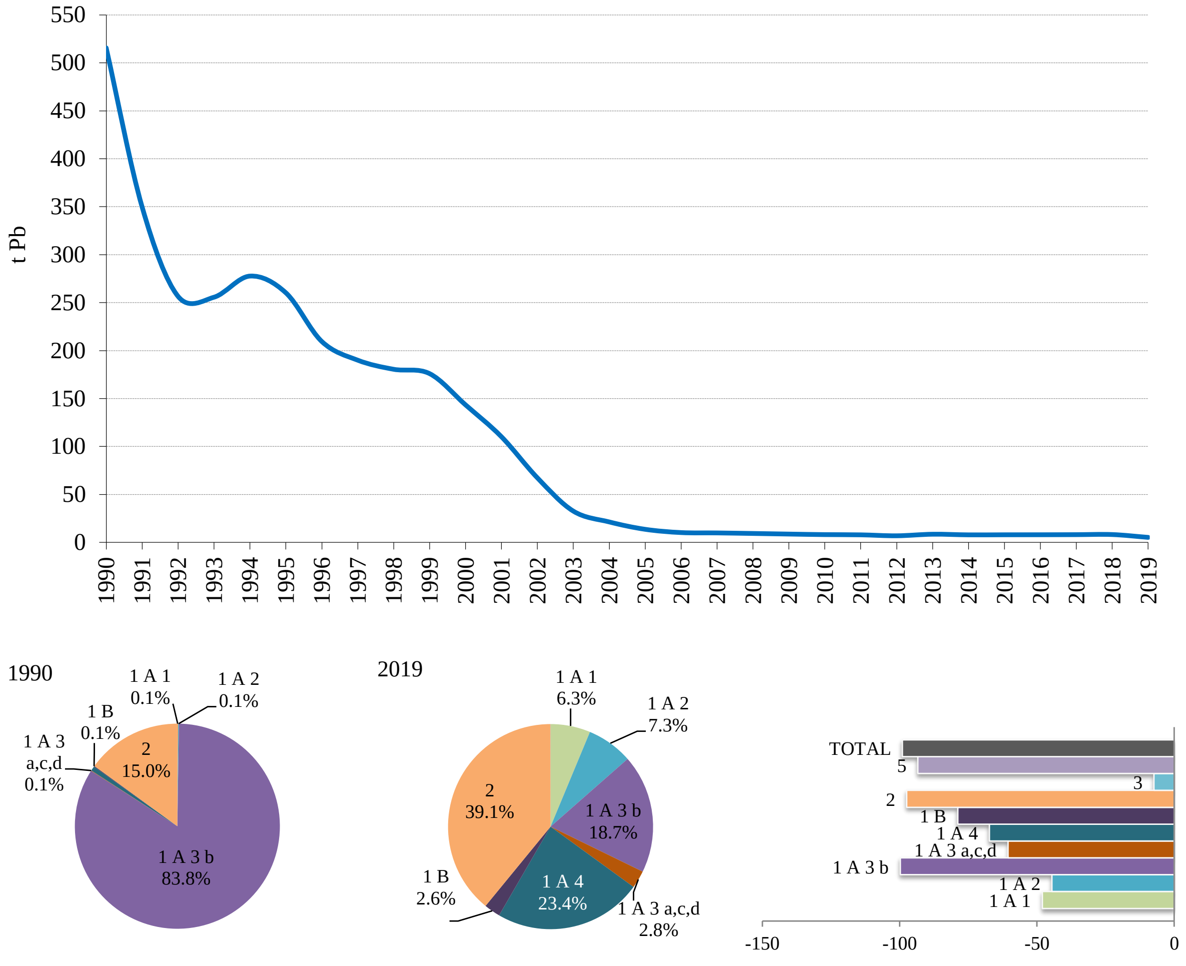


Figure 2.8.1-1 The Pb emissions (t/yr.) and percentage share by sector and variation in Pb emissions

Table 2.8.1-1 The Pb emissions by SNAP nomenclature in the period 1990-2019

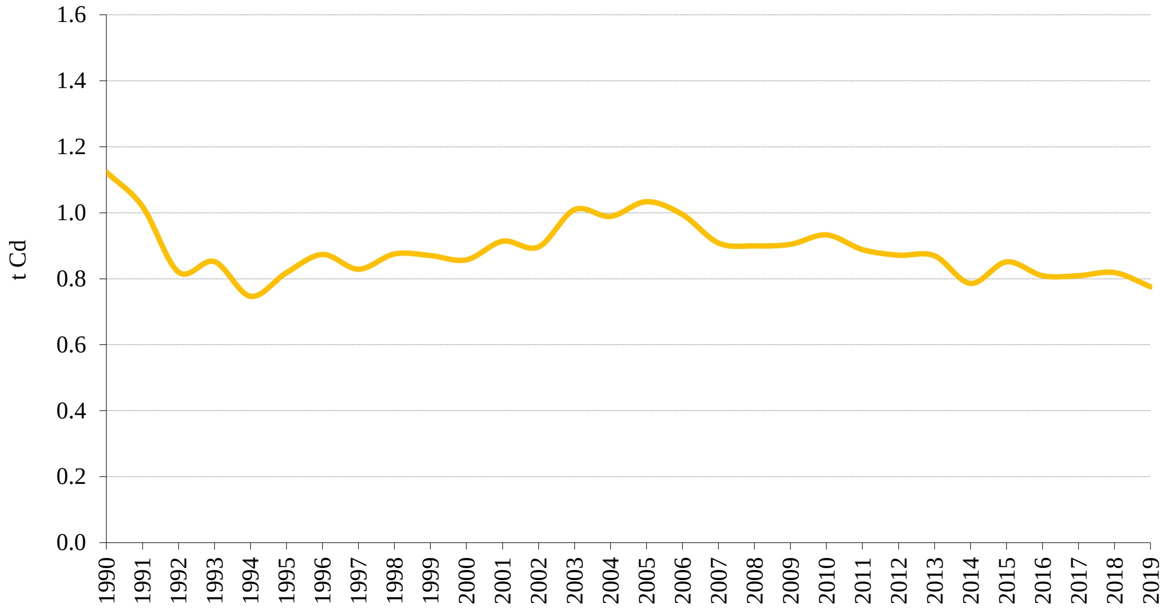
Pb											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	0.62	1.97	0.59	77.48	NA	0.56	432.2	2.16	0.013	1.8E-04	515.6
1991	0.53	1.79	0.41	29.45	NA	0.56	310.1	6.82	0.012	1.9E-04	349.7
1992	0.67	1.36	0.34	0.89	NA	0.56	249.8	2.85	0.012	1.0E-04	256.5
1993	0.54	1.48	0.29	0.88	NA	0.56	245.8	6.00	0.012	1.3E-04	255.6
1994	0.46	1.27	0.31	0.82	NA	0.56	268.6	5.63	0.012	1.2E-04	277.6
1995	0.51	1.33	0.28	0.69	NA	0.95	250.9	5.58	0.012	1.3E-04	260.2
1996	0.51	1.49	0.27	0.61	NA	1.40	200.4	4.80	0.012	1.2E-04	209.5
1997	0.59	1.37	0.31	0.63	NA	1.38	182.0	3.69	0.013	1.4E-04	189.9
1998	0.72	1.39	0.32	0.82	NA	0.94	173.3	2.95	0.015	1.5E-04	180.4

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
1999	0.75	1.38	0.33	0.77	NA	0.76	168.2	3.75	0.015	1.3E-04	175.9
2000	0.48	1.22	0.41	0.87	NA	0.55	137.2	2.67	0.017	1.1E-04	143.4
2001	0.52	1.28	0.43	0.80	NA	1.30	103.8	1.97	0.018	1.3E-04	110.1
2002	0.57	1.26	0.41	0.76	NA	6.50	56.8	0.92	0.016	1.5E-04	67.3
2003	0.74	1.45	0.42	0.83	NA	9.01	19.5	0.65	0.014	9.5E-05	32.6
2004	0.51	1.38	0.46	1.02	NA	4.86	12.5	0.52	0.014	1.4E-04	21.3
2005	0.58	1.47	0.47	1.03	NA	2.17	7.4	0.41	0.014	1.4E-04	13.6
2006	0.55	1.34	0.54	0.97	NA	1.64	4.8	0.36	0.015	1.5E-04	10.2
2007	0.59	1.26	0.45	1.04	NA	1.15	4.9	0.37	0.016	1.2E-04	9.8
2008	0.55	1.27	0.42	1.12	NA	0.80	4.7	0.34	0.013	1.7E-04	9.2
2009	0.51	1.32	0.39	0.95	NA	0.36	4.7	0.34	0.014	1.6E-04	8.6
2010	0.35	1.42	0.40	1.00	NA	0.14	4.5	0.22	0.005	1.4E-04	8.0
2011	0.40	1.38	0.34	0.94	NA	0.12	4.4	0.22	0.006	1.4E-04	7.8
2012	0.34	1.37	0.35	0.68	NA	0.01	3.9	0.19	0.008	1.3E-04	6.8
2013	0.31	1.35	0.37	0.96	NA	1.14	4.1	0.19	0.005	1.5E-04	8.4
2014	0.30	1.19	0.36	1.06	NA	0.81	3.9	0.19	0.005	1.4E-04	7.8
2015	0.32	1.35	0.34	0.94	NA	0.78	4.0	0.16	0.006	1.4E-04	7.9
2016	0.34	1.31	0.32	0.69	NA	1.00	4.0	0.19	0.006	1.7E-04	7.9
2017	0.27	1.28	0.38	0.73	NA	1.06	4.1	0.18	0.002	1.3E-04	8.0
2018	0.31	1.22	0.37	1.02	NA	1.28	3.7	0.18	0.002	1.6E-04	8.1
2019	0.32	1.18	0.36	0.79	NA	1.35	1.0	0.18	0.002	1.7E-04	5.2
2019 vs 1990	-48.0%	-40.3%	-38.5%	-99.0%	NA	143.7%	-99.8%	-91.5%	-87.0%	-7.4%	-99.0%
2019 vs 2018	3.0%	-3.1%	-1.3%	-22.1%	NA	6.1%	-74.1%	0.1%	-18.5%	7.3%	-36.3%

2.8.2. Cadmium (Cd)

The cadmium emission in 2019 was amounted to 0.78 t. The Cd emission has decrease by 31 % since 1990 and by 5.3 % in comparison to year before (Figure 2.8.2-1 and Table 2.8.2-1). Majority of Cd emission originates from the fuel combustion in Energy sector (84.6 % in 2019), with domination of Small combustion and mobile machinery sector (71.9 %). The second dominating sector in Cd emission in 2019 was IPPU with a contribution of 30.2 %. 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 - 2019, because of reduced consumption of fuel oil and a simultaneous increase in natural gas consumption. In addition, 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 27 %), 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). In addition, the war for Croatian independence caused a reduction in fuel consumption and production in IPPU sector In addition, emission dips can be seen in the years 1994, 2000, 2002 and 2014 when, due to the warmer winter, the consumption of biomass for heating was lower.



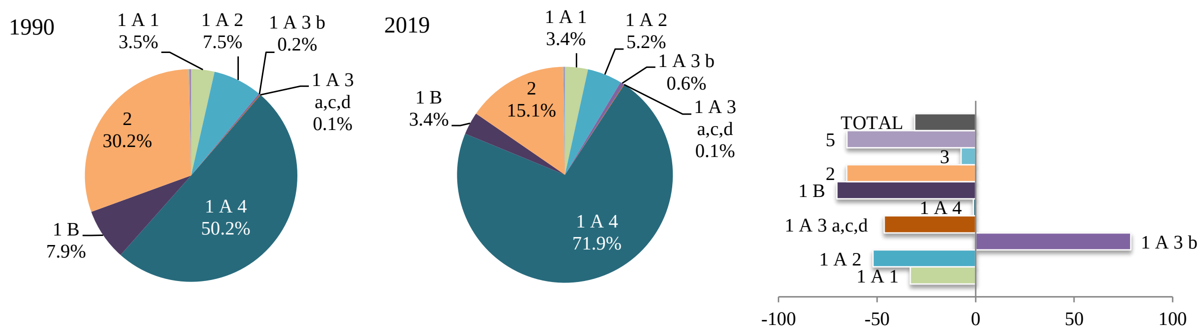


Figure 2.8.2-1 The Cd emissions (t/yr.) and percentage share by sector and variation in Cd emissions

Table 2.8.2-1 The Cd emissions by SNAP nomenclature in the period 1990-2019

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	0.08	0.36	NA	0.066	0.003	0.005	0.007	1.5E-03	1.12
1991	0.03	0.66	0.07	0.19	NA	0.062	0.002	0.003	0.005	1.5E-03	1.02
1992	0.03	0.57	0.06	0.09	NA	0.068	0.002	0.002	0.006	8.0E-04	0.82
1993	0.03	0.60	0.05	0.09	NA	0.062	0.002	0.002	0.005	1.0E-03	0.85
1994	0.03	0.55	0.05	0.09	NA	0.027	0.002	0.002	0.005	9.4E-04	0.75
1995	0.03	0.58	0.05	0.09	NA	0.066	0.002	0.002	0.006	1.0E-03	0.82
1996	0.03	0.64	0.05	0.07	NA	0.064	0.002	0.003	0.006	9.8E-04	0.87
1997	0.03	0.59	0.06	0.07	NA	0.063	0.003	0.002	0.006	1.1E-03	0.83
1998	0.03	0.59	0.07	0.10	NA	0.066	0.003	0.003	0.006	1.2E-03	0.87
1999	0.03	0.58	0.07	0.10	NA	0.076	0.003	0.003	0.006	1.1E-03	0.87
2000	0.03	0.52	0.10	0.12	NA	0.074	0.003	0.003	0.007	8.9E-04	0.86
2001	0.03	0.57	0.10	0.11	NA	0.098	0.003	0.003	0.006	1.1E-03	0.91
2002	0.03	0.55	0.09	0.11	NA	0.111	0.003	0.003	0.006	1.2E-03	0.90
2003	0.03	0.63	0.10	0.11	NA	0.120	0.003	0.004	0.006	7.6E-04	1.01
2004	0.03	0.61	0.11	0.13	NA	0.086	0.003	0.004	0.006	1.1E-03	0.99
2005	0.03	0.65	0.12	0.13	NA	0.083	0.003	0.004	0.006	1.1E-03	1.03
2006	0.03	0.60	0.15	0.12	NA	0.081	0.004	0.004	0.006	1.2E-03	0.99
2007	0.03	0.58	0.07	0.13	NA	0.081	0.004	0.004	0.006	9.7E-04	0.91
2008	0.03	0.58	0.07	0.13	NA	0.085	0.004	0.005	0.006	1.3E-03	0.90

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
2009	0.03	0.60	0.07	0.12	NA	0.062	0.004	0.004	0.006	1.3E-03	0.90
2010	0.03	0.65	0.06	0.12	NA	0.072	0.004	0.004	0.003	1.1E-03	0.93
2011	0.03	0.63	0.05	0.10	NA	0.063	0.004	0.004	0.004	1.1E-03	0.89
2012	0.03	0.63	0.05	0.09	NA	0.060	0.003	0.003	0.004	1.0E-03	0.87
2013	0.02	0.63	0.05	0.10	NA	0.054	0.004	0.003	0.004	1.2E-03	0.87
2014	0.02	0.55	0.05	0.11	NA	0.047	0.004	0.003	0.004	1.1E-03	0.79
2015	0.02	0.64	0.04	0.10	NA	0.046	0.004	0.003	0.004	1.1E-03	0.85
2016	0.02	0.62	0.03	0.08	NA	0.046	0.004	0.003	0.004	1.4E-03	0.81
2017	0.02	0.60	0.04	0.08	NA	0.051	0.004	0.003	0.003	1.0E-03	0.81
2018	0.03	0.57	0.04	0.10	NA	0.067	0.004	0.003	0.003	1.3E-03	0.82
2019	0.03	0.56	0.04	0.08	NA	0.066	0.005	0.004	0.002	1.3E-03	0.78
2019 vs 1990	-33.1%	-1.1%	-52.5%	-78.9%	NA	0.1%	78.8%	-24.3%	-63.1%	-7.4%	-31.0%
2019 vs 2018	-1.7%	-2.9%	-3.0%	-24.2%	NA	-1.5%	10.0%	2.8%	-17.1%	7.3%	-5.3%

2.8.3. Mercury (Hg)

The mercury emission in 2019 was amounted to 0.39 t (Figure and Table 2.8.3-1). Emission has decreased by 65.5 % since 1990, and by 8.5 % since year before. The majority of Hg emission in 2019 resulting from fuel combustion in the Energy sector (85.7 % in total Hg emission) where Manufacturing industries and construction participates with 33 %, Energy industries with 28 %, Small combustion with mobile machinery with 10.33 % and Fugitive emissions from fuels with 8.1 %. The second sector in dominance in Hg emission in 2019 has IPPU with a contribution of 11.5 %. Mercury emission originates from its content in fuels (e.g. coal, natural gas), raw materials at the entrance to the production processes (e.g. refining, production of steel and glass) and waste 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 (96 % in 1990). In 1993, the process units for removal of mercury from natural gas were put into operation. With this technical 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 emission has 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.

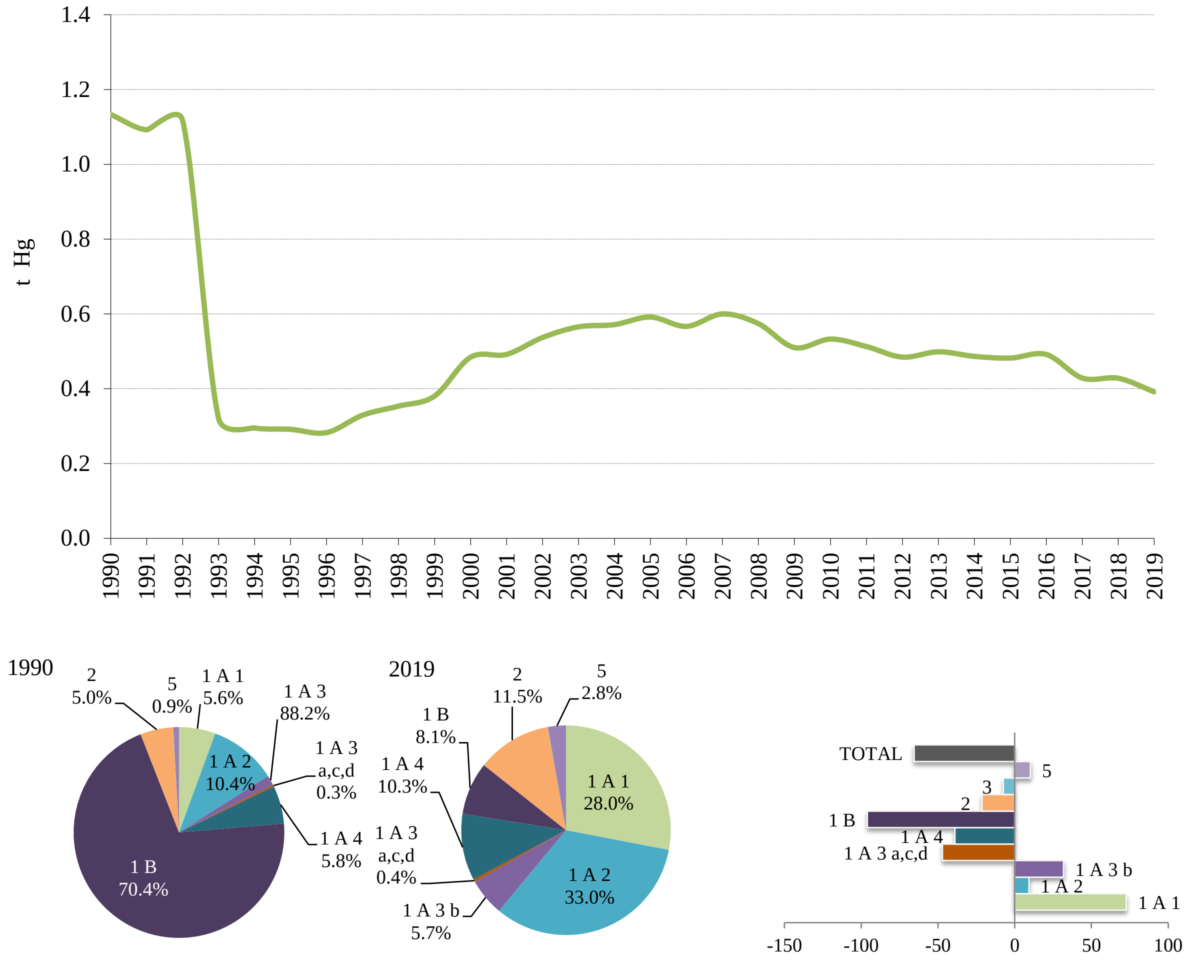


Figure 2.8.3-1 The Hg emissions (t/yr.) and percentage share by sector and variation in Hg emissions

Table 2.8.3-1 The Hg emissions by SNAP nomenclature in the period 1990-2019

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	0.05	0.017	3.2E-03	0.011	2.31E-04	1.13
1991	0.04	0.06	0.08	0.07	0.77	0.05	0.013	1.8E-03	0.010	2.44E-04	1.09
1992	0.06	0.04	0.09	0.06	0.80	0.04	0.012	1.4E-03	0.012	1.28E-04	1.12
1993	0.05	0.05	0.08	0.08	2.28E-03	0.05	0.012	1.3E-03	0.012	1.60E-04	0.32
1994	0.02	0.04	0.09	0.07	2.04E-03	0.05	0.013	8.0E-04	0.012	1.50E-04	0.29
1995	0.03	0.04	0.07	0.07	2.35E-03	0.05	0.014	1.1E-03	0.013	1.60E-04	0.29
1996	0.02	0.05	0.08	0.06	2.80E-03	0.05	0.015	1.5E-03	0.013	1.57E-04	0.28
1997	0.06	0.04	0.09	0.06	1.99E-03	0.05	0.017	1.2E-03	0.013	1.79E-04	0.33
1998	0.06	0.05	0.10	0.07	2.93E-03	0.05	0.018	1.1E-03	0.013	1.90E-04	0.35
1999	0.05	0.05	0.12	0.08	1.98E-03	0.05	0.019	1.0E-03	0.013	1.69E-04	0.38
2000	0.12	0.04	0.13	0.11	1.93E-03	0.04	0.019	1.0E-03	0.013	1.41E-04	0.48
2001	0.12	0.04	0.15	0.09	2.09E-03	0.04	0.019	1.0E-03	0.013	1.68E-04	0.49
2002	0.17	0.04	0.15	0.10	7.30E-04	0.04	0.020	1.2E-03	0.014	1.85E-04	0.54
2003	0.19	0.05	0.15	0.10	7.50E-04	0.04	0.021	1.2E-03	0.014	1.21E-04	0.57
2004	0.18	0.05	0.16	0.10	7.80E-04	0.04	0.022	1.1E-03	0.014	1.81E-04	0.57
2005	0.19	0.05	0.16	0.11	7.60E-04	0.04	0.022	1.2E-03	0.015	1.75E-04	0.59
2006	0.18	0.05	0.17	0.09	7.10E-04	0.04	0.023	1.2E-03	0.015	1.87E-04	0.57
2007	0.19	0.04	0.17	0.11	7.10E-04	0.04	0.024	1.3E-03	0.017	1.54E-04	0.60
2008	0.19	0.05	0.17	0.09	5.00E-05	0.04	0.023	1.5E-03	0.015	2.14E-04	0.57

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
2009	0.14	0.05	0.14	0.10	4.20E-05	0.04	0.023	1.6E-03	0.016	2.03E-04	0.51
2010	0.19	0.05	0.13	0.08	3.90E-05	0.04	0.023	1.3E-03	0.010	1.78E-04	0.53
2011	0.20	0.05	0.12	0.07	4.10E-05	0.04	0.022	1.3E-03	0.011	1.72E-04	0.51
2012	0.18	0.05	0.11	0.07	4.10E-05	0.04	0.020	1.3E-03	0.012	1.64E-04	0.48
2013	0.19	0.05	0.12	0.06	4.10E-05	0.04	0.021	1.4E-03	0.010	1.89E-04	0.50
2014	0.19	0.04	0.13	0.05	4.10E-05	0.04	0.021	1.5E-03	0.011	1.73E-04	0.49
2015	0.18	0.04	0.12	0.06	4.10E-05	0.04	0.022	1.4E-03	0.012	1.74E-04	0.48
2016	0.20	0.04	0.12	0.05	4.10E-05	0.04	0.022	1.5E-03	0.011	2.20E-04	0.49
2017	0.11	0.04	0.14	0.06	4.10E-05	0.04	0.024	1.5E-03	0.009	1.67E-04	0.43
2018	0.13	0.04	0.13	0.05	4.10E-05	0.04	0.022	1.6E-03	0.011	1.99E-04	0.43
2019	0.11	0.04	0.13	0.04	4.10E-05	0.04	0.022	1.7E-03	0.011	2.14E-04	0.39
2019 vs 1990	72.8%	-39.0%	9.3%	-66.2%	-100.0%	-14.8%	31.8%	-47.1%	5.6%	-7.4%	-65.5%
2019 vs 2018	-13.3%	-2.4%	-3.0%	-30.1%	0.0%	-0.5%	3.1%	3.8%	3.0%	7.3%	-8.5%

2.9. 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 because of tire and brake wear, Zinc is mostly emitted because 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.

2.9.1. Arsenic (As)

The Arsenic emission in 2019 was estimated to 0.59 t (Figure and Table 2.9.1-1). Emission has decreased by 93.1 % since 1990 and increased by 4.7 % since year before. The Energy sector is a significant source of Arsenic in 2019 (90 %). From non-energy sectors, IPPU sector is dominant, which contributed with 9.7 % to As emission in 2019 (glass production and steel production with less extent). As emission originates from 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 emission. 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 IPPU sector.

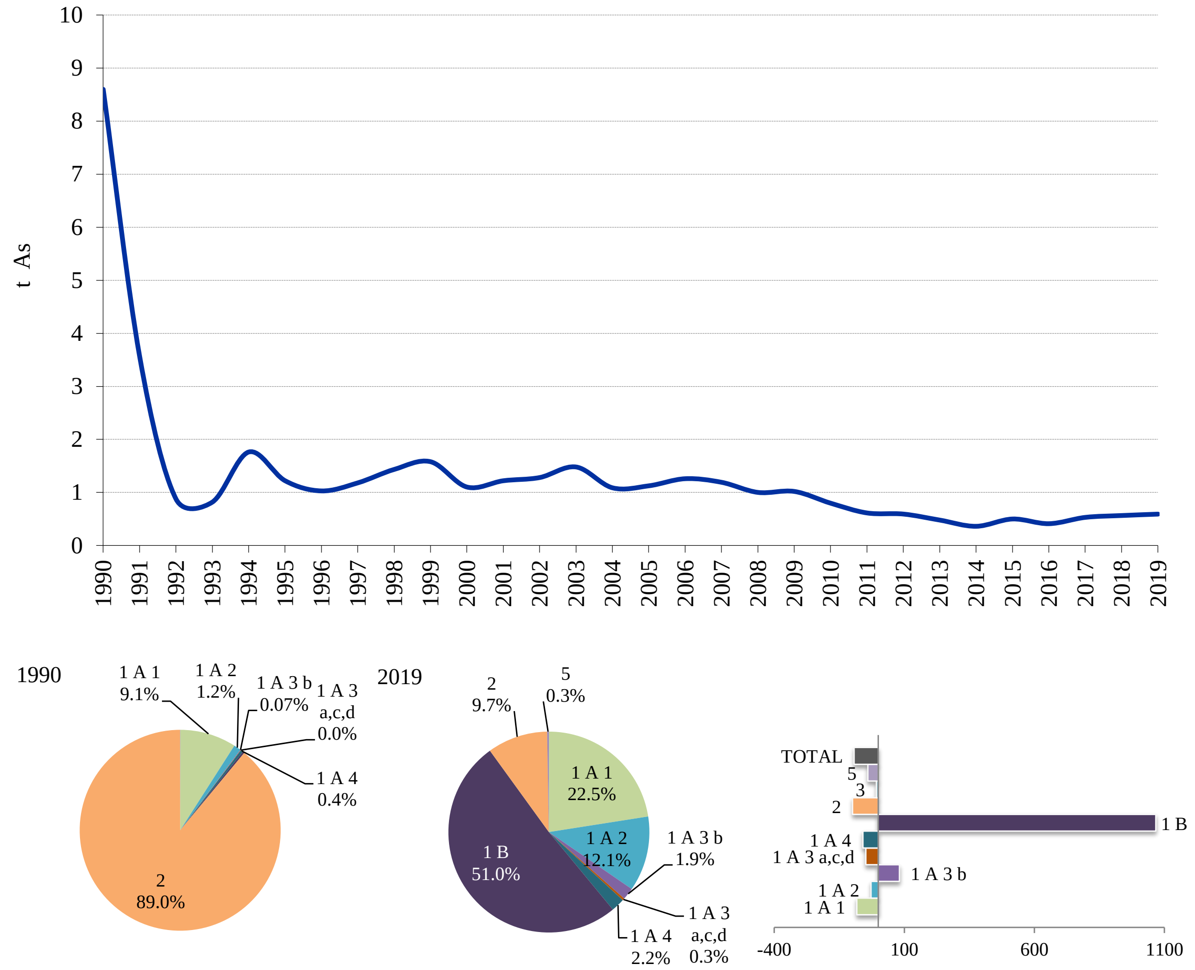


Figure 2.9.1-1 The As emissions (t/yr.) and percentage share by sector and variation in As emissions

Table 2.9.1-1 The As emissions by SNAP nomenclature in the period 1990-2019

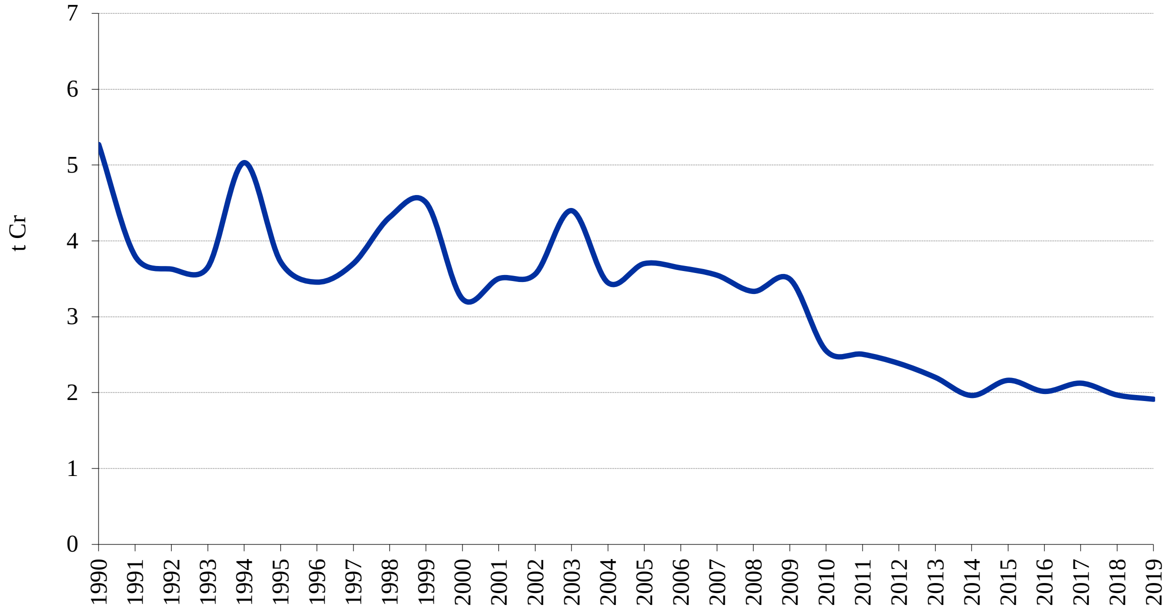
As											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	0.78	0.032	0.10	7.67	NA	0.001	0.0063	0.0039	0.0032	1.06E-05	8.60
1991	0.58	0.023	0.06	2.89	NA	0.001	0.0047	0.0034	0.0023	1.11E-05	3.57
1992	0.74	0.017	0.06	0.04	NA	0.001	0.0046	0.0076	0.0037	5.85E-06	0.88
1993	0.69	0.020	0.05	0.05	NA	0.001	0.0050	0.0085	0.0023	7.33E-06	0.82
1994	1.28	0.016	0.06	0.40	NA	0.001	0.0053	0.0013	0.0027	6.87E-06	1.76
1995	0.74	0.017	0.05	0.40	NA	0.002	0.0055	0.0052	0.0033	7.30E-06	1.22
1996	0.61	0.019	0.05	0.33	NA	0.002	0.0060	0.0120	0.0033	7.16E-06	1.03
1997	0.75	0.018	0.05	0.34	NA	0.002	0.0067	0.0087	0.0031	8.20E-06	1.18
1998	0.94	0.018	0.07	0.38	NA	0.002	0.0069	0.0033	0.0032	8.69E-06	1.43
1999	0.99	0.019	0.08	0.47	NA	0.001	0.0075	0.0026	0.0034	7.71E-06	1.58
2000	0.48	0.016	0.12	0.47	NA	0.001	0.0075	0.0020	0.0034	6.45E-06	1.10
2001	0.60	0.016	0.13	0.47	NA	0.002	0.0067	0.0034	0.0032	7.69E-06	1.22
2002	0.60	0.017	0.12	0.52	NA	0.011	0.0074	0.0061	0.0030	8.45E-06	1.28
2003	0.83	0.019	0.12	0.47	NA	0.015	0.0081	0.0058	0.0033	5.51E-06	1.48
2004	0.46	0.017	0.14	0.45	NA	0.008	0.0083	0.0012	0.0028	8.25E-06	1.09
2005	0.54	0.018	0.15	0.39	NA	0.004	0.0086	0.0013	0.0029	8.02E-06	1.12
2006	0.56	0.017	0.18	0.48	NA	0.003	0.0092	0.0014	0.0029	8.56E-06	1.26
2007	0.59	0.015	0.10	0.46	NA	0.002	0.0098	0.0014	0.0029	7.02E-06	1.19
2008	0.55	0.015	0.10	0.32	NA	0.001	0.0095	0.0027	0.0027	9.80E-06	1.00

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
2009	0.57	0.016	0.09	0.33	NA	0.001	0.0095	0.0022	0.0027	9.26E-06	1.02
2010	0.22	0.017	0.08	0.47	NA	0.000	0.0092	0.0028	0.0023	8.14E-06	0.80
2011	0.26	0.016	0.06	0.26	NA	0.000	0.0090	0.0027	0.0025	7.85E-06	0.61
2012	0.20	0.015	0.06	0.30	NA	0.000	0.0086	0.0027	0.0025	7.51E-06	0.59
2013	0.13	0.015	0.07	0.24	NA	0.002	0.0092	0.0016	0.0023	8.63E-06	0.48
2014	0.11	0.013	0.07	0.15	NA	0.001	0.0089	0.0017	0.0017	7.91E-06	0.36
2015	0.15	0.014	0.07	0.25	NA	0.001	0.0093	0.0017	0.0019	7.96E-06	0.50
2016	0.12	0.014	0.07	0.20	NA	0.002	0.0096	0.0017	0.0020	1.01E-05	0.41
2017	0.12	0.014	0.08	0.30	NA	0.002	0.0106	0.0018	0.0019	7.63E-06	0.53
2018	0.12	0.013	0.07	0.34	NA	0.002	0.010	0.0020	0.0017	9.12E-06	0.56
2019	0.13	0.013	0.07	0.36	NA	0.002	0.011	0.0020	0.0018	9.79E-06	0.59
2019 vs 1990	-82.9%	-59.6%	-28.3%	-95.4%	NA	143.7%	81.3%	-48.3%	-44.4%	-7.4%	-93.1%
2019 vs 2018	14.4%	-3.7%	-3.3%	3.3%	NA	6.1%	10.7%	4.0%	5.2%	7.3%	4.7%

2.9.2. Chromium (Cr)

The Chromium emission in 2019 was amounted to 1.9 t (Figure and Table 2.9.2-1). The Cr emission has decreased by 61.8 % 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 91.4 %) in comparison to 1990, was happened in IPPU 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 7.2 % of Cr emission in 2019 originates from the Energy industries, whereas the impact of this sector in the nineties was significantly higher (36.4 % in 1990). The annual Cr emissions from this source show long-term trend fluctuations between 1990 and 2019, which mostly depends on the type of fuel. Higher consumption of biomass, solid fuel and heavy fuel oil leads to higher Cr emission.



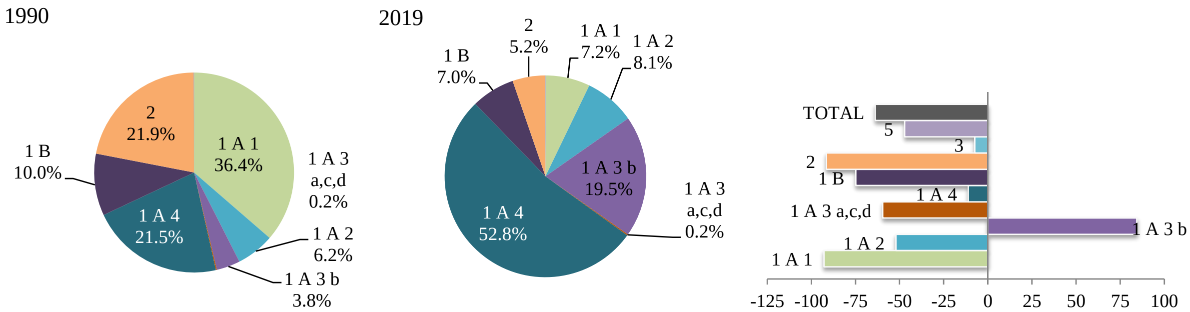


Figure 2.9.2-1 The Cr emissions (t/yr.) and percentage share by sector and variation in Cr emissions

Table 2.9.2-1 The Cr emissions by SNAP nomenclature in the period 1990-2019

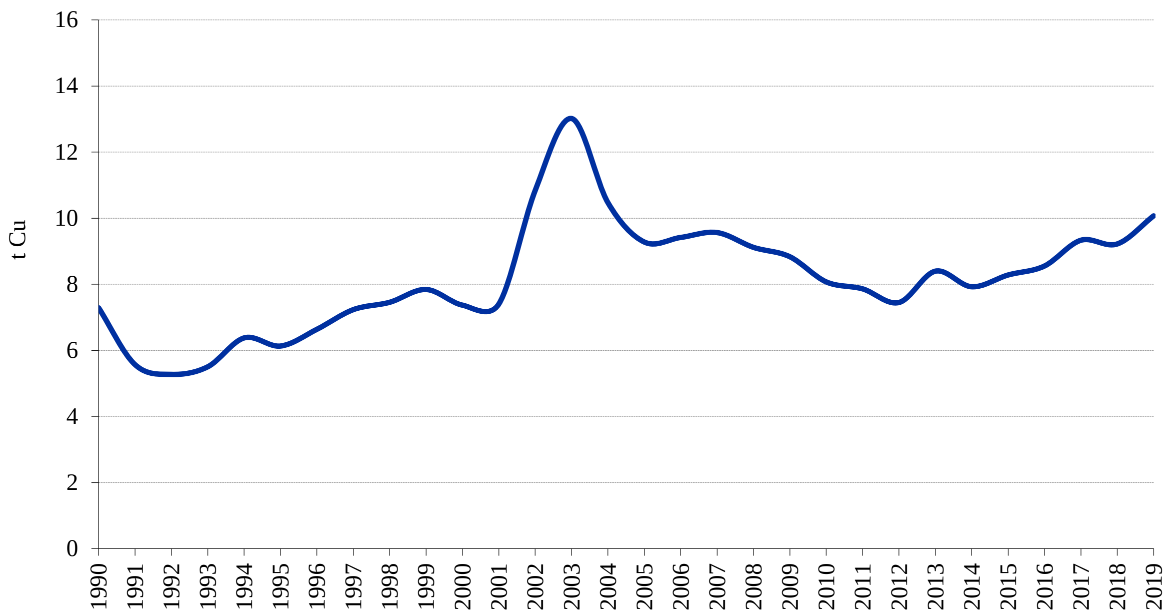
Cr											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	1.92	1.12	0.32	1.7	NA	0.011	0.20	0.026	0.014	1.32E-04	5.3
1991	1.42	1.24	0.23	0.72	NA	0.011	0.15	0.020	0.010	1.39E-04	3.8
1992	1.81	1.10	0.19	0.34	NA	0.011	0.15	0.016	0.011	7.32E-05	3.6
1993	1.70	1.17	0.17	0.42	NA	0.011	0.16	0.017	0.010	9.17E-05	3.7
1994	3.25	1.04	0.17	0.37	NA	0.011	0.17	0.013	0.011	8.59E-05	5.0
1995	1.92	1.10	0.15	0.33	NA	0.019	0.18	0.016	0.013	9.13E-05	3.7
1996	1.54	1.24	0.15	0.27	NA	0.028	0.19	0.023	0.012	8.95E-05	3.5
1997	1.84	1.15	0.17	0.27	NA	0.028	0.22	0.019	0.012	1.03E-04	3.7
1998	2.37	1.12	0.21	0.34	NA	0.019	0.22	0.016	0.012	1.09E-04	4.3
1999	2.51	1.13	0.20	0.38	NA	0.015	0.24	0.016	0.013	9.64E-05	4.5
2000	1.15	1.00	0.30	0.50	NA	0.011	0.24	0.017	0.014	8.06E-05	3.2
2001	1.41	1.08	0.30	0.44	NA	0.026	0.22	0.020	0.013	9.61E-05	3.5
2002	1.39	1.04	0.27	0.45	NA	0.129	0.24	0.022	0.012	1.06E-04	3.6
2003	1.97	1.20	0.30	0.46	NA	0.179	0.26	0.023	0.012	6.89E-05	4.4
2004	1.06	1.16	0.33	0.50	NA	0.097	0.27	0.018	0.011	1.03E-04	3.4
2005	1.25	1.22	0.36	0.52	NA	0.044	0.28	0.019	0.011	1.00E-04	3.7
2006	1.29	1.12	0.44	0.44	NA	0.033	0.30	0.020	0.011	1.07E-04	3.6
2007	1.35	1.07	0.24	0.51	NA	0.023	0.32	0.021	0.011	8.78E-05	3.5
2008	1.25	1.07	0.23	0.42	NA	0.017	0.31	0.025	0.010	1.22E-04	3.3

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
2009	1.32	1.12	0.22	0.50	NA	0.008	0.31	0.021	0.011	1.16E-04	3.5
2010	0.43	1.19	0.20	0.40	NA	0.003	0.30	0.021	0.006	1.02E-04	2.5
2011	0.52	1.16	0.16	0.34	NA	0.003	0.29	0.020	0.008	9.82E-05	2.5
2012	0.40	1.15	0.17	0.35	NA	0.000	0.28	0.019	0.008	9.39E-05	2.4
2013	0.22	1.14	0.17	0.32	NA	0.023	0.30	0.017	0.008	1.08E-04	2.2
2014	0.17	1.00	0.16	0.29	NA	0.016	0.29	0.017	0.008	9.89E-05	2.0
2015	0.23	1.15	0.14	0.29	NA	0.016	0.31	0.017	0.009	9.95E-05	2.2
2016	0.12	1.12	0.13	0.28	NA	0.020	0.31	0.017	0.010	1.26E-04	2.0
2017	0.18	1.08	0.16	0.31	NA	0.021	0.35	0.017	0.007	9.54E-05	2.1
2018	0.13	1.03	0.15	0.27	NA	0.025	0.34	0.017	0.007	1.14E-04	2.0
2019	0.14	1.00	0.15	0.20	NA	0.027	0.37	0.018	0.005	1.22E-04	1.9
2019 vs 1990	-92.9%	-11.0%	-52.7%	-87.9%	NA	143.7%	84.4%	-30.9%	-61.2%	-7.4%	-63.8%
2019 vs 2018	6.8%	-3.3%	-1.9%	-24.1%	NA	6.1%	11.0%	2.8%	-22.9%	7.3%	-2.8%

2.9.3. Copper (Cu)

The Cu emissions in 2019 have amounted to 10.7 t (Figure and Table 2.9.3-1). The Road transport sector (mostly automobile tire and brake wear) contributes with 78.1 % in 2019 and has the domination in the national copper emission.

Emission of copper is currently 38.2 % higher than 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).



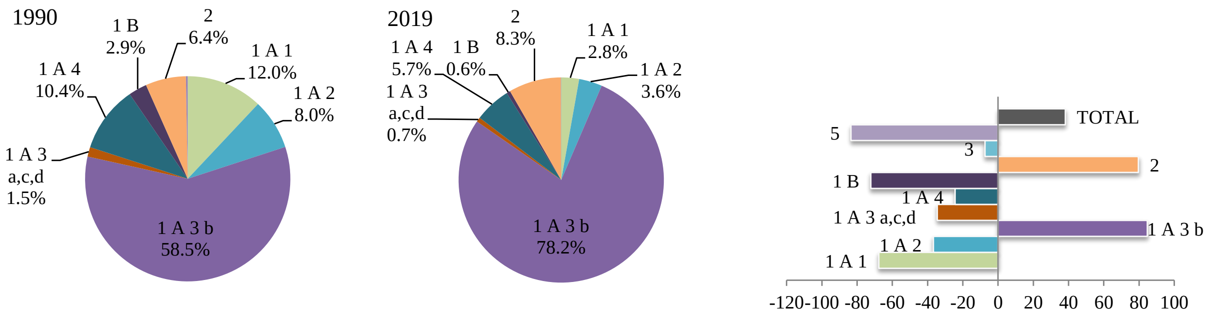


Figure 2.9.3-1 The Cu emissions (t/yr.) and percentage share by sector and variation in Cu emissions

Table 2.9.3-1 The Cu emissions by SNAP nomenclature in the period 1990-2019

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	0.35	0.29	NA	0.38	4.26	0.70	0.03	1.21E-04	7.3
1991	0.64	0.38	0.23	0.18	NA	0.38	3.20	0.53	0.02	1.27E-04	5.6
1992	0.80	0.31	0.19	0.12	NA	0.38	3.14	0.30	0.03	6.68E-05	5.3
1993	0.75	0.33	0.16	0.16	NA	0.38	3.44	0.27	0.02	8.36E-05	5.5
1994	1.35	0.29	0.18	0.14	NA	0.34	3.66	0.39	0.02	7.84E-05	6.4
1995	0.83	0.30	0.15	0.13	NA	0.60	3.73	0.36	0.03	8.33E-05	6.1
1996	0.69	0.34	0.15	0.10	NA	0.85	4.08	0.39	0.02	8.17E-05	6.6
1997	0.81	0.31	0.17	0.10	NA	0.84	4.59	0.38	0.03	9.35E-05	7.2
1998	1.02	0.31	0.18	0.13	NA	0.60	4.73	0.45	0.03	9.91E-05	7.5
1999	1.08	0.31	0.19	0.15	NA	0.51	5.11	0.46	0.03	8.79E-05	7.8
2000	0.57	0.28	0.25	0.20	NA	0.39	5.10	0.54	0.04	7.36E-05	7.4
2001	0.68	0.29	0.27	0.18	NA	0.83	4.55	0.57	0.04	8.77E-05	7.4
2002	0.69	0.28	0.26	0.18	NA	3.78	5.06	0.55	0.03	9.64E-05	10.8
2003	0.93	0.33	0.25	0.18	NA	5.20	5.50	0.59	0.03	6.29E-05	13.0
2004	0.56	0.31	0.28	0.19	NA	2.83	5.68	0.58	0.03	9.41E-05	10.5
2005	0.64	0.33	0.29	0.20	NA	1.31	5.86	0.61	0.03	9.15E-05	9.3
2006	0.65	0.30	0.34	0.17	NA	1.00	6.28	0.65	0.03	9.76E-05	9.4
2007	0.69	0.29	0.26	0.20	NA	0.73	6.70	0.67	0.03	8.01E-05	9.6
2008	0.63	0.29	0.24	0.16	NA	0.54	6.47	0.77	0.03	1.12E-04	9.1
2009	0.65	0.30	0.21	0.19	NA	0.26	6.52	0.67	0.03	1.06E-04	8.8
2010	0.30	0.32	0.22	0.15	NA	0.15	6.29	0.62	0.01	9.28E-05	8.1
2011	0.36	0.31	0.18	0.12	NA	0.13	6.13	0.61	0.01	8.96E-05	7.9
2012	0.30	0.31	0.18	0.13	NA	0.07	5.88	0.56	0.02	8.57E-05	7.4
2013	0.22	0.30	0.19	0.11	NA	0.70	6.30	0.55	0.01	9.85E-05	8.4
2014	0.20	0.27	0.19	0.09	NA	0.51	6.11	0.54	0.01	9.02E-05	7.9
2015	0.24	0.30	0.18	0.10	NA	0.49	6.42	0.53	0.01	9.08E-05	8.3
2016	0.23	0.29	0.17	0.10	NA	0.61	6.60	0.53	0.01	1.15E-04	8.5
2017	0.22	0.29	0.20	0.11	NA	0.65	7.33	0.53	0.01	8.71E-05	9.3
2018	0.25	0.27	0.19	0.09	NA	0.79	7.08	0.55	0.01	1.04E-04	9.2
2019	0.28	0.26	0.19	0.06	NA	0.83	7.87	0.56	0.01	1.12E-04	10.1
2019 vs 1990	-67.7%	-34.9%	-45.9%	-79.3%	NA	118.7%	84.8%	-19.4%	-79.5%	-7.4%	38.2%
2019 vs 2018	14.7%	-3.3%	-1.0%	-29.9%	NA	5.4%	11.2%	2.7%	-7.9%	7.3%	9.2%

2.9.4. Nickel (Ni)

Emission of Nickel in 2019 amounted to 2.8 t (Figure and Table 2.9.4-1). The Ni emission has declined by 83.6 %, since 1990. Majority of Ni emissions in historical trend originate from the Energy sector (83.3 % in 1990 and 90.3 % in 2019).

The historical trend of Ni emission from this source category shows long-term fluctuations between which mostly depend on the type of fuel in use. 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 in Siemens Martin' furnaces in Sisak, 1992. In recent years (since 2010), the trend records continuous reduction of Ni emission, as a result of the decreasing use of coal as a fuel in Small combustion sector (mainly residential).

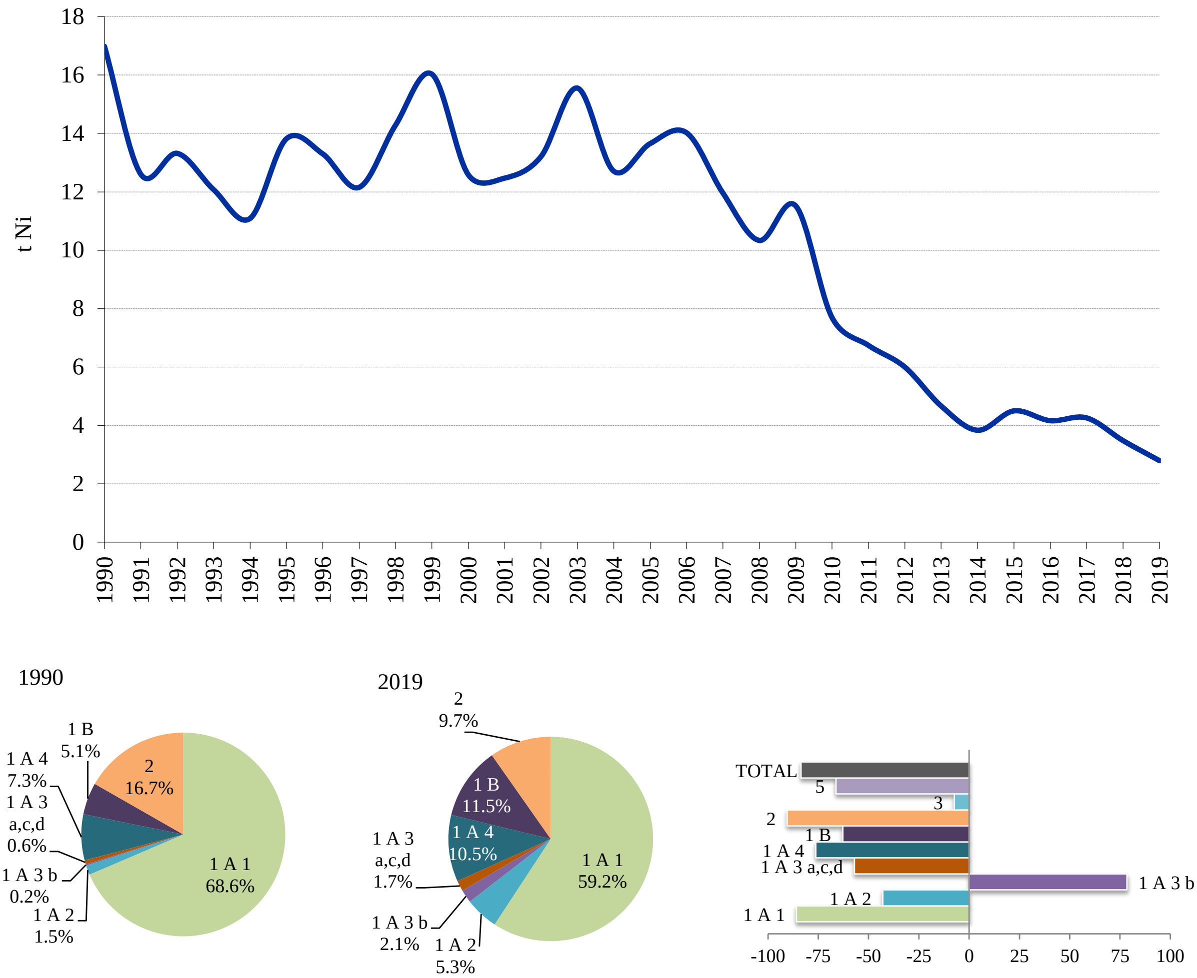


Figure 2.9.4-1The Ni emissions (t/yr.) and percentage share by sector and variation in Ni emissions

Table 2.9.4-1 The Ni emissions by SNAP nomenclature in the period 1990-2019

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	0.25	3.63	NA	0.05	0.03	0.13	0.013	8.6E-05	17.0
1991	9.7	0.81	0.16	1.75	NA	0.05	0.02	0.14	0.009	9.0E-05	12.6
1992	11.1	1.08	0.14	0.62	NA	0.05	0.02	0.34	0.009	4.8E-05	13.3
1993	9.5	1.21	0.11	0.75	NA	0.05	0.03	0.39	0.010	6.0E-05	12.1

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
1994	9.1	0.97	0.13	0.76	NA	0.03	0.03	0.06	0.010	5.6E-05	11.1
1995	11.6	1.02	0.11	0.74	NA	0.07	0.03	0.24	0.012	5.9E-05	13.8
1996	10.6	1.35	0.10	0.61	NA	0.08	0.03	0.55	0.011	5.8E-05	13.3
1997	9.6	1.28	0.12	0.62	NA	0.08	0.03	0.40	0.010	6.7E-05	12.2
1998	11.5	0.94	0.75	0.78	NA	0.07	0.04	0.15	0.011	7.1E-05	14.3
1999	13.0	1.25	0.73	0.86	NA	0.07	0.04	0.11	0.012	6.3E-05	16.0
2000	8.4	1.09	1.87	1.07	NA	0.06	0.04	0.09	0.012	5.2E-05	12.6
2001	8.5	0.95	1.74	0.96	NA	0.10	0.03	0.16	0.011	6.2E-05	12.5
2002	9.1	1.01	1.44	0.98	NA	0.30	0.04	0.28	0.010	6.9E-05	13.2
2003	11.0	1.07	1.74	0.99	NA	0.40	0.04	0.26	0.011	4.5E-05	15.6
2004	8.3	1.00	2.02	1.09	NA	0.23	0.04	0.05	0.010	6.7E-05	12.7
2005	8.9	0.94	2.52	1.10	NA	0.13	0.04	0.05	0.010	6.5E-05	13.7
2006	8.6	0.82	3.40	0.97	NA	0.11	0.05	0.06	0.010	7.0E-05	14.0
2007	9.4	0.70	0.54	1.11	NA	0.09	0.05	0.06	0.011	5.7E-05	12.0
2008	7.8	0.68	0.65	0.93	NA	0.08	0.05	0.12	0.010	8.0E-05	10.3
2009	9.0	0.66	0.68	1.03	NA	0.05	0.05	0.08	0.011	7.5E-05	11.5
2010	5.7	0.64	0.25	0.92	NA	0.04	0.05	0.12	0.005	6.6E-05	7.7
2011	5.1	0.59	0.14	0.75	NA	0.04	0.05	0.11	0.007	6.4E-05	6.7
2012	4.4	0.51	0.17	0.73	NA	0.03	0.04	0.11	0.007	6.1E-05	6.0
2013	3.1	0.45	0.20	0.71	NA	0.07	0.05	0.06	0.007	7.0E-05	4.7
2014	2.4	0.36	0.25	0.65	NA	0.05	0.05	0.06	0.008	6.4E-05	3.8
2015	3.1	0.42	0.14	0.66	NA	0.05	0.05	0.06	0.009	6.5E-05	4.5
2016	2.9	0.41	0.13	0.58	NA	0.06	0.05	0.06	0.010	8.2E-05	4.2
2017	2.9	0.40	0.15	0.65	NA	0.07	0.05	0.06	0.006	6.2E-05	4.3
2018	2.1	0.35	0.14	0.65	NA	0.08	0.05	0.07	0.007	7.4E-05	3.5
2019	1.7	0.28	0.14	0.50	NA	0.08	0.06	0.07	0.005	8.0E-05	2.8
2019 vs 1990	-85.8%	-77.0%	-43.7%	-86.2%	NA	55.4%	78.5%	-49.7%	-63.0%	-7.4%	-83.6%
2019 vs 2018	-22.3%	-19.9%	-1.6%	-22.8%	NA	2.9%	10.5%	3.6%	-29.8%	7.3%	-19.7%

2.9.5. Selenium (Se)

Emission of Selenium was amounted to 0.36 t in 2019 (Figure and Table 3.9.5-1) and was reduced by 18.8 % since 1990. The dominant sector in the Se emission is IPPU sector. It has contributed with 62.6 % in 2019, and in 1990 with 49.2 % in total Se emission. The domination within IPPU sector has glass production activity, due to the Se content in the raw material. That activity has recorded a decreasing trend in recent years, because of economic crisis since 2007. In 2019, about 17.7 % of Se emissions originated from fuel combustion in Manufacturing industry and construction, and 6.8 % from Energy industries.

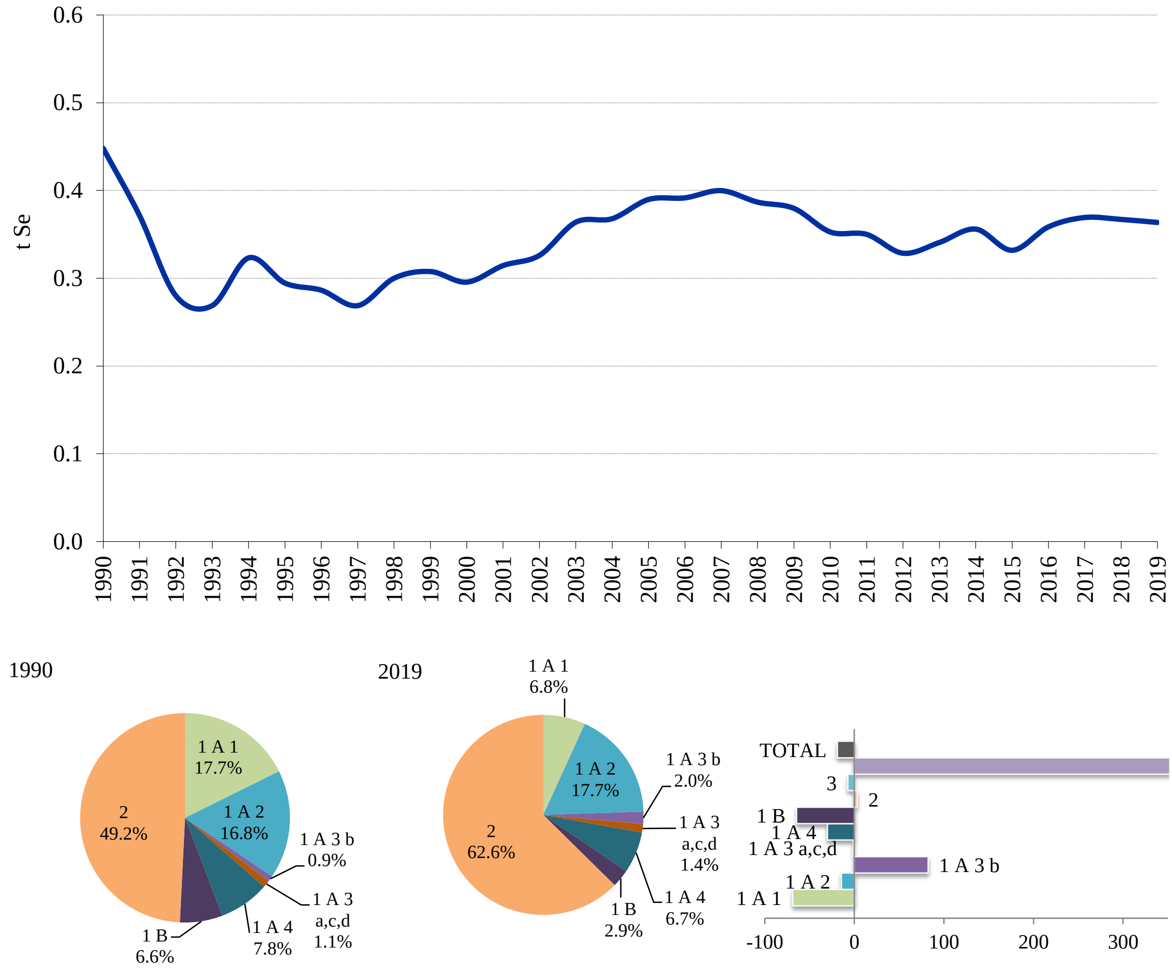


Figure 2.9.5-1 The Se emissions (t/yr.) and percentage share by sector and variation in Se emissions

Table 2.9.5-1 The Se emissions by SNAP nomenclature in the period 1990-2019

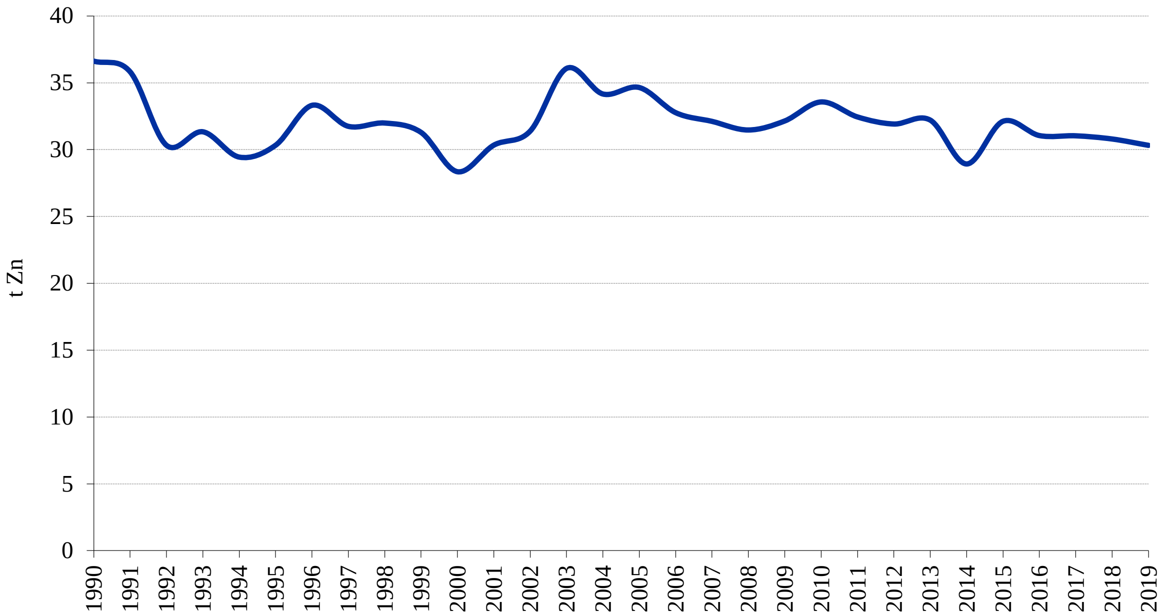
Se											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	t	t	t	t	t	t	t	t	t	t	t
1990	0.079	0.033	0.074	0.25	NA	NA	0.0040	0.0084	0.0026	3.3E-05	0.45
1991	0.059	0.031	0.048	0.22	NA	NA	0.0030	0.0064	0.0018	3.5E-05	0.37
1992	0.065	0.025	0.048	0.13	NA	NA	0.0029	0.0068	0.0017	1.8E-05	0.28
1993	0.063	0.027	0.041	0.13	NA	NA	0.0031	0.0063	0.0020	2.3E-05	0.27
1994	0.091	0.023	0.049	0.15	NA	NA	0.0034	0.0042	0.0020	2.1E-05	0.32
1995	0.068	0.024	0.040	0.15	NA	NA	0.0035	0.0055	0.0024	2.3E-05	0.29
1996	0.067	0.027	0.041	0.14	NA	NA	0.0038	0.0083	0.0022	2.2E-05	0.29
1997	0.068	0.025	0.047	0.12	NA	NA	0.0043	0.0068	0.0021	2.6E-05	0.27
1998	0.077	0.025	0.050	0.14	NA	NA	0.0045	0.0056	0.0022	2.7E-05	0.30
1999	0.080	0.025	0.061	0.13	NA	NA	0.0048	0.0054	0.0023	2.4E-05	0.31
2000	0.055	0.022	0.069	0.14	NA	NA	0.0048	0.0058	0.0024	2.0E-05	0.30
2001	0.057	0.024	0.078	0.14	NA	NA	0.0045	0.0064	0.0022	2.4E-05	0.31
2002	0.062	0.023	0.076	0.15	NA	NA	0.0049	0.0072	0.0020	2.6E-05	0.33
2003	0.075	0.027	0.075	0.17	NA	NA	0.0053	0.0074	0.0021	1.7E-05	0.36
2004	0.056	0.026	0.080	0.19	NA	NA	0.0055	0.0060	0.0020	2.6E-05	0.37
2005	0.059	0.027	0.083	0.21	NA	NA	0.0057	0.0065	0.0020	2.5E-05	0.39
2006	0.058	0.025	0.089	0.20	NA	NA	0.0061	0.0068	0.0019	2.7E-05	0.39
2007	0.063	0.024	0.087	0.21	NA	NA	0.0065	0.0071	0.0021	2.2E-05	0.40
2008	0.052	0.024	0.082	0.21	NA	NA	0.0063	0.0085	0.0019	3.1E-05	0.39

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
2009	0.058	0.025	0.068	0.21	NA	NA	0.0064	0.0082	0.0022	2.9E-05	0.38
2010	0.040	0.027	0.066	0.21	NA	NA	0.0061	0.0072	0.0011	2.5E-05	0.35
2011	0.040	0.026	0.058	0.21	NA	NA	0.0060	0.0072	0.0014	2.5E-05	0.35
2012	0.035	0.026	0.056	0.20	NA	NA	0.0057	0.0068	0.0016	2.3E-05	0.33
2013	0.026	0.025	0.061	0.21	NA	NA	0.0059	0.0068	0.0015	2.7E-05	0.34
2014	0.024	0.022	0.064	0.23	NA	NA	0.0058	0.0070	0.0016	2.5E-05	0.36
2015	0.028	0.026	0.061	0.20	NA	NA	0.0061	0.0069	0.0019	2.5E-05	0.33
2016	0.027	0.025	0.058	0.23	NA	NA	0.0064	0.0069	0.0022	3.1E-05	0.36
2017	0.026	0.024	0.067	0.24	NA	NA	0.0069	0.0072	0.0013	2.4E-05	0.37
2018	0.026	0.023	0.065	0.24	NA	NA	0.0067	0.0076	0.0014	2.8E-05	0.37
2019	0.025	0.023	0.063	0.24	NA	NA	0.0072	0.0078	0.0010	3.1E-05	0.36
2019 vs 1990	-68.8%	-31.3%	-14.3%	-4.1%	NA	NA	82.4%	-7.4%	-60.1%	-7.4%	-18.8%
2019 vs 2018	-3.7%	-2.8%	-2.7%	-0.2%	NA	NA	8.6%	3.5%	-28.4%	7.3%	-0.9%

2.9.6. Zinc (Zn)

The Zinc emission in 2019 has amounted to 30.3 t (Figure and Table 2.9.6-1) and has decreased by 17.2 % since 1990. The major sources of Zn emission in Croatia is fuel combustion in Energy sector which has contributed with 97.2 % to national total in 2019. Key sources in 2019 were: Small combustion and mobile machinery (72.9 %), Road transport (9.4 %) and Manufacturing industry and construction (7.3 %). 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).



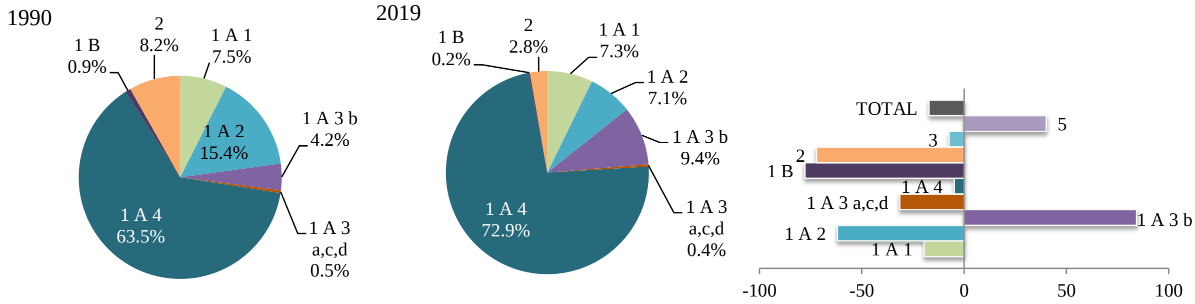


Figure 2.9.6-1 The Zn emissions (t/yr.) and percentage share by sector and variation in Zn emissions

Table 2.9.6-1 The Zn emissions by SNAP nomenclature in the period 1990-2019

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	5.5	3.1	NA	0.22	1.5	0.5	0.04	9.2E-04	36.6
1991	2.0	26.4	4.1	1.5	NA	0.21	1.2	0.4	0.03	9.7E-04	35.8
1992	2.1	22.7	3.3	0.6	NA	0.22	1.1	0.2	0.02	5.1E-04	30.3
1993	2.1	24.0	3.1	0.5	NA	0.21	1.2	0.2	0.03	6.4E-04	31.3
1994	2.7	21.6	2.9	0.5	NA	0.20	1.3	0.3	0.03	6.0E-04	29.4
1995	2.4	22.8	2.8	0.3	NA	0.35	1.4	0.2	0.03	6.4E-04	30.3
1996	2.4	25.6	2.7	0.3	NA	0.50	1.5	0.3	0.03	6.3E-04	33.3
1997	2.3	23.5	3.1	0.4	NA	0.49	1.7	0.3	0.03	7.2E-04	31.7
1998	2.4	23.6	3.0	0.5	NA	0.34	1.7	0.3	0.03	7.6E-04	32.0
1999	2.5	23.2	2.6	0.5	NA	0.29	1.9	0.3	0.04	6.7E-04	31.3
2000	1.9	20.6	2.9	0.5	NA	0.22	1.9	0.3	0.04	5.6E-04	28.3
2001	1.9	22.6	2.8	0.4	NA	0.48	1.7	0.4	0.04	6.7E-04	30.3
2002	2.1	21.7	2.8	0.3	NA	2.21	1.9	0.4	0.03	7.4E-04	31.4
2003	2.3	25.0	2.9	0.4	NA	3.04	2.1	0.4	0.03	4.8E-04	36.1
2004	2.0	24.3	3.1	0.6	NA	1.65	2.1	0.4	0.03	7.2E-04	34.2
2005	2.0	25.7	3.0	0.5	NA	0.76	2.2	0.4	0.03	7.0E-04	34.6
2006	1.9	23.6	3.3	0.5	NA	0.58	2.4	0.4	0.03	7.5E-04	32.8
2007	2.1	22.8	3.2	0.5	NA	0.42	2.5	0.4	0.03	6.1E-04	32.1
2008	1.7	22.9	2.9	0.7	NA	0.31	2.5	0.5	0.03	8.6E-04	31.5
2009	1.9	23.9	2.8	0.4	NA	0.15	2.5	0.4	0.03	8.1E-04	32.1
2010	1.5	25.7	2.9	0.6	NA	0.08	2.4	0.4	0.02	7.1E-04	33.6
2011	1.7	25.0	2.4	0.5	NA	0.07	2.3	0.4	0.02	6.9E-04	32.4
2012	1.5	25.0	2.6	0.2	NA	0.03	2.2	0.4	0.02	6.6E-04	31.9
2013	1.1	24.8	2.5	0.6	NA	0.40	2.3	0.4	0.02	7.6E-04	32.2
2014	1.2	21.9	2.2	0.7	NA	0.29	2.3	0.4	0.02	6.9E-04	28.9
2015	1.4	25.1	1.9	0.6	NA	0.28	2.4	0.4	0.03	7.0E-04	32.1
2016	1.6	24.3	1.7	0.2	NA	0.35	2.5	0.4	0.03	8.8E-04	31.0
2017	1.6	23.6	2.1	0.2	NA	0.38	2.7	0.4	0.02	6.7E-04	31.0
2018	2.0	22.6	2.1	0.7	NA	0.46	2.6	0.4	0.02	8.0E-04	30.8
2019	2.2	21.9	2.0	0.4	NA	0.48	2.8	0.4	0.02	8.6E-04	30.3
2019 vs 1990	-19.5%	-4.7%	-62.9%	-86.7%	NA	110.2%	84.3%	-21.4%	-53.4%	-7.4%	-17.2%
2019 vs 2018	9.9%	-2.9%	-1.4%	-39.0%	NA	21.5%	8.9%	3.1%	-24.9%	7.3%	-1.5%

2.10. 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 2.10-1). Reporting for HCH – Hexachlorocyclohexane (Lindan) emissions is excluded from the obligation to report since 2015.

Table 2.10-1 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

2.10.1. 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 2019, PCDD/PCDF emission has amounted to 27.0 g I- TEQ (Figure and Table 2.10.1-1). Emission has decreased by 45.1 % since 1990. The main contributor in PCDD/PCDF emission during historic period is fuel combustion in Energy sector. A key sources in 2019 were Small combustion and mobile machinery (81.5 % of total PCDD/PCDF emission) with domination of biomass combustion in Residential sector.

Fluctuations in the trend are directly dependent on the amount of biomass use in small residential 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 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, high efficiency stoves and boilers and pellet stoves and boilers (see Table 3.5-1, Figure 3.5-2). In addition, emission dips can be seen in the years 1994, 2000, 2002 and 2014 when, due to the warmer winter, the consumption of biomass for heating was lower (Figure 3.5-3).

Croatia has the obligation toward the Protocol on POPs to keep PCDD/PCDF emissions beyond the value in base year (1990). In 2019, Croatia is fulfilling an obligation towards the Protocol on POPs.

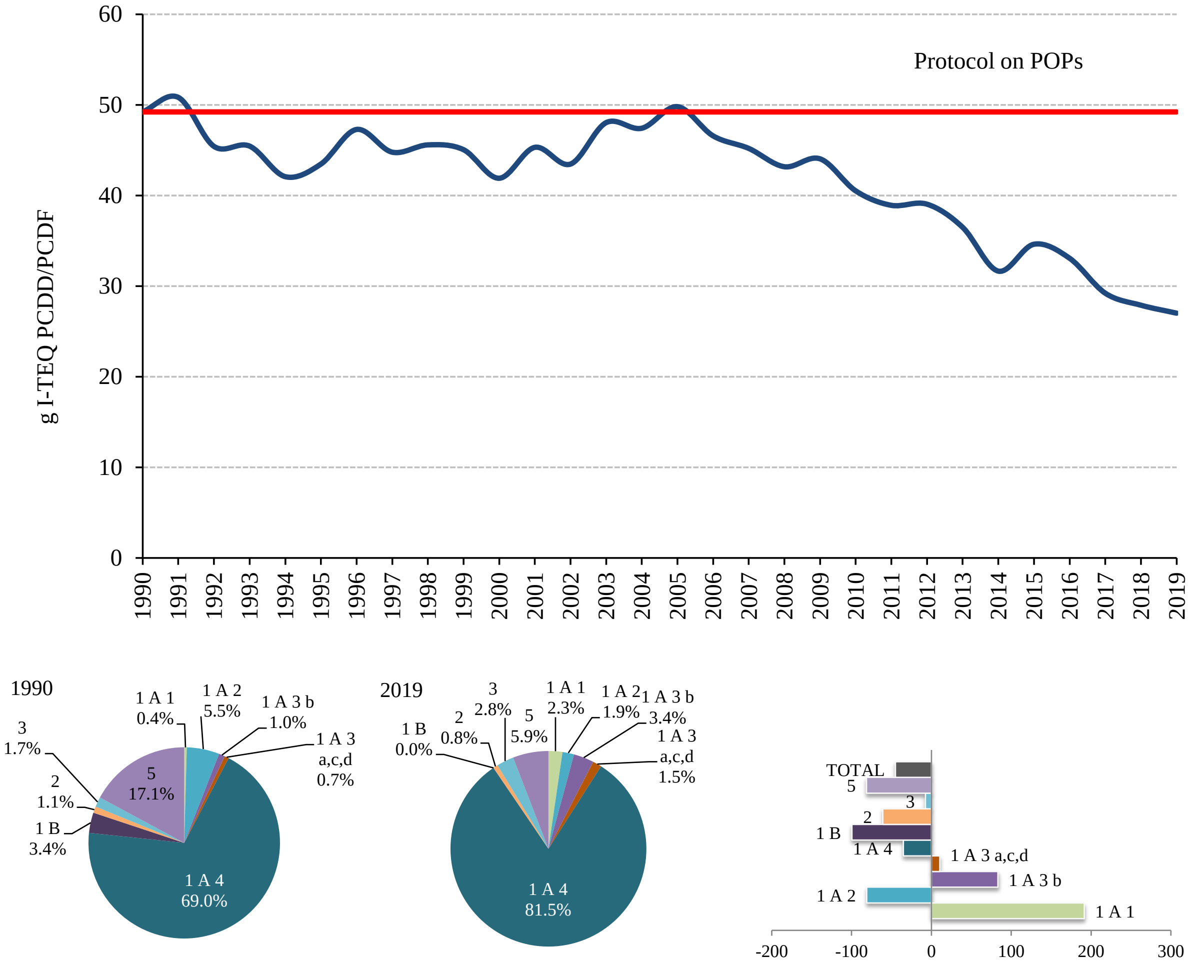


Figure 2.10.1-1 The PCDD/PCDF emissions (g I-TEQ/yr.) and percentage share by sector and variation in PCDD/PCDF emissions

Table 2.10.1-1 The PCDD/PCDF emissions by SNAP nomenclature in the period 1990-2019

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	34.0	2.7	2.22	NA	NA	0.49	0.36	8.4	0.8	49.2
1991	0.16	37.9	1.9	1.75	NA	NA	0.36	0.26	7.6	0.9	50.8
1992	0.22	32.2	1.3	1.54	NA	NA	0.33	0.30	9.1	0.5	45.4
1993	0.18	34.0	1.0	1.51	NA	NA	0.35	0.23	7.6	0.6	45.5
1994	0.25	30.7	1.0	1.04	NA	NA	0.38	0.15	8.1	0.5	42.1

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
1995	0.23	32.4	1.0	0.15	NA	NA	0.39	0.19	8.6	0.6	43.5
1996	0.14	36.3	0.8	0.15	NA	NA	0.43	0.25	8.6	0.6	47.3
1997	0.23	33.4	0.9	0.22	NA	NA	0.49	0.21	8.7	0.6	44.8
1998	0.21	33.7	0.7	0.33	NA	NA	0.53	0.21	9.2	0.7	45.6
1999	0.21	33.2	0.5	0.25	NA	NA	0.58	0.21	9.4	0.6	45.1
2000	0.24	29.6	0.7	0.24	NA	NA	0.59	0.21	9.9	0.5	41.9
2001	0.27	32.5	0.6	0.19	NA	NA	0.59	0.21	10.3	0.6	45.3
2002	0.31	31.2	0.6	0.12	NA	NA	0.64	0.23	9.7	0.7	43.5
2003	0.35	36.1	0.5	0.15	NA	NA	0.72	0.24	9.6	0.4	48.0
2004	0.30	35.2	0.6	0.28	NA	NA	0.77	0.24	9.4	0.6	47.4
2005	0.32	37.4	0.5	0.25	NA	NA	0.84	0.26	9.6	0.6	49.8
2006	0.30	33.5	0.6	0.26	NA	NA	0.94	0.27	10.0	0.7	46.6
2007	0.32	31.5	0.7	0.25	NA	NA	1.06	0.28	10.6	0.5	45.2
2008	0.32	30.8	0.5	0.44	NA	NA	1.04	0.33	9.0	0.8	43.2
2009	0.26	31.3	0.5	0.16	NA	NA	1.05	0.37	9.6	0.7	44.0
2010	0.28	32.9	0.8	0.33	NA	NA	1.01	0.28	4.3	0.6	40.5
2011	0.34	31.2	0.6	0.30	NA	NA	0.99	0.29	4.6	0.6	38.9
2012	0.31	30.3	0.6	0.02	NA	NA	0.97	0.27	5.9	0.6	39.0
2013	0.33	29.3	0.6	0.35	NA	NA	0.93	0.31	3.9	0.7	36.5
2014	0.32	25.1	0.5	0.45	NA	NA	0.93	0.34	3.4	0.6	31.7
2015	0.36	27.9	0.5	0.38	NA	NA	0.97	0.33	3.6	0.6	34.6
2016	0.5	26.3	0.5	0.01	NA	NA	0.99	0.34	3.7	0.8	33.1
2017	0.4	24.7	0.5	0.03	NA	NA	1.01	0.36	1.6	0.6	29.2
2018	0.5	23.1	0.5	0.42	NA	NA	0.91	0.38	1.4	0.7	27.9
2019	0.6	22.0	0.5	0.21	NA	NA	0.91	0.40	1.6	0.8	27.0
2019 vs 1990	191.6%	-35.2%	-81.0%	-90.3%	NA	NA	83.4%	10.5%	-81.2%	-7.4%	-45.1%
2019 vs 2018	23.3%	-4.7%	4.4%	-48.6%	NA	NA	-0.3%	4.0%	14.4%	7.3%	-3.1%

2.10.2. Polycyclic aromatic hydrocarbons (PAHs)

There are more than 100 of different polycyclic aromatic hydrocarbons, and annual emissions are estimated and reported (NFR19 tables) for four of them, as follows: benzo (a) pyrene, benzo (b) fluoranthene, benzo (k) fluoranthene, indeno (1,2,3-cd) pyrene along with total PAHs emission. The four PAHs are those defined by the Aarhus protocol. Emission of PAHs by sectors is presented in Figure and Table 2.10.2-1.

Emissions of PAHs were amounted to 13.4 t in 2019, and have declined by 38.8 % since 1990. The 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 happened as a result of the war for Croatian independence (1991 - 1995). A 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, high efficiency stoves and boilers and pellet stoves and boilers (see Table 3.5-1, Figure 3.5-2). In addition, emission dips can be seen in the years 1994, 2000, 2002 and 2014 when, due to the warmer winter, the consumption of biomass for heating was lower (Figure 3.5-3).

Croatia has the obligation toward the Protocol on POPs to keep the overall PAHs emission beyond the value in base year (1990). Croatia in 2019 fulfils the obligation towards the Protocol on POPs.

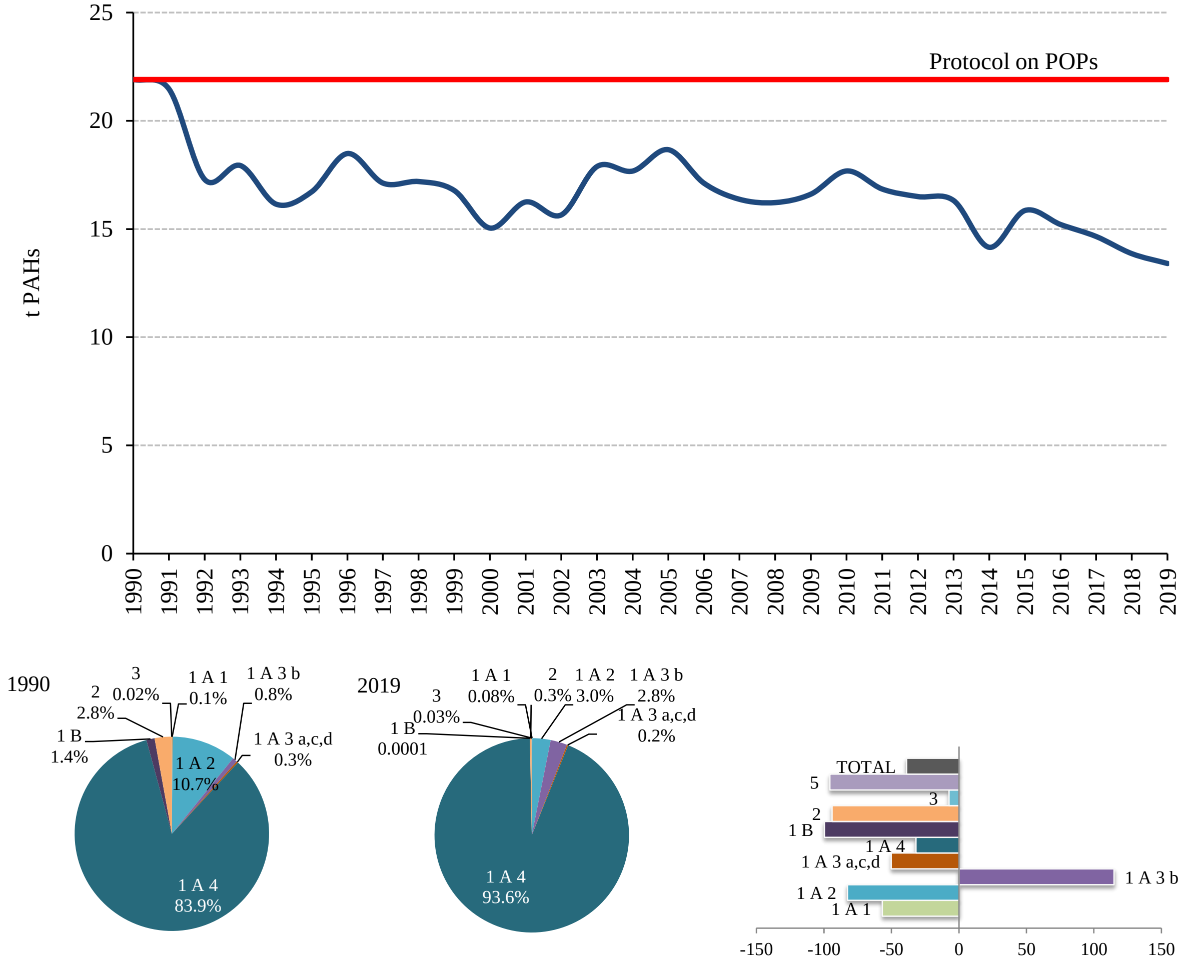


Figure 2.10.2-1 The PAHs emissions (kg/yr.), percentage share by sector and variation in PAHs emissions

Table 2.10.2-1 PAHs emissions by SNAP nomenclature in the period 1990-2019

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	0.026	18.36	2.34	0.92	NA	0.0039	0.17	8.5E-02	1.0E-05	0.0038	21.91
1991	0.019	19.25	1.63	0.37	NA	0.0031	0.13	4.0E-02	8.6E-06	0.0040	21.46
1992	0.025	15.71	1.13	0.27	NA	0.0038	0.13	1.7E-02	8.3E-06	0.0021	17.28
1993	0.023	16.51	0.97	0.26	NA	0.0034	0.14	2.0E-02	8.8E-06	0.0026	17.94
1994	0.045	14.78	0.96	0.18	NA	0.0025	0.15	3.1E-02	8.8E-06	0.0025	16.15
1995	0.025	15.54	0.93	0.02	NA	0.0039	0.16	2.8E-02	9.7E-06	0.0026	16.72
1996	0.020	17.38	0.85	0.02	NA	0.0040	0.17	3.1E-02	9.2E-06	0.0026	18.49
1997	0.025	15.95	0.88	0.04	NA	0.0038	0.19	2.9E-02	2.5E-05	0.0029	17.12
1998	0.033	16.14	0.73	0.05	NA	0.0040	0.20	3.3E-02	4.8E-05	0.0031	17.19
1999	0.034	15.89	0.56	0.04	NA	0.0046	0.21	3.2E-02	5.6E-05	0.0028	16.78
2000	0.015	14.10	0.63	0.04	NA	0.0040	0.22	3.5E-02	7.8E-05	0.0023	15.04
2001	0.019	15.34	0.60	0.03	NA	0.0050	0.21	3.6E-02	8.4E-05	0.0028	16.25
2002	0.019	14.75	0.60	0.02	NA	0.0054	0.23	3.5E-02	4.8E-05	0.0030	15.65
2003	0.027	17.03	0.47	0.02	NA	0.0361	0.25	3.6E-02	1.2E-05	0.0020	17.89
2004	0.014	16.52	0.56	0.05	NA	0.2378	0.26	3.7E-02	6.3E-06	0.0030	17.68
2005	0.017	17.59	0.55	0.04	NA	0.1437	0.28	4.0E-02	3.9E-06	0.0029	18.66

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	0.017	15.92	0.56	0.04	NA	0.2385	0.30	4.3E-02	1.1E-05	0.0031	17.12
2007	0.018	15.09	0.64	0.04	NA	0.2170	0.32	4.5E-02	9.9E-06	0.0025	16.37
2008	0.017	14.99	0.53	0.07	NA	0.2482	0.31	5.0E-02	1.0E-05	0.0035	16.22
2009	0.018	15.43	0.53	0.03	NA	0.2518	0.31	4.4E-02	4.3E-06	0.0033	16.61
2010	0.005	16.46	0.66	0.05	NA	0.1551	0.30	4.3E-02	2.1E-06	0.0029	17.68
2011	0.007	15.83	0.49	0.05	NA	0.1289	0.29	4.2E-02	2.7E-06	0.0028	16.84
2012	0.006	15.60	0.48	0.00	NA	0.0819	0.29	4.0E-02	3.0E-06	0.0027	16.50
2013	0.003	15.34	0.47	0.06	NA	0.1092	0.29	4.0E-02	2.9E-06	0.0031	16.31
2014	0.003	13.33	0.41	0.07	NA	0.0103	0.29	4.0E-02	3.1E-06	0.0028	14.15
2015	0.005	15.06	0.37	0.06	NA	0.0036	0.31	4.1E-02	3.7E-06	0.0029	15.85
2016	0.005	14.45	0.37	0.00	NA	0.0028	0.33	4.2E-02	4.3E-06	0.0036	15.21
2017	0.006	13.84	0.40	0.00	NA	0.0039	0.36	4.6E-02	2.5E-06	0.0027	14.65
2018	0.009	13.01	0.38	0.07	NA	0.0045	0.34	5.0E-02	2.8E-06	0.0033	13.86
2019	0.011	12.53	0.40	0.03	NA	0.0040	0.37	5.2E-02	2.0E-06	0.0035	13.40
2019 vs 1990	-56.8%	-31.8%	-82.9%	-96.2%	NA	4.6%	114.9%	-39.3%	-80.4%	-7.4%	-38.8%
2019 vs 2018	27.4%	-3.7%	6.5%	-48.6%	NA	-10.4%	8.8%	3.9%	-28.8%	7.3%	-3.3%

2.10.3. Hexachlorobenzene (HCB)

Hexachlorobenzene (HCB) is an industrial chemical but is also an integral part of solid fossil fuels and biomass. HCB emission is mainly originate from the use of pesticides in agriculture and forest sector, where HCB is present as a contaminant. According to the Pesticide Leaching Model (PELMO 3.31; Ferrari et al., 2005), all the HCB present as a contaminant will be volatilised. In addition to the use of pesticides, HCB emission occurs from biomass and solid fuel combustion and in minor extent from waste incineration, if it exists in the county.

The HCB emission in 2019 has amounted to 0.60 t (Figure and Table 2.10.3-1). In comparison to 1990, HCB emission has decreased by 91.5 %, due to the reduction in pesticide use, which is a key source of HCB emission (96.1% in 1990 and 51.5 % in 2019). The second key source in 2019 was the category Small combustion and mobile machinery (35.5 %) with the dominance of biomass combustion in the Residential sector. Fuel combustion in Energy industries (especially coal-fired power plants) has a growing impact on HCB emissions (0.1 % in 1990 and 8.9 % in 2019).

An increase in HCB emission, especially in the period 1990-2002, when pesticides with high levels of HCB contamination in active substances were used in Croatia, which have recently been banned. The Republic of Croatia has been reporting in a historical trend HCB emissions from the active substances of the following pesticides: Lindan, Atrazine, Simazin, Pichloram, Chlortalonil and Propazine. In past inventories, the key source of HCB emissions throughout the observed trend was the combustion of biomass in NFR category 1.A.4.b. and Small combustion - residential. In this year's inventory, the only key source in the 1990s is the NFR emissions category 3.D.f. Use of pesticides in agriculture and forest, and in recent years HCB emission has been contributed equally by small combustion appliance and the use of pesticides as two key emission sources.

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 2019, this obligation was fulfilled.

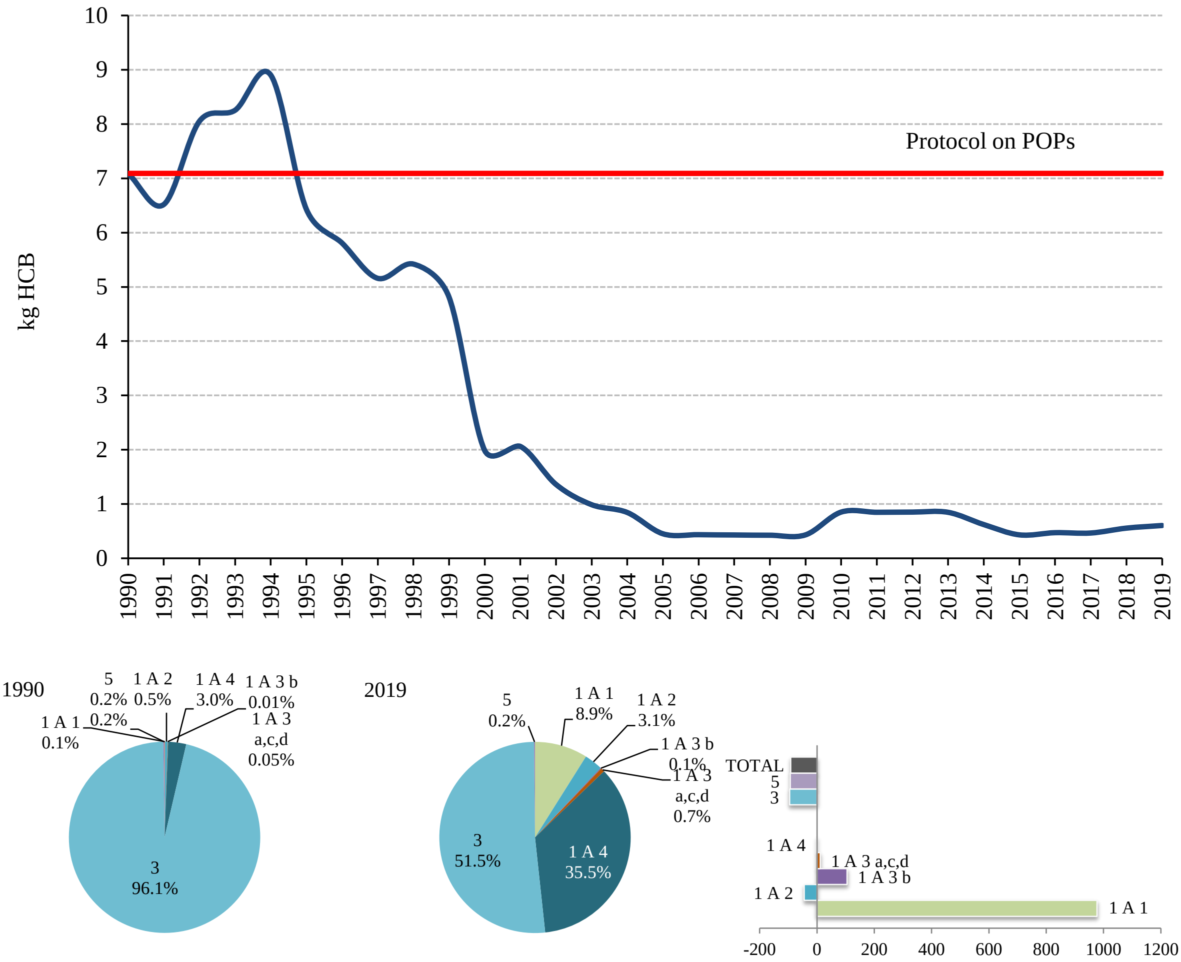


Figure 2.10.3-1 The HCB emission (kg/yr.), percentage share by sector and variation in HCB emissions

Table 2.10.3-1 The HCB emission by SNAP nomenclature in the period 1990-2019

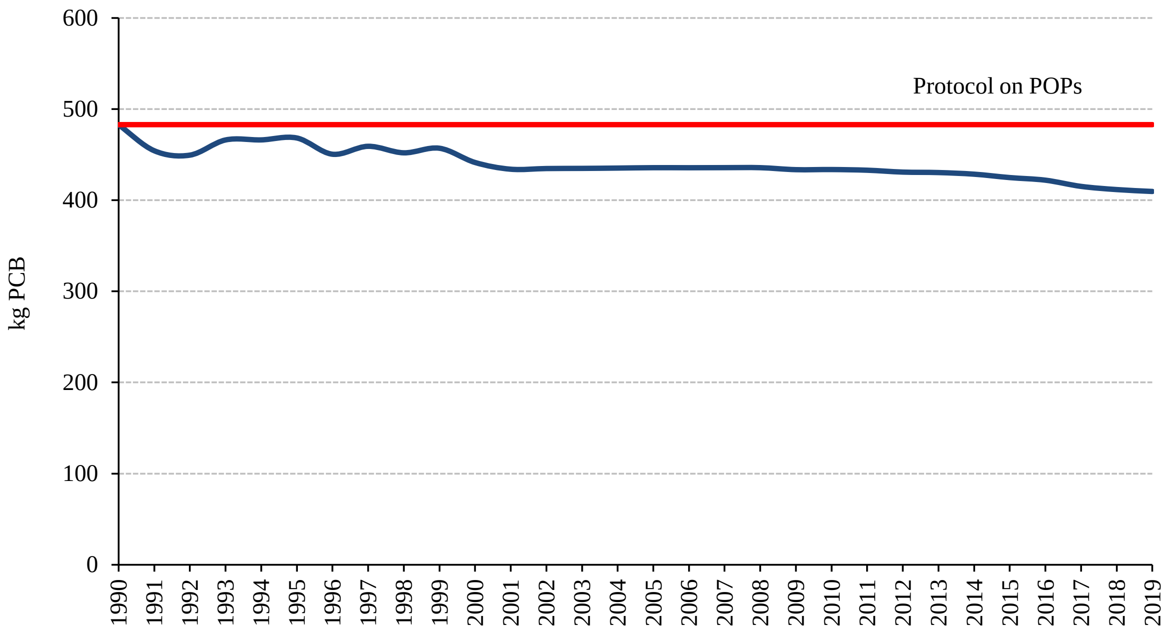
HCB											
SNAP	1	2	3	4	5	6	7	8	9	10	Total
Unit	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	0.005	0.22	0.034	NA	NA	NA	4.3E-04	3.5E-03	0.0147	6.82	7.09
1991	0.004	0.25	0.027	NA	NA	NA	3.2E-04	2.8E-03	0.0148	6.22	6.52
1992	0.005	0.22	0.024	NA	NA	NA	2.9E-04	4.2E-03	0.0148	7.78	8.05
1993	0.004	0.23	0.022	NA	NA	NA	2.9E-04	3.7E-03	0.0149	7.98	8.26
1994	0.003	0.21	0.021	NA	NA	NA	3.1E-04	1.6E-03	0.0150	8.65	8.91
1995	0.005	0.22	0.020	NA	NA	NA	3.4E-04	2.7E-03	0.0150	6.17	6.43
1996	0.004	0.25	0.020	NA	NA	NA	3.7E-04	4.6E-03	0.0150	5.52	5.81
1997	0.006	0.23	0.024	NA	NA	NA	4.3E-04	3.6E-03	0.0166	4.88	5.16
1998	0.006	0.23	0.024	NA	NA	NA	4.8E-04	2.5E-03	0.0188	5.14	5.42
1999	0.006	0.23	0.022	NA	NA	NA	5.2E-04	2.3E-03	0.0196	4.54	4.81
2000	0.010	0.20	0.024	NA	NA	NA	5.4E-04	2.2E-03	0.0219	1.73	1.99
2001	0.011	0.22	0.024	NA	NA	NA	5.4E-04	2.5E-03	0.0239	1.78	2.06
2002	0.013	0.21	0.024	NA	NA	NA	5.8E-04	3.2E-03	0.0207	1.09	1.36
2003	0.014	0.24	0.025	NA	NA	NA	6.7E-04	3.2E-03	0.0176	0.68	0.99
2004	0.013	0.24	0.027	NA	NA	NA	7.2E-04	2.3E-03	0.0181	0.54	0.84
2005	0.014	0.25	0.026	NA	NA	NA	8.0E-04	2.5E-03	0.0181	0.14	0.45
2006	0.013	0.23	0.029	NA	NA	NA	9.0E-04	2.6E-03	0.0193	0.14	0.43
2007	0.014	0.22	0.028	NA	NA	NA	1.0E-03	2.7E-03	0.0211	0.14	0.43
2008	0.014	0.22	0.026	NA	NA	NA	1.0E-03	3.4E-03	0.0171	0.14	0.42
2009	0.010	0.23	0.025	NA	NA	NA	1.0E-03	3.7E-03	0.0191	0.14	0.43

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
2010	0.014	0.25	0.025	NA	NA	NA	9.9E-04	3.1E-03	0.0061	0.55	0.85
2011	0.019	0.24	0.021	NA	NA	NA	9.7E-04	3.1E-03	0.0064	0.55	0.85
2012	0.018	0.24	0.023	NA	NA	NA	9.5E-04	2.9E-03	0.0100	0.55	0.85
2013	0.020	0.24	0.023	NA	NA	NA	9.0E-04	3.1E-03	0.0055	0.55	0.85
2014	0.020	0.21	0.020	NA	NA	NA	9.0E-04	3.4E-03	0.0058	0.36	0.62
2015	0.025	0.24	0.018	NA	NA	NA	9.5E-04	3.3E-03	0.0060	0.13	0.43
2016	0.034	0.24	0.015	NA	NA	NA	9.7E-04	3.3E-03	0.0063	0.17	0.47
2017	0.029	0.23	0.019	NA	NA	NA	9.8E-04	3.5E-03	0.0008	0.18	0.46
2018	0.043	0.22	0.019	NA	NA	NA	8.9E-04	3.8E-03	0.0010	0.27	0.55
2019	0.054	0.21	0.019	NA	NA	NA	8.8E-04	3.9E-03	0.0010	0.31	0.60
2019 vs 1990	977.3%	-0.9%	-44.8%	NA	NA	NA	105.3%	11.4%	-93.2%	-95.4%	-91.5%
2019 vs 2018	26.1%	-2.9%	-3.9%	NA	NA	NA	-0.7%	4.0%	3.2%	16.5%	8.7%

2.10.4. 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 2019 was estimated to about 409.7 kg (Figure and Table 2.10.4-1). 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 99.1 % to national PCBs emission in 2019. 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, which has slight downward trend.



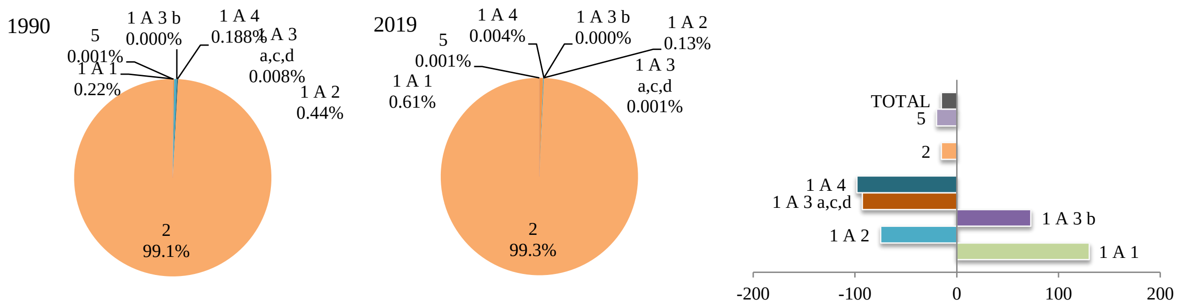


Figure 2.10.4-1 The PCBs emission (kg/yr.), percentage share by sector and variation in PCBs emissions

Table 2.10.4-1 The PCBs emissions by SNAP nomenclature in the period 1990-2019

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	2.1	0.85	NA	477.8	NA	4.0E-02	3.4E-03	NA	482.8
1991	0.8	0.47	1.4	0.35	NA	451.3	NA	1.7E-02	3.5E-03	NA	454.3
1992	1.1	0.14	0.9	0.25	NA	447.0	NA	7.3E-03	3.7E-03	NA	449.4
1993	0.8	0.20	0.7	0.19	NA	464.1	NA	7.7E-03	3.9E-03	NA	466.0
1994	0.2	0.10	0.8	0.16	NA	464.9	NA	1.5E-03	4.0E-03	NA	466.1
1995	0.4	0.09	0.7	0.11	NA	466.9	NA	4.9E-03	4.1E-03	NA	468.2
1996	0.2	0.10	0.6	0.11	NA	449.4	NA	1.1E-02	4.2E-03	NA	450.5
1997	1.0	0.09	0.6	0.17	NA	457.3	NA	7.9E-03	4.2E-03	NA	459.1
1998	1.0	0.13	0.5	0.26	NA	450.1	NA	3.4E-03	4.2E-03	NA	452.0
1999	0.9	0.11	0.4	0.19	NA	455.4	NA	2.8E-03	4.1E-03	NA	457.0
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	0.00	NA	426.8	NA	3.1E-03	3.7E-03	NA	430.9
2013	4.0	0.03	0.6	0.28	NA	425.6	NA	2.3E-03	2.8E-03	NA	430.4
2014	3.9	0.02	0.5	0.37	NA	423.8	NA	2.5E-03	3.0E-03	NA	428.6
2015	3.7	0.02	0.5	0.30	NA	420.4	NA	2.4E-03	3.2E-03	NA	424.9
2016	4.1	0.02	0.5	0.00	NA	417.4	NA	2.5E-03	3.2E-03	NA	422.1
2017	2.3	0.02	0.5	0.01	NA	412.5	NA	2.6E-03	2.3E-03	NA	415.3
2018	2.1	0.02	0.5	0.34	NA	408.8	NA	2.8E-03	2.6E-03	NA	411.8
2019	2.5	0.02	0.5	0.17	NA	406.5	NA	2.9E-03	2.7E-03	NA	409.7
2019 vs 1990	130.2%	-98.0%	-74.8%	-79.6%	NA	-14.9%	NA	-92.8%	-19.8%	NA	-15.1%
2019 vs 2018	16.9%	7.3%	4.1%	-49.1%	NA	-0.6%	NA	4.0%	3.2%	NA	-0.5%

3. 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 fuel for national navigation, maritime and river transport).

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).

3.1. 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 in 2019, had the source category 1.A.4 Small combustion (Figure 3.1-1), which has recorded decrease of fuel consumption (7.5 % since 1990).

Categories 1.A.1 Energy industries and 1.A.2 Manufacturing industries and construction have recorded significantly greater reduction in fuel consumption (as fallow: 43.2 % and 55 % since 1990). Regarding year before, category 1.A.1 has recorded an increase by 3.9 % while categories 1.A.2 and 1.A.4 a decrease in energy consumption as follows by 0.1 % and 2.7 %.

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.

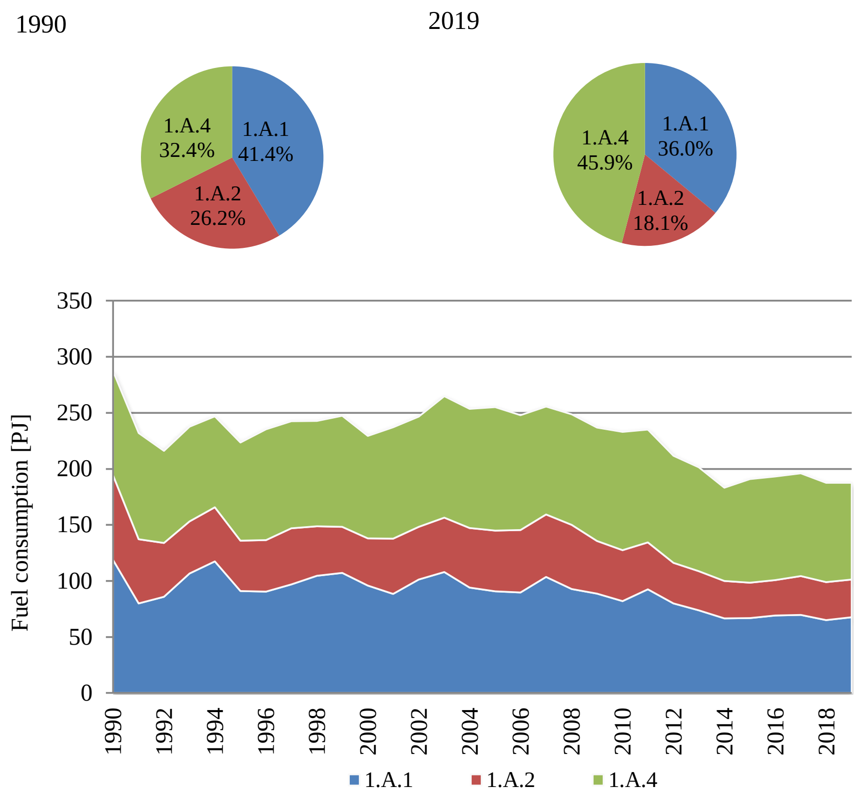


Figure 3.1-1 Activity data on fuel consumption for NFR codes 1.A.1, 1.A.2, 1.A.4

The structure of fuel consumption by type in Croatia is presented in Figure 3.1-2. Overall fuel consumption in the observed sectors decreased by 34.7 % in the historical period. Consumption of liquid fuel decreased by 74.2 %, gaseous fuel by 4.5 %, solid fuel by 33.3 % while biomass consumption increased by 23.4 %. Consumption of other fuels has been recorded in 1.A.4 since 2007 and is still negligible at the national level (0.15 % of total consumption of all fuels in 1.A).

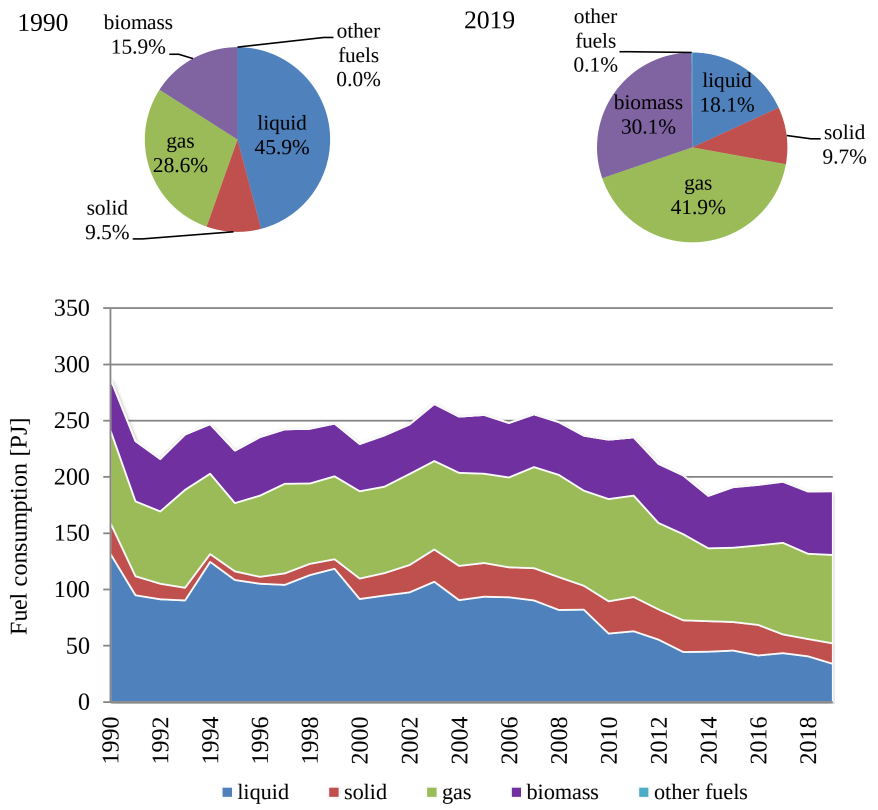


Figure 3.1-2 Activity data on fuel consumption by type for NFR codes 1.A.1, 1.A.2, 1.A.4

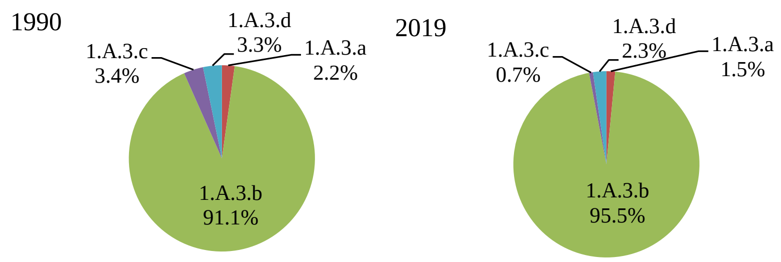
The source category 1.A.3 Transport includes fuel combustion in road transport, civil aviation, railways and navigation. The dominant NFR sector regarding fuel consumption in observed period was 1.A.3.b Road transport (Figure 3.1-3).

Road transport has contributed to overall transport fuel consumption in 20198 with 95.5 %, and has recorded an increase since 1990 by 77.1 %.

The 1.A.3.a Aviation (LTO) has contributed with 1.5 % to overall fuel consumption in transport sector in 2019, and has recorded an increase since 1990 by 16.3%.

The 1.A.3.c Railways has contributed with 0.7 % to overall transport fuel consumption in 2019, and has recorded a decrease by 66.4 % since 1990.

The 1.A.3.d Navigation has contributed with 2.3 % to overall transport fuel consumption in 2018 and has recorded an increase by 20.4 % in comparison to 1990.



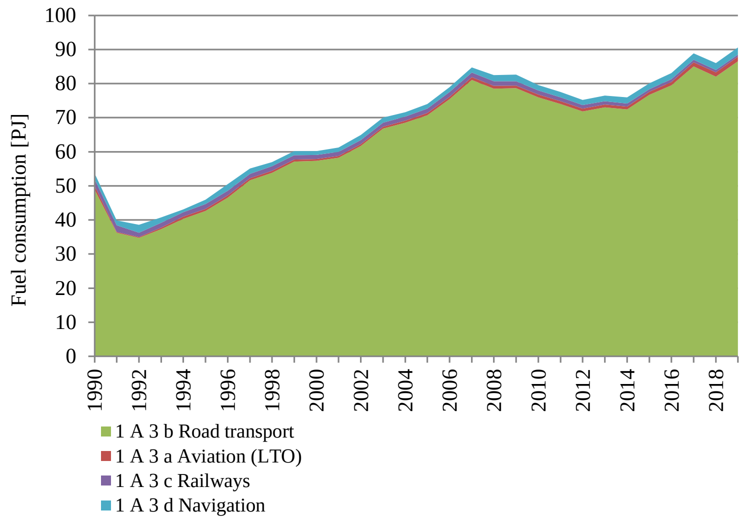


Figure 3.1-3 Consumption and percentage share for fossil fuel by types in 1.A.3 Transport

3.2. 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 the following types of plants are distinguished in Croatia:

- 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 2019 electricity generation capacities in Croatia encompassed 17 locations with large hydropower 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 Renewable Energy Systems (RES) (wind and sun). Thermal power plants are gas-fired, coal-fired and fuel oil-fired. Most gas-fired power plants can use extra light fuel oil as a replacement fuel. The majority owner of the production capacities of the Republic of Croatia is the HEP Group. (state-owned company). Private producers mostly own RES-powered power plants, which have been developing more intensively since 2006, i.e. after the introduction of the system of encouraging the production of electricity from RES.

Total available capacities of all power plants in the Republic of Croatia by the end of 2019 amount to 4711.8 MW. Out of this amount, 1781 MW is placed in thermal power plants, 2199.7 MW in hydro power plants, 646.3 in wind power plants, 84.8 MW in solar power plants. There is also 348 MW in the nuclear unit Krško (50% of total available capacity) used for Croatian power system.

The stated capacity of power plants does 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 and power lease or 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 3.2-1.

Table 3.2-1 Generating capacities of HPPs, TPPs and NPP Krško

Facility	Available Power (MW), net output	Fuel type
HPPs	2199.7	-
NPP Krško*	348	uranium oxide (UO_2)
TPP Plomin 1	105	coal
TPP Plomin 2**	210	coal
TPP Rijeka	303	fuel oil
CHP Sisak	229	fuel oil / natural gas
CHP Zagreb (east)	420	fuel oil / natural gas
CHP Zagreb (west)	50	fuel oil / natural gas / extra light oil
CPP Osijek	89	fuel oil / natural gas / extra light oil
KTE Jertovec	76	fuel oil / natural gas / extra light oil
Other biogas plants	51.9	biogas
Other biomass plants	75.5	biomass
Geothermal plants	10.0	
CHP in Industry	157.3	coal / natural gas / fuel oil/ wood
Other small CHP	4.3	natural gas
Total (HE+NE+TE)	4328.4	
* 50% of NPP Krško is owned by HEP, ** TPP Plomin 2 Ltd. (HEP and RWE Power Co-ownership – share 50% : 50%)		

Source: Energy in Croatia - 2019, Annual energy report, MESD

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 3.2-2.

Table 3.2-2 Processing Capacities of Oil and Lube Refineries

Processing Capacities	Installed Capacities (1000 t/year)
Oil Refinery Rijeka (Urinj)	
atmospheric distillation	4500
reforming	563
fluidized-bed catalytic cracking (FCC)	689
visbreaking	600
isomerization	235
hydrodesulphurization (HDS)	1204
mild hydrocracking (MHC)	622
hydrocracking	2600
Oil Refinery Sisak	
atmospheric distillation	3800
reforming	670
fluidized-bed catalytic cracking (FCC)	490
coking	280
vacuum distillation	895
bitumen	200
Lube Refinery Zagreb Ltd.	
lubricants	60

Source: Croatian NIR2021; MESD

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

Subsector 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, which in 2019 met 35.4% of domestic needs for natural gas. The production of gas from Pannon is slightly higher than the production realized from the Adriatic Sea. Most of the gas from Pannon comes from the fields of Duboka Podravina and Međimurje (deposits Molve, Kalinovac, Gola, Stari Gradac, Vučkovec and Zebanec). Reception and preparation of gas for transport from these fields is performed at the Molve III Central Gas Station. The installed production capacity of CPS Molve III is 5 million m^3 of gas 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 129/12) all LPSs 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.

According to the data from the EPR database, national energy balance and available information in the Republic of Croatia, no waste is currently co-incinerated in thermal power plants. Waste incineration takes place only in cement plants (sector 1.A.2.f) and in very small quantities.

For emission calculation for area sources (not LPSs) 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 GB2019. Emission factors together with the direct emissions for 2018 are given in Appendix 4 of this report.

In the 2017 inventory review cycle the TERT notes that this under estimate may be because annual emissions are calculated based on stack measurements. When continuously measurements are used to estimate annual emissions, there is a risk that operators have misinterpreted the IED and have used validated average values (after having subtracted the value of the confidence interval). This results in an under estimated emission of up to 20-30% depending on the pollutant and the confidence limits. The recommendation of the TERT was to organize and conduct surveys among operators, and obligors of continuous measurements according to the Ordinance on the monitoring of emissions of pollutants into the air from stationary sources (OG 129/12) who reports annual emission based on direct measurements.

As part of the inventory improvement project, the Contractor conducted surveys to HEP-Production d.o.o. which showed that all measured mass concentrations on the CEM system are used for the emission calculation. An example of a survey with a response is given below:

The type of data used to calculate the annual emissions reported to the EPR database	**YES/NO**
Validated mean mass concentration values (uncertainty corrected)	NO
All measured mass concentrations on the CEM system	YES

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. These are calculated on the base of annual fuel amount by type (produced and put on the market) and sulphur amount in fuel 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 database, the default emission factors from GB2019 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 GB2019, 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 3.2-1.

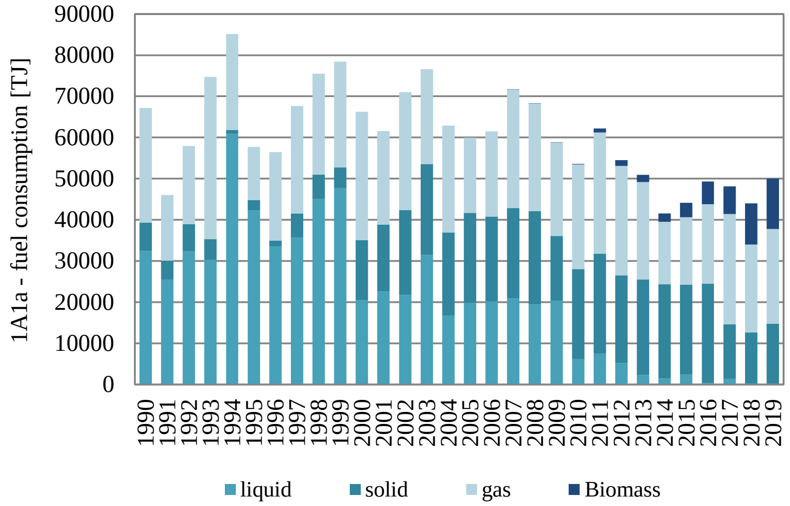


Figure 3.2-1 Activity data on fuel consumption by type for NFR 1.A.1.a

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

Methodology for emission calculation is Tier 2 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 GB2019 are used for emission calculations. Emission factors used for emissions calculation in 2019 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. These 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 3.2-2.

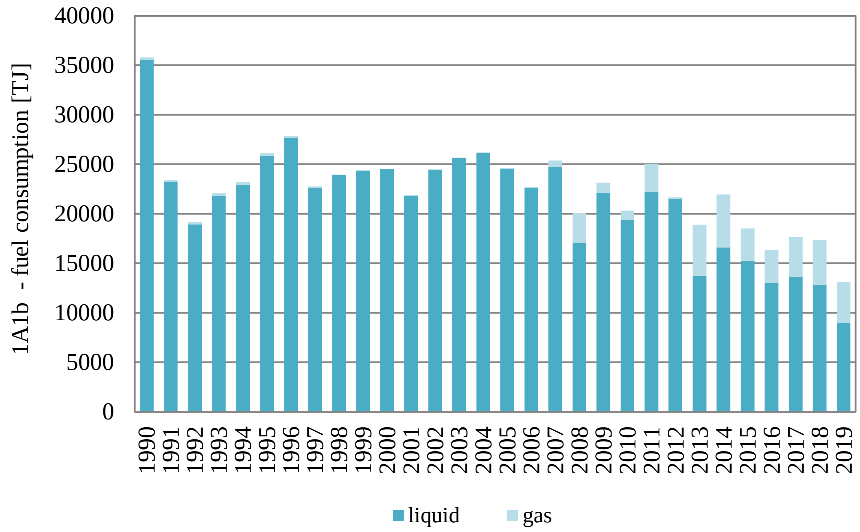


Figure 3.2-2 Activity data on fuel consumption by type for NFR 1.A.1.b

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 GB2019 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 2019 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 3.2-3.

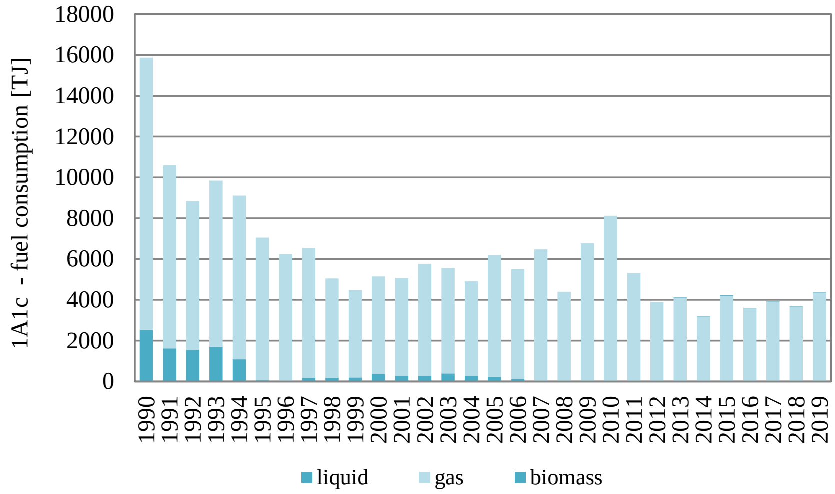


Figure 3.2-3 Activity data on fuel consumption by type for NFR 1.A.1.c

Recalculations and improvements

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

The error in subsector 1.A.1.a.iii due to the use of fuel for 2017 instead of 2018 has been corrected.

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

The error caused by using EF for SO_2 for 2017 instead of 2018 has been corrected.

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

There was no recalculation and improvements.

3.3. 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 whole observed historic period.

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 (GB2019). Croatia estimates all emissions for all pollutants which EF are provided in GB2019 for 1.A.2.a, 1.A.2.b, 1.A2.c, 1.A.2.e for all fuel types specified in annual national energy balances.

For NFR 1.A.2.f Non-metallic minerals code, plant-specific emission factors for SO_2, NOx, CO and PM were used for the whole observed period. The Non-metallic minerals sector includes all cement production plants in Croatia that dominate emissions within sector 1.A.2.f Non-metallic minerals and within the overall source category 1.A.2.

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 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.

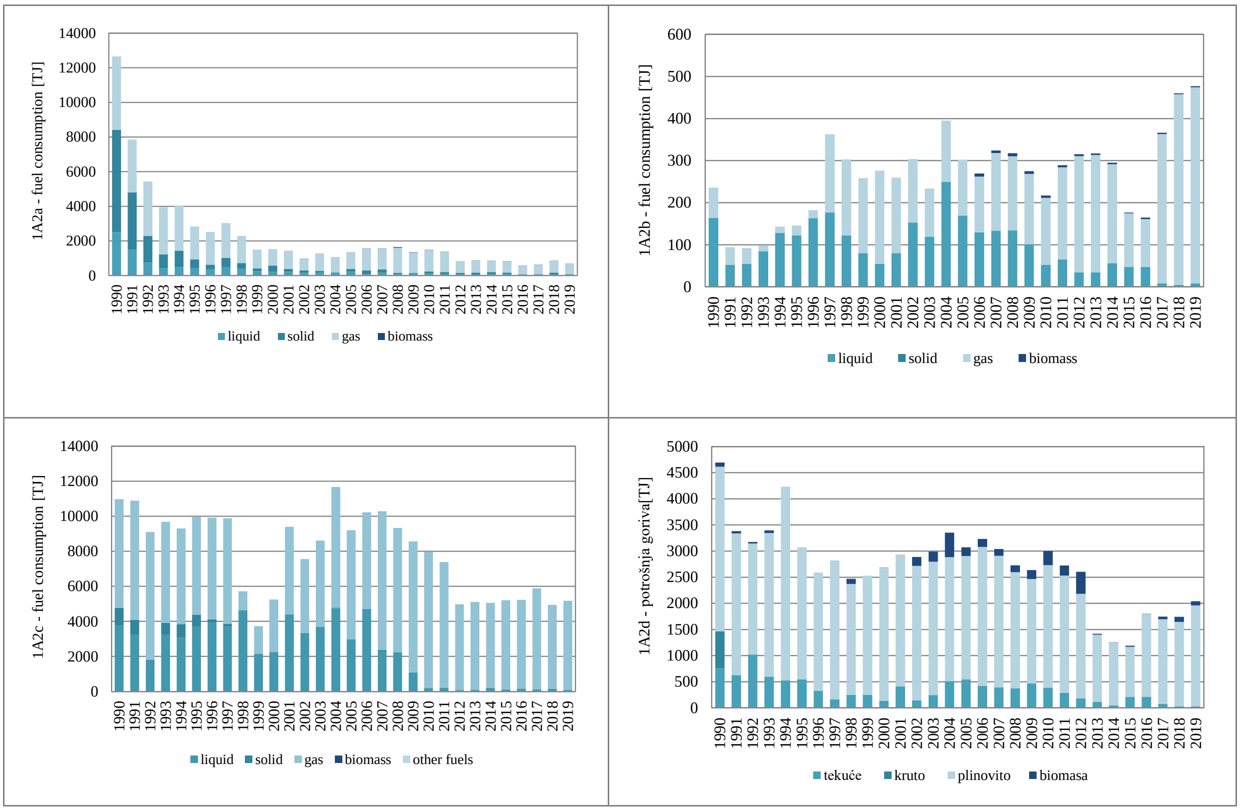
Country specific EF for SO_2

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 GB2019 (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 3.3-1.



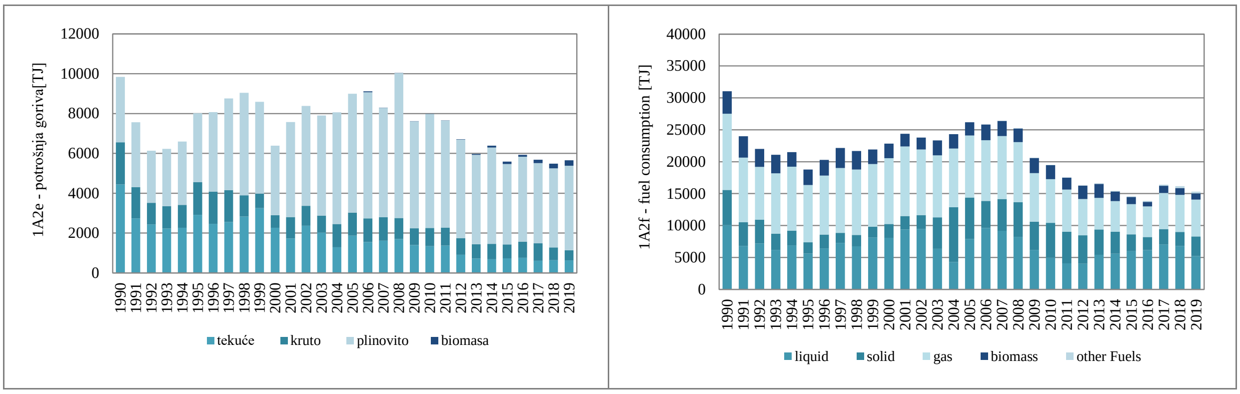


Figure 3.3-1 Activity data on fuel consumption by type for NFR codes 1.A.2.a, 1.A.2.b, 1.A.2.c, 1.A.2.d, 1.A.2.e, 1.A.2.f.

<u>Recalculations and improvements</u>

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

Error in subsector 1.A.2.f. caused by the use of direct emissions of one plant for 2017 instead of 2018 has been corrected.

3.4. Transport (NFR 1.A.3)

<u>Source category description</u>

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. 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”.

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

The Republic of Croatia has 9 airports: Zagreb, Split, Dubrovnik, Zadar, Osijek, Rijeka, Pula, Brač and Mali Lošinj 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) and 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 increased in 2019 from 2,604 km to a total of 2,617 km, of which 2,343 km (90%) are single track and the rest (274 km) are double track railway. The 37,5% (980 km) 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 1.A.3.d.ii 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 one, so no emissions occurred from this source category. 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 2019 for Pipeline transport 3,7 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 2019 in NGL plant only natural gas was used in own use purposes ($50,0*10^6$ 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 GB2013. 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 - 2019. 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 - 2019 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 (90%) 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 taken 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 5 were used. Regarding combustion of kerosene for stationary combustion, heavy metals, PCDD/PCDF and PAHs emission factors for NFR 1.A.2 were used. According to the methodology described in GB2019, it is necessary to designate a characteristic aircraft for the country, for which it is necessary to collect detailed data on aircraft at all airports in the Republic of Croatia. Since this is an inventory improvement that requires additional data to be collected, this methodology did not use GB2019 methodology, but GB2013 methodology.

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 3.4-1.

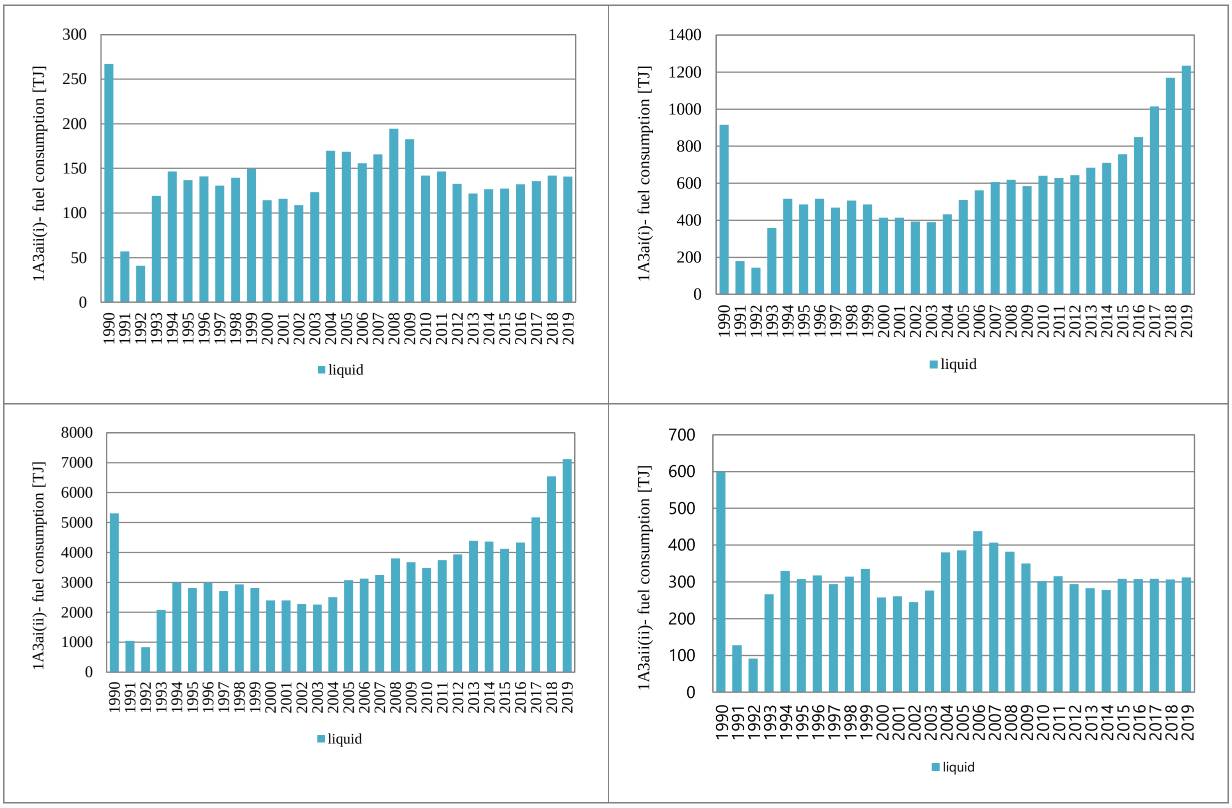


Figure 3.4-1 Activity data on fuel consumption for NFR codes 1.A.3.a.i(i), 1.A.3.a.ii(i), 1.A.3.a.i(ii), 1.A.3.a.ii(ii)

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

The COPERT 5 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:

a) type of vehicles (passenger cars, light duty vehicles, heavy duty vehicles, buses, mopeds, motorcycles),
b) type of motor (gasoline four-stroke, gasoline two-stroke, diesel, rotation motor and electromotor),
c) cylinder capacity (<0.8 lit, 0.8-1.4 lit 1.4-2.0 lit, >2.0 lit),
d) weight class (Rigid<7.5 t, 7,5-12 t, 12-14 t, 14-20 t, 20-26 t, 26-28t, 28-32 t, >32t, Articulated 14-20 t, 20-28 t, 28-34 t, 34-40 t, 40-50 t, 50-60 t) and
e) 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.

To calculate the SO_2 emissions from gasoline and diesel combustion, Croatia uses national values of the amount of S in each type of fuel (produced and placed on the market) and enters the annual budgeted factors into COPERT.
National gas vapour pressure values are entered in accordance with the legal regulations of the Republic of 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%).

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.

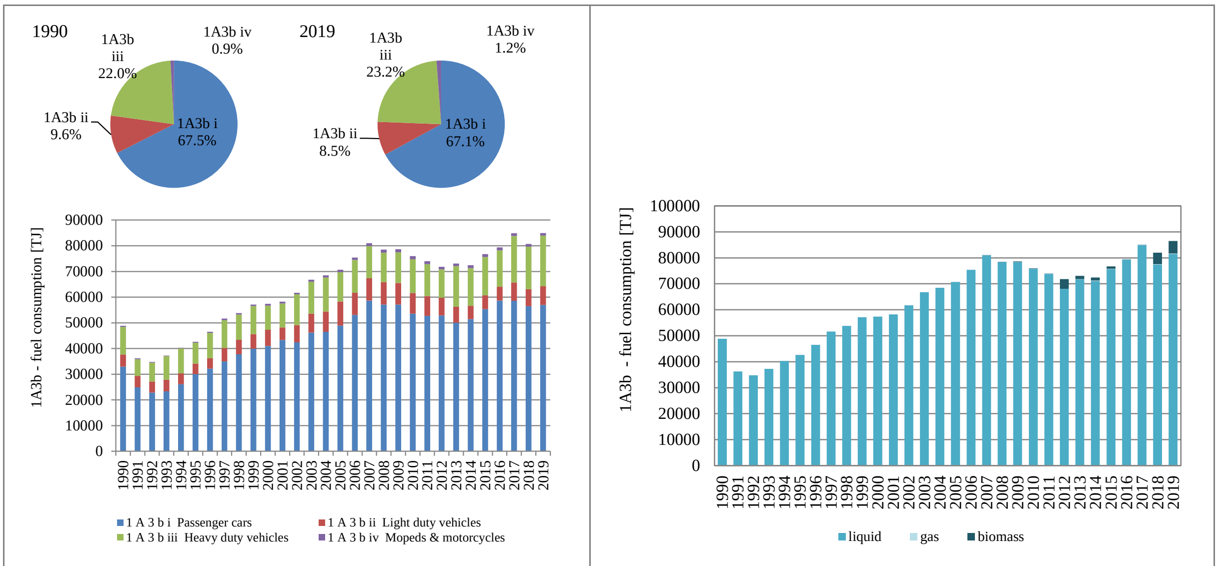
Country specific EF for SO_2

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 dominant fuel consumption activity in the road transport source category in 2019 has 1.A.3.b.i Passenger cars (68.2 %) and 1.A.3.b.iv Mopeds and Motorcycles has the smallest contribution (0.9 %). The sub-sector 1.A.3.b.ii Light Duty Vehicles has contributed with 10.9 % to overall fuel consumption within the road transportation and 1.A.3.b.iii Heavy duty vehicles with 21.6%. The trend of fuel consumption in road transportation has growing character (by 67.6 %) in the observed historic period. Fuel consumption in all categories has been growing since 1990 as follows: 1.A.3.b.iv Mopeds and motorcycles by 2.4 times 1.A.3.b.ii Light duty vehicles by 64.5%, 1 .A.3.bi Passenger cars by 71.6% and 1.A.3.b.iii Heavy duty vehicles by 54.3%.

The dominant fuel consumption activity in the road transport source category in 2019 has 1.A.3.b.i Passenger cars (67.1 %) and 1.A.3.b.iv Mopeds and Motorcycles has the smallest contribution (1.2 %). The sub-sector 1.A.3.b.ii Light Duty Vehicles has contributed with 8.5 % to overall fuel consumption within the road transportation in 2019, and 1.A.3.b.iii Heavy duty vehicles with 23.2 %. The trend of fuel consumption in road transportation has growing character in observed historic period (by 77.1 %). Fuel consumption in all categories has been growing since 1990 as follows: 1.A.3.b.iv Mopeds and motorcycles by 2.3 times 1.A.3.b.ii Light duty vehicles by 53.9%, 1 .A.3.bi Passenger cars by 72.8% and 1.A.3.b.iii Heavy duty vehicles by 83.9%. Consumption of biomass and gaseous fuels in road transport is still negligible at the national level.

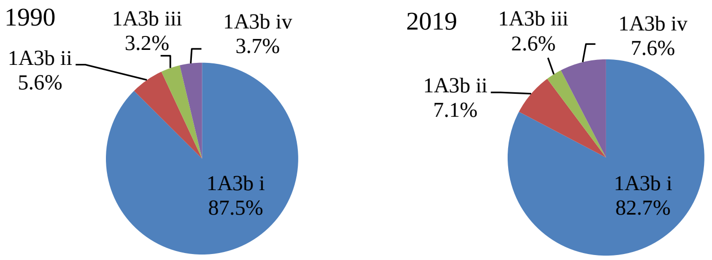
The Figure 3.4-2 shows the fuel consumption by type of vehicle in road transport.



Fuel consumption by type of vehicle	*Fuel consumption by fuel type*

Figure 3.4-2 Fuel consumption by type of vehicle and type of fuel used in road transport

The total number of vehicles in the historic period was increased by 60.8 % (Figure 3.4-3 and Table 3.4-1). The increase was largely a result of increasing number of passenger cars by 58.8 % because they presented 86.4 % of the total number of vehicles in road traffic in 2019. The number of light duty vehicles increase by 2.1 times, mopeds and motorcycles by 3.4 times and heavy duty vehicles by 35.6 % in the observing period. The type and class of vehicle, their speed and driving share on each type of road are shown in Table 3.4-2.



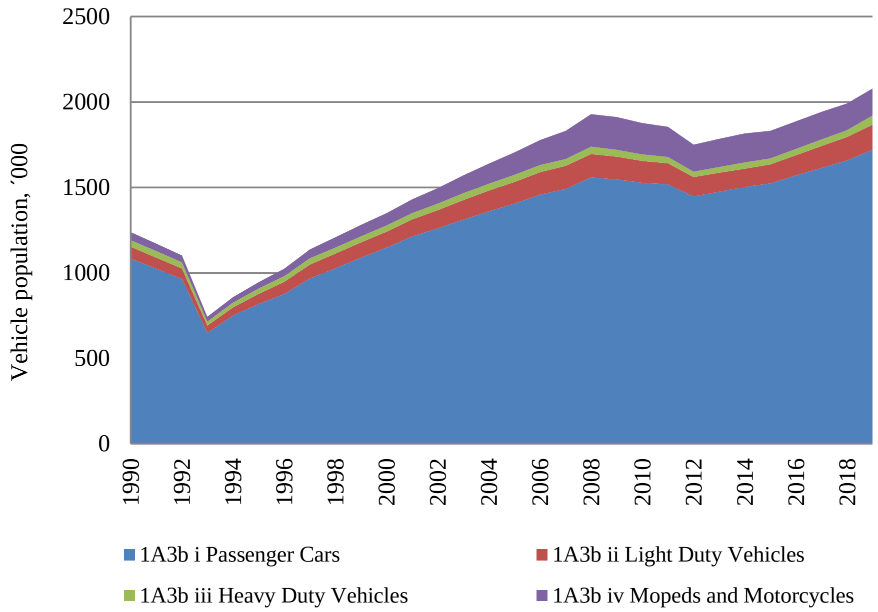


Figure 3.4-3 Number of each type of vehicle in the road transportation

Table 3.4-1 Number of road motor vehicles, using fossil fuels, by type ('000)

Vehicle type,	Passenger Cars	Light Duty Vehicles	Heavy Duty Vehicles	Mopeds Motorcycles
Year / unit	´000	´000	´000	´000
1990	1083,111	68,789	39,887	46,166
1991	1024,491	65,068	37,727	43,668
1992	964,257	61,241	35,504	41,100
1993	649,782	41,269	23,923	27,696
1994	750,494	47,665	27,635	31,989
1995	817,290	59,526	31,283	37,596
1996	877,072	69,847	33,923	44,525
1997	966,986	81,576	36,219	52,937
1998	1025,723	86,299	36,370	59,891
1999	1088,304	89,549	36,188	66,301
2000	1147,519	93,195	36,257	72,800
2001	1213,592	98,779	37,123	80,455
2002	1260,431	106,338	38,512	90,974
2003	1311,403	114,565	39,908	104,299
2004	1360,190	120,870	40,629	117,637
2005	1405,499	126,630	40,819	132,904
2006	1458,011	131,089	41,210	147,931
2007	1491,828	133,836	41,259	163,645
2008	1558,131	137,680	42,699	190,078
2009	1546,680	133,298	40,654	191,584
2010	1526,800	127,920	38,031	183,619
2011	1517,328	123,849	36,421	176,582
2012	1446,673	112,988	33,101	158,487
2013	1475,062	109,693	34,408	164,400
2014	1503,412	106,389	35,742	170,296
2015	1523,720	110,039	35,389	162,599
2016	1570,167	117,682	38,219	161,581
2017	1614,445	127,218	39,230	162,252
2018	1658,528	135,687	40,533	156,088
2019	1719,826	147,551	54,104	157,839

Source: MIA, Processing: Ekonerg Ltd.

Table 3.4-2 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
	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 is not a key source. The default Tier 1 emission factors, stratified by fuel types, are from GB2019. 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 3.4-4).

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.

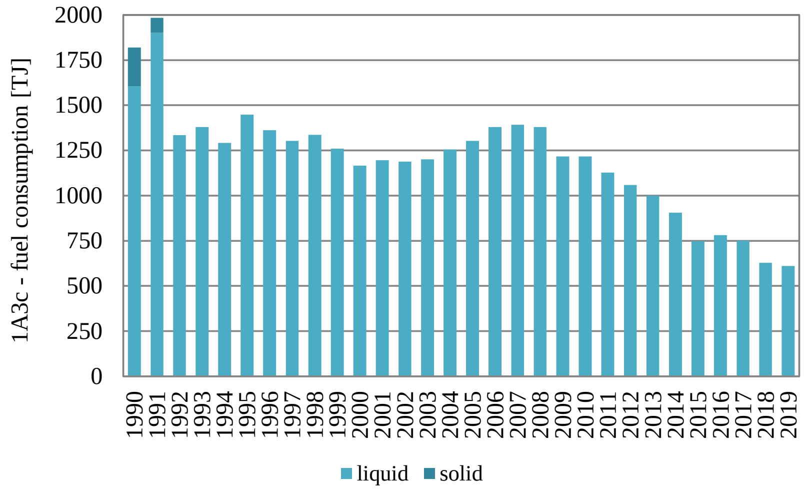


Figure 3.4-4 Activity data on fuel consumption for NFR 1.A.3.c

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 are not 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 GB 2019 were used for fuel: gasoline, fuel oil and diesel. For pollutants for which EF are not recommended in GB 2019, 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.

For the use of Tier 2 EF's from GB2019, it is necessary to obtain more detailed national data. This improvement is included in the Data collection program for future submissions.

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 3.4-5.

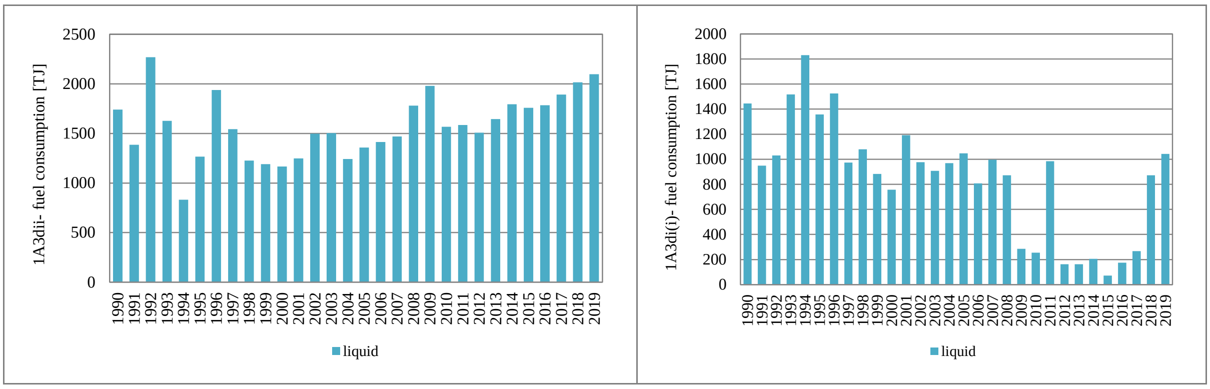


Figure 3.4-5 Activity data on fuel consumption for NFR codes 1.A.3.d.ii, and 1.A.3.d.i(i)

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

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)

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

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

In Category 1A3b, the following recalculations were performed:

- A new version of the COPERT 5 model was used
- The fuel quality year is set to match the year being calculated. In the last submission for all years quality for 1996 was used
- Emissions of PAHs for NFR 1.A.3.b.vi for the period 1990-2019 have been calculated as recommended by the TERT.

Railways (1.A.3.c)

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

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

During the NECD review 2020, the TERT noted that EF for small recreational boats (i.e. from Table 3-5 of the GB2019) have been applied to estimate emissions for marine diesel oil/gas oil from larger ships in source category 1.A.3.d.ii. This error is corrected in this year submission using Tier 1 EF for marine diesel oil / gas oil (from the Table 3-2 GB2019), resulting with recalculation of emissions for the entire period 1990 – 2018.

Following the conducted recalculation, the TERT recommends the use of Tier 2 methodology for the 1.A.3.d.ii source category. For the Tier 2 methodology, more detailed national activity data are required, which is included in the Data collection program for future submissions.

3.5. 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, LPG, natural gas and wood, Croatia use default EF SO_2 from GB2019.

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

All emission factors are default Tier 1 from GB2019, and are presented by NFR sectors in Appendix 4 of this report.

Structure of fuel combustion in Commercial/Institutional sector for period 1990 – 2019 is presented in Figure 3.5-1.

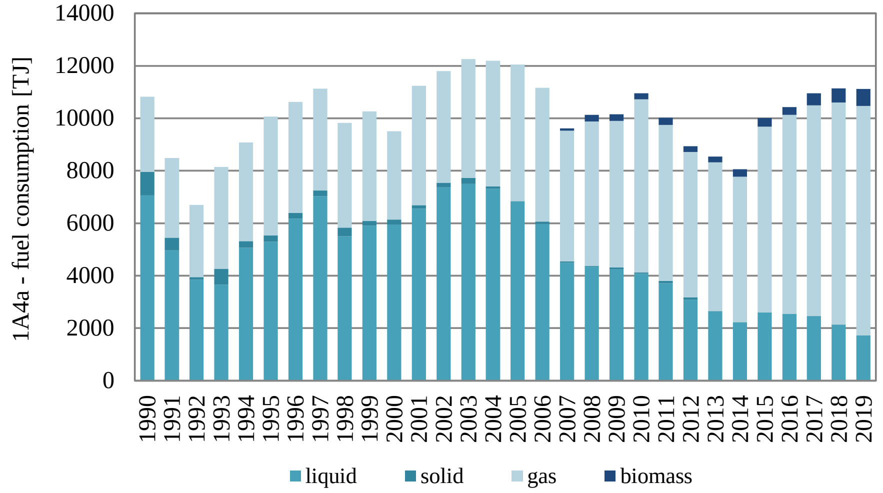


Figure 3.5-1 Activity data on fuel consumption by fuel type for NFR 1.A.4.a

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.

The improvement of the emission calculation for biomass combustion in Residential combustion was carried out in 2019, on the basis of which a new model for biomass was created. Until then, the inventory has used a model that included IIASA GAINS data for the Republic of Croatia and expert assessment of the share for technologies with low emissions according to Table 3.5-1. These shares were also used to create the current emission projections. For the years between the years listed in the Table 3.5-1, the shares of each technology are calculated using the linear interpolation method.

Table 3.5-1 Technology shares according to IIASA GAINS model and expert assessment for the Republic of Croatia

Technology type for biomass combustion	GAINS model		Expert assessment
	1990	2005	2010
Open fireplaces	4.4%	5.9%	6.0%
Boilers (manual feed)	39.4%	29.4%	18.4%
Conventional stoves	56.2%	64.7%	44.5%
Advanced /ECO-labelled stoves	0%	0%	31.0%
Pellet stoves and boilers	0%	0%	0.1%

Source: IIASA GAINS; Ekonerg Ltd.

During 2017, households were surveyed in four agglomerations of the Republic of Croatia, five zones and one city related to the use of energy in households and present biomass combustion technologies. The surveys were carried out within the framework of the project: "Creating a register of pollutants with spatial distribution in the high resolution EMEP grid". In addition to these surveys, the creation of a new model for biomass also includes surveys conducted in 2019 by the EIHP on the same topic and surveys conducted with sellers of biomass stoves and boilers. As the surveys conducted in 2017 did not provide any response for the presence of technology - ECO-labelled stoves / boilers that were included in the previous emission inventory (Table 4.5-1), and answers were provided for the existence of highly efficient stoves / boilers it was necessary to further explore the representation of these two technologies in the domestic market. The study confirmed that ECO-labelled stoves/boilers are sold domestically, but because of the expensiveness of these and the absence of subsidies, their sales are not high. Based on the information received, it is estimated that they are installed in households at a slightly higher percentage than pellet stoves / boilers. The results of the surveys, statistical analysis of the results, proposed and selected new shares of biomass combustion technologies in small combustion plants and other details related to the creation of a new model for biomass within this emission category are presented in the document "The Report on improvement made for the Energy Sector" part of the Agreement for the service for preparation of Improvement of emission inventories under LRTAP Convention for sectors: Energy, Agriculture and Production Processes 800/02-19/39JN, Executor: Ekonerg Ltd. for the Client: MESD.

A combined set of averages for zones and agglomerations with processed results of surveys conducted in 2019 was selected for the proposal of new shares (Table 3.5-2) were considered, which takes into account the whole of Croatia. In this way, a more complete picture of the representation of a particular technology is obtained, which also includes the specifics of each of agglomeration, one city and zones, since they are used in the assessment of air quality.

Table 3.5-2 Three sets of combustion technology share according to the results of the surveys in 2017 and 2019 with the estimated set share for 2017

Technology type for biomass combustion	Survey analysis results for 2017 for agglomerations and one city	Survey analysis results for 2017 for zones	EIHP survey analysis results for 2019 for Croatia	Estimated set for 2017
Open fireplaces	12.5%	5.3%	13.29%	10.4%
Boilers (manual feed)	11.2%	21.4%	22.39%	18.3%
Conventional stoves	32.9%	34.7%	39.72%	35.8%
Advanced /ECO-labelled stoves	14.1%	10.6%	10.93%	11.9%
high-efficiency stoves	28.1%	21.1%	12.86%	20.7%
Pellet stoves and boilers	1.3%	7.0%	0.80%	3.0%
Total	100.0%	100.0%	100%	100.0%

Source: Ekonerg Ltd.

The estimated set for 2017, i.e. new shares of biomass combustion technologies in residential, indicated that the share of fireplaces technology proposed by IIASA GAINS for Croatia was partially underestimated, so new estimation of share for 1990 and 2005 were started. The estimate included a linear interpolation method using the results of surveys, i.e. the estimated set of technology shares for 2017, GAINS share data for Croatia for 1990, 2005 and 2010 as a starting point for correction and GAINS increase / decrease factors between 2005 and 1990 and between 2010 and 2005. With the help of the increase / decrease factors for the years 2005 and 2010 and the estimated set of technology shares for 2017, the shares for the historical year 2005 were first corrected. With the help of the increase / decrease factors for 1990 and 2005 and the obtained corrected shares for the historical 2005, the shares for the historical 1990 were then adjusted. For the years between 1990-2005, 2005 - 2010, 2010 - 2017, the shares of each technology were calculated using the linear interpolation method.

The results of the corrections made and the newly proposed model for biomass are presented in Table 3.5-3.

Table 3.5-3 Technology shares based on survey results, research-based expert assessment and IIASA GAINS model

Technology type for biomass combustion	1990	2005	2017
Open fireplaces	8.5%	10.0%	10.4%
Boilers (manual feed)	33.0%	23.0%	18.3%
Conventional stoves	58.5%	67.0%	35.8%
Advanced /ECO-labelled stoves	0%	0%	11.9%
high-efficiency stoves	0%	0%	20.7%
Pellet stoves and boilers	0%	0%	3.0%

Source: Ekonerg Ltd.

Due to new shares and the inclusion of additional technology (high energy efficiency stoves) for combustion of biomass in residential, there have been significant changes in the emissions of those pollutants whose emissions depend on the combustion technology (NOx, NMVOC, NH_3, CO, particulates, dioxins / furans, PAHs and PCBs). This resulted in a reduction of NOx emission and increase in the emission of the other mentioned pollutants. Heavy metals, SO_2 and HCB emissions were not affected by this improvement. The improvement assumes that the impact of new technologies has been started since 2005, when the market sale / use of technologies with lower emissions were approximately start in Croatia. It is believed that this increase will, from the PM emission point of view, give a more realistic national picture of both the emissions and the correlation of these emissions with the concentrations of particulate matter in the air and the assessment of air quality in zones and agglomerations.

For coal, two types of technology were assumed: (I) coal combustion in heating stoves and (II) coal combustion in single house boilers (<50 kW) (table 3.5-4). 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.

Table 3.5-4 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%

Source: the GAINS model

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 GB2019 are represented in equal proportions for the period since 1990 (Table 3.5-5). For liquid fuels two possible technologies in accordance with GB2019 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 GB2019 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 3.5-5 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 GB2019

Two types of solid fuel were used in 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 and natural gas. Structure of fuel combustion in Residential sector for period 1990 – 2019 is presented in Figure 3.5-3.

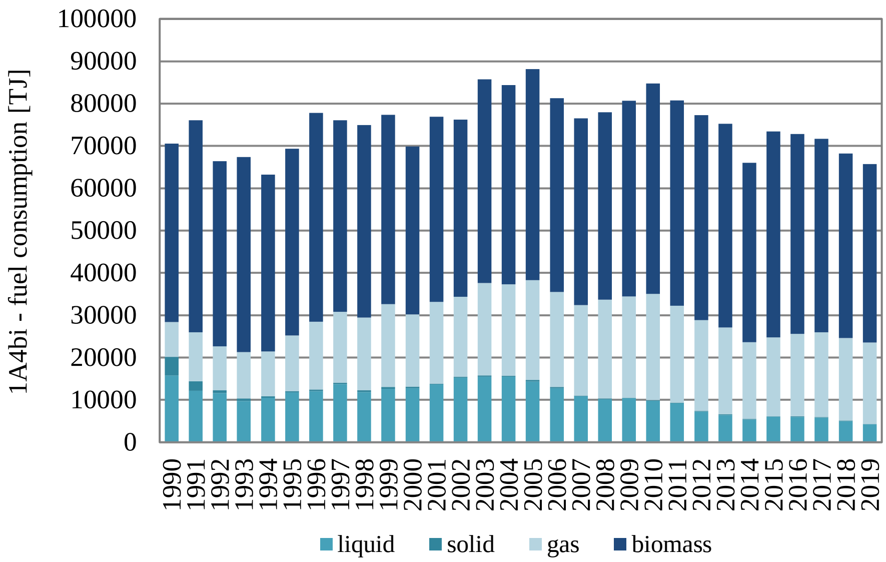


Figure 3.5-3 Activity data on fuel consumption by fuel type for NFR 1.A.4.b.i

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 GB2019 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, liquefied petroleum gases, natural gas and wood, Croatia use default EF SO_2 from GB2019.

All factors are presented for last historic 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 GB2019, and are presented by NFR sectors in Appendix 4 of this report. Structure of fuel combustion in Agriculture/Forestry sector for observed period is presented in Figure 3.5-4.

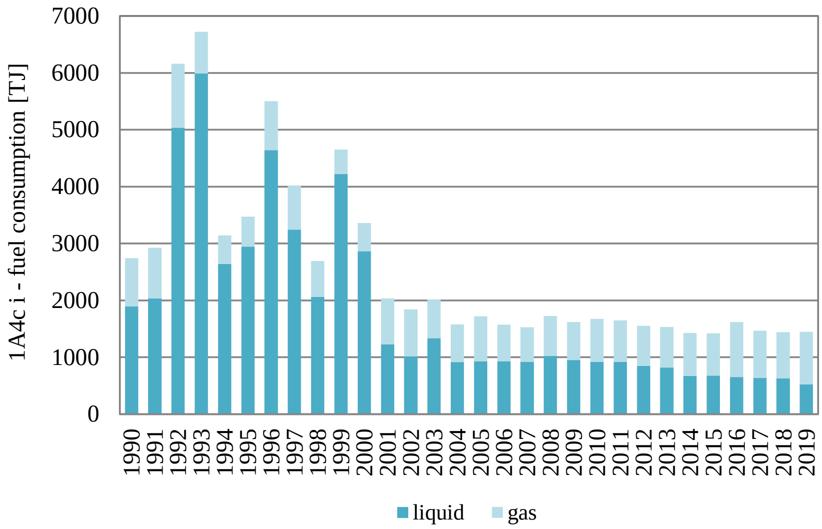


Figure 3.5-4 Activity data on fuel consumption by fuel type for NFR 1.A.4.c.i

Recalculations and improvements

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

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

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

Recalculation of emissions for 2018 of all pollutants from biomass due to misuse of the amount of wood for 2017 instead of 2018, which resulted in a reduction of emissions of relevant pollutants (see Annex 8).

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

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

3.6. 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.

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 fuel for national navigation, maritime and river transport).

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 GB2019 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 GB2019, 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 provided in Appendix 9 of this Report.

For heavy metals and POPs, GB2019 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 SO2

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, liquefied petroleum gases and natural gas, Croatia use default EF SO_2 from GB2019.

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.

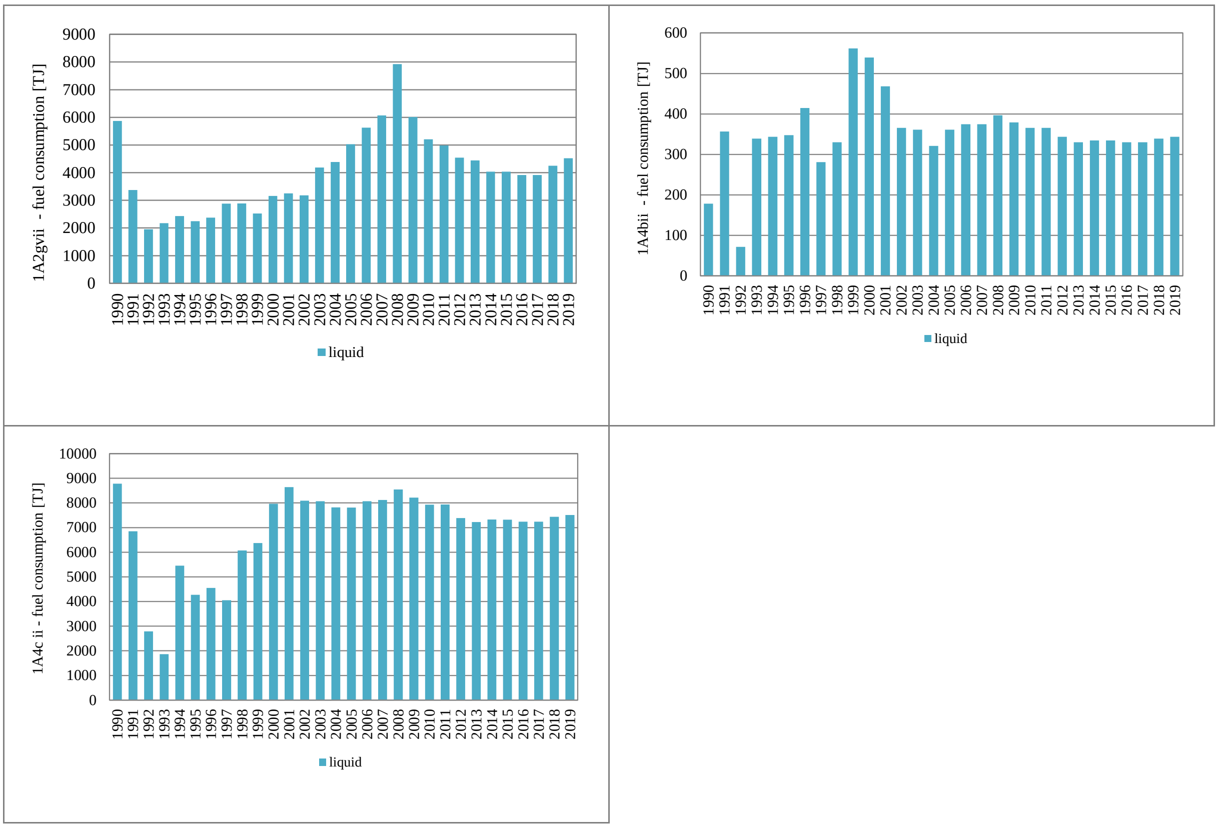


Figure 3.6-1 Activity data on fuel consumption for NFR codes 1.A.2.g.iv, 1.A.4.b.ii and 1.A.4.c.ii

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.

3.7. 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 3.7-1 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 3.7-1 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

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

Source category description

Source category NFR 1.B encompasses fugitive emissions from coal, oil and natural gas. During all stages of the production and use of fossil fuels, from the extraction to their final use, fuel components can be released in the form of fugitive emissions.

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

This source 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).

In Croatian inventory, this category encompasses emissions from coal mining and handling, which was present in Croatia until 1999, as well as emissions from coal transformation (coke production), which was present until 1994. From 1990 to 1999, coal production in Croatia has been on a steady decline. Only Istrian underground coal mines were active and they produced 0.015 - 0.174 mil. t of coal.

For other fugitive emissions from solid fuels (NFR 1.B.1.c) Croatia does not report emissions, i.e. the notation key "NO" is used.

All underground and surface excavation activities result in fugitive emissions of CH_4, NMVOC and particulate matter, which arise during coal mining and handling. In addition, coke plant is a major source of fugitive emissions such as: SO_2, NOx, NMVOC, CH_4, CO_2, CO, NH_3, particulate matter and heavy metals as well as PAHs.

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

This source category includes subcategories: Oil - Exploration, production, transport (NFR 1.B.2.a.i), Fugitive emissions oil - Refining, storage (NFR 1.B.2.a.iv), Distribution of oil products (NFR 1.B.2.a.v), Natural gas – Exploration, production, transport (NFR 1.B.2.b), Venting and flaring (NFR 1.B.2.c), and Other fugitive emissions from energy production (NFR 1.B.2.d) – for which Croatia does not report emissions, i.e. the notation key "NO" is used.

This category encompasses fugitive emissions from various activities of exploration and production, refining, storage transport, processing and distribution of crude oil, petroleum products (gasoline) and natural gas. Fugitive emissions in this category also include emissions arising from gas flared on oil-and gas-production installations for safety, and emissions due to venting activities in oil and gas production.

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

Exploration, production and transport of oil in the Republic of Croatia is carried out by the company INA-Industrija nafte, within the business segment „Exploration & Production of oil and gas“ (former INA NAFTAPLIN). Number of active oil fields has changed over the years of the time series. The greatest quantities of oil come from the eight most significant fields, which contain 83% of total reserves discovered in Croatia. During the war (1991-1995), a significantly smaller number of oil fields were active. All fields in Croatia are “on shore” fields.

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

Exploration and production of natural gas in Croatia is carried out by the company INA-Industrija nafte, within the business segment „Exploration & Production of oil and gas“. Main gas fields, with 70% of total reserves, are located in the three largest gas and gas condensate fields: Molve, Kalinovac and Stari Gradac. Molve provides between 70% - 75% of gas and condensate per year in Croatia. One of the old gas fields - Okoli, in the Sava Depression, has been turned into underground gas storage of the capacity of 500 mil. m^3. Additional information are provided in Chapter 4.2. (NFR 1.A.1), under the NFR 1.A.1.c category description.

Transmission is carried out by the transmission system operator - Plinacro Ltd and distribution system operators (36 companies). In addition, this category includes Hg emission that originates from the process of cleaning natural gas at the central gas station (Molve). Natural gas produced in Croatian gas fields contains a significant amount of Hg (516 $\mu g/m^3$), which has not been extracted from natural gas until 1992. In 1993, technology for Hg emission reduction was put in operation, resulting in reduced emission to about 0.12 $\mu g/m^3$.

Transmission system consists of international, main, regional and branch pipelines and supporting facilities, reducing and metering stations of various capacities, and other facilities and systems that enable reliable and secure gas transmission. Basic information regarding Croatian transmission system are shown in Table 3.8-1.

Table 3.8-1 Basic information on the natural gas transmission system of the Republic of Croatia

Natural gas transmission system of the Republic of Croatia	
Number of transmission system operators	1
The total length of pipelines	2693 km
Interconnections / transmission system operators:	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 Ltd. UMS Etan, Ivanić Grad / INA - Ltd. UMS PS Ferdinandovac / INA Ltd. UMS PS Gola / INA Ltd. UMS PS Hampovica / INA Ltd. UMS Terminal Pula / INAGIP Ltd
Number of connections for end users connected to transmission system:	36
Number of connections to the distribution systems and the number of distribution system operators:	Number of ports: 158 Number of operators: 36
Number of balancing zones:	1

Source: Plinacro Ltd. (http://www.plinacro.hr)

Fugitive emissions oil - Refining, storage (NFR 1.B.2.a.iv)

Refining/storage is carried out in oil refineries at two locations, in Rijeka (RNR) and Sisak (RNS). Production capacities of the refineries are shown in Table 4.2-2. Emissions calculation for RNS refinery includes emissions from FCC regenerators (without CO boiler), catalytic reforming unit, coking plant (since 1994) and Claus installation (since 2007). For RNR refinery, emissions include FCC regenerators (without CO boiler), catalytic reforming unit (two units) and Claus installation (since 1997). In addition, emissions from storage and handling of petroleum products in refineries are included in calculations.

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

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

- shipping and delivery of products at refinery dispatch stations (SNAP 050501),
- transport and depot stations (SNAP 050502), and
- reloading and handling of oil products at service stations (retail trade) (SNAP 050503).

Distribution is carried out by the company INA-Industrija nafte, within the business segment „Consumer Services & Retail“. Only gasoline is considered to be significant oil product for NMVOC emission occurring at the refinery site.

Shipping and delivery of products at refinery dispatch stations

Shipping and delivery of oil products is carried out at two refinery dispatch stations - in Sisak and Rijeka.

Shipping and delivery of gasoline in RNS refinery is carried out by road and rail transport, and by barge transport on the Sava River, at the port for receiving and unloading of crude oil and for loading the products on the barges. Shipping and delivery of gasoline, derivatives and tert-butyl methyl ether (MTBT) in RNR refinery is carried out through the terminals for road, rail and marine transport.

Gasoline transport and depot stations

Emissions from gasoline transport, in accordance with GB2019, were identified as negligible. This section includes emissions from gasoline storage at terminals. According to GB2019, the methodology for calculating emissions from gasoline storage at terminals in refineries is covered under the category 1.B.2.a.iv.

Service stations

Handling and manipulation of gasoline is carried out and at service stations. Majority of emissions at service stations are emissions from gasoline tanks, and GB2019 proposes only gasoline emission factors.

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

Flaring represents controlled release of pollutants, including NOx, NMVOC, SO_2, CO, particles and heavy metals into the atmosphere. The inventory includes emissions from the two subcategories: 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 NFR 1.B.1.a (SNAP 050102 Underground mining and SNAP 050103 Storage of solid fuel) are calculated by Tier 1 EMEP/EEA methodology and with „top-down“ approach – by multiplying process specific activity data by corresponding EMEP/EEA Tier 1 emission factors (GB2019).

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provided 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.

The source of activity data for the total mass of coal produced by underground mining for NFR 1.B.1.a is national energy balance. Annual amounts of coal produced are presented in Table 3.8-2.

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

Fugitive emissions from NFR 1.B.1.b Fugitive emissions from solid fuel: solid fuel transformation (SNAP 040201 Coke oven (door leakage and extinction)) are calculated by Tier 1 EMEP/EEA methodology and „top-down“ approach, i.e. by multiplying process specific activity data by corresponding EMEP/EEA Tier 1 emission factors (GB2019).

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

All emission factors used for the preparation of the IIR are presented in Appendix 4.

Source of activity data for the production of coke is national energy balance. Annual amounts of coke produced are presented in Table 3.8-2.

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

This category is not present in Croatia, thus notation key "NO" is used.

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

Fugitive emissions from NFR 1.B.2.a.i are calculated by Tier 2 EMEP/EEA methodology, i.e. by multiplying process specific activity data by corresponding Tier 2 emission factors (GB2019).

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provided 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 produced, which is taken from the national energy balance (Table 3.8-2).

Table 3.8-2 Activity data for NFR 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	Coal mining / handling (quantities of coal produced)	Solid fuel transformation (quantities of coke produced)	Other fugitive emissions from solid fuel	Oil - Exploration, production and transport (quantities of crude oil produced)	Other fugitive emissions not included 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

NFR	1.B.1.a	1.B.1.b	1.B.1.c	1.B.2.a.i	1.B.3
Name	Coal mining / handling (quantities of coal produced)	Solid fuel transformation (quantities of coke produced)	Other fugitive emissions from solid fuel	Oil - Exploration, production and transport (quantities of crude oil produced)	Other fugitive emissions not included in 1.B.2
Unit	kt	kt	-	kt	-
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
2018	NO	NO	NA	732.1	NO
2019	NO	NO	NA	705.7	NO

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

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

Fugitive emissions from refining / storage (NFR 1.B.2.a.iv) were calculated using the Tier 2 EMEP/EEA methodology (GB2019) and "bottom-up" approach; multiplying relevant activity data by 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 provided in Appendix 9 of this Report.

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

Activities within NFR 1.B.2.a.iv Refining/storage include: 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. Other abatement technology was not taken into account. The existing facilities at refineries do not have abatement technology installed within the catalytic cracking activity.

Data on total annual amount of fresh feed for each type of unit, and annual sulphur production (Claus installation) were obtained from MESD (survey requests to refineries). Activity data for calculating emissions from storage and handling of oil products in refineries is annual total throughput of crude oil in each refinery, which is taken from national energy balance. Detail activity data for NFR 1.B.2.a.iv are presented in Table 3.8-3.

Table 3.8-3 Activity data for NFR 1.B.2.a.iv, represented by the relevant SNAP codes

SNAP	040102a	040102b	040105	040103	040104
SNAP, Name	Catalytic Cracking unit regenerator (total amount of fresh feed)	Catalytic reforming unit (total amount of fresh feed)	Other - Fluid coking unit (total amount of fresh feed)	Sulphur recovery plant (sulphur production)	Storage and handling of petroleum products in refinery (crude oil throughput)
Unit	1000 m^3	1000 m^3	1000 m^3	kt product	kt product
1990	1281.4	1604.8	NO	NO	6860.7
1991	894.9	1025.8	NO	NO	4510.9
1992	698.1	765.2	NO	NO	3935.0
1993	945.7	1090.0	NO	NO	4914.8
1994	842.2	965.9	160.1	NO	4994.3
1995	883.4	1240.1	160.2	NO	5336.1
1996	702.8	1219.0	130.6	NO	5112.7
1997	699.9	1105.8	139.1	2.2	5112.0
1998	898.9	1035.1	154.9	5.3	5007.5
1999	1037.2	1136.6	194.7	5.9	5474.8
2000	1385.2	1208.7	190.5	8.3	5162.8
2001	1217.4	1159.5	190.5	6.7	4831.6
2002	1247.8	1028.7	214.2	7.1	4830.0
2003	1242.7	1204.5	189.3	7.5	4861.7
2004	1348.9	1184.5	176.8	8.5	5079.3
2005	1394.2	1048.2	149.6	8.1	4944.7
2006	1138.2	1033.7	192.0	6.7	4716.4
2007	1369.9	1067.4	181.2	8.9	5077.4
2008	1066.0	925.7	116.8	9.5	4308.7
2009	1330.0	1048.7	122.4	10.0	4824.4
2010	1027.8	931.0	184.8	6.4	4256.6
2011	836.2	743.1	91.2	16.3	3502.7
2012	906.2	775.1	109.4	17.5	2924.9
2013	753.7	729.7	83.7	15.9	3062.5
2014	632.8	661.9	38.5	19.4	2444.4
2015	664.6	681.1	90.0	17.5	2998.2
2016	665.4	718.6	62.0	21.7	3250.5
2017	744.3	871.7	107.9	24.2	3562.5
2018	567.4	847.7	127.7	23.3	3697.6
2019	392.1	694.3	134.3	11.8	2711.7

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

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

Fugitive emissions from NFR 1.B.2.a.v Distribution of oil products, SNAP 050502 Refinery dispatch station, and SNAP 050503 Service stations (including refuelling of cars) were calculated by Tier 2 EMEP/EEA methodology (GB2019) and "bottom-up" approach, i.e. by multiplying relevant activity data by the recommended EMEP / EEA Tier 2 emission factors, both stratified according to different techniques in the distribution of oil products. According to the proposed methodology, emissions from refinery, storage tanks, are reported in 1.B.2.a.iv and emissions from loading of mobile containers in refinery are reported in 1.B.2.a.v.

For source category SNAP 050502 Transport and depots (except 050503), according to GB2019, 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 (gasoline storage) are covered in 1.B.2.a.iv.

For source category SNAP 050400 Liquid fuel distribution (except gasoline distribution), there are no Tier 2 EFs in EMEP/EEA GB2019, thus EFs from Corinair (vol. 2, p. 57) were used:

- for 0504 – total crude oil, production + import and 040104 = 0.02 kg/t; related to VOC emission from crude storage and handling in external floating roof tanks;
- for 0504 – import = 0.3 kg/t; related to VOC emission from ballasting of crude oil tankers.

Detail country specific activity data are collected:

- loading facilities at refinery dispatch stations, depots and storages - volume of volatile products loaded into different transport modes (road, rail and marine tankers); loading practices for specific modes of transport (top, bottom or combined); type and extent of emission control measures in place. Data source is national oil company;
- service stations - quantity of gasoline sold; type and extent of emission control measures in place (Stage IB, Stage II). Data source is national oil company, together with 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.

Data on crude oil production and imports are taken from the energy balance.

Activity data for NFR 1.B.2.a.v are presented in Table 3.8-4.

Table 3.8-4 Activity data for NFR 1.B.2.a.v, presented by relevant SNAP codes 0505

Activity	Service stations, Storage tank filling	Service stations, Storage tank breathing	Service stations, Automobile refuelling	Service stations, Automobile refuelling: drips and spills	Refinery dispatch stations, Road tankers	Refinery dispatch stations, Rail tankers	Refinery dispatch stations, Marine tankers
SNAP	50503	50503	50503	50503	50501	50501	50501
Unit	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline
1990	764.0	764.0	764.0	764.0	426.4	399.9	995.3
1991	590.5	590.5	590.5	590.5	324.5	304.3	757.5
1992	511.4	511.4	511.4	511.4	227.5	213.4	531.1
1993	497.0	497.0	497.0	497.0	298.6	280.0	697.1
1994	545.6	545.6	545.6	545.6	321.0	301.1	749.4
1995	575.1	575.1	575.1	575.1	360.7	338.2	842.0
1996	626.0	626.0	626.0	626.0	319.6	299.7	746.0
1997	678.0	678.0	678.0	678.0	325.7	305.5	760.4
1998	737.3	737.3	737.3	737.3	338.8	317.7	790.9
1999	781.7	781.7	781.7	781.7	296.2	277.8	691.5
2000	784.4	784.4	784.4	784.4	313.5	293.9	731.7
2001	753.8	753.8	753.8	753.8	293.1	274.8	684.1
2002	759.0	759.0	759.0	759.0	301.1	282.3	702.8
2003	757.3	757.3	757.3	757.3	315.9	296.3	737.5
2004	723.7	723.7	723.7	723.7	319.1	299.3	744.9
2005	709.6	709.6	709.6	709.6	333.5	312.7	778.5
2006	711.3	711.3	711.3	711.3	325.4	305.1	759.5

Activity	Service stations, Storage tank filling	Service stations, Storage tank breathing	Service stations, Automobile refuelling	Service stations, Automobile refuelling: drips and spills	Refinery dispatch stations, Road tankers	Refinery dispatch stations, Rail tankers	Refinery dispatch stations, Marine tankers
SNAP	50503	50503	50503	50503	50501	50501	50501
Unit	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline	kt gasoline
2007	725.3	725.3	725.3	725.3	341.1	319.9	796.3
2008	696.3	696.3	696.3	696.3	308.2	250.8	730.1
2009	692.3	692.3	692.3	692.3	269.8	286.5	871.4
2010	650.5	650.5	650.5	650.5	229.4	275.6	819.1
2011	634.9	634.9	634.9	634.9	192.0	243.3	651.6
2012	590.1	590.1	590.1	590.1	178.4	234.4	746.5
2013	576.2	576.2	576.2	576.2	170.8	198.3	657.7
2014	532.7	532.7	532.7	532.7	141.8	241.7	562.9
2015	531.5	531.5	531.5	531.5	132.3	238.0	690.0
2016	533.4	533.4	533.4	533.4	278.5	177.5	557.8
2016	513.2	513.2	513.2	513.2	354.7	133.7	676.8
2017	498.7	498.7	498.7	498.7	329.3	249.3	450.1
2018	764.0	764.0	764.0	764.0	426.4	399.9	995.3
2019	476.6	476.6	476.6	476.6	341.9	235.3	288.8

Source: MESDC with EIHP, MESD, INA d.d; Processing: Ekonerg Ltd

Activity data related to production and import of crude oil for SNAP 0504 Liquid fuel distribution (except gasoline distribution), are shown in Table 3.8-5.

Table 3.8-5 Activity data for NFR 1.B.2.a.v, SNAP 0504

Activity	Production + import of crude oil	Import of crude oil
SNAP	050400	050400
Unit	kt crude oil	kt crude oil
1990	6854.1	4157.9
1991	4834.2	2903.3
1992	4468.2	2725.3
1993	4457.0	2729.9
1994	4728.7	3152.1
1995	5305.0	3804.7
1996	5569.4	4100.3
1997	5195.4	5195.4
1998	4926.1	3536.7
1999	5770.4	4477.7
2000	5128.2	3914.3
2001	5029.2	3908.4
2002	5003.9	3895.4
2003	4818.4	3766.3
2004	5198.6	4197.6
2005	4944.7	3998.7
2006	4716.4	3799.0
2007	5077.4	4198.3
2008	4308.7	3473.3
2009	4824.4	4048.2
2010	4256.6	3536.2
2011	3502.7	2838.3
2012	2924.9	2325.0
2013	3062.5	2461.8

Activity	Production + import of crude oil	Import of crude oil
SNAP	050400	050400
Unit	kt crude oil	kt crude oil
2014	2444.4	1851.2
2015	2998.2	2328.0
2016	3250.5	2513.4
2017	3562.5	2818.0
2018	3697.6	2965.5
2019	2711.7	2006.0

Source: National energy balance

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

Fugitive emissions from NFR 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. For the calculation of emissions from SNAP 090203, EMEP/EEA Tier 2 approach is used (except for SO_2 and NMVOC emission). For the calculation of emissions from SNAP 090206 EMEP/EEA, Tier 1 approach is used. Both the activity data and the emission factors are stratified according to different activities that occur in Croatia. Emission calculation is carried out by multiplying process specific activity data for the specific technology by the corresponding EMEP/EEA emission factor (GB2019).

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provided 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 is the annual flared amount in refineries. The data for the flared amount for each refinery were collected for the period since 2010. The source of data is INA Ltd. Quantities of gas flared in refineries in the period 1990-2009 are not available, thus they were estimated using the average value of known quantities of flared gas in the period 2010-2014 and estimated quantities of crude input for each refinery. The average crude oil density in Croatia is assumed to be 0.86 kg/dm^3.

For NMVOC and SO_2 emission calculation, Tier 1 approach is used, because data on flared gas composition are not available. Activity data used for Tier 1 approach is the annual total throughput of refineries. Furthermore, data on total amount of crude oil input to the refineries are used, along with amount of fuel used by type in each refinery.

Source of data for the total amount of crude oil is national energy balance. Source of data for the annual amount of fuels for the period since 2008 is the national EPR, and for the period 1990-2004 documentation for the preparation of the Energy Development Strategy of the Republic of Croatia (OG 130/09), obtained from the company INA Ltd. For the remaining period 2005-2007, amount of fuels by type and refinery were estimated by linear interpolation method. Data on annual fuel amounts are used to determine annual amount of crude oil input to each refinery. Data on total crude oil are confidential.

Activity data for SNAP 090206 is the annual volume of gas flared in oil and gas extraction. Data were collected for the period since 2009. Annual volume of gas flared in gas and oil extraction in the period 1990 - 2008 is not available, and it was estimated using average value of the known quantities of annual gas flared in the period since 2009 and the annual volume of total gas and crude oil extracted in Croatia. It is assumed that the average density of natural gas is 0.73 kg/m^3.

Table 3.8-6 gives the overview of activity data for NFR 1.B.2.c Venting and Flaring.

Table 3.8-6 Activity data for NFR 1.B.2.c Venting and Flaring

Activity data	Gas flared in refineries	Crude oil throughput in refineries	Gas flared in gas and oil extraction
Unit	TJ	Gg	1000 m^3
1990	939.1	6860.7	22313.5
1991	775.9	4510.9	19824.6
1992	402.2	3935	14265.6
1993	696.6	4914.8	18026.0
1994	675.7	4994.3	14848.5
1995	879.9	5336.1	12105.4
1996	850.6	5112.7	11294.2
1997	893.1	5112	13585.2
1998	1023.9	5007.5	12421.7
1999	1068.3	5474.8	14990.7
2000	1153.3	5162.8	12960.6
2001	1083.0	4831.6	15899.0
2002	1015.3	4830	16767.5
2003	1052.1	4861.7	17314.6
2004	907.2	5079.3	17381.3
2005	901.8	4944.7	18055.0
2006	922.7	4716.4	21453.9
2007	973.2	5077.4	22865.1
2008	998.5	4308.7	21578.8
2009	996.4	4824.4	19029.6
2010	638.0	4256.6	12015.5
2011	818.6	3502.7	14906.3
2012	939.0	2924.9	11197.6
2013	888.3	3062.5	10813.9
2014	947.7	2444.4	15176.4
2015	1159.4	2998.2	12451.5
2016	1336.3	3250.5	12911.5
2017	765.0	3562.5	11799.2
2018	832.3	3697.6	20263.2
2019	284.7	2711.7	16941.1

Source: MESD with EIHP, MESD, INA Ltd. Processing: Ekonerg Ltd.

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

Emissions from the exploration, production and transport of natural gas are calculated by applying the Tier 2 EMEP/EEA methodology (GB2019). To apply the Tier 2 approach, both the activity data and the emission factors need to be stratified according to the different activities within this source category – exploration/production and transport of natural gas.

For the calculation of NMVOC emission from natural gas exploration/production (1.B.2.b.i; SNAP 050300), data on gas production taken from energy balance are used together with recommended emission factor (GB2019).

For the activity of natural gas transmission (1.B.2.b.ii; SNAP 050600), a project of emission calculation improvement, led by the MESD, was conducted for this submission. For the calculation of NMVOC emission, data on annual CH_4 emission reported to the EPR by the company Plinacro Ltd were used (available since 2011). In natural gas transmission system, the only loss in the network occurs during the maintenance of pipeline sections. According to Plinacro Ltd, there is a very good network maintenance and loses are minimized, but they are considerably different for each year. NMVOC emission was calculated using the equation 1.

$$E_{NMVOC} = E_{CH4} \times (W_{NMVOC} / W_{CH4}) \quad (1)$$

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 the EPR

All values refer to the volume of gas of 1 m^3 in standard conditions, in which the absolute pressure of gas equals 101.325 Pa (1.01325 bar) and temperature of gas is 288.15 K (15° C).

Standard gas quality in Croatia is regulated by law, and gas quality monitoring and reporting is in the legal competence of Plinacro Ltd.[31]

Activity data for natural gas transmission, which had hitherto been used in calculations, were obtained from Plinacro Ltd, and were available for the period since 2002. Data for the period 1990-2001 were estimated based on data on natural gas production and the average share of transmitted gas in the total amount of natural gas produced. For this inventory, in the scope of emission calculation improvement project, data on gas transmission (consumption) for the whole time series were taken from national energy balance, and they are now also harmonized with data used in the NIR.

Based on specific data on CH_4 emission available since 2011 and specific data on mass composition of natural gas, specific NMVOC emission factors were calculated (CH_4 emission data were formerly available since 2010, and now data were collected for the period since 1998, with all input data updated).

For all data that remained unavailable, an estimate was carried out, based on the available data. For CH_4 emission, average annual emission of the 5 closest years with available data was used, i.e. average of CH_4 emissions during 2011-2015. For 2016, CH_4 emission was not reported in EPR, thus average value of the years 2015 and 2017 was taken. Moreover, data on annual gas composition for the period 1990-1997 were estimated on the basis of average annual gas composition in the 5 closest years, i.e. 1998-2002.

NMVOC emission factors for natural gas transmission are given in Table 3.8-7. Used activity data for NFR 1.B.2.b are given in Table 3.8-8.

Table 3.8-7 Tier 2 emission factors for NMVOC emission calculation for NFR 1.B.2.b.ii

Activity		Transmission of natural gas (transport + distribution)
Category		1.B.2.b.ii
Pollutant		NMVOC
Tier 2 emission factor, g/1000m^3	1990	3.95
	1991	4.26
	1992	4.11
	1993	3.89
	1994	4.14
	1995	4.48
	1996	3.99
	1997	3.85

[31] As of October 1 2019, the gas quality monitoring system by chromatographs has been implemented in accordance with the amendments to the Network Rules, and the method of publishing gas quality information has also been amended. In accordance with the Network Rules of the Transmission System, as of October 1, Plinacro Ltd publishes information on the gas quality monitoring system and on the determined gas quality.

	1998	3.51
	1999	3.53
	2000	3.44
	2001	4.15
	2002	4.55
	2003	7.02
	2004	4.83
	2005	3.68
	2006	3.51
	2007	3.59
	2008	3.84
	2009	4.91
	2010	2.47
	2011	5.40
	2012	15.58
	2013	10.35
	2014	20.49
	2015	4.27
	2016	4.36
	2017	2.86
	2018	15.29
	2019	19.92

Table 3.8-8 Activity data for NFR 1.B.2.b

NFR	1.B.2.b.i	1.B.2.b.i	1.B.2.b.ii	1.B.2.b.ii
SNAP	050300	050300	050600	050600
Name	Natural gas production	Natural gas production	Natural gas transmission	Natural gas transmission
Unit	1000 m^3	PJ	1000 m^3	TJ
1990	1982300	67.3	2686600	0.091
1991	1824300	64.0	2487400	0.087
1992	1803000	63.0	2578800	0.089
1993	2049000	73.1	2723000	0.096
1994	1792000	63.3	2562000	0.089
1995	1966400	69.1	2367900	0.083
1996	1785600	63.7	2653400	0.093
1997	1717200	66.1	2750500	0.101
1998	1570100	55.8	2644300	0.092
1999	1550550	55.6	2680800	0.094
2000	1638500	59.4	2704800	0.095
2001	2010400	70.9	2834200	0.099
2002	2120300	74.5	2901800	0.101
2003	2189600	76.8	2884400	0.100
2004	2198100	77.1	3009300	0.105
2005	2283400	79.8	2909900	0.101
2006	2713500	94.3	2877800	0.100
2007	2892100	100.1	3306700	0.114
2008	2729400	94.0	3205100	0.110
2009	2704800	93.5	2959400	0.102
2010	2727200	93.9	3241500	0.111
2011	2471400	85.0	3165000	0.109
2012	2013100	69.2	2971700	0.102
2013	1856100	63.1	2809900	0.096
2014	1747000	60.5	2443600	0.085
2015	1780500	61.6	2519200	0.087
2016	1647200	57.5	2611400	0.091
2017	1483500	51.8	3008300	0.105

NFR	1.B.2.b.i	1.B.2.b.i	1.B.2.b.ii	1.B.2.b.ii
SNAP	050300	050300	050600	050600
Name	Natural gas production	Natural gas production	Natural gas transmission	Natural gas transmission
Unit	1000 m^3	PJ	1000 m^3	TJ
2018	1230100	43.1	2770500	0.096
2019	1028900	36.1	2908000	0.101

Source: National energy balance; processing: Ekonerg Ltd.

After the implementation of the improvement project, as expected, the greatest differences in emissions are present in the period until 2010, and in 2017. The reason for this is the use of new, more accurate data (primarily data on the average annual composition of natural gas), and avoiding the use of estimates of unavailable data to a greater extent. Because CH_4 emissions data are available in the EPR database from 2011 onwards, NMVOC emission calculated from CH_4 emission for that period are much less different (differences relate primarily to the rounding of decimals), with the exception of 2017, for which data on natural gas composition were collected and updated.

Since most of the emissions in NFR category 1.b.2.b are emissions from natural gas production, differences resulting from the use of the former and the new approach, are not so significant at the level of the entire category.

Generally, emissions from production have increased significantly since 2002 due to an increase in the amount of extracted gas, and have dropped after 2010 due to a decrease in gas extraction. Emissions from transmission from 2011 onwards depend on the amounts of CH_4 released during maintenance activities (which vary considerably over the years) and on the composition of natural gas, making the emission trend uneven. In the period 1990-2010, these emissions are more uniform because they depend only on annual differences in the composition of natural gas, since the assumed amount of CH_4 released is the same for all years (average value of available data).

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. Such activities are not present in Croatia and the notation key "NO" was used.

Recalculations and improvements

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

Recalculation of NMVOC emissions for SNAP 050400 was performed due to correcting a minor error in data input in CollectER for 1991, 1992 and 2018.

There were no other recalculations/improvements for NFR 1.B.

4. Industrial processes and product use (NFR 2)

This chapter gives an overview of Industrial processes and product use sector and contains information on methodologies, activity data, emission factors, recalculations and planned improvements. Industrial processes include emissions that originate from various process activities. Emissions from fuel combustion in industry are allocated to NFR 1.A.2.f.i. Product use covers solvents and solvent-based products. Solvents are chemical compounds, which are used to dissolve substances such as paints, glues, ink, rubber, etc. or for cleaning purposes (degreasing). Since solvents consist mainly of NMVOC, solvent use is a major source of anthropogenic NMVOC emissions. Once released into the atmosphere, NMVOCs react with reactive molecules (mainly HO-radicals) to form CO_2.

This source category includes the following sub-sectors:

- 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 Ferroalloys 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

In general, method for emissions calculation includes multiplying activity data by the corresponding emission factors. The methodology for all activities within this sector is presented in detail in the following sections.

Emission factors are expressed as a quantity of pollutant emission per unit of production/consumption or per population. Used emission factors are for the most part taken from the *EMEP/EEA Guidebook – 2019*. The source of the emission factors used is indicated in the description of each category, and an overview of all emission factors by NFR codes and pollutants is given in Appendix 4.

The following sources of information are generally used for activity (or emissions) data for Industrial processes and product use sector:

- National production statistics obtained from the CBS (Annual Statistical Reports, Industrial production, Annual PRODCOM Results),
- EUROSTAT database,
- Annual population estimates obtained from the CBS,
- Data on direct emissions as reported annually by facilities in legally required forms under the Croatian EPR,
- 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.

4.1. Mineral products (NFR 2.A)

Source category description

This source category covers process-related emissions resulting from various activities in the production and use of a variety of mineral industry products. The following processes are included: 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”, since PM emissions from this category are included in other NFR 2.A codes.

Cement production (NFR 2.A.1)

Cement production includes: raw materials extraction and pre-processing, heating the raw materials in a kiln to produce clinker, blending and grinding of clinker to cement, storage, packing and delivery of cement.

The main emissions from cement production are emissions from kiln systems. However, only emissions of particulate matter, which mainly originate from pre- and after-treatment are considered in this sector. Emissions from the kiln are a combination of combustion and process emissions but the emissions of other pollutants are assumed to originate mainly from fuel combustion, and are therefore allocated to the Energy sector.

During the reporting period, there were seven factories in operation in Croatia. Four factories were active during the whole time series. 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 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 again since 1998 (and is still active), and the second one from 1990 to 2009 and during 2014).

Production varied depending on the economic situation and demand on the market. 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)

Basic types of processes occurring within the lime work operations include: quarrying and crushing of minerals, combustion of fuels in lime kilns, storage, packing and delivery of produced lime.

As in cement production, only emissions of particulate matter from lime production are considered in this sector. Emissions from the kiln are a combination of combustion and process emissions but the emissions of other pollutants are assumed to originate mainly from fuel combustion and are therefore allocated to the Energy sector.

During the reporting period, five lime factories were active in Croatia, with two of them producing both quicklime and dolomitic lime and three producing only quicklime. One factory ceased its operations in 2009 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. Also, one factory ceased production in 2010 and restarted its operations in 2019). Entire 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. Production data are available since 1991 for one factory, since 1992 for the second factory and since 1999 for the third factory. 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)[32].

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 was 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, which include a series of steps – from the preparation of raw materials, to melting in a furnace, to final steps in product finishing. Emissions from glass production (apart from the main emission - CO_2, originating from the carbonisation process) include heavy metals, black carbon and dust, while emissions from mineral wool production include NH_3, NMVOC and dust.

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

There are two mineral wool plants in Croatia. One plant started its operations in 2007. The second plant is currently included in the calculations only for 2019, and additional research is in progress. All information on the operation of this plant before 2019 is currently being collected. All new findings will be included in the next IIR.

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, etc., gravel, sand and clay excavation, extraction of salt as well as mining and quarrying of other minerals.

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[32] 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 are impaired by incomparability with typical production conditions during non-war years.

These activities, which include extraction (with the use of mining explosives, if needed), transportation and crushing of minerals, result in emission of particulate matter. National production statistics by type of minerals is a source of activity data for emission calculation.

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

Construction of infrastructure and buildings is an important source of fugitive particulate matter emissions. In construction industry, there are many activities that result in emissions, such as land clearing and demolition, equipment movements and other various construction activities.

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 is based on Tier 2 EMEP/EEA approach, for all factories except one. For the one factory, which ceased its operations in 1994, it was not possible to collect the data needed for higher tier approach, thus Tier 1 method had to be used. All emission factors for cement production emission are taken from GB2019.

As mentioned, for six factories, it was decided in direct contacts with operators 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 the whole time series.

For the remaining, seventh factory, Tier 1 emission factors assume an „averaged“ or typical technology and abatement implementation and integrate all different sub-processes in the cement production between feeding the raw material into the process and the final shipment off the facility.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provided 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 GB2019.

Activity data on clinker production were taken from the NIR. Originally, these data were collected by a survey of all cement manufacturers and cross-checked with national statistics on clinker production.

Activity data on clinker production are presented in Table 4.1-1. Emission factors, presented by NFR sectors and pollutants, are given in Appendix 4.

Lime production (NFR 2.A.2)

Methodology for emission calculation is based on Tier 2 EMEP/EEA approach. Tier 2 controlled PM emission factors from GB2019 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.

Information on inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors by NFR source category are provided 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 GB2019.

Data on the amount of lime produced in Croatia includes the amount of lime produced in lime factories and sugar factories, and lime produced for the needs of pig iron production (in 1990 and 1991). Activity data were taken from the NIR. Originally, these data were collected by a survey of all lime manufacturers and cross-checked with national statistics on lime production.

Activity data on lime production are presented in Table 4.1-1. Emission factors, presented by NFR sectors and pollutants, are given in Appendix 4.

Glass production (NFR 2.A.3)

Methodology for emission calculation is based on Tier 1 EMEP/EEA approach. Recommended Tier 1 emission factors from GB2019 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. This results in products made from imported glass (without any melting activities occurring in Croatia) being included in activity data for this category.

Methodology for emission calculation for mineral wool production is based on Tier 3 EMEP/EEA approach, i.e. it is based on continuously measured and verified annual emissions. 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 provided in Appendix 9 of this Report.

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 4.1-1. Emission factors used for the preparation of the IIR 2020, 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 approach. The recommended Tier 1 emission factors from GB2019 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 they are presented in Table 4.1-1.

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

Emission factors, 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 approach, 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 according to Tier 1 EMEP/EEA GB2019 methodology. A comprehensive emissions calculation improvement project is currently being prepared, which will include the collection and processing of all available data and estimates of any missing data, and its results are expected to be included in the next IIR.

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

Emission factors, presented by NFR sectors and pollutants, are given in Appendix 4. Activity data, taken from the Annual Statistical Reports, are presented in Table 4.1-1.

Table 4.1-1 Activity data for NFR 2.A.1, 2.A.2, 2.A.3, 2.A.5.a and 2.A.5.b

NFR	2.A.1	2.A.1	2.A.2	2.A.3	2.A.5.a	2.A.5.b
	Clinker (Tier 2 approach)	Clinker (Tier 1 approach)	Lime production	Glass and mineral wool production	Quarrying and mining of minerals other than coal	Construction and demolition
Unit	kt	kt	kt	kt	Mt	m^2
1990	1919.2	143.3	232.3	275.5	27.0	2826634
1991	1209.3	127.8	165.4	252.9	18.9	2119965
1992	1428.6	137.7	124.5	143.9	18.5	1411541
1993	1214.5	90.6	134.5	134.4	16.8	1345926
1994	1537.9	45.8	140.1	162.2	19.8	1499057
1995	1197.6	NO	139.7	166.8	20.4	1918453
1996	1306.3	NO	175.7	153.8	23.2	2359648
1997	1533.8	NO	186.9	127.3	17.6	2216206
1998	1649.1	NO	195.4	148.3	18.8	2206747
1999	2151.0	NO	189.1	136.3	19.4	2012288
2000	2382.1	NO	193.0	139.1	20.8	717801
2001	2739.2	NO	239.4	150.3	23.7	2061231
2002	2698.6	NO	269.3	158.5	26.2	2942136
2003	2692.1	NO	249.3	187.0	31.2	3438150
2004	2852.2	NO	284.0	210.6	33.2	3449089
2005	2926.6	NO	308,1	227.8	30.9	4089576
2006	3104.4	NO	358,1	228.7	35.9	4570084
2007	3160.5	NO	367,0	237.5	37.5	5218050
2008	2995.1	NO	342,6	255.1	43.9	4882190
2009	2439.1	NO	246,8	280.9	35.0	3967687
2010	2320.5	NO	216,1	295.2	24.2	3388897
2011	2071.7	NO	182,1	320.5	25.6	2703950
2012	1996.5	NO	138,4	300.1	24.9	2727335
2013	2198.3	NO	127.0	327.4	23.7	1961243
2014	2318.5	NO	135.6	364.9	23.5	1695871
2015	2155.8	NO	134.2	334.8	24.3	1924884
2016	2055.2	NO	125.1	378.1	23.0	1853646
2017	2411.1	NO	145.7	395.0	23.7	2065404
2018	2325.8	NO	146.3	404.6	24.2	2249797
2019	2272.4	NO	146.1	452.5	26.6	2609758

Source: CBS, survey results from cement and lime producers and EPR data base; Processing: Ekonerg Ltd

Recalculations and improvements

Lime production (NFR 2.A.2)

Recalculation was performed for the period 2005-2010, and for 2012 due to harmonizing the AD with NIR.

There was no recalculation or other improvements for other source categories.

4.2. 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 activities are included: 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).

Adipic acid production (2.B.3) and Carbide production (2.B.5) are not in Croatia.

For source category 2.A.10.b Croatia is using notation key “IE”, since 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. Ammonia production process results in emissions of NOx, NMVOC, CO and NH_3.

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 feedstock, is vaporized, mixed with air and burned over a platinum/rhodium alloy catalyst. Both plants utilize dual-pressure production processes. Nitric acid is used in the manufacture of fertilizers by the same facility.

Nitric acid production results in NOx emission.

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. The causes of the fluctuation in emissions were technical problems associated with the operation of the installed SCR (loss of catalyser and system reconstruction, as well as frequent shutdowns and start-ups of the plants). At Plant 2, this technology was put into trial operation in December 2017.

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, which results in emission of various pollutants, as described below. Production of the following chemical products was shut down: ammonium phosphate and carbon black in 2009; ethylene, propylene, polyethylene LD and polystyrene in 2011; 1,2 dichloroethane in 2001; vinyl chloride in 2002; polyvinylchloride in 2000, styrene and ethyl benzene in 1991 (with a short reactivation of ethyl benzene production during 1995 and 1996). Production of polyethylene LD was reactivated in 2014 and 2015 and was stopped again in 2016. Production of sulphuric acid was stopped for two years, in 2010 and 2011.

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. Tier 2 EFs from GB2019 were used for all emissions except for NOx, for which the facility specific annual emission factors were used since 1998 (direct emissions measurements divided by quantities of ammonia produced, for each year). For the period 1990-1997, an average NOx emission factor was calculated and used, based on available direct emissions measurements.

It is assumed that annual changes in the composition of natural gas (feedstock) and technical problems related to the operation of the installed emission reduction technology are the reason for occasional fluctuations in NOx emission factors. Other official explanations were not obtained.

Data on 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 of direct emissions measurements are taken from the EPR database.

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

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

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 provided 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 GB2019 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 GB2019 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 GB2019 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. For the period 2000-2009, facility specific direct CO emissions were reported.

For Ammonium phosphate production, Tier 2 emission factors from GB2019 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 provided 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)). Activity data for this category are presented in Tables 4.2-1 and 4.2-2. Emission factors, presented by NFR sectors and pollutants, are given in Appendix 4.

Table 4.2-1 Activity data for NFR 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

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
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
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
2018	396690	289498	NO	57469	NO	267410	361142
2019	480665	302067	NO	75170	NO	194610	452480

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

Table 4.2-2 Activity data for NFR 2.B.10.a, represented by the relevant SNAP codes

NFR	2.B.10.a									
Name	Styrene	Ethylene	Propylene	1,2 dichloro-ethane	Vinyl-chloride	Poly-ethylene LD	PVC	Polystyrene	Ethyl-benzene	Formaldehyde
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

NFR	2.B.10.a									
Name	Styrene	Ethylene	Propylene	1,2 dichloro-ethane	Vinyl-chloride	Poly-ethylene LD	PVC	Polystyrene	Ethyl-benzene	Formaldehyde
SNAP	040510	040501	040502	040503	040504	040506	040508	040511	040518	040517
Unit	t	t	t	t	t	t	t	t	t	t
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
2018	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.0
2019	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Source: CBS, Processing: Ekonerg Ltd

Recalculations and improvements

There was no recalculation or other improvement for this source category.

4.3. 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 present in Croatia: 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 other metals such as magnesium, lead, zinc, copper, nickel etc. in Croatia.

Emission Calculation Improvement Project, led by the MESD, was conducted for the activity of steel production in EAFs, which included updating the activity data in order to harmonize them with the NIR.

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

In the scope of iron and steel production, the following activities were present in Croatia during the time series: 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).

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 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. All production of steel in Croatia was stopped during 2016.

Since 1990, there were two rolling mills processes present in Croatia, hot and cold. In 2009, cold rolling mill process was stopped.

Pig iron production results in process emission of PM, heavy metals, PCBs, PAH and PCDD/PCDF. In OHF, process emissions consist mainly of PM, heavy metals and NMVOC, as well as PCBs, PAH, and PCDD/PCDF, while in EAF, process NOx and CO emissions are also generated. In the rolling mills, PM emissions are generated (also with NMVOC present in hot process).

Ferroalloys production (NFR 2.C.2, SNAP 0403)

Ferroalloys are alloys of iron and metals such as silicon, manganese and chromium. Ferroalloys production typically involves the use of electric arc furnaces and raw materials with relatively variable physical properties.

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. The production fluctuated over the years, mainly as a result of discontinuous operations caused by the war in Croatia.

Ferroalloys production results in process emission of particulate matter.

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 technologies were applied in Croatia: prebaked anodes with side feed and prebake anodes with central feed.

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.

Primary aluminium production results in emission of NOx, CO, SO_2, TSP, PM, BC, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno[1,2,3-cd]pyrene.

Methodology, emission factors and activity data

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

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 provided in Appendix 9 of this Report.

All emission factors are in accordance with the GB2019. Emission factors used for the preparation of the IIR 2020, presented by NFR sectors and pollutants, are given in Appendix 4.

For the activity of steel production in EAFs, an Emission Calculation Improvement Project was conducted, led by the MESD, which included updating the activity data in order to harmonize them with the NIR. After the in-country review of the NIR, all data under this activity were revised, and in addition to minor adjustments, it was also established that steel production data for the period 2012-2017 by mistake also contain quantities of cast iron produced. These data in the NIR were separated as a separate subcategory after the review, but since iron foundries are not included in the calculation of emissions according the EMEP/EEA methodology, they were completely excluded from NFR 2.C.1.

Activity data on iron production in blast furnaces, as well as steel production in OHF, were also taken from the NIR.

Activity data for rolling mills for the period 1990-2008 were taken from the scientific article „Sofilić et all, Archives of Metallurgy and Materials; Vol. 53, 2009, Issue 2“, and for the period after 2008, data were taken from the Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS).

Ferroalloys production (NFR 2.C.2, SNAP 0403)

Emission calculation is based on the Tier 1 EMEP/EEA methodology and implies multiplication of annual amount of products by the proposed emission factor.

Emission factors are expressed as the quantity of emissions of pollutants per unit of production. All emission factors are taken from GB2019.

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

Annual production of ferroalloys was extracted from statistical reports published by Central Bureau of Statistics.

Aluminium production (NFR 2.C.3, SNAP 0401)

Emission calculation is based on the Tier 2 EMEP/EEA methodology and implies multiplication of annual amount of products by the corresponding emission factor.

Emission factors are expressed as the quantity of emissions of pollutants per unit of production. All emission factors are taken from GB2019 (primary aluminium production, pre-baked cell).

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

Data on primary aluminium production were collected by a survey of aluminium manufacturer.

Activity data for the production of iron, steel, ferroalloys and primary aluminium are shown in Table 4.3-1.

Table 4.3-1 Activity data for NFR 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
2005	73640	NO	NO	116393	NO	NO
2006	80516	NO	NO	147189	NO	NO
2007	76252	NO	NO	144409	NO	NO
2008	138865	NO	NO	188307	NO	NO
2009	46264	NO	NO	79187	NO	NO
2010	103427	NO	NO	78472	NO	NO
2011	95907	NO	NO	82310	NO	NO
2012	1037	NO	NO	28060	NO	NO
2013	111009	NO	NO	42248	NO	NO
2014	146465	NO	NO	35851	NO	NO
2015	121533	NO	NO	24886	NO	NO
2016	NO	NO	NO	13084	NO	NO
2017	3856	NO	NO	13151	NO	NO
2018	135775	NO	NO	11157	NO	NO
2019	69126	NO	NO	9894	NO	NO

Source: NIR 2020 (original source: CBS and survey requests to producers), scientific article "Sofilić et all"; Processing: Ekonerg Ltd

Recalculations and improvements

There was no recalculation or other improvements for this category.

4.4. 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.

Emission Calculation Improvement Project, led by the MESD, was conducted for the Chemical products subcategory. The project included the updating of emission factors and activity data according to the new GB2019, and including the activity of asphalt blowing in the emissions calculation.

Domestic solvent use including fungicides (NFR 2.D.3.a)

Domestic solvent use including fungicides covers emissions of NMVOCs arising from the domestic use of solvent-containing products. Many of these products are also used in industry and commerce. Croatian inventory stratified the following products/activities: Cosmetics and toiletries products, Car care products, DIY/buildings, Paint/varnish removers and solvents, DIY/buildings, Sealants, filling agents, Pesticides, and Domestic use of pharmaceutical products. Source of activity data are Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS), except for the activity Domestic use of pharmaceutical products, for which annual national population statistics are used. Further distinction between aerosol and non-aerosol products is not available in national statistics. According to new the GB2019, Hg emission from fluorescent tubes is no longer included in this category.

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 weight of asphalt produced for road paving is used to calculate emissions of NMVOCs and PM from this source category. Data on the amount of asphalt produced were obtained from the Croatian Asphalt Society, which collects data from all asphalt plants in the Republic of Croatia.

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. National production of shingles is used as activity data (Annual Statistical Reports, Industrial production, Annual PRODCOM Results).

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 NMVOC emissions. The use of paints is generally not considered relevant for emissions of particulate matter, heavy metals or persistent organic pollutants.

Degreasing (NFR 2.D.3.e)

Degreasing is a process of 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). Degreasing results in NMVOC emission.

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. In general, dry cleaning process can be divided into following steps: cleaning in a solvent bath, drying with hot air and recovery of solvent, deodorisation (final drying) and regeneration of used solvent. Dry cleaning results in NMVOC emission.

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), Asphalt blowing (SNAP 060310) and Adhesive, magnetic tapes, films and photographs manufacturing (SNAP 060311). Almost all of these activities still exist in Croatia with the exception of rubber processing which was stopped during 2006, polystyrene foam processing which was stopped during 2011, and Asphalt blowing which was present from 2003 to 2014. 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. Tyre production does not occur in Croatia.

All activities in this category result in NMVOC emissions except for asphalt blowing, for which NMVOC, TSP, Cd, As, Cr, Ni, Se and PAH emissions are calculated.

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 the following activities that are present in Croatia: 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 publicly 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 propellant 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. Sulphate process results in emissions of NOx, CO, NMVOC, SO_2 and PM; acid sulphite process results in emissions of SO_2, NOx, NMVOC and PM, while neutral sulphite semi-chemical process results in NMVOC emissions.

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. Emissions from food and beverages industry include NMVOC emissions from various processes in production chain.

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 matter emissions. The relevant activity statistic is the mass of wood products processed in Croatia.

Production of POPs (NFR 2.J)

According to GB2019, 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 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, measuring and control instruments (including laboratory and hospital instruments), electrical equipment and light bodies (light bulbs). Other products (e.g. paints, pharmaceuticals, dental amalgams) may also be a source of Hg emissions but are unlikely to be very significant on a national level.

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 GB2019 methodology. Emission factors are expressed as the emission per annual production unit or per number of inhabitants, and are shown in Appendix 4. Activity data for NFR 2.D.3.a, represented by the relevant SNAP code are given in Table 4.4-1.

Following the TERT's recommendation given in the Final Review Report 2020, Croatia started an investigation of the Car care products category due to a significant increase in activity data from this category in the last several years, including 2019, which has resulted in increased emissions. The investigation is ongoing and all relevant data points are being addressed through consultations with the relevant authorities. Croatia will report about the findings about reasons for these increases in the next IIR and correct emission estimates if needed.

Table 4.4-1 Activity data for NFR code 2.D.3.a, represented by the relevant SNAP code

	Cosmetics and toiletries	House-hold products	Car care products	DIY/ buildings, Paint/ varnish removers & solvents	DIY/ buildings, Sealants, filling agents	Pharmace-utical products	Various products: pesticides
SNAP	060408-1	060408-2	060408-3	060408-4	060408-5	060411	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

	Cosmetics and toiletries	House-hold products	Car care products	DIY/ buildings, Paint/ varnish removers & solvents	DIY/ buildings, Sealants, filling agents	Pharmace-utical products	Various products: pesticides
SNAP	060408-1	060408-2	060408-3	060408-4	060408-5	060411	060408-7
Unit	kg products	kg products	kg products	kg solvent	kg products	population	t products
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
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	12017481	584000	4792000	4124531	462
2018	317124	7361617	16950005	739000	5102000	4087843	327
2019	334492	7039742	36322094	778000	4819000	4065253	480

Source: CBS, Processing: Ekonerg Ltd

Road paving with asphalt (NFR 2.D.3.b)

For this category, the emissions calculation improvement with a transition to Tier 2 was carried out. Methodology used is based on EMEP/EEA GB2019 and recommended emission factors.

Following the inquiry sent to the Croatian Asphalt Society, it was determined that only drum mix-hot mix asphalt plants are used in Croatia. Therefore, it was possible to calculate Tier 2 emissions using activity data on annual weight of asphalt produced for road paving. Revised activity data were collected from Croatian Asphalt Society which were used for this year's calculations. Since only data from 2008-2019 are available, for the period before 2008, an estimate of data on asphalt production was conducted using the available data on bitumen production in 1990-2007 and the mean value of the asphalt/bitumen ratio from the period 2008-2019.

Also, additional research of this category is ongoing and all information on possible use of abatement technologies are currently being collected. Any new findings will be included in the next IIR.

Emission factors are expressed as the amount of emissions per annual production unit and are shown in Appendix 4. Activity data for NFR 2.D.3.b are presented in Table 4.4-2.

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

Asphalt roofing (NFR 2.D.3.c)

Methodology for emission estimation is based on the Tier 1 EMEP/EEA 2019 methodology. The recommended Tier 1 emission factors from the GB2019 are used. Emission factors are expressed as the amount of emission per annual production unit and are shown in Appendix 4. Activity data for NFR 2.D.3.c are presented in Table 4.4-2.

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

Coating applications (NFR 2.D.3.d)

The emission calculation is performed using Tier 1 EMEP/EEA 2019 methodology; multiplication of annual consumption of paint by the appropriate emission factor. 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, together with 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. Total amount of paint used is presumed to be equal to 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 2.D.3.d are presented in Table 4.4-2.

Degreasing (NFR 2.D.3.e)

For the calculation of NMVOC emissions, the consumption of the most common organic solvents for degreasing was used (according to GB2019). 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 GB2019 Tier 2 EF (open-top degreaser), and it is expressed as the amount of NMVOC per annual unit of degreasing product. Emission factor is given in Appendix 4. Activity data for NFR 2.D.3.e are given in Table 4.4-2.

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 GB2019 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 GB2019 as grams per kilogram of cleaned textiles, TERT has proposed using the following NMVOC emission calculation method: the second paragraph of Section 3.2.1. Dry Cleaning in GB 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.

Emission factor is expressed as the amount of NMVOC emissions per annual amount of solvent used for dry cleaning, and it is shown in Appendix 4. Activity data for NFR 2.D.3.f are presented in Table 4.4-2.

Table 4.4-2 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 cleaning
SNAP	040611	040610	060100	060100	060100	060201	060202
Unit	kt	kt	t	t	t	t	t
1990	594.1	24.5	28819.1	28819.1	28819.1	14792.6	428.4
1991	425.8	14.5	20840.0	20840.0	20840.0	6108.5	338.1
1992	105.5	14.3	14493.3	14493.3	14493.3	1839.8	298.4
1993	83.0	13.0	13355.3	13355.3	13355.3	1692.2	274.6
1994	754.0	13.6	13014.2	13014.2	13014.2	2782.4	295.5
1995	801.0	14.8	13863.7	13863.7	13863.7	27874.4	315.2
1996	1004.4	19.7	15231.3	15231.3	15231.3	19951.5	335.5
1997	1515.4	6.0	16263.9	16263.9	16263.9	2439.2	352.4
1998	1484.5	9.9	16483.2	16483.2	16483.2	2436.2	358.8
1999	1623.0	13.6	15941.8	15941.8	15941.8	2186.8	356.5
2000	1456.5	23.4	15472.0	15472.0	15472.0	2614.7	368.9
2001	1141.5	11.6	15480.4	15480.4	15480.4	2344.5	380.4
2002	2197.5	9.5	16434.6	16434.6	16434.6	2488.0	390.8
2003	3377.9	24.7	17151.8	17151.8	17151.8	2506.8	403.3
2004	4002.8	24.9	18860.1	18860.1	18860.1	3269.9	288.5
2005	3593.3	43.8	19481.9	19481.9	19481.9	2944.0	261.0
2006	3314.6	72.7	21080.1	21080.1	21080.1	3423.1	230.8
2007	3285.4	46.8	18429.3	18429.3	18429.3	3911.5	224.2
2008	4290.0	25.3	21103.1	21103.1	21103.1	3778.9	176.7
2009	3230.0	23.5	16636.1	16636.1	16636.1	3370.3	143.6

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 cleaning
SNAP	040611	040610	060100	060100	060100	060201	060202
Unit	kt	kt	t	t	t	t	t
2010	2170.0	18.0	16047.4	16047.4	16047.4	3627.8	132.8
2011	2550.0	16.6	16160.3	16160.3	16160.3	3097.3	132.1
2012	2500.0	10.0	15173.5	15173.5	15173.5	2985.8	112.7
2013	2760.0	16.5	14051.8	14051.8	14051.8	155.5	65.8
2014	2300.0	13.1	14170.2	14170.2	14170.2	84.4	144.1
2015	2150.0	38.5	13911.9	13911.9	13911.9	142.7	98.9
2016	2200.0	17.3	16368.7	16368.7	16368.7	85.4	122.6
2017	2160.0	27.6	12207.3	12207.3	12207.3	145.5	86.7
2018	2540.0	15.9	16000.7	16000.7	16000.7	136.6	86.5
2019	2620.0	18.9	18686.0	18686.0	18686.0	113.0	82.7

Source: CBS, EUROSTAT; Processing: Ekonerg Ltd

Chemical products (NFR 2.D.3.g)

For this category, an Emission Calculation Improvement Project, led by the Ministry of Environment and Energy, has been implemented. The project included the updating of emission factors and activity data according to the new GB2019, and including the activity of asphalt blowing in the emissions calculation.

For the activities: PVC processing, polyurethane processing, rubber processing, pharmaceutical products manufacturing, paints manufacturing, inks manufacturing and glues manufacturing, recommended emission factors from *CORINAIR Technical Annexes. Vol. 2 Default emission factors handbook (1994)* were used in previous calculations. For all of these activities, except for PVC processing, GB2019 proposes Tier 2 NMVOC emission factors. For PVC processing, only Tier 1 emission factor is available in GB, thus it was used in calculations. For polyester processing, activity data needed for Tier 2 approach were not available, thus Tier 1 NMVOC emission factor was used as well.

For asphalt blowing, recommended Tier 2 emission factors were used (EMEP/EEA GB2019, Table 3-8).

Methodology for emissions estimate from the source category Chemical products is based on Tier 2 approach of the EMEP/EEA methodology (GB2019) for all activities except polyester and PVC processing.

For PVC processing, only Tier 1 emission factor is available in GB, thus it was used in calculations. For polyester processing, activity data needed for Tier 2 approach were not available, thus Tier 1 NMVOC emission factor was used as well. The inquiries for requesting data were sent to the Croatian Chamber of Commerce and the companies engaged, which all stated that they do not have the required data.

For asphalt blowing, recommended Tier 2 emission factors were used (EMEP/EEA GB2019, Table 3-8). Additional research of this activity, which includes possible use of abatement technologies in the plant is in progress. All results of this research will be included in the next IIR.

Activity data used in calculations are taken from annual statistical reports on industrial production (annual PRODCOM results) for all activities except for asphalt blowing (for which data obtained from refineries were used), and for pharmaceutical products manufacturing (for which data obtained from manufacturers were used).

Data on solvents used in pharmaceutical products manufacturing are currently available from four manufacturers, for the period 2004-2018. For the years prior to that period, data are not available and they were estimated based on the average data values for the closest three years (2004-2006). For 2019, data from 2018 were used. Further investigation of this activity is ongoing, which includes the revision of solvent use data (especially data which were missing and had to be estimated), and the possible use of abatement technologies in plants. All results of this research will be included in the next IIR.

Emission factors are presented in Appendix 4. Activity data for various activities in the scope of NFR 2.D.3.g are presented in Table 4.4-3.

Table 4.4-3 Activity data for NFR code 2.D.3.g, represented by the relevant SNAP codes

NFR 2.D.3.g	Polyester processing	PVC processing	Polyurethane processing	Polystyrene foam processing	Rubber processing	Pharmaceutical products manufacturing
SNAP	060301	060302	060303	060304	060305	060306
Unit	kt	kt	kt	kt	kt	t solvents
1990	6.0	49.7	3.8	7.8	5.7	34.2
1991	4.2	30.7	2.8	7.3	5.4	34.2
1992	3.5	20.0	1.7	6.7	2.4	34.2
1993	2.6	15.1	2.0	6.6	2.5	34.2
1994	2.5	5.5	2.5	9.3	2.3	34.2
1995	2.2	5.3	2.9	6.4	2.3	34.2
1996	3.4	5.3	1.8	7.6	1.3	34.2
1997	7.0	5.2	1.8	10.4	0.03	34.2
1998	8.3	4.2	1.8	9.9	0.02	34.2
1999	5.6	2.9	1.8	5.3	0.02	34.2
2000	12.8	1.5	1.9	3.6	0.02	34.2
2001	9.7	1.0	2.8	1.4	0.02	34.2
2002	14.7	8.4	5.6	NO	0.02	34.2
2003	9.7	8.4	2.9	NO	0.01	34.2
2004	10.9	10.1	2.5	1.0	0.01	34.5
2005	10.9	9.4	2.9	1.7	0.004	30.9
2006	14.1	8.0	2.4	11.0	0.004	37.2
2007	16.5	8.6	1.9	15.8	NO	45.6
2008	16.5	9.3	1.9	16.2	NO	46.6
2009	14.0	6.8	1.0	11.1	NO	41.6
2010	7.3	4.7	0.8	10.1	NO	1887.3
2011	7.1	3.8	0.6	0.6	NO	2313.9
2012	7.7	3.8	0.6	NO	NO	2946.0
2013	7.9	3.2	0.5	NO	NO	2099.1
2014	7.3	0.7	0.6	NO	NO	3620.2
2015	8.5	0.9	0.4	NO	NO	4468.9
2016	8.1	1.0	0.6	NO	NO	5599.7
2017	8.8	0.9	0.5	NO	NO	5754.4
2018	8.6	1.3	0.6	NO	NO	5740.2
2019	8.9	1.4	0.5	NO	NO	5740.2

Source: CBS (annual PRODCOM results), INA d.d., pharmaceuticals manufacturers, Processing*:* Ekonerg Ltd

Table 4.4-3, cont.

NFR 2.D.3.g	Paints manufacturing	Inks manufacturing	Glues manufacturing	Adhesive, magnetic tapes, films and photographs manufacturing	Asphalt blowing
SNAP	060307	060308	060309	060311	060310
Unit	kt	kt	kt	m^2	kt
1990	22.0	4.7	21.6	1009.0	NO
1991	13.8	3.6	13.4	776.0	NO
1992	9.5	1.4	7.1	469.0	NO
1993	9.1	1.0	10.9	299.0	NO
1994	10.8	1.5	11.2	239.0	NO
1995	10.78	1.4	10.1	320.0	NO
1996	13.9	1.5	17.2	592.0	NO
1997	15.0	1.4	10.9	404.0	NO
1998	15.5	1.1	10.4	419.0	NO
1999	15.2	0.8	8.2	257.0	NO
2000	15.1	0.9	10.4	344.0	NO
2001	16.8	0.8	12.4	339.0	NO
2002	15.2	0.9	25.8	323.0	NO
2003	15.3	0.8	30.9	138.0	11.1
2004	15.0	0.9	46.1	27.0	90.0
2005	16.4	0.7	56.6	109.0	53.5
2006	17.3	0.7	71.3	108.0	91.1
2007	20.1	0.9	81.8	75.3	82.2
2008	19.7	0.9	77.7	93.3	94.4
2009	15.2	0.6	33.8	95.4	95.8
2010	16.4	0.3	35.5	95.2	57.6
2011	16.6	0.4	28.7	74.0	48.0
2012	14.3	0.3	28.8	41.0	29.3
2013	12.6	0.3	31.6	NO	39.2
2014	14.2	0.3	21.6	NO	2.9
2015	14.6	0.3	18.8	NO	NO
2016	17.4	0.3	19.0	NO	NO
2017	17.3	0.3	16.5	NO	NO
2018	16.0	0.4	23.3	NO	NO
2019	16.3	0.3	22.8	NO	NO

Source: CBS (annual PRODCOM results), INA d.d., pharmaceuticals manufacturers, 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 2019 methodology.

Data on the amounts of ink (import/export/production) were taken from the Eurostat database (from the year 2001 onward). In addition to Eurostat database, 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 is expressed as the amount of NMVOC emissions per annual unit of ink used, and it is shown in Appendix 4. Activity data for NFR code 2.D.3.h are represented in Table 4.4-4.

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 2019 approach. Tier 2 emission factors used 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, in 2014, the project "Improvement of calculation of VOC emissions from the sector Domestic solvent use and other use of solvents" was prepared. The project, inter alia, encompassed inclusion of abatement technologies for NMVOC emissions, for which rates of penetration were 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. Abatement technologies included in calculations (taken from the GAINS model), include: activated carbon adsorption (ACA), emulsions (EMU), hot melts-100% solid (HOTM), incineration (INC) and no control (NOC). Accordingly, EFs were calculated for each year of the time series based on EMEP/EEA GB 2013 (for this category same as revised 2016 and 2019 GB), Tier 2 approach and inclusion of abatement technologies, with capacities controlled for each technology defined as follows:

	1990	***2005***	***2010***	***2030***
- *ACA*	0%	0%	2%	10%
- *EMU*	0%	50%	50%	55%
- *HOTM*	0%	7%	15%	20%
- *INC*	0%	10%	8%	5%
- *NOC*	100%	33%	25%	10%

All emission factors for source category 2.D.3.i, 2.G are shown 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 provided in Appendix 9 of this Report.

For this source category, basic activity statistics are stratified by activities 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 2019.

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 propellant 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.

Basic activity statistics data are taken from Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS).

As source of activity data for Cooling lubricant (SNAP 060604-2) and Lubricant (SNAP 060604-3), national energy balance was used. 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).

Activity data for NFR 2.D.3.i and NFR 2.G are shown in Tables 4.4-4 and 4.4-5.

Table 4.4-4 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

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
2016	4.70	507.70	290.00	8162	1278
2017	4.71	1240.47	622.78	9097	1349
2018	4.65	1054.08	584.18	12042	1629
2019	4.67	1366.62	427.33	11823	1728

Source: CBS, EUROSTAT; Processing: Ekonerg Ltd

Table 4.4-5 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 vehicles	1000 pairs of shoes	t	t	t
1990	121158	21591	751	26384	3109	130496	63304
1991	28401	13209	704	11977	1152	111631	54153
1992	72700	7079	657	8751	757	79388	38512
1993	42622	7479	438	13865	778	97300	47200
1994	72922	6280	503	8407	1081	108198	52487
1995	73551	7180	548	9408	934	105380	51120
1996	69991	8972	588	5766	964	113931	55269
1997	132847	10874	648	6715	1124	124705	60495
1998	157060	10379	687	5192	1102	93394	45306
1999	100509	8206	729	5159	1123	33500	15500
2000	25260	10355	768	2381	603	30000	14600
2001	24256	12385	673	2279	539	31100	20600
2002	155631	25851	58	3891	912	33600	24200
2003	151524	30873	7	4935	1583	29000	25100
2004	95505	46119	36	7130	1983	39400	19400
2005	123783	56573	152	5477	4724	35400	21700
2006	129269	71330	45	5776	6319	38100	19400
2007	98045	81768	70	5803	3872	45100	16400
2008	96740	77701	48	5443	2023	38900	17200
2009	76898	33849	25	5069	1722	37300	14800
2010	83669	35507	26	5276	2449	33200	11200
2011	86646	28722	10	4966	1668	33400	10300
2012	26214	28801	16	4486	1989	29700	10200
2013	34087	31622	5	4533	1394	28700	9700
2014	44358	21616	5	5148	522	29800	12200
2015	51005	18810	5	5010	500	32200	10900
2016	47170	18955	5	4989	827	34500	18400
2017	61879	16530	5	6086	1660	33900	16900
2018	66927	23291	5	6276	2165	34300	15600
2019	45742	22765	5	5901	1174	35300	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 2019 methodology. For all activities in the source category 2.H.1, recommended Tier 2 emission factors are used according to the EMEP/EEA 2019. Emission factors are expressed as the amount of 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 4.4-6.

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

Activity data for different SNAP codes within the NFR code 2.H.1 are presented in Table 4.4-6.

Table 4.4-6 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
2018	38767	NO	NO	113729	4087843
2019	46852	NO	NO	100264	4065253

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 2019 methodology. For all activities in this category, 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 given in Table 4.4-7.

Table 4.4-7 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	2800	1222	40848	24507	970853	20064	135315	12905
1991	205425	111499	2247	1125	32337	21000	755750	10016	104501	12591
1992	202327	109924	2720	6119	23525	17723	653431	94666	90577	8248
1993	185419	851302	2481	5517	21307	14687	650745	78847	86103	7296
1994	201668	858680	3156	3238	22371	13094	530053	11544	86112	8420
1995	172510	829480	3170	3106	23505	24507	519900	17534	86795	8003
1996	154330	793676	3291	4187	24146	16637	477753	19531	89773	8144
1997	154443	548426	3662	3582	26151	16170	476549	14138	84603	8643
1998	139070	626098	3759	3157	26507	15755	537653	13920	82321	8429
1999	124364	483515	3606	3267	25666	16124	496339	11396	79562	7639
2000	122585	612812	3993	3208	26320	20261	694835	56729	134297	7768
2001	123620	548667	3779	2537	26943	16414	530348	13069	84992	7955
2002	138063	600463	3638	2652	29454	22232	559542	17389	101742	11056
2003	136241	638412	3701	2475	36822	27378	583495	14656	101212	11181
2004	140597	631784	3606	2187	34988	30635	758976	21493	101972	10545
2005	136930	504248	3495	2816	36322	25427	534785	24538	106546	9697
2006	144683	534735	3688	2039	36313	31814	590284	32034	116218	13040
2007	202890	652852	3810	4958	39349	29600	643886	32832	115739	13549
2008	194473	508689	3879	5265	46395	4688	637284	31576	223998	12832
2009	191204	556945	3674	4882	47396	17284	602422	25595	133945	13934
2010	193074	463463	3438	5561	49494	16136	599633	26156	131874	13010
2011	192282	488750	3738	5130	49221	17542	654202	32932	141720	14203
2012	193307	441905	3625	4192	47762	16200	656880	29672	137243	12129
2013	157647	487803	3443	5350	47365	15010	654983	27384	130385	11667
2014	194812	452727	3416	4992	50662	13574	736066	33538	130027	11620
2015	190523	472699	3396	4460	49691	12839	517659	24882	125013	11927
2016	183009	484895	3365	4133	47555	12039	696173	33386	135622	14513
2017	185677	460889	3343	4387	48755	11615	675234	33194	143199	13497
2018	176738	500608	3468	4658	47806	11478	724469	12646	143043	13354
2019	170650	514891	3266	4400	47036	10931	727980	19243	150486	11725

Source: CBS; Processing: Ekonerg Ltd

Wood processing (NFR 2.I)

The methodology for emission estimation is based on the Tier 1 of EMEP/EEA 2019 methodology. Proposed Tier 1 emission factors are used according to GB2019 and are presented in Appendix 4. Activity data are taken from the Annual Statistical Reports, Industrial production, Annual PRODCOM Results (CBS). Activity data for NFR code 2.I is presented in Table 4.4-6.

Consumption of POPs and heavy metals (NFR 2.K)

For PCBs and Hg emission calculation from sub-sector 2.K, Tier 1 default emission factors were used. 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 are used as relevant activity data for emission calculation (Table 4.4-6).

Recalculations and improvements

Road paving (NFR 2.D.3.b)

Croatia moved to a higher tier (Tier 2, GB2019) and a recalculation of all emissions for the whole time-series was performed for this activity.

For the rest of the categories, there were no recalculations or other improvements.

5. Agriculture (NFR 3)

This chapter gives an overview of the sector NFR 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}) HCB, NMVOC 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.2.c Other Organic Fertilisers Applied to Soils
    - 3.D.a.3 Urine and dung deposited by grazing animals
    - 3.D.c Farm-level agricultural operations including storage, handling and transport of agricultural products
    - 3.D.e Cultivated crops
    - 3.D.f Use of pesticides
- 3.F Field burning of agricultural residues

There are 5 main sources of activity data for emission calculation: the Central Bureau of Statistics (CBS), Croatian Agricultural Agency (CAA), Ministry of Economy and Sustainable Development, FAOSTAT and fertilizer companies.

5.1. Manure management (NFR 3.B)

Source category description

The manure management is source of emissions of NH_3, NO, NMVOC and PM. The NH_3, 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 (NH_3, PM, NMVOC), manure storage (NH_3, NO, NMVOC), field-applied manure (NH_3, NO, NMVOC) and manure deposited during grazing (NH_3, 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

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 (EMEP/EEA GB2016) was used for all animal categories other than Swine and Poultry, for which Tier 3 method was used. A Tier 3 method was used to utilise the calculation procedure outlined under Tier 2, but with the inclusion of abatement measures.

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 excretion rate (Nex)) were developed by the experts from the Faculty of Agriculture, University of Zagreb and are presented in Table 5.1-9 for the year 2019.

Tier 3 methodology for swine and poultry: To implement possible abatement measures, additional data on livestock building / management and methods of storage and application of manure was collected as part of an estimate calculation improvement project. This was done by analysing information in Environmental permits[33] for farms. In total, permits for 71 farms were analysed. Animals were sorted by applicable abatement measures. Abatement measures were taken from „Guidance Document for Preventing and Abating Ammonia Emissions from Agricultural Sources", ECE/EB.AIR/120. Where the emission reduction potential of a measure was given in a form of a range, average value was selected. Reduction potentials are presented in Table 5.1-2 and 5.1-3.

[33] An environmental permit is issued for facilities carrying out the activities that may cause pollutant emissions into the soil, air, water and sea and the facilities that will carry out such activities after construction, or reconstruction and commissioning. Regulation on environmental permit Official Gazette 8/14, 5/18

Table 5.1-1 Percentage of animals with applicable abatement measures within the total animal number

Animal category		Percentage of animals on processed farms of the total number in Republic of Croatia	Percentage of animals from processed farms with applicable abatement measures
Swine	Fattening pigs	12%	10%
	Sows	12%	10%
Poultry	Laying hens	36%	29%
	Broilers	26%	26%
	Turkeys	70%	16%

Source: MESD; Processing: Ekonerg Ltd

For sows and fattening pigs, reduction of emissions was calculated according to the reduction potentials for animal housing systems, manure storage techniques and manure application techniques. For laying hens, broilers and turkeys, emission reduction is only applicable for animal housing systems. Final emission abatement was obtained as a percentage of animals with applicable reduction methods / technologies in relation to the total number of animals in the Republic of Croatia.

Table 5.1-2 Reduction potentials used for determination of reduction factors for animal housing systems

Housing system	NH_3 emission abatement potential (%)
Fattening pigs	
Partially slatted floor with reduced pit	17.5%
Frequent manure removal	25%
Sows	
Water and manure channel	50%
Frequent manure removal	25%
Laying hens	
Enriched cages, ventilated belts, 2 removals a week	35%
Enriched cages, ventilated belts, removals more than 2 times a week	40%
Broilers	
Fan-ventilated house with fully littered floor with non-leaking drinking system	25%
Turkeys	
Fan ventilated house with fully littered floor and non-leaking drinking system	12.5%

Source: Guidance Document for Preventing and Abating Ammonia Emissions from Agricultural Sources“, ECE/EB.AIR/120.

Table 5.1-3 Reduction potentials used for determination of reduction factors for manure storage and manure application techniques

Manure storage technique	NH_3 emission abatement potential (%)
Tight lid, roof or tent structure	80%
Plastic sheeting (floating cover)	60%
Natural crust (floating cover)	40%
Plastic sheeting (floating cover)	40%
Manure application technique	NH_3 emission abatement potential (%)
Incorporation of surface applied slurry (within 4 h)	55%
Injecting slurry (closed slot) - deep injection (> 15cm)	85%
Incorporation of surface applied slurry (within 24 h)	30%

Source: Guidance Document for Preventing and Abating Ammonia Emissions from Agricultural Sources“, ECE/EB.AIR/120.

Data for cattle farms are not currently available, therefore reduction techniques were not applicable to cattle.

Reduction potentials for NO_x were not estimated or applied due to missing default values or ranges of emissions reduction, so it is likely that NO_x emission have remained overestimated.

Analysis was conducted for each year from 1990 to 2019 and for each animal category separately, and are reported as a percentage reduction of emissions (Tables 5.1-4 – 5.1-8).

Table 5.1-4 Share of fattening pigs with reduction measures and percentage reduction of emissions

Year	Number of animals (total)	Animal housing system		Manure storage techniques		Manure application techniques	
		Number of animals in reduction	Emission reduction (%)	Number of animals in reduction	Emission reduction (%)	Number of animals in reduction	Emission reduction (%)
1990	1341000	16148	1.2%	24926	1.9%	35849	2.7%
1991	1387000	16148	1.2%	24926	1.8%	35849	2.6%
1992	1002000	16148	1.6%	24926	2.5%	35849	3.6%
1993	1069000	16148	1.5%	24926	2.3%	35849	3.4%
1994	1149000	16148	1.4%	24926	2.2%	35849	3.1%
1995	993000	16148	1.6%	24926	2.5%	35849	3.6%
1996	1016000	16148	1.6%	24926	2.5%	35849	3.5%
1997	991000	16148	1.6%	24926	2.5%	35849	3.6%
1998	980000	16148	1.6%	24926	2.5%	35849	3.7%
1999	1157000	16148	1.4%	24926	2.2%	35849	3.1%
2000	1048296	16148	1.5%	24926	2.4%	35849	3.4%
2001	1046721	16148	1.5%	24926	2.4%	35849	3.4%
2002	1096308	16148	1.5%	24926	2.3%	35849	3.3%
2003	1145756	16148	1.4%	24926	2.2%	35849	3.1%
2004	1259889	16148	1.3%	24926	2.0%	35849	2.8%
2005	1005609	16148	1.6%	24926	2.5%	35849	3.6%
2006	1289820	16148	1.3%	24926	1.9%	35849	2.8%
2007	1165708	16148	1.4%	24926	2.1%	35849	3.1%
2008	941819	22220	2.4%	51126	5.4%	43699	4.6%
2009	1082225	25095	2.3%	60326	5.6%	63631	5.9%
2010	1066618	29605	2.8%	86666	8.1%	63631	6.0%
2011	1104031	32856	3.0%	96485	8.7%	84497	7.7%
2012	1056381	32856	3.1%	96485	9.1%	84497	8.0%
2013	983007	32856	3.3%	96485	9.8%	84497	8.6%
2014	1036943	32856	3.2%	96485	9.3%	84497	8.1%
2015	1044762	32856	3.1%	96485	9.2%	84497	8.1%
2016	1040696	32856	3.2%	96485	9.3%	84497	8.1%
2017	992668	32856	3.3%	96485	9.7%	84497	8.5%
2018	924956	33748	3.6%	100010	10.8%	86027	9.3%
2019	894828	19651	2.2%	50845	5.7%	64259	7.2%

Processing: Ekonerg Ltd

Table 5.1-5 Share of sows with reduction measures and percentage reduction of emissions

Year	Number of animals (total)	Animal housing system		Manure storage techniques		Manure application techniques	
		Number of animals in reduction	Emission reduction (%)	Number of animals in reduction	Emission reduction (%	Number of animals in reduction	Emission reduction (%)
1990	232000	3668	1.6%	2934	1.3%	6236	2.7%
1991	234000	3668	1.6%	2934	1.3%	6236	2.7%
1992	180000	3668	2.0%	2934	1.6%	6236	3.5%
1993	193000	3668	1.9%	2934	1.5%	6236	3.2%
1994	198000	3668	1.9%	2934	1.5%	6236	3.1%
1995	182000	3668	2.0%	2934	1.6%	6236	3.4%
1996	181000	3668	2.0%	2934	1.6%	6236	3.4%
1997	185000	3668	2.0%	2934	1.6%	6236	3.4%
1998	186000	3668	2.0%	2934	1.6%	6236	3.4%
1999	205000	3668	1.8%	2934	1.4%	6236	3.0%
2000	185249	3668	2.0%	2934	1.6%	6236	3.4%
2001	187102	3668	2.0%	2934	1.6%	6236	3.3%
2002	190189	3668	1.9%	2934	1.5%	6236	3.3%
2003	200907	3668	1.8%	2934	1.5%	6236	3.1%
2004	229446	3668	1.6%	2934	1.3%	6236	2.7%
2005	199351	3668	1.8%	2934	1.5%	6236	3.1%
2006	198668	3668	1.8%	2934	1.5%	6236	3.1%
2007	182635	4868	2.7%	3854	2.1%	8276	4.5%
2008	162063	8943	5.5%	10034	6.2%	12761	7.9%
2009	167649	8943	5.3%	10034	6.0%	12761	7.6%
2010	163956	11643	7.1%	15474	9.4%	16331	10.0%
2011	129375	12643	9.8%	15474	12.0%	16331	12.6%
2012	125966	12643	10.0%	15474	12.3%	16331	13.0%
2013	127643	12643	9.9%	15474	12.1%	16331	12.8%
2014	119277	12643	10.6%	15474	13.0%	16331	13.7%
2015	150377	12643	8.4%	15474	10.3%	16331	10.9%
2016	152593	12643	8.3%	15474	10.1%	16331	10.7%
2017	159761	12643	7.9%	15474	9.7%	16331	10.2%
2018	155506	12643	8.1%	15474	10.0%	16331	10.5%
2019	160019	7991	5.0%	9196	5.8%	9978	6.2%

Processing: Ekonerg Ltd

Table 5.1-6 Share of laying hens with reduction measures and percentage reduction of emissions

Year.	Number of animals (total)	Animal housing system	
		Number of animals in reduction	Emission reduction (%)
1990	7756000	454983	5.9%
1991	7671000	454983	5.9%
1992	6648000	454983	6.8%
1993	6321000	454983	7.2%
1994	6253000	454983	7.3%

Year.	Number of animals (total)	Animal housing system	
		Number of animals in reduction	Emission reduction (%)
1995	6503000	454983	7.0%
1996	6260000	454983	7.3%
1997	6089000	454983	7.5%
1998	5853000	454983	7.8%
1999	5851000	454983	7.8%
2000	5988000	454983	7.6%
2001	5709000	454983	8.0%
2002	5775000	454983	7.9%
2003	5610000	454983	8.1%
2004	6447000	454983	7.1%
2005	6056000	454983	7.5%
2006	5758000	454983	7.9%
2007	5529907	454983	8.2%
2008	5486401	454983	8.3%
2009	5673000	454983	8.0%
2010	4357905	454983	10.4%
2011	4078789	454983	11.2%
2012	3696170	509863	13.8%
2013	3979081	570036	14.3%
2014	3722447	590623	15.9%
2015	3017389	590623	19.6%
2016	3496860	624223	17.9%
2017	3843140	624223	16.2%
2018	2777952	624223	22.5%
2019	2786363	282816	10.1%

Processing: Ekonerg Ltd

Table 5.1-7 Share of broilers with reduction measures and percentage reduction of emissions

Year	Number of animals (total)	Animal housing system	
		Number of animals in reduction	Emission reduction (%)
1990	854870	0	0
1991	825378	0	0
1992	656923	0	0
1993	634679	0	0
1994	624982	0	0
1995	601038	0	0
1996	549502	0	0
1997	547103	0	0
1998	497816	0	0
1999	545000	0	0
2000	516000	0	0
2001	497000	0	0

Year	Number of animals (total)	Animal housing system	
		Number of animals in reduction	Emission reduction (%)
2002	528000	0	0
2003	477000	16796	3.5%
2004	599000	16796	2.8%
2005	431000	16796	3.9%
2006	573000	16796	2.9%
2007	677474	16796	2.5%
2008	577486	16796	2.9%
2009	584000	16796	2.9%
2010	726301	16796	2.3%
2011	608666	16796	2.8%
2012	470701	16796	3.6%
2013	444116	16796	3.8%
2014	369446	18553	5.0%
2015	495034	18553	3.7%
2016	511844	18553	3.6%
2017	493072	18553	3.8%
2018	442028	18553	4.2%

Processing: Ekonerg Ltd

Table 5.1-8 Share of turkeys with reduction measures and percentage reduction of emissions

Year	Number of animals (total)	Animal housing system	
		Number of animals in reduction	Emission reduction (%)
1990	854870	0	0
1991	825378	0	0
1992	656923	0	0
1993	634679	0	0
1994	624982	0	0
1995	601038	0	0
1996	549502	0	0
1997	547103	0	0
1998	497816	0	0
1999	545000	0	0
2000	516000	0	0
2001	497000	0	0
2002	528000	0	0
2003	477000	16796	3.5%
2004	599000	16796	2.8%
2005	431000	16796	3.9%
2006	573000	16796	2.9%
2007	677474	16796	2.5%
2008	577486	16796	2.9%
2009	584000	16796	2.9%

Year	Number of animals (total)	Animal housing system	
		Number of animals in reduction	Emission reduction (%)
2010	726301	16796	2.3%
2011	608666	16796	2.8%
2012	470701	16796	3.6%
2013	444116	16796	3.8%
2014	369446	18553	5.0%
2015	495034	18553	3.7%
2016	511844	18553	3.6%
2017	493072	18553	3.8%
2018	442028	18553	4.2%
2019	511289	9982	2.0%

Processing: Ekonerg Ltd

Table 5.1-9 Animal categories Nex* and percentage of slurry % for the year 2019

Animal category	Nex	Slurry manure type (%)
Dairy cows (100501)	98.61	64.4
Other cattle (100502)	39.35	47.6
Sheep (100505)	15.05	0
Goats (100511)	17.99	0
Horses etc. (100506)	35.78	0
Fattening pigs (100953)	9.31	92.3
Sows (100504)	30.35	82.8
Layers (100507)	0.63	8.4
Broilers (100508)	0.36	1
Turkeys (100509)	1.84	0
Ducks (100509)	0.82	2
Geese (100509)	0.82	15

*Nex – Nitrogen excretion rate

NMVOC methodology and EF used for emissions calculation was Tier 2 methodology (GB 2019), using the default Tier 2 EFs for NMVOCs (Table 3.9, Table 3.10, Table 3.11, Table 3.12, GB2019) for the whole time period.

Proportion of animals on silage feed was estimated by the experts from the Faculty of Agriculture, University of Zagreb, and are presented in Table 5.1-10.

Table 5.1-10 Percentage (%) of animal categories on silage feeding for selected years and year 2019

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
2019	83	72	1

For PM, GB2019 Tier 1 methodology and default EF (Table 3.5, GB2019) 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 5.1-11. Trend of animal number for each livestock category is presented in Tables 5.1-12 and 5.1-13.

Table 5.1-11 Sources for activity data for NFR code 4.B Animal husbandry and manure management

Livestock categories	CBS	FAO	CAA
Dairy cattle	1990-2019		2008-2019
Other cattle	1990-2019		
Sheep	1990-2019		
Goats	1990-1991; 1999-2019	1992-1998	
Horses	1990-1994		1995-2019
Mules/assess	1990-1991, 2018-2019	1992-1994	1995-2017
Swine	1990-2019		
Poultry	1990-2019		

Table 5.1-12 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
Name	Dairy cows	Other cows (mature)	Other cows (young)	Sheep	Goats	Horses	Mules/ asses	Breedin g pigs	Market pigs
Unit	animal	animal	animal	animal	animal	animal	Unit	animal	animal
1990	462718	47405	315804	751000	172000	39000	17000	232000	1341000
1991	443566	65873	268586	753000	133000	36000	13000	234000	1387000
1992	359863	29830	195326	539000	113809	26000	13440	180000	1002000
1993	347245	47269	209368	525000	105000	22000	12430	193000	1069000
1994	325809	28338	162736	444000	107685	21000	6640	198000	1149000
1995	316943	35873	149209	453000	107292	4685	1549	182000	993000
1996	293893	36373	141822	427000	105271	5274	1750	181000	1016000
1997	283652	33965	137815	453000	99544	5886	1902	185000	991000
1998	273516	38451	134112	427000	84403	6540	2077	186000	980000
1999	268438	29339	140920	488000	78000	7309	2255	205000	1157000
2000	262209	26933	137428	528675	79393	9611	2518	185249	1048296
2001	254096	28104	156223	539498	92943	10871	2780	187102	1046721
2002	247026	32285	137802	580016	96534	13570	3097	190189	1096308
2003	252211	29424	162685	586641	86087	15217	3033	200907	1145756
2004	226289	48078	191568	721578	126060	17057	3195	229446	1259889
2005	234966	38787	197272	796480	134483	17883	3146	199351	1005609
2006	232923	37300	212682	679839	102877	18885	3299	198668	1289820
2007	225407	32052	209618	645992	91902	18075	3415	182635	1165708
2008	212625	37799	203131	643384	83877	19687	3591	162063	941819

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
Name	Dairy cows	Other cows (mature)	Other cows (young)	Sheep	Goats	Horses	Mules/ asses	Breedin g pigs	Market pigs
Unit	animal	animal	animal	animal	animal	animal	Unit	animal	animal
2009	212220	28284	206647	619044	76119	19958	3617	167649	1082225
2010	206537	23534	214243	629437	75215	20537	3722	163956	1066618
2011	184745	25683	236127	638608	70030	21836	3365	129375	1104031
2012	180555	26415	244547	679313	71978	22426	3363	125966	1056381
2013	168025	37467	236940	620000	69000	21256	3273	127643	983007
2014	159394	62289	218954	604866	60697	21144	2159	119277	1036943
2015	151502	52433	236157	607711	62057	21868	2468	150377	1044762
2016	146510	54357	243746	618896	75530	22775	2862	152593	1040696
2017	139443	55523	255791	636808	76771	23209	3270	159761	992668
2018	135851	28302	249972	636294	80064	23649	3705	155506	924956
2019	130025	31941	258273	657197	81540	24700	4100	160019	894828

Source: CBS, FAO, CAA; Processing: Ekonerg Ltd

Table 5.1-13 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	50848	13284	160976
2018	2777952	7525121	442028	55603	16089	596011
2019	2786363	8895498	511289	52114	16533	484894

Source: CBS; Processing: Ekonerg Ltd

Recalculations and improvements

Emission of NOx for category 3.B.4.g.i laying hens was recalculated for the entire period 1990 – 2018 due to an error in activity data.

During the 2020 NECD review, the TERT noted that the values of the effectiveness of the some of the NH_3 abatement techniques that refer to Guidance document ECE/EB AIR/120 are inccorrect. Consequently, emissions of NH_3 were recalculated for the categories of sows, fattening pigs, laying hens and turkeys due to incorrect NH_3 abatement techniques and incorrect NH_3 abatement potentials. Emissions were recalculated for the entire period 1990 - 2018.

Emissions of PM_{10} i $PM_{2,5}$ were recalculated for categories of sows, laying hens, fattening pigs and broilers due to the metodology change from Tier 1 EF (GB 2016) to the Tier 1 FE (GB 2019).

During the 2020 NECD review, the TERT found inconsistencies in the N excretion rate (Nex) between CRF and IIR. Differences between values of N excretion rate 2020 IIR table 5.1-9 and 2020 CRF are found for all the key categories and for non key categories. This issue has been corrected in this year submision and the N excretion rate is harmonized with CRF. That resulted with the recalculation of NH_3 i NOx emissions for the entire period 1990 – 2018 for all animal categories.

Planned improvement is collecting further data on used abatement measures for swine and poultry, collecting data on abatement for cattle categories and upgrading methodology to EMEP/EEA GB 2019.

5.2. 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 GB2019), NFR 3.D.b Indirect emissions from managed soils (no EF and provided in GB2019), NFR 3.D.d Off-farm storage, handling and transport of bulk agricultural products (no EF and provided in GB2019).

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 of 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 pathogens 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 communal waste water purifiers was also used. For the year 2019, 11 sludge producers and 13 sludge users are reported.

Other Organic Fertilisers Applied to Soils (NFR 3.D.a.2.c)

Source of NH_3 and NOx emissions from organic fertilisers, other than livestock manure and sewage sludge, applied to soils (including digestate and compost). Activity data for this source category will be available and processed in the next year submission.

Livestock manure applied to soils category (NFR 3.D.a.3)

Emissions of NH_3 and NOx due 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).

Cultivated crops (NFR 3.D.e)

Relates to the NMVOC emissions from agricultural operations, using the data on cropland and grassland.

Use of pesticides (NFR 3.D.f)

Pesticide emissions originate mainly from their use in the agricultural and forest sectors. Other emission sources (e.g. the manufacturing of pesticides or emission of imported products) are not included in this source category.

In the EMEP/EEA Guidebook 2013, the following pesticides were included: Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene (HCB), Mirex, Toxaphene, pentachlorophenol and Lindane. The use of these pesticides as pure substances listed in the Aarhus Protocol on Persistent Organic Pollutants (POPs) and the Stockholm Convention has already been prohibited by most of the parties who have ratified the Protocol. In accordance with the POP Protocol art. 3, para 8, and art. 9, para. 1 (b) only substances (PAHs, Dioxins/furans, HCB and PCBs) listed in Annex III shall be reported.

Since the early 1990s, HCB has no longer been used as a pure substance. However, it can be present as an impurity or as a by-product in certain pesticides or chemicals. Some of this pesticides, e.g. Chlorthalonil (fungicide) and Picloram (herbicide) are still in use and their application is approved until 2017 or longer (see the EU database on pesticides). In 2014, more than 75% of the total pesticide sales (396 kt) in the EU 28 were fungicides and herbicides (see Eurostat database, pesticide sales). More than 24 million tonnes of fungicides and herbicides have been used worldwide. For this reason, pesticide applications are still a source of HCB emissions.

Emissions arise following the application of pesticides either from volatilization of pesticides deposited to leaf or soil prior to uptake by the crop or soil, or from ‘spray drift’ – the movement of fine droplets of pesticide spray away from the target application zone to areas downwind. For the calculation of emissions, only primary emissions of active input (e.g. evaporation during application, evaporation from the plant and soil surface after application) have to be taken into account. Further emission paths are neglected, due to the persistence and the high sorption behaviour of the respective pesticide or HCB on the organic soil substance.

In general, pesticides are characterized by their chemical structure and property of semi-volatility. The latter determines the emission behaviour. A Dutch study (MJPG, 1995) estimates that on average, 25% of all pesticide used is emitted to the air. However, the use of the most dangerous pesticides has been prohibited by international agreement (see Table 5.3.1). Only emissions related to pesticides use that are currently reported are those of The only emissions related to pesticide use that shall be currently reported are those of HCB, which is present as a contaminant. According to the Pesticide Leaching Model (PELMO 3.31; Ferrari et al, 2005), all the HCB present as a contaminant will be volatilised.

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 GB2019 methodology was used and for NOx emission calculations Tier 1 GB2019 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 GB2019, 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 (Z*aninović, 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.

This estimate is based on the amount of N in mineral fertiliser that is annually consumed in the Republic of Croatia and on the “Mineral fertiliser consumption, in tonnes of nitrogen” dataset obtained from the CBS.

- Data on the consumption of mineral fertilisers that are produced and applied in Croatia were obtained from companies that produces synthetic fertilizers for the time period 1992-1999, since CBS has no data on N applied from mineral fertilizers before the time period before 2000 (Table 5.5-1). Data on mineral fertilizers produced and applied in Croatia in 1990 and 1991 have been estimated by extrapolation method using the pattern from 1992 to 1999.
- “Mineral fertiliser consumption, NUTS 0, in tonnes of nutrient” CBS dataset is available starting from the year 2000, with peak consumption in 2008.

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.

Since official CBS data on N consumption (with no segregation for each fertilizer type) is available for the period from 2000 (and is also used as AD set for CRF tables), mineral fertilizer production dana on each fertilizer type was used as vector to distribute the CBS data. It is expected that CBS data will be available soon for the entire 1990-2000 time period.

Activity data for nitrogen (N) applied for each type of mineral fertilizer is shown in Table 5.2-1.

Table 5.2-1 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	Ammonium sulphate	Ammonium sulfonitrate	TOTAL
Unit	kg N	kg N	kg N	kg N	kg N	kg N	kg N	kg N
1990	31376015	39030122	36285992	0	721273	0	0	0
1991	31957265	38643459	37441717	0	672217	0	0	0
1992	41093640	43521030	39921424	0	282405	0	0	0
1993	32705540	27743580	29856295	0	1053575	0	0	0
1994	29839280	36707850	29814546	0	549065	0	0	0
1995	29038880	35701020	28395908	0	279725	0	0	0
1996	32894140	34644780	30768659	0	81740	0	0	0
1997	42897760	43609050	35924213	0	920915	0	0	0
1998	27755940	38790630	28358872	0	341030	0	0	0
1999	31669160	34221420	39495688	0	235170	0	0	0
2000	38179584	39921706	39861836	0	41875	0	0	0
2001	57768696	37933147	32340662	0	300495	0	0	0
2002	50655639	38065664	31650881	0	96815	0	0	0

NFR 3.D.1a	N (nitrogen) applied							
Name	Urea	Calcium ammonium nitrate	NPK	Ammonium nitrate	Urea ammonium nitrate	Ammonium sulphate	Ammonium sulfonitrate	TOTAL
Unit	kg N	kg N	kg N	kg N	kg N	kg N	kg N	kg N
2003	42176472	31017324	33360685	0	5203219	1863300	0	0
2004	45109237	32069375	33625948	0	5126147	1647293	0	0
2005	41939650	36264840	36438674	0	4983133	1682703	0	0
2006	41555040	40021849	37732772	0	3024324	1540316	0	0
2007	46486607	39451328	40122830	0	3574246	813389	0	0
2008	65532821	55416207	47907534	0	467684	827953	0	0
2009	33343767	30669628	26144086	0	15769	619850	0	0
2010	45043935	38246014	25485034	0	23187	547131	0	0
2011	56381522	38898515	29057189	0	19372	658501	0	0
2012	52977787	31041560	22209100	0	0	655953	0	0
2013	32923601	28558977	16160081	0	0	276940	0	0
2014	27880685	28878928	16627034	0	0	293602	0	0
2015	35233951	32046047	19745358	0	8341	345630	41252	7121
2016	31518361	26429010	12965009	0	542053	328108	189915	347543
2017	40251540	31397799	25147230	0	248205	350025	234633	782570
2018	49232412	32678534	15837330	0	0	635677	594076	441971
2019	43956766	35984500	16236897	0	195	559099	419647	362495

Source: CBS; Processing: Ekonerg Ltd

Livestock manure applied to soils (NFR 3.D.a.2.a)

Methodology used for NH_3 emissions is GB2019, Tier 2 – NH_3 emissions were calculated within the NFR 3.B category ("mass-flow" approach) using the same AD set.

For NOx emissions, Tier 1 methodology was used (no Tier 2 methodology is available in GB2019). 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 GB2019 methodology.

Due to the harmonization of the Nex (nitrogen excretion rate) values in the IIR with the CRF values of Nex, emissions of NH_3 and NOx were recalculated for the entire period 1990 – 2018.

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 2018 submission, IIR 1990 – 2016. Following the revision, TERT recommended (HR-3Da2b-2018-0001) to modify the default Tier1 methodology 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 5.2-2 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
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
2018	66571
2019	24285

Source: Ministry of Environment and Energy; Processing: Ekonerg Ltd.

Other Organic Fertilisers Applied to Soils (NFR 3.D.a.2.c)

For emissions from other organic fertilisers, Tier 1 methodology should be used. For the emission of NH_3 from N applied in digestates derived from material other than manure, values should be obtained from Chapter 6.3. Biological treatment of waste — Anaerobic digestion at biogas facilities (NFR 5.B.2). Activity data are still not available, and collecting these data is a long-term goal. It is assumed that emissions from this subsector are negligibly small. Further details are given in Croatia's National Inventory Report 2019, Chapter 5.5.1.2

Urine and dung deposited by grazing animals (NFR 3.D.a.3)

Methodology used for NH_3 emissions is GB2019, Tier 2 – NH_3 emissions were calculated within the 3.B category (“mass-flow” approach).

For NOx emissions, GB2019 Tier 1 methodology was used (no Tier 2 methodology is available in GB2019). 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 GB2019 methodology.

Due to the harmonization of the Nex (nitrogen excretion rate) values in the IIR with the CRF values of Nex, emissions of NH_3 and NOx were recalculated for entire period 1990 – 2018.

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, GB2019, 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 whole historic period is presented in table 5.2-3.

Table 5.2-3 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
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
2018	1485645
2019	1504445

Source: CBS

Cultivated crops (NFR 3.D.e)

The calculation for NMVOC estimates was performed using Tier 2 methodology according to the EMEP/EEA GB 2019. Emissions were estimated for all of the relevant crop types for which EFs are available in the 2019 EMEP/EEA Guidebook (wheat, rye and rape, Table 3.3, GB 2019). For the remaining cropland area an average of the highest and lowest EF (wheat and rape) was applied (0.83 kg NMVOC/ha)[34].

Croatia has cold climate condition (*Zaninović, M. et al*). Therefore, the emission factor for pasture (grass 15°C) of 0.41 kg NMVOC/ha/yr following the GB 2019, Table 3.3, has been taken. Emissions are currently calculated with the following formula:

$$E_{NMVOC\_cl\_gl} = \Sigma A_{cl,gl} * EF_{cl,gl}$$

where:

$E_{NMVOC\_cl,gl}$ = annual NMVOC emission flux from cropland and grassland areas (kg NMVOC)

$A_{cl,gl}$ = annual cropland area, annual grassland area (ha)

$EF_{cl,gl}$=EF of wheat, rye, rape and average EF (wheat and rape) for cropland and grass (15°C) for grassland (kg NMVOC/ha

Table 5.2-4 Activity data for NFR code 3.D.e

NFR 3.D.e	grassland - CLC	cropland - CBS (wheat + rye + rape)	wheat	rye	rape
Unit	ha	ha	ha	ha	ha
1990	1201059	1625377	318955	3053	12647
1991	1200671	1625009	324460	2974	9004
1992	1200284	1624962	168865	2252	11743
1993	1199896	1624240	211845	2453	13010
1994	1199509	1623886	198381	2963	13889
1995	1199121	1623503	227044	1930	10982
1996	1198733	1623062	200852	2043	7651
1997	1198346	1622790	208377	1959	5356
1998	1197958	1622480	241734	2146	8949
1999	1197571	1622026	169280	2446	16234
2000	1197183	1621796	182333	2738	12886
2001	1196795	1616080	184274	2981	10319
2002	1196408	1610192	179153	3244	13041
2003	1196020	1604187	157175	2960	15524
2004	1195633	1598067	162634	2869	14282
2005	1195245	1589570	146253	1848	20149
2006	1194857	1581233	175551	2008	8413
2007	1188825	1577328	175045	1731	13069
2008	1182792	1575735	156536	1367	22372
2009	1176759	1571723	180376	998	28723
2010	1170727	1567096	168507	1035	16339
2011	1164694	1561075	149797	871	17536
2012	1158662	1556125	186949	846	9893
2013	1157755	1549061	204506	1019	17972
2014	1156848	1540670	156139	1373	23122
2015	1155942	1534442	140986	1093	21977

[34] Recommended approach as preseneted in the NEC Review 2017 (EC 2017) for Austria

NFR 3.D.e	grassland - CLC	cropland - CBS (wheat + rye + rape)	wheat	rye	rape
Unit	ha	ha	ha	ha	ha
2016	1155035	1532960	168029	1285	36778
2017	1154128	1528949	116151	774	48616
2018	1153222	1528332	135708	1292	55032
2019	1153222	1527293	141602	1292	41361

Sources: CBS, NIR

Activity data used for NMVOC emission calculations is the agricultural area under wheat, rye and rape, data provided by Croatian Bureau of Statistics. For the grassland, data was taken from the land use area calculation in the Land use, Land Use Change and Forestry (LULUCF) sector. Further details are given in Croatia's National Inventory Report 2019, Chapter 5.3.3.

Use of pesticides (NFR 3.D.f)

HCB emission was calculated by using Tier 1 methodology (GB 2019) by summing the amount of each pesticide applied and the concentration of HCB in that pesticide (i.e. its impurity factor):

$$E_{pest} = \Sigma\ (m_{pest\_i}\ x\ IF_i)$$

where:

E_{pest} = total emission of HCB (in mg a^{-1}, unit conversion reported in kg),

m_{pest_i} = mass of individual pesticide i applied (kg a^{-1}),

IF_i= impurity factor of HCB in the ith pesticide (mg kg^{-1})

Impurities derived from the manufacturing process and/or product storage are present in all pesticide active ingredients. Impurities can have an adverse impact on human health, the environment or both. Maximum impurity standards (here used as an impurity factor, IF) are listed for specific active constituents. One of the listed substances is HCB. Before pesticide regulations were implemented, HCB impurity levels in many active substances were quite high but producers were obliged to reduce the impurity levels dramatically. Today, the amounts of impurities are clearly below the legally defined impurity levels but national standards for HCB impurity can differ between countries and depend on the year of implementation. Emission factors for emission calculation are given in the Table 5.2-5.

Table 5.2-5 Tier 1 emission factors for source category 3.D.f Use of pesticides

Active substances	1990 mg/kg	1995 mg/kg	2000 mg/kg	2005 mg/kg	2010 mg/kg	2015 mg/kg	Banned in EU since	EU Directives or Regulations
Atrazine	2,50	1	1	Use stopped	Use stopped	Use stopped	End 2003	No 2004/248/EC
Clopyralid	not used in EU	not used in EU	not used in EU	not used in EU	2.50	2.50		Reg. (EU) No 2019/168, 06/64/EC, No 540/2011, No 678/2014
Chlorothalonil	300	300	40	10	40	40		2005/53/EC, Reg. (EU) 2018/1262, Reg. (EU) No 540/2011,

Active substances	1990 mg/kg	1995 mg/kg	2000 mg/kg	2005 mg/kg	2010 mg/kg	2015 mg/kg	Banned in EU since	EU Directives or Regulations
								Reg.(EU) 2017/1511, Reg. (EU) No 533/2013
Chlorthal-dimethyl	1000	1000	40	40	Use stopped	Use stopped	End 2010	2009/715/EC ******
Endosulfan	0.1	0.1	0.1	0.1	Use stopped	Use stopped	End 2005	05/864/EC, No 1107/2009
Lindane	100	50	50	50	Use stopped	Use stopped	End 2007	1107/2009, 850/2004, 2000/801/EG
Quintozene	500	500	500	Use stopped	Use stopped	Use stopped	End 2000	No 2000/816/EC
Picloram	50	50	50	50	50	50		No 540/2011, 2010/39/EU, Reg. (EU) No 2018/1796
Propazine	1	1	1	Use stopped	Use stopped	Use stopped		No 2002/2076
Simazine	1	1	1	Use stopped	Use stopped	Use stopped	End 2004	No 2004/247/EC
Pentachlorophenol (PCP)	50	50	50	Use stopped	Use stopped	Use stopped	End 2002	No 2002/2076

Source: GB2019

Sources of activity data are Central Bureau of Statistics (CBS) and Ministry of Agriculture. The annual sales of relevant active substance (in kilograms) is used to conclude the quantity that is applied, using the assumption that during the year, all the pesticides sold to farmers, ranchers, foresters, etc. are applied.

As a result of the study it was concluded that the following pesticides: Propazine, Pentchlorophenol, Quintozene, Chlorthaldimethyl and Endosulfan were not / are not in use in the Republic of Croatia and will be marked with notation key „NO“ in the Inventory. Annual quantities of pesticide active substance sold in the Republic of Croatia are shown in Table 5.2-6.

Only the quantities produced were available for Lindane, and it was assumed in the HCB emission calculation that the amount of Lindane produced was equal to the amount of active substance produced, and that it was equal to the amount of active substance sold. Use of Lindane in Croatia was banned in 2002.

Only the quantities of sold Atrazine were available for the period 1990 – 1993. Consequently, quantities of the active substance of atrazine sold for the period 1990 – 1993 were estimated using a mean value of 88% for the proportions of the active substance of atrazine sold in the sold quantity of atrazine in the period 1994 – 2003. Share of active substance of atrazine sold in sold amount of atrazine in the period 1994 – 2003 ranged from 76 - 97%. Use of Atrazine in Croatia was banned in 2004.

There was no production or sales of Simazine in the period 1990 – 1991. Only the quantities of sold Simazine were available for the period 1992 – 1993. Consequently, the quantities of the active substance of simazine sold for the 1992 – 1993 period were estimated using a mean value of 55% for the proportions of sold active substance of other triazine-based herbicides and sold active substance in the sold quantity of other triazine-based herbicides in the period 1994 – 2007. Share of sold active substance of other triazine-based herbicides in the sold amount of other triazine-based herbicides in the 1994 – 2007 period ranged from 45 – 71%. Use of Simazine in Croatia was banned in 1994.

For Picloram and Chlorthalonil, only available data were the data on annual sales of active substance since the year 2013. For the historical trend from 1990 to 2012, the quantity of active substance sold in 2013 was taken into calculation and it was applied for all years in 1990 – 2012 period.

Data on annual sales of active substance since 2013 were available for Propazine. Propazine has only been in use in the EU since 2010. For the period 2010 – 2012 the quantity of active substance sold in 2013 was taken into calculation and applied for all years in the period 2010 – 2012.

Table 5.2-6 Annual sales of active substance in kilograms for the pesticides in Croatia

Annual sales of active substance (kg)						
Year	Lindane	Atrazine	Simazine	Picloram	Chlorthalonil	Clopyralid
1990	11700	635752	NO	82.7	13,515.22	NO
1991	12663	356727	NO	82.7	13,515.22	NO
1992	13625	935968	21984	82.7	13,515.22	NO
1993	16243	912127	13740	82.7	13,515.22	NO
1994	14633	1253000	use stopped	82.7	13,515.22	NO
1995	15488	1334000		82.7	13,515.22	NO
1996	12800	818000		82.7	13,515.22	NO
1997	4300	606000		82.7	13,515.22	NO
1998	7000	732000		82.7	13,515.22	NO
1999	6500	168000		82.7	13,515.22	NO
2000	9800	695000		82.7	13,515.22	NO
2001	4200	1024000		82.7	13,515.22	NO
2002	use stopped	544000		82.7	13,515.22	NO
2003		138245		82.7	13,515.22	NO
2004		use stopped		82.7	13,515.22	NO
2005				82.7	13,515.22	NO
2006				82.7	13,515.22	NO
2007				82.7	13,515.22	NO
2008				82.7	13,515.22	NO
2009				82.7	13,515.22	NO
2010				82.7	13,515.22	2,784.54
2011				82.7	13,515.22	2,784.54
2012				82.7	13,515.22	2,784.54
2013				82.7	13,515.22	2,784.54
2014				101.1	8,603.01	3,086.57
2015				101.9	3,066.80	2,174.11
2016				84.2	4,078.80	2,597.73
2017				87.7	4,187.62	3,096.47
2018				105.8	6,406.20	2,085.05
2019				89.14	7,552.40	1,736.55

Sources: CBS, Ministry of Agriculture

Recalculations and improvements

Inorganic N fertilizers (including urea) (NFR 3.D.1.a)

There was no recalculations or other improvements for these source category.

Animal manure applied to soils (NFR 3.D.a.2.a)

Emission of NH_3 was recalculated for years 1996, 1997 and 2014 due to incorrect EF's for sheeps.

Emissions of NH_3 and NOx were recalculated for years 2015 and 2016 due to incorrect activity data for sows.

During the 2020 NECD review, the TERT found inconsistencies in the N excretion between CRF and IIR. Differences between values of Nexcretion rate 2020 IIR table 5.1-9 and 2020 CRF are found for all the key categories and for non key categories. This issue is corrected in this year submision and the N excretion rate is harmonized with CRF. That resulted with a recalculation of NH3 and NOx emissions for the entire period from 1990 to 2018 for all emission sources in the 3.D.a.2.a category.

Urine and dung deposited by grazing animals (NFR 3.D.a.3)

During the 2020 NECD review, the TERT found inconsistencies in the N excretion between CRF and IIR. Differences between values of Nexcretion rate 2020 IIR table 5.1-9 and 2020 CRF are found for all the key categories and for non key categories. This issue is corrected in this year submision and the N excretion rate is harmonized with CRF. That resulted with a recalculation of NH3 and NOx emissions for the entire period from 1990 to 2018 for all emission sources in the 3.D.a.3 category.

Farm-level agricultural operations including storage, handling and transport of agricultural products (NFR 3.D.c)

There was no recalculations or other improvements for these source category.

Cultivated crops (NFR 3.D.e)

NMVOC emissions were recalculated for the entire period 1990 – 2018 due to changes in activity data for cropland and grassland area that are obtained from CORINE Land Cover (CLC).

Use of pesticides (NFR 3.D.f)

There was no recalculations or other improvements for these source category.

5.3. Field burning of agricultural residues (NFR 3.F)

Source category description

Field burning of agricultural residues is a minor source of several pollutants. The practice of burning crop residues is used as a quick and favourable method for clearing the land from crop residues that enables further and undisturbed land tillage. Field burning can also improve the fight against diseases and pests of certain crops. This activity is prohibited by the EU legislation and by the Croatian legislation (Ordinance on good agricultural and environmental conditions (OG 89/11)).

This category does not include activities of burning crop residues after their use for another purpose, for example, straw used for protection of agricultural products during storage at the farms. This activities should be included in the sector NFR 5.C.2 Waste.

Field burning of agricultural residues results in emission of a number of pollutants into the atmosphere including ammonia (NH_3), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), sulphur dioxide (SO_2), carbon monoxide (CO) and particles (PM), including black carbon (BC). Burning of agricultural residues also results in emission of heavy metals and dioxins .

Methodology, emission factors and activity data

Tier 1 methodology is based on estimates for amounts of agricultural residues and the application of a default emission factors for each pollutant, and this level of calculation will be used for emission calculation in the Republic of Croatia.

Tier 1 methodology uses the general equation for calculation of emissions from field burning of agricultural residues:

$$E_{\text{pollutant}} = AR_{\text{residue\_burnt}} \cdot EF_{\text{pollutant}}$$

where:

$E_{\text{pollutant}}$ – emission (E) of pollutant (kg);

$AR_{\text{residue\_burnt}}$ – activity rate (AR), mass of residue burnt (kg dry matter);

$EF_{\text{pollutant}}$ – emission factor (EF) for pollutant (kg kg^{-1} dry matter).

This equation is applied at the national level, using annual national total amount of residue burned. Value of the activity rate ($AR_{\text{residue\_burnt}}$) is the product of the land area on which the crops whose residues are burnt were grown (A), mass of the fuel available for combustion, in tonnes per hectare (M_b) and combustion factor (C_f). Default values are given in the 2006 IPPC Guidelines, Vol. 4, Chapter 2, Table 2.6.

Emission factors for calculation of emissions caused by field burning of agricultural residues are given in Annex 4.

Activity data should include estimates of land areas for each type, which are then used to estimate residues that are commonly burned, the fraction of residue burned and the dry matter content of residue. The mass of crop residue burned can be calculated from the following equation:

$$AR_{residue\_burnt} = A \cdot Y \cdot s \cdot d \cdot p_{\text{b}} \cdot C_{\text{f}}$$

where:

A – area of land on which crops are grown whose residues are burned (ha);

Y – average crop yield (kg ha^{-1})

s – ratio between the mass of crop residues and the average crop yield

d – dry matter content of the yield;

p_b – proportion of residues that are burned (not used elsewhere);

C_f – combustion factor (proportion of the fuel present at the time of the fire that is actually burned).

The most important data to collect for calculation of emissions are the actual amounts of crop produced (by type) with residues that are commonly burned. Considering that such data are missing, and in the absence of better data, the values given below are used.

Default values of the ratio of residue mass to crop yield (s) are given in Table 5.3-1. To ensure consistency with the IPCC Guidelines 2006 (Chapter 2.4), and with the assumption that the dry matter content in yield (d) is 0.85, for crops other than wheat, maize and rice, values for wheat should be used.

Data on the harvested area (Table 5.3-2) and yield (Table 5.3-3) of the most important crops are obtained from the CBS for all years in data set. Value for the proportion of residues that are burned (p_b) is set at the conservative 0.5 (50%), since there is currently no data on actually burned area of agricultural residues.

Table 5.3-1. Default values for estimating the amount of residues burned

CROP	Ratio of residue mass to crop yield (s)	Average crop yield (Y), kg ha^{-1} fresh weight	Combustion factor (C_f)
Wheat	1.3	3.6	0.9
Barley	1.2		
Maize	1.0	11.8	0.8
Oats	1.3		
Rye	1.6		
Rice	1.4	4.6	0.8
Peas	1.5		
Beans	2.1		
Soybeans	2.1		

Source: IPCC, 2000., EMEP/EEA GB 2019

Table 5.3-2. Data on the harvested area of the most important crops

Harvested area (ha)	Wheat	Barley	Maize	Oats	Rye	Peas	Beans	Soybeans
1990	318955	51565	503342	25495	3053	3402	8132	27260
1991	324460	51643	488178	23425	2974	3174	8921	22840
1992	168865	32873	370205	17582	2252	2597	5980	26220
1993	211845	36605	373166	17204	2453	2738	6514	21424
1994	198381	36225	370517	18493	2963	2899	6958	20435
1995	227044	32518	354059	15763	1930	2915	6733	15018
1996	200852	31034	360824	16290	2043	2787	6975	16423
1997	208377	33759	370986	18142	1959	3041	7521	16030
1998	241734	42737	377536	21669	2146	562	5946	34015
1999	169280	44517	383925	24124	2446	660	6581	46336
2000	182333	55511	292431	26042	2738	555	7470	47484
2001	184274	61267	305867	26103	2981	778	7149	41621
2002	179153	61165	306805	24484	3244	872	7104	47897
2003	157175	65001	304722	25300	2960	889	6826	49860
2004	162634	67538	306347	23457	2869	813	6137	36979
2005	146253	50341	318973	21185	1848	447	6477	48211
2006	175551	59159	296195	24914	2008	326	6367	62810
2007	175045	59000	288549	27967	1731	374	4451	46506
2008	156536	65536	314062	19873	1367	351	2147	35789
2009	180376	59584	296910	20901	998	372	1947	44292
2010	168507	52524	296768	19280	1035	221	1276	56456
2011	149797	48318	305130	25344	871	252	1232	58896
2012	186949	56905	299161	28514	846	139	788	54109

Harvested area (ha)	Wheat	Barley	Maize	Oats	Rye	Peas	Beans	Soybeans
2013	204506	53796	288365	21656	1019	154	1097	47156
2014	156139	46160	252567	21146	1373	219	1483	47104
2015	140986	43700	263970	23462	1093	94	1475	88867
2016	168029	56483	252072	26572	1285	71	1574	78614
2017	116151	53950	247119	23139	774	71	1539	85133
2018	135708	50988	235352	15885	774	147	1403	77087
2019	141602	53662	255887	18499	1292	143	1113	78334

Source: CBS

Table 5.3-3 Data on yield of the most important crops

Yield (tonnes / ha)	Wheat	Barley	Maize	Oats	Rye	Peas	Beans	Soybeans
1990	5.02	3.81	3.88	2.44	5.19	0.29	2.27	2.03
1991	4.61	3.60	4.89	2.30	4.73	0.31	2.46	2.47
1992	3.90	3.25	3.67	2.57	2.69	0.31	2.67	1.76
1993	4.19	3.43	4.48	2.39	2.56	0.12	2.70	2.31
1994	3.78	2.98	4.55	2.29	2.41	0.14	2.96	2.16
1995	3.86	3.18	4.90	2.43	2.62	0.29	3.24	2.29
1996	3.69	2.84	5.23	2.43	2.70	0.22	2.90	2.19
1997	4.00	3.21	5.88	2.58	2.56	0.19	2.73	2.46
1998	4.22	3.36	5.25	2.59	2.58	1.33	3.53	2.28
1999	3.30	2.81	5.56	2.36	2.55	1.25	3.39	2.50
2000	4.75	3.24	4.07	2.37	2.64	1.65	0.36	1.38
2001	4.40	3.13	5.67	2.74	3.62	2.48	0.62	2.21
2002	4.59	3.38	6.38	3.03	2.84	2.39	0.73	2.70
2003	3.22	2.46	4.20	2.10	2.02	1.30	0.73	1.66
2004	4.93	3.52	6.31	3.13	3.13	2.29	0.73	2.65
2005	4.11	3.23	6.92	2.34	2.56	2.00	0.93	2.48
2006	4.58	3.64	6.53	2.67	2.73	2.19	0.64	2.77
2007	4.64	3.82	4.94	2.01	2.52	1.79	0.56	1.95
2008	5.48	4.26	7.98	3.29	2.98	2.48	1.52	3.01
2009	5.19	4.09	7.35	2.98	2.87	2.57	1.26	2.60
2010	4.04	3.28	6.97	2.50	2.42	1.54	1.29	2.72
2011	5.22	4.01	5.68	3.05	3.39	2.76	0.86	2.50
2012	5.35	4.14	4.34	3.32	2.87	2.91	0.60	1.79
2013	4.88	3.74	6.50	2.78	2.90	1.23	1.35	2.36
2014	4.16	3.80	8.10	2.67	2.04	2.64	0.90	2.79
2015	5.38	4.43	6.47	3.06	3.07	2.06	0.78	2.21
2016	5.71	4.66	8.55	3.03	3.62	3.46	0.93	3.10
2017	5.87	4.83	6.31	2.95	3.32	2.00	0.87	2.44
2018	5.44	4.46	9.12	2.82	3.32	2.14	1.24	3.18
2019	5.58	4.46	8.98	3.11	3.17	3.49	1.24	3.12

Source: CBS

Recalculations and improvements

Due to an error in activity data on maize area, emissions for this source category were recalculated for entire period 1990 – 2018.

As the current emission estimate is probably overestimated due to using p_b value of 0.5, long term planned improvement is getting a better national estimate for the value.

6. 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.2 Industrial 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 [35] and Waste Management Plan[36]. 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[37] 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

35 Sustainable Waste Management Act (OG 94/13, 73/17, 14/19, 98/19)
36 Waste Management Plan of the Republic of Croatia for the period 2017 - 2022 (OG 3/17)
37 Waste Framework Directive 2008/98/EC

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 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 methodology, multiplying activity data for each sub category with an emission factor, is applied. A CS methodology was developed to estimate a NMVOC emission factor from 5.A, for all years in reporting period.

Emission factors are expressed as the quantity of pollutant emission per unit of waste treated. Used emission factors are from GB2019 and GB2009 (for emission factors not estimated in GB2019, for NFR 5.C.1.b.i) as well CS NMVOC emission factors for 5.A. 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 2021, 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 (MESD);
- 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.

6.1. 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). According to the requirements of the 2006 IPCC Guidelines, Croatia included the CH_4 emissions for category 5.A Solid waste disposal from municipal solid waste (MSW), industrial waste (IW) and sludge disposed at landfills for the entire time series. This improve the accuracy and completeness of the inventory.

Detailed explanations of the data sources and methods of assessment the data for emission estimates are contained in the NIR 2021.

Data source for disposed waste amounts is MESD. 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 MESD is collecting and processing waste data, among other the data reported to the EPR; data on waste management permits and certificates, and data for Waste Management Information System. By the Ordinance on the Environmental Pollution Register (OG 87/15), adopted according to Environment Protection Act, the MESD 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 of 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 MESD that is cooperating with competent offices in counties and with companies collecting MSW or landfills management, 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 the EPR database and Waste Management Information System database, operated by MESD. Total annual MSW disposed to landfills 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[38]. 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 *Environment Report (2012)*, Croatian Environment Agency. Data for the quantity of disposed MSW in 2005 were obtained from *Waste Management Plan in the Republic of Croatia for 2007 - 2015* (OG *85/07, 126/10, 31/11, 46/15*). 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 - 2019 were obtained from the databases EPR 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 - 2019 were obtained from the EPR - reports delivered by the operators of active landfills. Data on the quantity of disposed biodegradable MSW for the period 2010 - 2019 were obtained from the Waste Management Information System - reports on landfills and waste disposal.

Data on the quantity of disposed IW 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

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[38] 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

the period 2010 - 2016. Data on the quantity of generated and disposed IW for the period 2010 - 2019 were obtained from the EPR - reports delivered by the operators of active landfills. Data on the quantity of disposed biodegradable IW for the period 2010 - 2019 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 - 2019 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 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 MESD in prescribed form (Form on landfills and landfilling of waste). Once a year, MESD requests data on remediation status of landfills from the Environment Protection and Energy Efficiency Fund, which is co-financing remediation of almost all of official landfills.

Emissions from combustion of landfill gas used for electricity generation are allocated in the Energy sector (1.A.1, 1.A.4).

Methodology, emission factors and activity data

According to the recommendation by TERT during review in 2019, a technical correction were performed for NMVOC emissions from 5.A. CS methodology was developed to estimate a NMVOC EF for all years in reporting period, based on the CH_4 emissions estimated in the framework of the NIR report. CH_4 emission ratio per ton of disposed waste was used, converted into a volume of CH_4 per tonne of disposed waste (using the molecular volume of CH_4) and then into a volume of biogas per tonne of disposed waste (applying the fraction of CH_4 in biogas F = 50%) and then the fraction of NMVOC in biogas (5.65 g/m^3 of landfill gas), presented in the note at the bottom of Table 3-1, Chapter 5.A of the EMEP/EEA GB2019, was applied. The NMVOC emission factor is presented in Appendix 4.

The Tier 1 EMEP/EEA methodology from GB2019 is used for emissions calculation of $PM_{2,5}$, PM_{10} and TSP. Tier 2 is not available for this source. Recommended Tier 1 emission factors from GB2019 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 provided in Appendix 9 of this Report.

Relevant activity data is an annual amount of landfilled waste. The activity data is presented in Table 6.1-1. Solid waste disposal trend during the reporting period depends on the multiple factors. For the period 1990 - 2009, there was increasing of disposed waste due to increasing of waste generation, mainly caused by increasing of living standard. 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 - 2015, there is a fluctuating trend of landfilled waste, which is affected by measures to avoid/reduce and recycle waste and remediation of illegal landfills. Since 2016, the quantities of landfilled waste have been reduced slightly as a result of more intensive implementation of the measures undertaken to avoid/reduce and recycle waste, which are still not sufficiently applied.

As the calculated CH_4 emissions in the NIR report, which are estimated using the kinetic model (IPCC FOD model), are used to calculate NMVOC emissions, the NMVOC emissions have been increased throughout the reporting period, which has only slowed down after 2016 and has started to decline from 2019. Regarding the application of the Tier 1 EMEP/ EEA methodology for $PM_{2,5}$, PM_{10} and TSP, emissions have been decreased since 2010, when the quantities of landfilled waste started to decrease, first with a fluctuating trend until 2015, and then with a declining trend.

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 solid waste disposal on land.

Table 6.1-1 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 and 5.D.2, 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.1
SNAP	090401	091005	090202	090207	090901	091002	091001	091007
Name	Solid waste disposal on land	Composting	Industrial waste incineration	Clinical waste incineration	Cremation	Residential/commercial wastewater	Industrial wastewater	Domestic wastewater - Latrines
Unit	kt	kt	kt	kt	corps	1000 m^3	1000 m^3	popul.
1990	1050.436	NE	0.250	0.140	1464	NO	104000	433305
1991	1061.948	NE	0.250	0.140	1786	NO	94488	431084
1992	1078.940	NE	0.250	0.140	2287	NO	46785	428862
1993	1111.838	NE	0.250	0.140	2760	NO	87343	428862
1994	1148.735	NE	0.250	0.140	3037	NO	34419	426640
1995	1210.797	NE	0.250	0.140	3109	54353	33758	422196
1996	1264.429	NE	0.250	0.140	3385	58009	93836	419974
1997	1327.111	NE	1.031	0.140	3476	61661	41857	417752
1998	1395.683	NE	2.168	0.140	3312	87796	30985	415531
1999	1461.113	NE	2.580	0.140	3201	88785	28924	413309
2000	1426.158	NE	3.652	0.142	3080	86579	22208	411087
2001	1497.490	NE	3.967	0.156	2972	83533	21337	408865
2002	1570.222	NE	2.206	0.158	3254	81196	21883	406643
2003	1642.954	NE	0.400	0.163	3392	84283	28408	404421
2004	1714.686	NE	0.120	0.173	3404	160277	22468	402199
2005	1787.497	NE	0.005	0.176	3633	132280	15984	399978
2006	1952.135	NE	0.350	0.188	3593	140906	19758	397756
2007	2116.773	15.230	0.285	0.205	3962	140228	14118	395534
2008	2240.286	14.860	0.316	0.165	3911	192033	16507	393312
2009	2290.490	12.490	IE	0.185	4060	206042	17445	391090
2010	1998.998	13.480	IE	0.054	4314	205709	26679	388868
2011	2033.592	14.020	IE	0.057	4344	209150	7205	386646
2012	1951.002	25.960	IE	0.093	4478	259135	11536	384425
2013	1992.832	41.091	IE	0.048	4601	295264	12574	382203
2014	1830.499	39.723	IE	0.051	4803	268002	13301	379981
2015	1918.659	74.877	IE	0.052	5373	256690	12943	377759
2016	1769.572	37.488	IE	0.056	5128	275162	11901	375537
2017	1683.640	42.444	IE	NO	5496	264034	15117	373315

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.1
SNAP	090401	091005	090202	090207	090901	091002	091001	091007
Name	Solid waste disposal on land	Composting	Industrial waste incineration	Clinical waste incineration	Cremation	Residential/commercial wastewater	Industrial wastewater	Domestic wastewater - Latrines
Unit	kt	kt	kt	kt	corps	1000 m^3	1000 m^3	popul.
2018	1601.602	47.594	IE	NO	6440	281243	17260	371093
2019	1593.402	49.610	IE	NO	6648	301436	16417	368872

Source: 5.A, 5.B.1 and 5.C - MESD, 5.D - CBS, Processing: Ekonerg Ltd

Recalculation and improvements

AD for 2018 was corrected according to data in the UNFCCC GHG emissions report (NIR), in order to harmonize AD used in both reports (IIR and NIR). The recalculation was made for 2018.

6.2. Biological treatment of waste – composting (NFR 5.B.1)

Source category description

According to GB2019, NH_3 emission resulting from composting are included in this category (Technologies – Compost production, SNAP 091005). 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 – 2019. Data on different types of waste (wet weight) have been used for NH_3 emission calculation for the period 2007 – 2019. Emissions for previous period (1990 – 2006) are not estimated because activity data are not available yet. 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 and to include them in the inventory to be complete.

The official source of activity data for waste composting is MESD that is collecting and processing waste data, among other data reported to the databases EPR and Waste Management Information System. By the Ordinance on the Environmental Pollution Register (OG 87/15), adopted according to Environment Protection Act, the MESD is collecting data on the quantities and types of waste produced, collected, recovered or disposed. The MESD 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 GB2019 are used for NH_3 emission calculation from composting. The NH_3 emission factor is presented in Appendix 4.

Relevant activity data is the annual quantity of composted municipal and industrial solid waste, sludge and other organic waste. The activity data is presented in Table 6.1-1. Activity data for the period 1990 – 2006 are not available yet. MESD coordinates conducting a comprehensive research regarding activity data and parameters for category 5.B.1 Biological treatment of waste

– composting, for the entire time series. Data will be collected from the individual composting plants within the planned project, which is in preparation.

A fluctuating trend of activity data for composting of waste during the period 2007 - 2019 was due to multiple factors, which depend primarily on the separate collection of biodegradable waste and its treatment in composting plants. In some years, such as 2012 and 2015, there was a significant increase in the amount of biodegradable waste that was composted, due to the use of the maximum capacity of all composting plants operating at that time - data are available in the databases EPR and Waste Management Information System. The planned project, which will collect data individually from each composting plant, will analyses the data throughout the reporting period, including these fluctuating data, and correct them if necessary.

Recalculation and improvements

There was no recalculation and other improvement for this source category.

Future improvements are related primarily to aggregation of accurate data for NH_3 emission calculations for the entire reporting period. Data will be collected from the individual composting plants within the planned project. This primarily refers for the pre-2007 years, for which activity data need to be investigated. The planned project will analyse the data throughout the reporting period, including fluctuating data, and correct them if necessary.

6.3. Biological treatment of waste – anaerobic digestion at biogas facilities (NFR 5.B.2)

Emissions from anaerobic digestion of organic waste at biogas facilities (NFR 5.B.2) are included in the Energy sector (NFR 1.A.1 and 1.A.4), due to energy recovery. This refers on the emissions generated by the combustion of the biogas. Biogas produced by anaerobic digestion at biogas facilities is used for electricity generation. Therefore, the notation key „IE“ (included elsewhere) has been used for the period in which the activity existed (2009 – 2019).

Potential NH_3 emissions from pre- and post-storage as well as possible leakage during solid-liquid separation are not included in the inventory yet. The feedstock for anaerobic digestion consists of agricultural manure and several biodegradable wastes. Data should be investigated for the entire activity period and included in the inventory. Data will be collected from the individual biogas plants within the planned project, which is in preparation.

6.4. Waste incineration (NFR 5.C.1)

Source category description

Waste incineration (NFR 5.C.1) includes emission of pollutants from 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 municipal waste incineration (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. In Croatia, animal carcasses are burned in several small plants. Data have not been collected so far, which will be done in one of the following reports.

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 MESD that collects data from emission point sources in the EPR database. According to the Article 21 of Ordinance on the Environmental Pollution Register (OG 87/15), 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 MESD 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. 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 90/15).

Clinical waste incineration (NFR 5.C.1.b.iii)

The official source of activity data for clinical waste incineration is MESD that collects data from emission point sources in the EPR database. According to the Article 21 of Ordinance on the Environmental Pollution Register (OG 87/15), 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 in the period 2017 – 2019, neither with energy recovery nor without energy recovery. MESD has confirmed that pharmaceutical waste was exported, and potentially infectious waste was disposed of at landfills after autoclaving. Therefore, notation key “NO” is used for the period 2017 – 2019.

Incineration plants for clinical waste in Croatia were not modern facilities. The longest-running plant had started with the incineration of clinical waste in 1986, using gas furnaces and no information on installed abatement technologies are available for this facility. The other two facilities were within the hospitals. One facility that operated from 1988 to 2011 had only installed a system of flue gas purification by a wet process. For the second facility that operated from 2001 to 2012 there are no available information on installed abatement technologies. Batch incineration without agitation was used in all facilities.

Cremation (NFR 5.C.1.b.v)

The official source of activity data for cremation is MESD 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 GB2019 (and GB2009 for emission factors not estimated in GB2019) 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 provided in Appendix 9 of this Report.

Relevant activity data is the annual quantity of incinerated industrial waste. The activity data is presented in Table 6.1-1.

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 the EPR database. Data for the period 2009 - 2019 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 OZO forms - Recovery/disposal. As there is no longer a plant operating without energy recovery since 2009, all emissions related to the incineration of industrial waste are reported within the Energy sector. Since 2009, the source category Incineration of Production Waste (NFR 5.C.1.b.i) has been marked “IE” in the report. Cement kilns are included in this source category, emissions are included in NFR 1.A.2.f.

Clinical waste incineration (NFR 5.C.1.b.iii)

The Tier 1 EMEP/EEA methodology and recommended Tier 1 emission factors from GB2019 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 provided in Appendix 9 of this Report.

Relevant activity data for clinical waste incineration is the annual quantity of incinerated clinical waste. 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. From 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 GB2019 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 provided in Appendix 9 of this Report.

Relevant activity data for cremation is the number of incinerated corpses. The activity data is presented in Table 6.1-1.

The trend of cremated bodies is fluctuating and mostly growing throughout the observed period.

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.

6.5. Open burning of waste (NFR 5.C.2)

Open burning of waste (NFR 5.C.2) is prohibited by law in Croatia. The notation key „NO“ (not occurring) has been used for the entire reporting period. which will be corrected in the next submission to "NE" (eng. Not estimated), according to the information on the implementation of the activity of open burning of waste during the periods of the year when these activities are permitted.

According to the Fire Protection Act (OG 92/2010), Article 8, paragraph 2, local self-government units make a decision on permitted open fires for burning agricultural waste - forest residues from pruning, residues from orchards and vineyards from pruning, etc. From 1 June to 31 October, and in periods when a large and very high risk of open fire has been declared in the area of the local self-government, any open fire is prohibited.

In 1995, the Waste Act was adopted in the Republic of Croatia, which prohibits the incineration of waste in the open. Furthermore, in accordance with the Fire Protection Act of 2010 and based on the Decision of each local self-government unit, citizens must obtain the approval of the competent public fire brigade and take appropriate precautions for each open fire. Also, in accordance with the Law on Sustainable Waste Management, it is allowed to use one's own waste from agriculture, wood waste, cork waste without obtaining a permit, but not in the open. The decision on the conditions for lighting fires in the open space determines the measures and rules related to the burning of these types of materials in the open space. This decision is based on the Fire Protection Act, the Forest Act, the Agricultural Land Act and the statutes at the regional level.

Data for this activity is not available at this time. In the Annual Data Collection Plan includes activity data need to be investigated (agricultural wastes – forest residues, orchard crops, etc.) for the entire reporting period, particularly for the periods that no prohibitions were in place. Data are planned to be collected within the planned inventory improvement project.

6.6. Wastewater handling (NFR 5.D)

Source category description

Activities considered within this source category are Domestic wastewater handling (NFR 5.D.1) and Industrial wastewater handling (NFR 5.D.2).

Domestic wastewater handling (NFR 5.D.1)

In the scope of this source category, Croatia is reporting emissions from wastewater treatment in residential/commercial sectors and latrines.

Processing wastewater in residential/commercial sectors is most commonly used aerobic biological treatment. Biological treatment plants have minor influence on the emissions of pollutants. Disposal of residential/commercial wastewater, particularly in rural areas where systems such as septic tanks are used, are partly anaerobic. NMVOC emissions are reporting in this source category.

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.

Industrial wastewater handling (NFR 5.D.2)

In the scope of this source category, Croatia is reporting emissions from wastewater treatment in industry. Processing wastewater is most commonly used aerobic biological treatment. Biological treatment plants have minor influence on the emissions of pollutants. NMVOC emissions are reporting in this source category.

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 GB2019 are used for NMVOC emission calculation in wastewater handling from residential/commercial sectors. The NMVOC emission factor is presented in Appendix 4.

The relevant activity data for wastewater from residential/commercial sectors are the annual amounts of total wastewater treated in residential/commercial sectors.

The source of activity data for wastewater from residential/commercial sectors is Croatian 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 – 2019 are available from statistical reports and releases. The activity data is presented in Table 6.1-1.

During the reporting period (1990 - 2019) 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.

The Tier 2 EMEP/EEA methodology and recommended Tier 2 emission factor from GB2019 are used for NH_3 emission calculation from latrine. The NH_3 emission factor is presented in Appendix 4.

The relevant activity data for latrine is the number of residents who use latrines. The source of activity data is Croatian 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 - 2019 are assessed according to these statistical data with extrapolation method. The activity data is presented in Table 6.1-1.

During the reporting period (1990 - 2019) there is a decreasing trend in the number of inhabitants using latrines, caused by increasing of living standard i.e. increase in the number of inhabitants connected to public drainage systems.

Industrial wastewater handling (NFR 5.D.2)

The Tier 2 EMEP/EEA methodology and recommended Tier 2 emission factor from GB2019 are used for NMVOC emission calculation from industrial wastewater handling. The NMVOC emission factor is presented in Appendix 4.

The relevant activity data is the annual amount of total wastewater treated in industry.

The source of activity data for wastewater from industry is Croatian 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 – 2019 are available from statistical reports and releases. The activity data is presented in Table 6.1-1.

During the reporting period (1990 - 2019) there is a fluctuating trend in the quantity of wastewater treated in industry. The quantities of wastewater treated in industry 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.

Recalculation and improvements

Domestic wastewater handling (NFR 5.D.1), Industrial wastewater handling (NFR 5.D.2)

According to the recommendation by the TERT during review in 2020, allocation of wastewater from residential/commercial sectors from category 5.D.2 to category 5.D.1 has been performed. Accordingly, recalculations of NMVOC emissions for category 5.D.1 and category 5.D.2 were performed for the period 1990 - 2018.

In order to more accurately estimate NH_3 emissions from latrine, it is necessary to collect data and provide an expert assessment of the number of inhabitants using latrine, especially for rural and urban areas, for the entire reporting period. Data will be collected within the planned project.

6.7. 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 GB2019 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 provided 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 6.7-1.

Table 6.7-1 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
2018	487	782	91	20	639
2019	478	897	104	23	732

Source: MIA, Processing: Ekonerg Ltd

During the reporting period (1990 - 2019) there is a fluctuating trend of car fires and house fires. In 2019, the number of house fires increased by around 15% compared to 2018, while the number of car fires slightly decreased.

Recalculation and improvements

There was no recalculation and other improvement in this report.

7. Natural sources (NFR 11)

7.1. 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 GB2019 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 GB2019 will be available.

Available activity data is area of forest burnt. The overview of activity data used for emission calculation from forest fire are presented in Table 7.1-1.

Table 7.1-1 Activity data of the sector 11.B – Forest fires

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

NFR 11.B	Area of forest burnt
Unit	ha
2017	48543
2018	1506
2019	2180

Data source: CBS, St.Y.

Recalculation and improvements

The recalculations of SO_2, NOx, NMVOC, CO and NH_3 emissions for 2017 and 2018 were performed due to the revision of activity statistics by the CBS. The total area burned in hectares has increased, as have emissions.

8. Recalculations and improvements

This chapter gives an overview of all recalculations and other changes included into this report within the chapters from 3 to 7. 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.

8.1. Recalculations and other changes

<u>Energy sector</u>

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

The error in subsector 1.A.1.a.iii due to the use of fuel for 2017 instead of 2018 has been corrected..

Refineries (NFR 1.A.1.b)

Error corrected due to using EF for SO_2 for 2017 instead of 2018.

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

Error in subsector 1.A.2.f.1. caused by the use of direct emissions of one plant for 2017 instead of 2018 has been corrected.

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

In NFR category 1.A.3.b, the following recalculations were performed:

- A new version of the COPERT 5 model was used
- The fuel quality year is set to match the year being calculated. In the last submission for all years quality for 1996 was used
- Emissions of PAH subsector 1A3bvi for the full range from 1990-2019 have been calculated as recommended by the ERT

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

All relevant emissions for the period from 1990 to 2018 were recalculated due to correction of emission factors for 1.A.3.d.ii National navigation (shipping).

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

Recalculation of emissions for 2018 of all pollutants from biomass due to misuse of the amount of wood for 2017 instead of 2018, which resulted in a reduction of emissions of relevant pollutants (see Annex 8).

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

Recalculation of NMVOC emissions for SNAP 0504 due to a detected minor error in data input in CollectER for 1991, 1992 and 2018.

Industrial processes and product use sector

Lime production (NFR 2.A.2)

Recalculation of all emissions (TSP, PM and BC) was performed for the period 2005-2010 and for 2012, due to harmonizing AD with NIR.

Road paving (NFR 2.D.3.b)

Croatia moved to a higher tier (Tier 2, GB2019) and therefore recalculation of emissions (NMVOC, TSP, PM and BC) was performed for the whole time-series.

Agriculture sector

Manure Management (NFR 3.B)

Recalculation of NH_3 emissions (for sows, fattening pigs, laying hens and turkeys) was performed for the period 1990-2018 due to an error in ammonia abatement potentials.

Recalculation of NH_3 and NOx emission were performed for all animal categories due to harmonization of N excretion rate (Nex) with CRF for the period 1990 -2018.

Emissions of NOx were recalculated (for laying hens) for the period 1990-2018 due to incorrect activity data.

Recalculation of PM_{10} and $PM_{2,5}$ emissions were performed for the period 1990-2018 (for sows, fattening pigs, laying hens, broilers and turkeys) due to update to Tier 1 EF's to GB 2019.

Animal manure applied to soils (NFR 3.D.a.2.a)

Recalculation of NH_3 and NOx emission were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 -2018.

Urine and dung deposited by grazing animals (NFR 3.D.a.3)

Recalculation of NH_3 and NOx emission were performed for all animal categories due to harmonization of Nex with CRF for the period 1990 -2018.

Cultivated crops (NFR 3.D.e)

Emissions of NMVOC were recalculated for 1990 – 2018 due to the change in activity data for cropland and grassland area.

Field burning of agricultural residues (NFR 3.F)

Emissions of all relevant pollutants were recalculated for the entire period 1990 – 2018 due to an error in activity data.

Waste sector

Biological treatment of waste – solid waste disposal on land (NFR 5.A)

AD for 2018 was corrected according to data in the UNFCCC GHG emissions report (NIR), in order to harmonize AD used in both reports (IIR and NIR). The recalculation was made for 2018.

Domestic wastewater handling (NFR 5.D.1) and Industrial wastewater handling (NFR 5.D.2)

According to the recommendation by the TERT during review in 2020, allocation of wastewater from residential/commercial sectors from category 5.D.2 to category 5.D.1 has been performed. Accordingly, recalculations of NMVOC emissions for category 5.D.1 and category 5.D.2 were performed for the period 1990 - 2018.

Natural sources (NFR 11)

Forest fires (NFR 11.B)

The recalculation of SO_2, NOx, NMHOS, CO and NH_3 emissions for 2017 and 2018 has been carried out to revise the activity statistics data.

8.2. 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)

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 GB2019 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).

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

For NOx emission calculation from marine diesel oil / gas oil, Croatia uses Tier 1 EF (GB2019). Plan is to recalculate emission to recommended Tier 2 EF (GB2019). For the use of Tier 2 EF's from GB 2019, it is necessary to obtain more detailed national data. This improvement is included in the Data collection program, and it will be included in one of the next submissions.

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.

In addition, one plant which produces mineral wool is currently included in emissions estimates only for the year 2019, for all emissions that are reported to the EPR for this plant. Additional research is in progress and all information on the operation of this plant prior to 2019 are currently being collected. All available data will be processed as part of the emissions calculation improvement project, which is being prepared, and its results are expected to be included in the next IIR.

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

The plan is to recalculate emissions for the entire reporting period for this category according to Tier 1 EMEP/EEA GB2019 methodology. A comprehensive emissions calculation improvement project is being prepared, which will include collection and processing of all available data and estimates of any missing data, and its results are expected to be included in the next IIR.

Domestic solvent use including fungicides (NFR 2.D.3.a)

Following TERT's recommendation, research of the Car care products category was initiated, due to a significant AD increase in the last few years, which resulted in an increase in emissions. Research is ongoing and all relevant data are being analysed in consultation with competent authorities. Croatia will report its findings on the reasons for these increases in the next IIR, and, if necessary, correct the emission estimates.

Road paving (NFR 2.D.3.b)

An emissions calculation improvement project is being prepared, which will include collection and processing of all available data on the possible use of abatement technologies within asphalt manufacturing plants. Results of this project are expected to be included in the next IIR.

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 GB2019 methodology. Since trend analysis should be carried out, the recalculations will be included in one of the next submissions, provided the required financial resources are made available.

Chemical products (NFR 2.D.3.g)

Within this category, it is planned to improve emissions calculations for activities Pharmaceutical products manufacturing and Asphalt blowing. An emissions calculation improvement project is currently being prepared, which will include collection and processing of all available data. For the activity Pharmaceutical products manufacturing, a revision of solvent use data (especially those that were estimated and not calculated) is planned, as well as the inclusion of abatement technologies used in plants. Also, for Asphalt blowing, it is planned to include in calculations the use of abatement technologies in asphalt plants. Results of this project are expected to be included in the next IIR.

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 GB2019 methodology. Since trend analysis should be carried out, the recalculations will be included in one of the next submissions, provided the required financial resources are made available.

Agriculture sector

Manure management (NFR 3.B)

The plan is also to improve emission calculation of NH_3 (Nex and other parameters used in the emission estimates that are taken from the „Improvement of NH_3, CH_4 and N_2O 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 In-country review. As a part of this revised project, updated national emission factors and parameters are expected, as well as incorporation of existing abatement measures for cattle farms. Also, planned improvement is upgrading methodology to EMEP/EEA GB2019.

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)

As the current emission estimate is probably overestimated due to using p_b value of 0.5, long term planned improvement is getting a better national estimate for the value.

Waste sector

Biological treatment of waste - composting (NFR 5.B.1)

Future improvements are related primarily to aggregation of accurate data for NH_3 emission calculations for the entire reporting period. Data will be collected from the individual composting plants within the planned project. This primarily refers for the pre-2007 years, for which activity data need to be investigated. The planned project will analyse the data throughout the reporting period, including fluctuating data, and correct them if necessary.

Biological treatment of waste - anaerobic digestion at biogas facilities (5.B.2)

Potential NH_3 emissions from pre- and post-storage as well as possible leakage during solid-liquid separation are not included in the inventory yet. The feedstock for anaerobic digestion consists of agricultural manure and several biodegradable wastes. Data should be investigated for the entire activity period and included in the inventory. Data will be collected from the individual biogas plants within the planned project, which is in preparation.

Open burning of waste (NFR 5.C.2)

Data for this activity is not available at this time. In the Annual Data Collection Plan includes activity data need to be investigated (agricultural wastes – forest residues, orchard crops, etc.) for the entire reporting period, particularly for the periods that no prohibitions were in place. Data are planned to be collected within the planned inventory improvement project.

Domestic wastewater handling (NFR 5.D.1)

In order to more accurately estimate NH_3 emissions from latrine, it is necessary to collect data and provide an expert assessment of the number of inhabitants using latrine, especially for rural and urban areas, for the entire reporting period. Data will be collected within the planned project.

Other natural sources

11 C Other natural resources - Animals

The inclusion of NH_3 emissions from category 11.C is not a priority activity and the plan is to supplement the inventory with this category in the next submission.

9. Projections

Projections of air emissions according to the aggregate NFR were prepared for the following pollutants: SO_2, NOx, NMVOC, NH_3, $PM_{2.5}$ and BC using the EMEP / EEA Manual for the inventory of air pollutant emissions 2019 (hereinafter GB2019), Chapter 8. Projections and Annex IV Projection Reporting Format Reporting Guidelines 2014

National emission projections were prepared in accordance with the annual national emission inventory for year X-3 (X = year of submission).

The submission year is 2021, and the relevant inventory is the one submitted in 2020, which refers to the reporting period 1990-2018 (IIR 2020). This means that the sectoral sets of activity data and sets of pollutant emission factors have been updated in accordance with the submission in 2020 and have been included as a starting point for the preparation of emission projections.

The projections have been prepared for 2020, 2025, 2030, 2040 and 2050 and include two sets of scenarios: a scenario with existing measures (hereinafter: WM) and a scenario with additional measures (hereinafter: WAM) taking into account consider the definition of a scenario without measures (WOM).

WAM scenario was considered for those pollutants for which the prescribed reduction obligations are not achieved in WM scenario by including additional measures by key sources of release with respect to the observed substance. Additional measures were proposed by experts with the aim of fulfilling the given obligations and were included in those categories of sources where, given the defined parameters of the basic strategic documents, it was possible to implement it.

Projections of air pollutant emissions as well as policies and measures (hereinafter: PaM) that are included in their development are coherent with national energy and climate strategic and planning documents, some of which have not yet been adopted and which are listed below:

- Energy Development Strategy of the Republic of Croatia until 2030 with a view to 2050 (OG 25/20),
- Proposal of the low-carbon development strategy of the Republic of Croatia until 2030 with a view to 2050,
- Draft Action Plan for the Implementation of the Low Carbon Development Strategy of the Republic of Croatia from 2021 to 2025 and
- Integrated National Energy and Climate Plan of the Republic of Croatia for the period from 2021 to 2030.

They are also coherent with the projections of greenhouse gas emissions reported by the Republic of Croatia in accordance with the EU and the United Nations Framework Convention on Climate Change (hereinafter: UNFCCC). This means that all activity data are needed to make pollutant emission projections based on identical baseline assumptions and parameters as well as to calculate greenhouse gas emissions. In this sense, the documents that ensure this coherence are the following:

- Report on the implementation of policies and measures to reduce emissions and increase greenhouse gas sinks in the Republic of Croatia, Ministry of Environmental and Nature Protection, March 2019.
- Report on projections of greenhouse gas emissions by sources and their removal to abysses Republic of Croatia, Ministry of Environmental and Nature Protection, March 2019.

This chapter provides an overview of the methodologies used, the basic model interface, models, assumptions and parameters, sensitivity and the resulting presentation of projection trends as well as historical emission trends (2005-2018) with a presentation of compliance with the prescribed obligations.

More details on the projections of pollutant emissions and the PaMs used can be found in the document: "Report on Projections of Pollutant Emissions into the Air" of Contract no. 517-02-3-1-20-18, Preparation of emission projections according to the collective NFR, MESD. March 2021.

9.1. Methodology and basic model interface

Methodology

Two groups of scenarios are considered; scenario with existing measures (WM) and scenario with additional measures (WAM).

Scenario with existing measures (WM): the projection covers policies and measures that are being implemented and adopted:

- Policies and measures implemented: legislation in force, or one or more voluntary agreements have been established, or financial resources have been allocated, or human resources have been mobilized.
- Policies and measures adopted: a formal decision of the Government has been made, showing a clear commitment to continue implementing

Scenario with additional measures (WAM): covers planned policies and measures

- Planned policies and measures: options that are being discussed and there is a real chance that they will be adopted and implemented in the future.

For understanding, the meaning of the following terms is stated:

- Planned policies / measures are those that are not yet formally prescribed in legislation;
- Adopted policies / measures are those agreed and prescribed in legislation,
- Implementation of a policy / measure when actions have been taken or a process is underway to take action which is often carried out over several years.

Emission projections are a function of future activity data and pollutant emission factors. Future activity data is based on data sets, including projections of economic growth (GDP), industrial growth, changes in population, changes in arable land use, and traffic requirements. Future emission factors reflect technological advances, environmental regulations, improved working conditions, new technology and / or control impact rates, and any other expected changes.

Levels 1 and 2 in accordance with GB2019 were used for the preparation of projections, and depending on the importance of individual sectors on the emission of individual pollutants. The levels were applied through the basic Leap model interface. Level 2 in the calculation of emission projections for the Republic of Croatia implies sector-specific projections of activity data and, if necessary, the inclusion of future emission factors depending on the sector (and pollutant) when reduction measures for the observed sector are included. In this sense, the application of the Level 2 model included the stratification of defined source categories into sub-activities (SNAP level) in order to include in the emission factor the introduction of new technology with lower emissions. Stratification allows for a number of years to include the envisaged measure only for that particular activity in an appropriate volume (controlled capacity) for each year of the projection.

Basic model interface

The basic model interface used to create projections is LEAP (Low Emissions Analysis Platform).

LEAP is a software tool for analysing energy policies and assessing ways to mitigate climate change. It is an integrated modelling tool intended for creating energy balances and planning the development of individual energy sectors and energy in general, which makes it suitable for monitoring energy consumption, production and exploitation of raw materials in all sectors of the economy. In addition to greenhouse gas monitoring, LEAP can also be used to analyse emissions of local and regional air pollutants and short-term air pollutants (SLCPs), making it well-suited for studying the climate benefits of local air pollution reduction. LEAP can be used to create models of different energy systems, each of which requires its own unique data structures. It supports a wide range of different modelling methodologies: on the demand side, they range from bottom-up, end-use calculation techniques to top-down macroeconomic modelling. LEAP also includes a number of optional specialized methodologies, including stock traffic modelling for areas such as traffic planning. In terms of supply, LEAP provides a range of calculation and simulation methodologies that are strong enough to model production planning and electricity sector expansion, but that are also flexible and transparent enough to allow LEAP to easily incorporate data and results from other more specialized models.

The structure of the LEAP model calculation is shown in Figure 9.1-1.

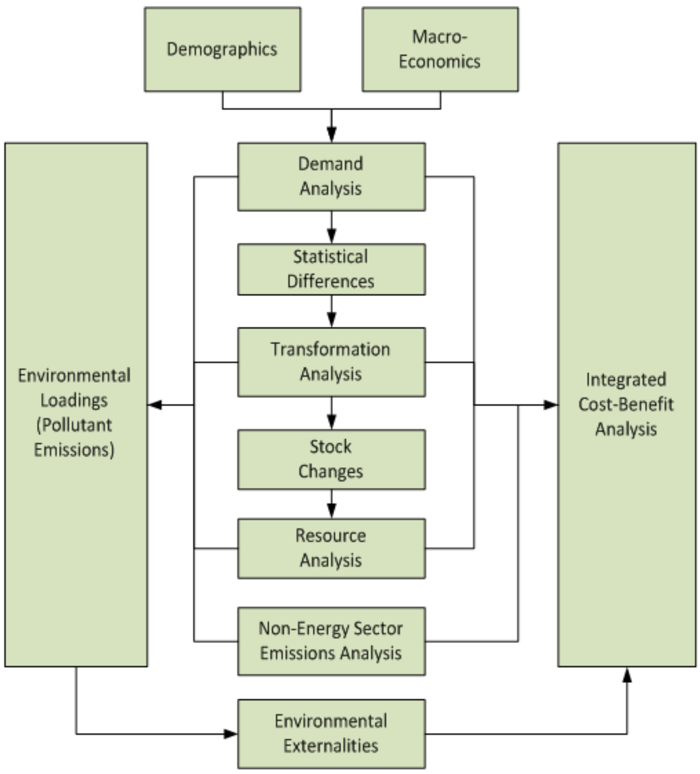


Figure 9.1-1. LEAP calculation structure

Source: Heaps, C.G., 2016. Long-range Energy Alternatives Planning (LEAP) system. [Software version: 2018.1.40] Stockholm Environment Institute. Somerville, MA, USA. https://www.energycommunity.org

The LEAP model stores data from the last historical year (X-3), all sectoral activity data and emission factors up to the SNAP level, and assumed parameters.

LEAP was also used as a framework for the integration of sector projections and thus included input data from other sector models such as models for the energy sector: MAED, MESSAGE, PLEXOS and engineering simulation models for the category of household fuel combustion - energy for sectors: Industrial processes and product use, Agriculture and Waste.

For the purpose of making national projections, LEAP has been upgraded with activities to the SNAP level so that it can be used not only for projections of greenhouse gas emissions but also for projections of pollutants into the air. In LEAP, the same baseline assumptions and activity data were used to relate to the associated emission factors.

9.2. Sources of parameters, methods and models used

Below is a list of literature, documents used to make projections of GHG emissions and pollutants.

- Guidelines for the preparation of the national report of the Parties to Annex I to the Convention (FCCC / CP / 1999/7, Part II)
- Guidelines for the preparation of information arising from Article 7 of the Kyoto Protocol (FCCC / KP / CMP / 2005/8, Appendix 2)
- Air Protection Act (OG 127/19)
- Regulation (EU) no. Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information relating to climate change at national and Union level and repealing Decision no. 280/2004 / EC
- Commission Implementing Regulation (EU) no. 749/2014 of 30 June 2014 on the structure, format, procedures for the submission and review of information submitted by Member States in accordance with Regulation (EU) no. 525/2013 of the European Parliament and of the Council
- Plan for air protection, ozone layer and climate change mitigation in the Republic of Croatia for the period from 2013 to 2017 (OG 139/13)
- Seventh National Report and Third Biennial Report of the Republic of Croatia under the United Nations Framework Convention on Climate Change (UNFCCC), Ministry of Environment and Energy, 2018.
- Report on the inventory of greenhouse gases in the territory of the Republic of Croatia for the period 1990-2018 (NIR 2020), Ministry of Environment and Energy, April 2020.
- Framework for the development of the Low-Carbon Development Strategy of Croatia, Ministry of Environmental and Nature Protection, 2013
- National Action Plan for Renewable Energy Sources, Ministry of Economy, 2013.
- Fourth National Energy Efficiency Action Plan of the Republic of Croatia for the period until 2019, Ministry of Environmental Protection and Energy, 2019.
- Long-term strategy for encouraging investments in the renovation of the national building fund of the Republic of Croatia (OG 74/14)
- Program for energy renovation of apartment buildings for the period from 2014 to 2020 with a detailed plan for the period from 2014 to 2016 (OG 78/14)

- Energy renovation program for family houses for the period from 2014 to 2020 with a detailed plan for the period from 2014 to 2016 (OG 43/14, 36/15)
- Energy renovation program for commercial non-residential buildings for the period 2014-2020 with a detailed plan for energy renovation of commercial non-residential buildings for the period 2014-2016 (OG 98/14)
- Program for energy renovation of public sector buildings for the period 2014-2015, Ministry of Construction and Physical Planning, 2013, (OG 48/17, 116/18)
- Program for energy renovation of public sector buildings for the period 2016-2020 (OG 22/17)
- Decree on substances that deplete the ozone layer and fluorinated greenhouse gases (OG 90/14)
- Waste Management Strategy of the Republic of Croatia (OG 130/05)
- Waste Management Plan of the Republic of Croatia for the period 2017 - 2022 (OG 3/17)
- Law on Sustainable Waste Management (OG 94/13, 73/17, 14/19, 98/19)
- Decision no. 529/2013 / EU of the European Parliament and of the Council of 21 May 2013 on rules for the calculation of emissions and removals of greenhouse gases arising from activities related to land use, land conversion and forestry and information on measures related to those activities
- Report on the use of revenues from the sale of greenhouse gas emission units by auctions in the Republic of Croatia in 2015, Ministry of Environmental Protection and Energy, 2017.
- Report on the use of revenues from the sale of greenhouse gas emission units by auctions in the Republic of Croatia in 2016, Ministry of Environmental Protection and Energy, 2018.
- Draft integrated national energy and climate plan of the Republic of Croatia for the period from 2021 to 2030, Ministry of Environmental Protection and Energy, 2018.
- Decision on the adoption of the Air Pollution Control Program for the period from 2020 to 2029 (OG 90/19).
- Report on the implementation of policies and measures to reduce emissions and increase greenhouse gas sinks in the Republic of Croatia, Ministry of Environmental and Nature Protection, March 2019.
- Report on projections of greenhouse gas emissions by sources and their removal to abysses Republic of Croatia, Ministry of Environmental and Nature Protection, March 2019.

The sources of methods and models used to make projections of GHG emissions and pollutants are as follows:

- EMEP/EEA air pollutant emission inventory guidebook 2019, Technical guidance to prepare national emission inventories (https://www.eea.europa.eu/publications/emep-eea-guidebook-2019),
- IPCC Guidelines for National Greenhouse Gas Inventories (http://www.ipcc-nggip.iges.or.jp/public/2006gl/),
- MAED (Model for Analysis of Energy Demand) available at: https://www.iaea.org/topics/energy-planning/energy-modelling-tools,

- MESSAGE (Model for Energy Supply Strategy Alternatives and their General Environmental Impact) available at: https://www.iaea.org/topics/energy-planning/energy-modelling-tools,
- PLEXOS (PLEXOS Market Simulation Software), https://energyexemplar.com/software/#features,
- LEAP (Low Emissions Analysis Platform), https://www.energycommunity.org/default.asp?action=introduction,
- IPPU model, engineering simulation model performed in a tabular calculation interface,
- Waste model, engineering simulation model performed in a spreadsheet calculation interface,
- Model for the category combustion in the residential - energy, engineering simulation model performed in a tabular calculation interface and
- Agriculture model, an engineering simulation model performed in a spreadsheet calculation interface.

9.3. Sectoral methods and models, assumptions and visualization of projected key flows

This subchapter presents the sectoral methods and models, assumptions and visualization of the projection of key flows, which, together with future emission factors, determined the trends of projections of pollutant emissions.

Projections of all sectors were prepared using engineering simulation models incorporated into LEAP. Engineering simulation models have been prepared for the category of Residential fuel combustion - energy and for Industrial processes and product use, Agriculture and Waste sectors.

The models were performed in a tabular calculation interface and structured according to the tabular structure of the GHG and pollutant emission inventory in accordance with the following UNFCCC (2006 IPPC Guidelines) and UNECE CLRTAP (GB2019).

Their detail with respect to LPS goes to the level of individual production units, existing and future, and for other categories it is at the level of NFR / SNAP sources of discharge.

The models are of the "bottom-up" type, as they are based on sectoral data and individual emission sources, and CO_2, CH_4, N_2O, HFC, PFC and SF_6 emissions from greenhouse gases and NOx, NMVOC, NH_3, $PM_{2.5}$ and BC of pollutants.

Projections are made for the period 2020-2050 on an annual basis, with a step every 5 years until 2030 and every 10 years until 2050.

9.3.1. Energy (stationary and mobile combustion and fugitive emissions)

Methodology and models

In making projections for the Energy sector (mobile and fixed), the simulation model MAED (Model for Analysis of Energy Demand) and the simulation-optimization model MESSAGE (Model for Energy Supply Strategy Alternatives and their General Environmental Impact) were used, in which the energy sector model was created. Croatian.

For the Fugitive Emissions from Fuel (NFR 1B) energy subsector, projections were made based on energy balance flows, refinery production capacity, crude oil production, oil imports, natural gas production and consumption, gasoline production, and natural gas and oil extraction intensity projections.

MAED model

The MAED model assesses future energy needs based on medium- and long-term scenarios of socio-economic, technological and demographic development. Energy consumption is broken down into a large number of final consumption categories corresponding to different products and services. The impacts of social, economic and technological driving factors from a particular scenario are assessed. They are combined for the overall picture of future growth in energy consumption. - Final energy consumption projections for all forms of energy (eg fossil fuels, biomass, solar energy, electricity, etc.) are made using a bottom-up approach that allows the analysis of structural changes on the energy use side in different sectors (eg industry , household, service sector, transport). Ultimate energy efficiency measures are important for achieving climate change mitigation goals.

The MAED model was used to analyse the final energy consumption. Final energy consumption scenarios take into account the necessary reduction of greenhouse gas emissions by 2030/2050. in all energy-consuming sectors, as well as feedback on expected climate change on the ways and dynamics of consumption of different forms of energy (e.g. changes in seasonal energy use, changes in heating and cooling needs, etc.). The output data from the model are energy consumption and driving parameters (e.g. population number and structure, GDP structure, etc.). These data were analysed for two geographical and climatic zones of Croatia - continental Croatia and Adriatic Croatia (also official statistical regions). The time coverage of the model is until 2050, with annual time steps with seasonal and daily variations.

MESSAGE model

The MESSAGE model combines technologies and fuels to build so-called "energy chains", enabling the mapping of energy flows from supply (resource extraction) to demand (energy services). The model can help design long-term strategies by analysing optimal energy mix costs, investment needs and other costs for new infrastructure, security of energy supply, energy resource utilization, rate of introduction of new technologies (technological learning), environmental constraints. For each selected scenario, based on the availability of local resources and sources of primary forms of energy, the possibilities of meeting the needs for all forms of energy (e.g. heat, electricity, natural gas, biomass, etc.) were analysed.

The MESSAGE model was used to optimize the power system and district heating systems (in terms of heat production), as well as the PLEXOS model to analyse / confirm the feasibility of the power system on an hourly basis in selected characteristic years. The output of the model shows the possibility of meeting the needs for all forms of energy (e.g. heat, electricity, natural gas, biomass, etc.). The time coverage of the model is until 2050 with annual time steps, and the model includes seasonal and daily differences.

The MESSAGE model uses the MAED model for input data. Based on this, for networked systems (e.g. electricity, natural gas) the analysis and optimization of the operation and development of the generation, transmission / distribution and distribution system to end users on the principle of minimum costs, taking into account environmental impacts (including greenhouse gas emissions)), strategic determinants in the field of energy security and the impact of participation in the functioning of the regional market (possible cooperation in the exploitation of regional energy potential and infrastructure exchange). The availability and condition of the existing energy infrastructure, replacement of elements and construction of new system elements (e.g. power plants, transmission lines, pipelines, etc.) were also considered.

PLEXOS model

PLEXOS Market Simulation Software provides robust simulation capabilities in electrical, water and gas systems focused on complete user control, transparency and accuracy through a number of limitations and uncertainties.

For validation and evaluation - the MESSAGE model for optimization of electric power system and centralized thermal systems (in the part of heat production) and PLEXOS model for analysis / confirmation of feasibility of electric power system operation at hourly level in selected characteristic years were used. The use of PLEXOS is to analyse / confirm the feasibility of the power system, per hour, in selected characteristic years. PLEXOS uses the results from the MAED and MESSAGE models for input data, and the model is structured based on the structure of the power system.

Model for category NFR 1.A.4.b.i Residential

The model for the discharge category NFR 1.A.4.b.i Residential, which is the key source of $PM_{2.5}$, NOx, NMVOC and BC emissions from wood biomass combustion, is an engineering simulation model performed in a tabular calculation interface. The model includes the defined impact dynamics of low-emission wood biomass combustion technologies by 2050 for WM and WAM scenarios (Table 9.3-1). The household model is built into the LEAP model via emission factors for SO_2, NOx, NMVOC, NH_3, $PM_{2.5}$ and BC in which the dynamics of the impact of lower emission combustion technologies is incorporated.

The dynamics of the impact is also based on two Commission (EU) regulations implementing Directive 2009/125 / EC (OJ L 193):

- COMMISSION REGULATION (EU) 2015/1185 of 24 April 2015 implementing Directive 2009/125 / EC of the European Parliament and of the Council as regards ecodesign requirements for solid space heating appliances (applicable from 1 January 2022) and
- COMMISSION REGULATION (EU) 2015/1189 of 28 April 2015 implementing Directive 2009/125 / EC of the European Parliament and of the Council as regards ecodesign requirements for solid fuel boilers (applicable from 1 January 2020)

These two regulations are essential for the assumption of replacing old wood biomass combustion technologies in households with new ones because they define specific ecodesign requirements for PM, NMVOC, NOx and CO emissions that suppliers must place on the market. The assumption is that by applying these two regulations, it will not be possible to procure a device (boilers) on wood biomass on the market, which does not meet the prescribed requirements, i.e. it will not be possible to procure a device called old conventional technologies (devices with high emissions of pollutants).

Assumptions

Table 9.3.1-1 contains more detailed assumptions used in making projections for the Energy sector.

Table 9.3.1-1 Assumptions for projections – Energy (stationary and mobile combustion and fugitive emissions)

ENERGY (STATIONARY AND MOBILE COMBUSTION AND FUGITIVE EMISSIONS)

Final energy demand

Final energy demand is projected in different sectors - industry, transport, services, residential and agriculture, fisheries and forestry. The basis for the projections are national macroeconomic parameters. During the energy intensity projections, the development of technology and changes in habits were taken into account. In WM and WAM scenarios, the impacts of each measure were modelled.

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 duty vehicles) and by type of technology or purpose (passenger and freight) and by types of technologies and fuel used.
- services – by branches (tourism, trade, education, health), climatic zone (coastal or continental Croatia), purpose (heating, preparation of domestic hot water, cooking, cooling, electrical appliances and lighting), and by type of fuel used. Heating demand is modelled on the level of useful and final energy.
- residential – by climatic zone (coastal or continental Croatia), purpose (heating, preparation of domestic hot water, 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 - the scenario of average fertility and average migration is assumed, in accordance with the population projections made for the purposes of drafting the Energy Strategy: Population projections of the Republic of Croatia, 2018.

WM scenario

In the period up to 2050, the expected development is simulated based on existing measures and market progress:

- market improvements in energy efficiency and fuel substitution in the industrial sector,
- renovation of the housing stock (renovation, replacement and new construction) at the rate of 0.75% of the area of the housing stock per year up to the standard of almost zero energy consumption (including the use of renewable energy sources),
- the impact of electric and hybrid vehicles is expected, whose share in the total passenger activity in road traffic will reach 2.5% in 2030, and 30% in 2050, respectively,
- the share of rail transport in the structure of freight activity recorded a very slow increase; diesel-powered N2 and N3 heavy duty vehicles will continue to dominate,

The category NFR 1A4bi Residential is a key source of $PM_{2.5}$, NOx, NMVOC and BC emissions from wooden biomass combustion, so in the preparation of the projections, the assumed impact dynamics of wood biomass combustion technologies with lower emissions by 2050 were used for the WM scenario according to the table below:

Technology for biomass combustion	Technology influence dynamics for WM scenario					
	2018	2020	2025	2030	2040	2050
Open stoves, fireplaces	10%	10%	8%	7%	7%	7%
Boilers < 50 kW	18%	17%	14%	12%	12%	12%
Conventional stoves	35%	33%	28%	24%	24%	24%
Advanced / ecolabelled stoves and boilers	12%	13%	16%	19%	19%	19%
High-efficiency stoves	21%	23%	28%	33%	33%	33%
Pellet stoves and boilers	4%	4%	5%	6%	6%	6%

The WM scenario assumes the replacement of old technologies by a total of 20% by 2030 with a step of 3% (2.9%) per year from the defined percentages in 2018 (2019-2029). At the same time, in order to achieve a total share of all technologies of 100%, new technologies are growing each with

ENERGY (STATIONARY AND MOBILE COMBUSTION AND FUGITIVE EMISSIONS)	
	a step of 4.88% per year from the shares defined for 2018. From 2031 to 2050, the shares remain the same as in 2030. assuming no major influence of new technologies.
WAM scenario	Continue to promote energy efficiency beyond 2020, with the following key assumptions: • renovation of 1.3% of buildings per year to almost zero energy consumption standards (including the use of renewable energy sources), • the influence of electric and hybrid vehicles is expected, whose share in the total passenger activity in road traffic will reach 3.5% in 2030, and 65% in 2050, • incentive measures for co-financing the purchase of vehicles powered by alternative fuels until the moment when the minimum representation of vehicles on the market is reached. The minimum level of representation will be considered a share of 1 % in the total number of vehicles registered in the country, • an increase in the share of freight transport activities realized by rail (electric locomotives) to about 30% in 2050, • in urban passenger transport, electrification of almost 85% of total passenger activity is expected by 2050, • improvements in energy efficiency in industry along with fuel replacement towards greater use of renewable energy and electricity. The category NFR 1A4bi Residential is a key source of $PM_{2.5}$, NOx, NMVOC and BC emissions from wooden biomass combustion, so in the preparation of the projections, the assumed impact dynamics of wood biomass combustion technologies with lower emissions by 2050 were used for the WAM scenario according to the table below:

Technology for biomass combustion	Technology influence dynamics for WAM scenario					
	2018	2020.	2018	2030.	2018	2050.
Open stoves, fireplaces	10%	9%	6%	3%	3,0%	3%
Boilers < 50 kW	18%	16%	12%	8%	8,0%	8%
Conventional stoves	35%	31%	20%	10%	10,0%	10%
Advanced / ecolabelled stoves and boilers	12%	16%	24%	33%	33,0%	33%
High-efficiency stoves	21%	22%	24%	26%	26,0%	26%
Pellet stoves and boilers	4%	7%	13%	20%	20,0%	20%

The WAM scenario assumes a more intensive replacement of old technologies by a total of 41.7% by 2030, by 6.386% (open fireplaces), 5.01% (boilers) and 6.478% (conv. Stoves and closed fireplaces) with steps as follows: -0.64%, -0.89% and -2.25% per annum of the defined percentages in 2018 (2019-2029). In order to reach the total share of all technologies of 100%, new technologies are growing by: 15.557% (eco-furnaces), 2.025% (efficient furnaces) and 37.88% (pellet systems) from 2018 to 2030 with steps as follows: 1.89%, 0.43% and 1.47% per annum of the shares defined for 2018. From 2031 to 2050, the shares remain the same as in 2030, assuming no major impact new technologies.

Energy transformations and resources	
The power system was analysed by simulating market development using software for hourly optimization of operation and development. The price of emission allowances in the EU ETS is assumed as in the 2016 EU reference scenario. The refinery operation simulation was done to meet domestic demand as much as possible with existing capacities, meaning without building new refineries and with reducing production in the WM and WAM scenarios.	
WM scenario	Assumptions: • by 2020, the installed capacity of power plants using renewable energy sources in accordance with the National Action Plan for Renewable Energy Sources until 2020 (2013)

ENERGY (STATIONARY AND MOBILE COMBUSTION AND FUGITIVE EMISSIONS)	
	and the Tariff System for Renewable Energy Sources and Efficient Cogeneration (OG 133/13, 151/13, 20/14, 107/14 and 100/15), • in the period after 2020, it was simulated with software for long-term operation and construction of the power system according to the principle of the lowest cost or ideal market conditions. The model also includes a part of the district heating system in the area of large cities that is supplied from cogeneration, • the price of emission units is assumed as in the EU Reference Scenario 2016, • the analysis showed that renewable energy sources will be competitive and without the need for financial support for solar and wind power plants, • the analysis shows that new coal-fired power plants are not competitive due to the increase in the price of emission permits and the reduction of investment costs in renewable energy sources, • it is assumed that the level of net electricity imports is gradually decreasing.
WAM scenario	Assumptions include the continuous development of a policy to encourage renewable energy sources beyond 2020: • in the period after 2020, it was simulated with software for long-term operation and construction of the power system according to the principle of the lowest cost or ideal market conditions. The model also includes a part of the district heating system in the area of large cities that is supplied from cogeneration, • the price of emission units is assumed as in the EU Reference Scenario 2016, • the analysis showed that renewable energy sources will be competitive and without the need for financial support for solar and wind power plants, • the analysis shows that new coal-fired power plants are not competitive due to the increase in the price of emission permits and the reduction of investment costs in renewable energy sources, • it is assumed that the level of net electricity imports is gradually decreasing.

Source: Report on projections of greenhouse gas emissions, and Report on projections of air pollutant emissions, Ekonerg Ltd.

Parameters

The parameters used for the Energy sector for the WM and WAM scenarios are presented in Tables 9.3.1-2 to 9.3.1-6, and relate to total fuel consumption, electricity production, direct energy consumption, transport and climate.

Table 9.3.1-2 Parameters for projections – Energy: Total fuel consumption, WM and WAM scenarios

Parameter, scenario	Unit	2018	2020	2025	2030	2040	2050
Coal and coke, WM	PJ	14.430	15.603	12.623	9.643	1.195	0.832
Coal and coke, WAM	PJ	14.430	15.603	11.811	8.019	1.014	0.572
Liquid fossil fuels, WM	PJ	167.811	150.880	153.089	155.298	145.211	141.268
Liquid fossil fuels, WAM	PJ	167.811	150.880	151.947	153.014	136.787	131.554
Gaseous fossil fuels, WM	PJ	96.434	97.893	100.154	102.415	112.891	109.744
Gaseous fossil fuels, WAM	PJ	96.434	97.893	96.563	95.232	93.332	88.927
Biomass without liquid biofuels (e.g. wood), WM	PJ	52.387	49.476	54.421	59.365	53.785	44.635
Biomass without liquid biofuels (e.g. wood), WAM	PJ	52.387	49.476	52.748	56.020	47.575	40.083
Liquid biofuels (e.g. bio-oils), WM	PJ	1.130	2.383	2.826	3.268	12.749	12.808

Parameter, scenario	Unit	2018	2020	2025	2030	2040	2050
Liquid biofuels (e.g. bio-oils), WAM	PJ	1.130	2.383	3.935	5.486	11.610	8.110
Solar, WM	PJ	1.228	1.297	2.415	3.533	7.714	11.961
Solar, WAM	PJ	1.228	1.297	3.181	5.065	11.118	17.300
Other renewable (wind, geothermal etc.), WM	PJ	81.941	36.026	42.439	48.851	62.640	70.934
Other renewable (wind, geothermal etc.), WAM	PJ	81.941	36.026	42.278	48.529	66.614	77.948

Table 9.3.1-3 Parameters for projections – Energy: Total electricity production, WM and WAM scenarios

Parameter, scenario	Unit	2018	2020	2025	2030	2040	2050
Coa, WM	GWh	1445.23	1549.57	1266.77	983.98	8.87	9.16
Coal, WAM	GWh	1445.23	1549.57	1149.38	749.20	8.89	9.10
Liquid fossil fuels, WM	GWh	50.22	28.20	28.18	28.17	27.23	31.56
Liquid fossil fuels, WAM	GWh	50.22	28.20	27.96	27.71	24.43	25.98
Gaseous fossil fuels, WM	GWh	2060.63	2413.88	2509.05	2604.21	3860.39	3927.92
Gaseous fossil fuels, WAM	GWh	2060.63	2413.88	2522.26	2630.63	2703.17	3699.61
Renewable, WM	GWh	11547.93	10738.93	12464.48	14190.02	18307.57	21955.91
Renewable, WAM	GWh	11547.93	10738.93	12384.43	14029.92	17823.46	23763.92

Table 9.3.1-4 Parameters for projections – Energy: Final energy demand, WM and WAM scenarios

Parameter, scenario	Unit	2018	2020	2025	2030	2040	2050
Industry, WM	PJ	46.541	47.557	48.628	49.684	48.251	45.127
Industry, WAM	PJ	46.541	47.557	48.569	49.566	47.912	44.610
Transport, WM	PJ	92.347	93.971	95.460	97.119	91.669	78.303
Transport, WAM	PJ	92.347	93.971	93.259	92.640	86.017	68.435
Residential, WM	PJ	98.662	96.783	99.314	102.737	95.180	83.056
Residential, WAM	PJ	98.662	96.783	96.389	97.186	83.799	68.595
Agriculture, forestry and fishing, WM	PJ	9.158	8.854	8.588	8.322	7.878	7.178
Agriculture, forestry and fishing, WAM	PJ	9.15	8.854	8.586	8.318	7.874	7.176
Services, WM	PJ	33.242	34.509	37.009	39.757	41.852	41.680
Services, WAM	PJ	33.242	34.509	36.700	39.157	39.515	36.784
Other, WM and WAM	PJ	-	-	-	-	-	-

Table 9.3.1-5 Projection parameters – climate, WM and WAM scenarios

Parameter	2018	2020	2025	2030	2040	2050
Degree - day of heating	2288	2288	2261	2235	2181	2181

Table 9.3.1-6 Projection parameters - Energy: Transport, WM and WAM scenario

Parameter, scenario	Unit	2018	2020	2025	2030	2040	2050
Number of passenger kilometers, all forms, WM and WAM	10^9 pkm	40.6	41.0	42.2	43.9	44.9	44.7
Freight, WM and WAM	10^9 tkm	11.6	11.6	11.6	11.6	11.6	11.6
Energy consumption in road transport, WM	kten	1,995.5	2,031.3	2,051.6	2,077.8	1,930.7	1,572.1
Energy consumption in road transport, WAM	kten	1,995.5	2,031.3	1,998.2	1,969.1	1,789.5	1,291.3

Visualization of projected key energy flows

Visualization of the projection of key energy flows in WM and WAM scenarios for NFR categories of fixed Energy: 1.A.1.a, 1.A.1.b, 1.A.1.c is presented in Figure 9.3.1-1, for 1.A.2 in Figure 9.3.1-2 and for 1.A.4 and 1.A.4.b.i in Figure 9.3.1-3, while the movement of energy flows in NFR 1.A.3.b Road traffic shown in Figure 9.3.1-4.

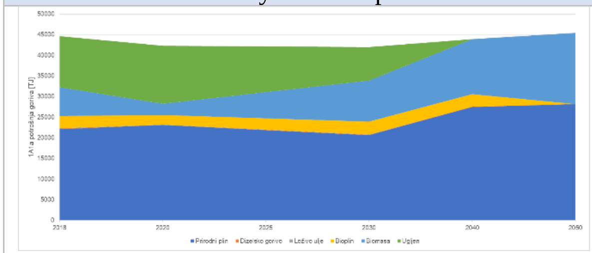
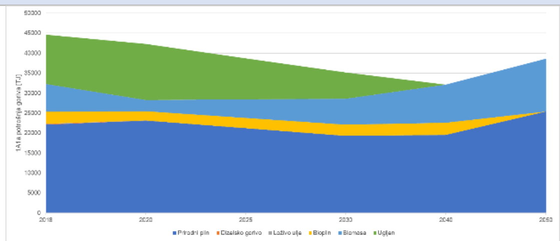
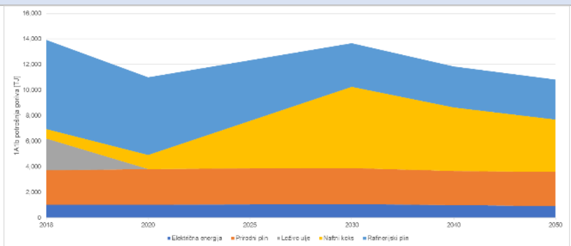
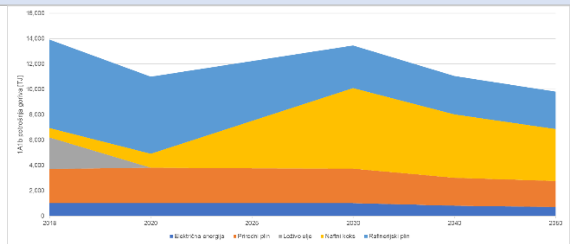
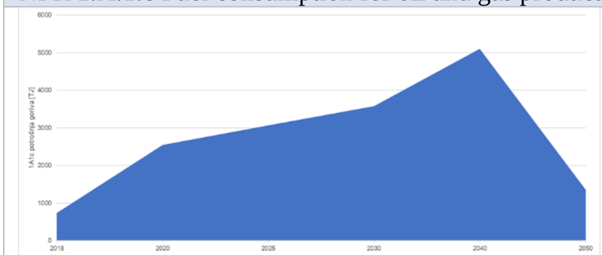
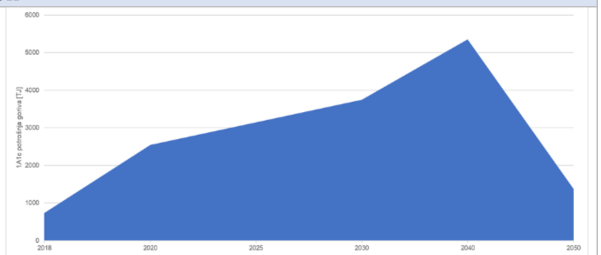
WM scenario	WAM scenario
NFR 1.A.1.a Electricity and heat production	
	
NFR 1.A.1.b Refineries	
	
NFR 1.A.1.c Fuel consumption for oil and gas production	
	

Figure 9.3.1-1 Energy flow trends in NFR categories of stationary Energy: 1.A.1.a, 1.A.1.b, 1.A.1.c, for WM and WAM scenarios

Source: Ekonerg Ltd, Ref. 58

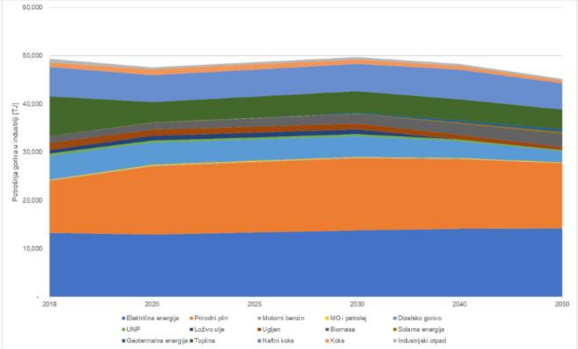
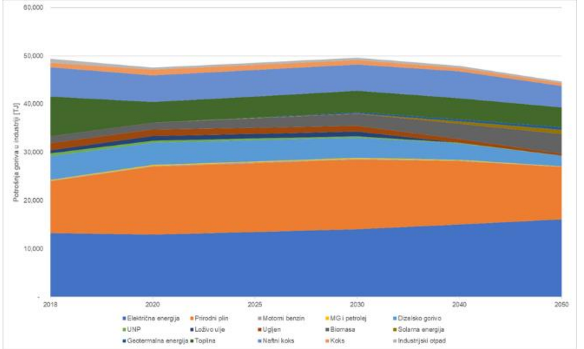
WM scenario	WAM scenario
NFR 1.A.2 Industry and construction	
	

Figure 9.3.1-2 Energy flow trends in NFR category of stationary Energy: 1.A.2 for WM and WAM scenarios

Source: Ekonerg Ltd, Ref. 58

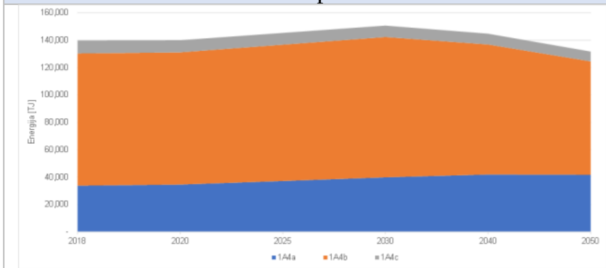
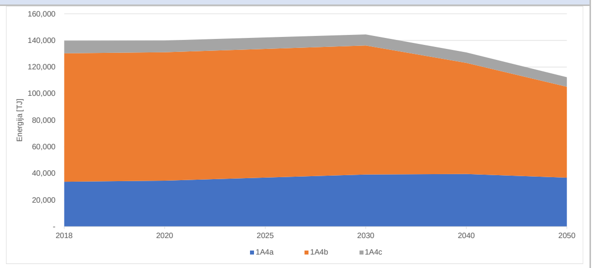
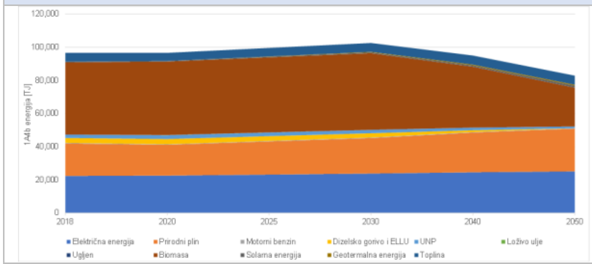
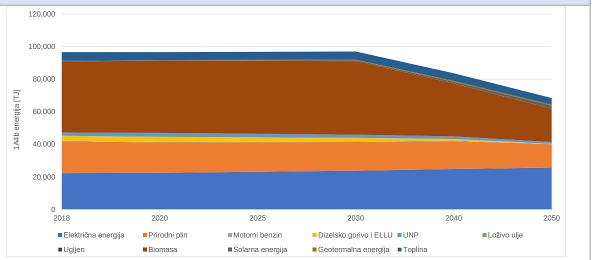
WM scenario	WAM scenario
NFR 1.A.4 General consumption	
	
NFR 1.A.4.b Residential	
	

Figure 9.3.1-3 Energy flow trends in NFR categories of stationary Energy: 1.A.4, 1.A.4.b.i for WM and WAM scenarios

Source: Ekonerg Ltd, Ref. 58

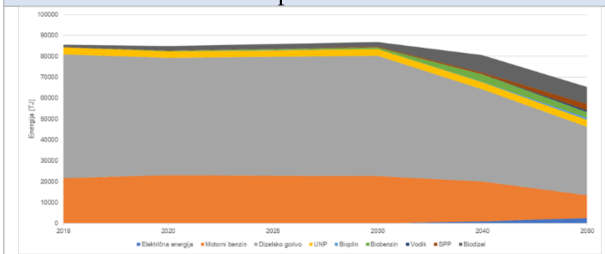
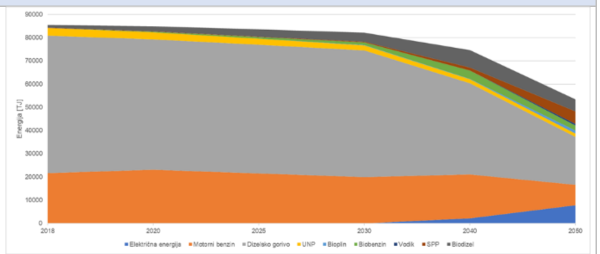
WM scenario	WAM scenario
NFR 1.A.3.b Road transport	
	

Figure 9.3.1-4 Energy flow trends in NFR 1.A.3.b Road transport for WM and WAM scenarios

Source: Ekonerg Ltd, Ref. 58

9.3.2. Industrial Processes and Product Use

Methodology and models

It should be noted that methodology used in the national inventory for certain key NMVOC sources from the use of solvents and solvent-based products does not include abatement technologies. Therefore, historical trend does not show a decrease in NMVOC emissions as a result of the implementation of existing legislation, such as Regulation on limit values of VOC content in certain paints and varnishes used in construction and vehicle finishing products (OG 69/13). Projected emission factors in 2020 assume the implementation of prescribed reduction measures within NFR 2.D - 2L categories. For other years until 2050, a conservative approach has been applied, which means further implementation of measures with the assumption that emission factors will remain constant (2020-2050).

Assumptions

Table 9.3.2-1 provides more detailed assumptions used in making projections for the Industrial Processes and Product Use sector.

Table 9.3.2-1 Assumptions for projections – Industrial Processes and Product Use

INDUSTRIAL PROCESES AND PRODUCT USE	
The projections were made on the basis of the expected development of individual industries, which includes the targets for 2035 and 2050, respectively. Emission projections are based on the situation and projections of macroeconomic parameters from 2018 - the annual growth rate of gross domestic product and gross value added and population decline, as well as the results of sectoral analysis and studies (cement production and production of chemicals: ammonia, nitric acid, NPK fertilizers, sulfuric acids and urea).	
WM scenario	Assumptions • no installation of additional capacities; • Production will reach maximum values by 2035. The Industrial Strategy of the Republic of Croatia 2014-2020 defines the goals of industrial development and key indicators of Croatian industry in the period 2014-2020. According to the "realistic scenario", by the year 2020, reaching the level of physical volume of industrial production from 2008 is expected, when the highest level of economic activity was achieved 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 cement and chemicals production (ammonia, nitric acid, NPK fertilizers, sulfuric acid and urea) and projected macroeconomic indicators of gross value added by other industries, the annual growth rate of gross domestic product and population decline. The scenario includes the application of measures defined by strategic and planning sectoral documents included in the business policy of cement and chemical producers, which is conditioned by market demands, laws and regulations and requirements for the application of best available techniques in production processes. Of the sectoral analysis, it is important to point out the planned increase in sulfuric acid production (based on data obtained from manufacturers), which results in a significant increase in projected SO2 emissions from this activity (expected production is over 2.5 times higher in 2030 and about 3.5 times higher in 2050, compared to 2018). The methodology used in the national inventory for certain key NMVOC sources from the use of solvents and solvent-based products does not include abatement technologies. Therefore, historical trend does not show a decrease in NMVOC emissions as a result of the implementation of existing legislation, such as Regulation on limit values of VOC content in certain paints and varnishes used in construction and vehicle finishing products (OG 69/13). Projected emission factors in 2020 assume the implementation of prescribed reduction measures and for other years until 2050, a conservative approach has been applied, which means further implementation of measures with the assumption that emission factors will remain constant.

INDUSTRIAL PROCESES AND PRODUCT USE	
WAM scenario	Assumptions: • application of cost-effective measures to reduce process emissions in cement production by gradually reducing the share of clinker in production, ie by increasing the share of mineral additives in cement. The main emissions from cement production are emissions from the kiln system. However, only particulate emissions are considered in this sector, which mainly originate from activities carried out in the production of clinker in kilns. Kiln emissions are a combination of combustion and production process emissions, but emissions of other pollutants are assumed to originate mainly from fuel combustion and are therefore allocated to the Energy sector. Increasing the share of mineral additives in cement reduces the share of clinker and thus the need for clinker production, and consequently reduces emissions from this production process. It is assumed that the share of clinker in cement in 2020 is the same as in the WM scenario, in 2030 it is 65%, and in 2050 50%.

Source: Report on projections of greenhouse gas emissions, and Report on projections of air pollutant emissions, Ekonerg Ltd.

Parameters

Parameters used for sector NFR 2 Industrial processes and product use are presented in Table 9.3.2-2, and relate to clinker production.

Table 9.3.2-2 Assumptions for projections – Industrial Processes and Product Use

Parameter (t)	2018	2020	2025	2030	2040	2050
Clinker production – WM scenario	2325845	2497500	2525000	2585000	2585000	2585000
Clinker production – WAM scenario	2325845	2139298	2223431	2307565	2041308	1775050

Visualization of projected key production flows

Projections of key production flows in WM and WAM scenarios for the sector NFR 2 are presented in Figure 9.3.2-1, with the production of NPK fertilizers and urea, and in Figure 9.3.2-2, with the trend of GDP projection for manufacturing industry and GDP of the construction sector.

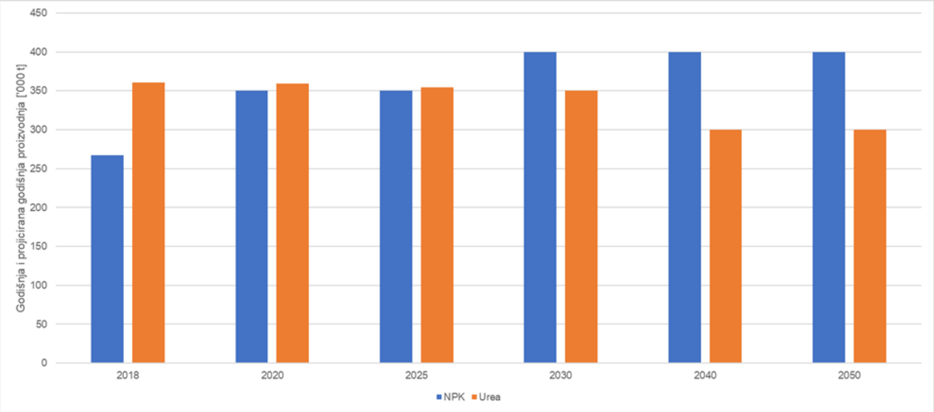


Figure 9.3.2-1 Production of NPK fertilizers and urea

Source: Ekonerg Ltd, Ref. 58

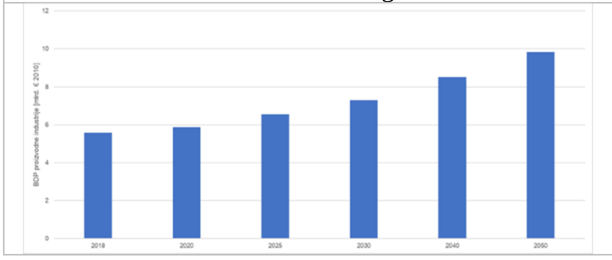
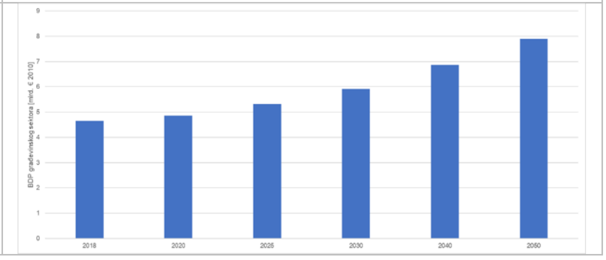
<table>
<tr><th colspan="2">WM and WAM scenario</th></tr>
<tr><td>GDP of the manufacturing industries</td><td>GDP of the construction sector</td></tr>
<tr><td></td><td></td></tr>
</table>

Figure 9.3.2-2 GDP projections for manufacturing industries and construction sector

Source: Ekonerg Ltd, Ref. 58

9.3.3. Agriculture

Methodology and models

Described in the introductory part of subsection 9.3, without additional specifics.

Assumptions

Table 9.3.3-1 provides more detailed assumptions used in making projections for the Agriculture sector.

Table 9.3.3-1 Projection assumptions - Agriculture

<table>
<tr><th colspan="2">AGRICULTURE</th></tr>
<tr><td colspan="2">The projections were made based on the expected future state of the key parameters.
When forming the reference scenario, the model of emission projections was set using the following assumptions:
• Projections of the trend of activity input data for livestock and crop production were taken from the global FAO[39] report "The future of food and agriculture - alternative routes until 2050", using the BAU (business as usual) scenario of the report.
• Use of mineral fertilizers obtained by extrapolation of the existing trend for the period from 2000 to 2018.
• Implementation of the rural development program for the period 2014-2020.
• Minor changes in the livestock system and diet (changes in the fertilization system and genetic progress, increased digestibility and feed quality.
Estimation uncertainty due to lack of adequate and reliable statistical and economic indicators.
Both scenarios, WM and WAM, assume that there will be a retention of the existing level or a slight decrease in livestock (with the exception of a slight increase in non-dairy cattle and pigs), and a retention or slight increase in crop production.</td></tr>
<tr><td>WM scenario</td><td>Assumptions:
• implementation of the Rural Development Program in the period 2014-2020, including changes in the cattle management system (improvement of facilities or housing as well as manure removal systems and genetic improvements) and animal nutrition (feed processing</td></tr>
</table>

[39] FAO 2018. The future of food and agriculture – Alternative pathways to 2050. Rome. 224 pp. Licence: CC BY-NC-SA 3.0 IGO

AGRICULTURE	
	with the aim of increasing digestibility, improving feed quality and improving grazing systems, feed processing to increase digestibility, use of feed additives); • the application of mineral fertilizers (nitrogen) to the soil is maintained at the level resulting from the trend of mineral fertilizer consumption in the period from 2000 to 2018 - that is, it assumes that there will be no increase in mineral fertilizer consumption despite estimated changes in crop production and livestock production.
WAM scenario	Assumptions: • change in the diet of cattle and pigs and the quality of animal feed, • anaerobic digestion of manure and biogas production, • improvement of buildings or dwellings as well as manure management systems, • improvement and change of tillage system (reduced tillage) i • improving the method of application of mineral fertilizers. The positive effect of the implementation of measures on the total greenhouse gas emissions in the agricultural sector is reflected in the direct reduction of emissions of methane and nitrogen compounds.

Source: Report on projections of greenhouse gas emissions, and Report on projections of air pollutant emissions, Ekonerg Ltd.

Parameters

The parameters used for the projections in the NFR 3 Agriculture sector are shown in Table 9.3.3-2.

Table 9.3.3-2 Assumptions for projections - Agriculture

Parameter	Unit	2018	2020	2025	2030	2040	2050
Dairy cows	1000 animal	135.851	177.177	170.573	159.784	148.026	142.363
Non-dairy cattle	1000 animal	278.274	279.623	283.526	187.661	295.837	302.723
sheep	1000 animal	636.294	652.763	639.040	620.725	595.281	575.703
goats	1000 animal	80.064	69.227	67.846	65.910	63.417	61.548
horses	1000 animal	23.649	22	23	24	26	27
mules / asses	1000 animal	3.705	2.2	2.5	3	3.7	4
pigs	1000 animal	1080.462	1200.047	1204.252	1225.881	1215.717	1213.438
poultry	1000 animal	11412.804	10281.589	10187.596	10074.633	9885.265	9649.030
laying hens	1000 animal	2777.952	3781.002	3720.952	3652.707	3525.529	3441.613
broilers	1000 animal	7525.121	4970.586	4891.644	4801.926	4634.736	4524.418
pure	1000 animal	442.028	612	630	648	690	673.200
ducks	1000 animal	55.603	204	210	216	230	224.400
geese	1000 animal	16.089	105	105	108	115	112.200
crops	ha	1526059	1536813	1536813	1536813	1536813	1536813
grassland	ha	1185967	1185328	1182135	1178942	1172555	1166168
Total burned crop area	kg of dry matter	772728	1228878	1245831	1312653	1312054	1188523
Mineral N fertilizers (WM)	kg	97748276	100587216	98866910	95946604	91305992	86665380
Mineral N fertilizers (WAM)	kg	97748276	100233589	97380819	94554928	88983396	83217181

Visualization of projected key energy flows

Visualization of the projection of key agricultural flows in WM and WAM scenarios for the NFR 3 Agriculture sector is presented in Figure 9.3.3-1 with a trend of the number of animals by species and in Figure 9.3.3-2 with a trend in the amount of fertilizer for WM and WAM scenario

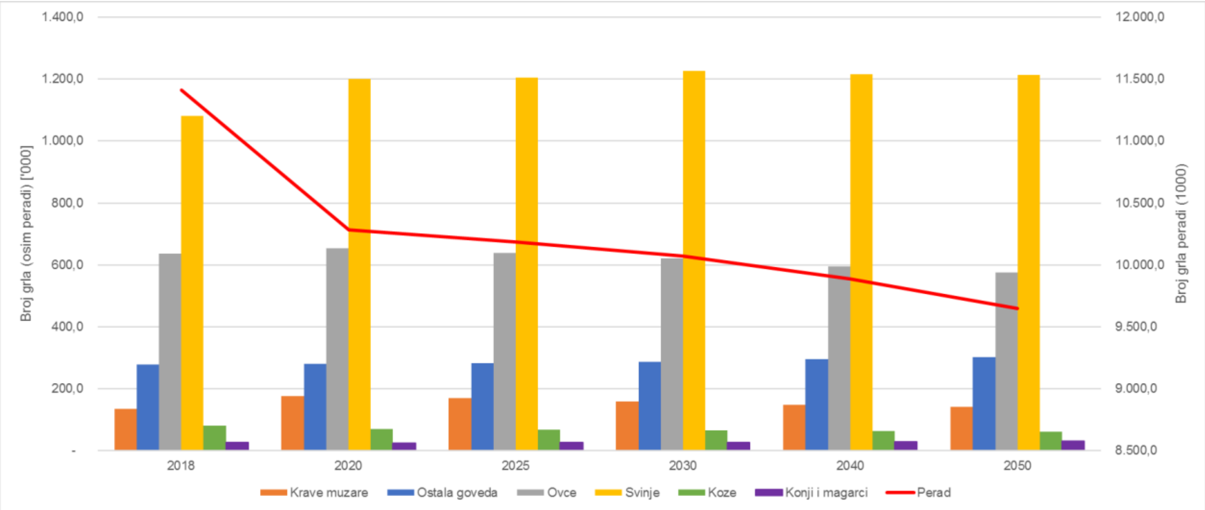


Figure 9.3.3-1 Animal flow trends per species for WM and WAM scenarios

Source: Ekonerg Ltd, Ref. 58

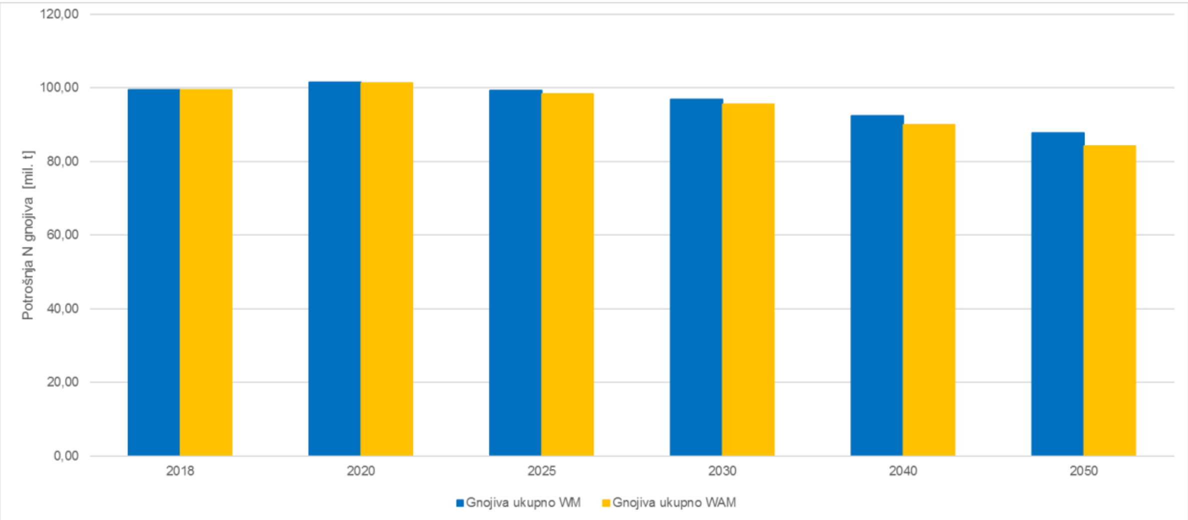


Figure 9.3.3-2 Flow of the amount of fertilizer for WM and WAM scenarios

Source: Ekonerg Ltd, Ref. 58

9.3.4. Waste

Methodology and models

Described in the introductory part of subsection 9.3, without additional specifics.

According to the recommendation of the team of experts for technical inspection during 2019, a methodology was developed for the assessment of national emission factors for NMVOC for category 5A Disposal of solid waste, for all years in the reporting period. The national emission factor for NMVOC has been estimated on the basis of CH_4 emissions estimated in the NIR report and is included in the NMVOC emission calculation for category 5A.

Assumptions

The assumptions used in making the projections are shown in Table 9.3.4-1.

Table 9.3.4-1 Assumptions for projections – Waste

WASTE	
The projections were carried out on the basis of expected development and future state of parameters for the projections - the amount of generated and landfilled solid waste (municipal solid waste, industrial waste and sludge from wastewater treatment), the organic fraction of solid waste, the fraction of recovered/flared methane and the amount of composted organic waste. Emission projections start from the situation and projections of macroeconomic parameters in 2018 - the projected dynamics of the annual growth rate of gross domestic product and the decline of population.	
WM scenario	Assumptions: Solid waste disposal – reduction of the amount of generated and landfilled solid waste due to the application of measures defined by sectoral legislation harmonized with EU legislation. 4 July 2018 came into force the new EU rules with legally binding targets for waste recycling and reduction of waste disposal. Croatia was given the possibility of a delay of five years to meet the targets because it is among the Member States that are in 2013 prepared for re-use and recycled less than 20% of its municipal waste or landfilled more than 60% of its municipal waste. The five-year delay is included in the projections. Composting – continuous increase in the amount of waste that is being processed by composting due to the application of measures defined by sectoral legislation harmonized with EU legislation. The increase in the amount of waste to be composted depends on the reduction of the amount of landfilled biodegradable waste and the proportion of biodegradable waste that will be treated by composting and digestion. Waste incineration – no more incineration of clinical waste is carried out without energy recovery, it is assumed decrease in the number of cremated bodies. Wastewater handling – 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 residents in households using latrine. Other waste – fires on vehicles and buildings - trends depend on projections of vehicle number and macroeconomic parameters. 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 and decline of population. The scenario includes the existing legal framework of the Republic of Croatia and the adopted EU legal framework from the waste sector for the period until 2035. Projections of emissions of greenhouse gases and pollutants from the waste sector are based on the implementation of measures prescribed by sectoral legislation, harmonized with EU legislation.
WAM scenario	The with additional measures scenario is the same as the with measures scenario since no additional measures to reduce emissions of greenhouse gases and pollutants have been identified.

Source: Report on projections of greenhouse gas emissions, and Report on projections of air pollutant emissions, Ekonerg Ltd.

Parameters

The parameters used for the projections in the NFR 5 Waste sector are shown in Table 9.3.4-2.

Table 9.3.4-2 Projection parameters - waste

Parameter	Unit	2018	2020	2025	2030	2040	2050
Amount of solid waste generated (WM and WAM scenarios)	t	2.428.937	2.273.117	2.212.504	2.204.261	2.178.611	2.168.263
Organic share of solid waste (WM and WAM scenarios)	%	65	24	18	12	6	1
Amount of solid waste disposed of in landfills (WM and WAM scenarios)	t	1.601.602	1.136.55	553.126	440.852	217.861	21.683
Amount of waste incinerated	t	NO	NO	NO	NO	NO	NO
Amount of composted waste	t	47.594	277.512	478.343	679.235	864.598	1.034.773

NO – *not occurring*

Visualization of projected key energy flows

The annual and projected annual quantities of solid waste landfilled and composted waste are shown as follows in Figures 9.3.4-1 and 9.3.4-2.

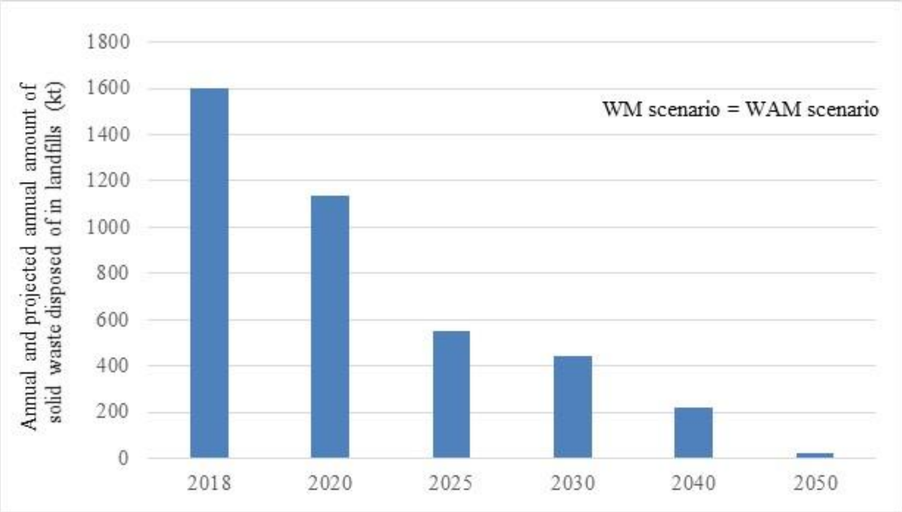


Figure 9.3.4-1 Annual and projected annual amount of solid waste disposed of in landfills (kt)

Source: Ekonerg Ltd, Ref. 58

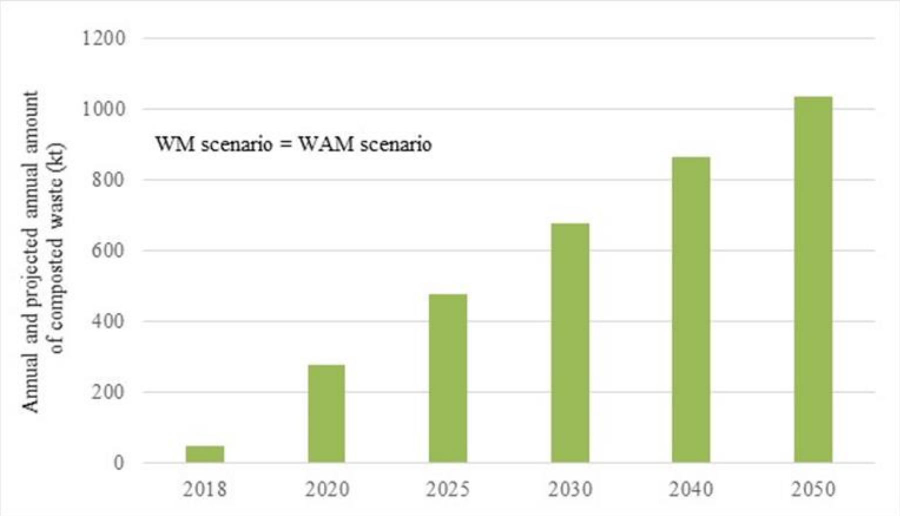


Figure 9.3.4-2 Annual and projected annual amount of composted waste (kt)

Source: Ekonerg Ltd, Ref. 58

9.4. Results

An overview summary table showing current emissions in 2018, calculated reduction commitments and emission projections for WM and WAM in 2020 and 2030 for NOx, SO_2, NMVOC, NH_3, $PM_{2.5}$ and BC is given below (Table 9.4 -1).

The summary table and graphs exclude NOx and NMVOC emissions from 3B and 3D. According to the compliance rule with the reduction obligation relating to: emissions from sector 3B (manure management) and 3D (agricultural soils) are not calculated for NOx and NMVOC. The application of adjustments is not taken into account. (Source: NECD Briefing 2020).

The summary table indicates in red that the default reduction obligation for the WM and WAM scenarios has been exceeded.

Table 9.4-1 Emissions in 2018, calculated reduction commitments, and emission projections for WM and WAM scenarios for the two periods 2020 - 2029 and 2030-onwards for NOx, SO_2, NMVOC, NH_3 i $PM_{2.5}$

Pollutant	Unit	Emission	Projekcije					
		2018	2020 - 2029	2020		2030 - onwards	2030	
			Reduction commitment	WM	WAM	Reduction commitment	WM	WAM
NOx	kt	43.73	53.54	40.76	40.47	33.37	38.69	37.27
SO_2	kt	10.30	26.39	6.89	6.78	9.97	9.33	9.01
NMVOC	kt	63.15	69.13	53.34	52.54	54.47	53.81	48.10
NH_3	kt	35.66	42.46	36.64	35.92	32.17	36.89	30.71
$PM_{2.5}$	kt	28.73	34.32	27.67	26.49	18.83	26.47	18.57
BC	kt	3.89	-	3.70	3.59	-	3.52	2.81

Source: Ekoneg Ltd, Ref. 58

Presentations of historical emissions (2005-2018) with the results of emission projections for WM and WAM scenarios and prescribed reduction obligations for two periods: 2020 - 2029 and 2030 - further by pollutant are also given graphically in Figures 9.4-1 to 9.4-6.

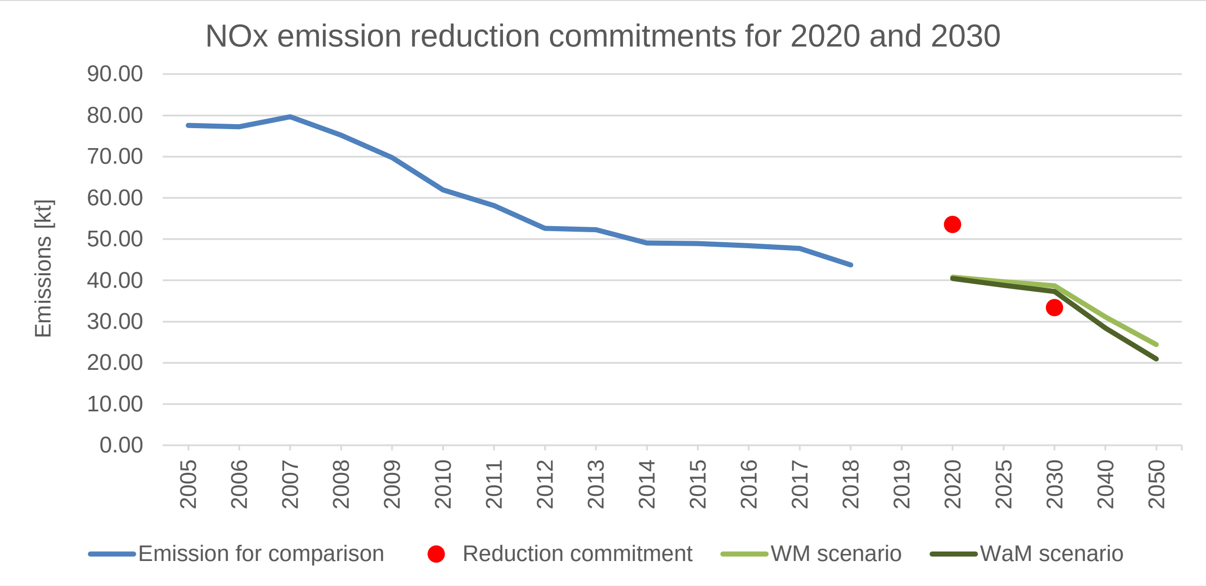


Figure 9.4-1 Trend and projections of NOx emissions

Source: Ekonerg Ltd, Ref. 58

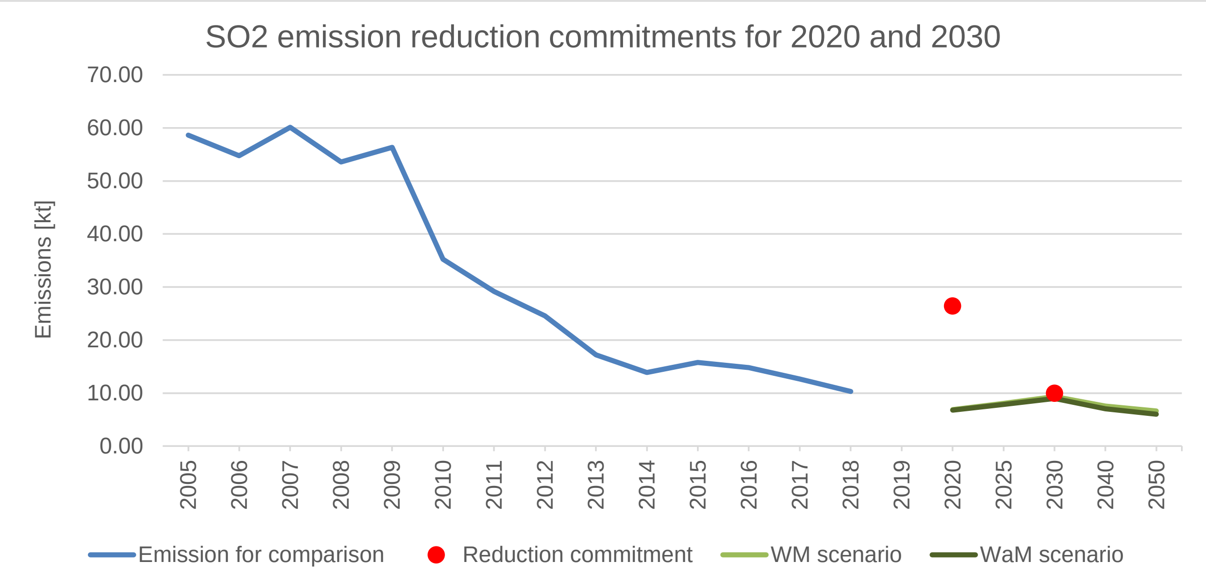


Figure 9.4-2 Trend and projections of SO_2 emissions

Source: Ekonerg Ltd, Ref. 58

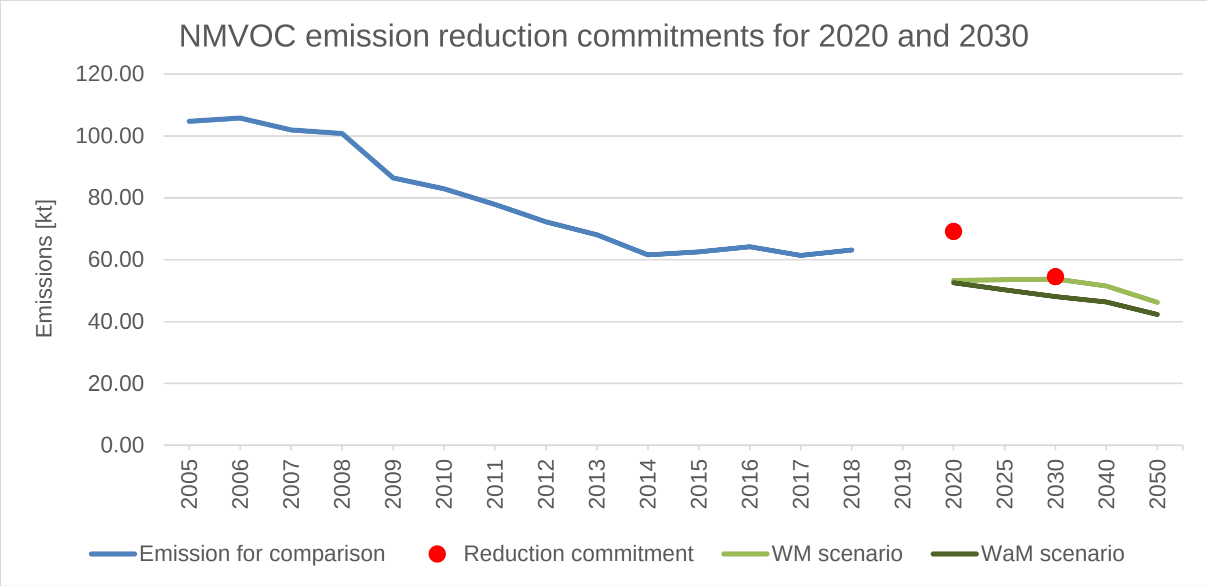


Figure 9.4-3 Trend and projections of NMVOC emissions

Source: Ekonerg Ltd, Ref. 58

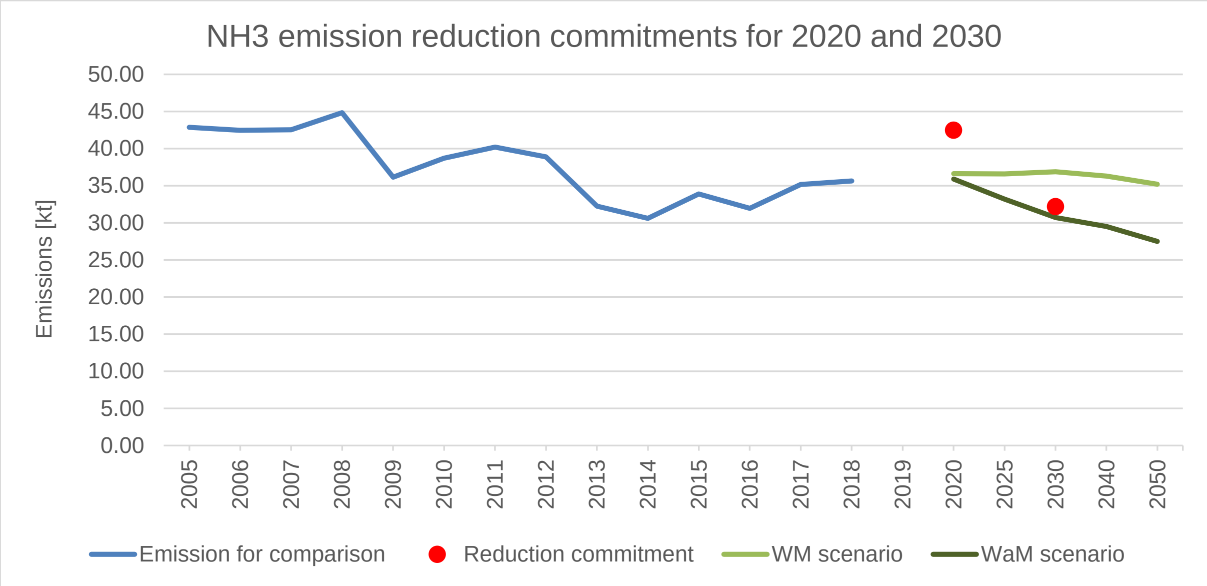


Figure 9.4-4 Trend and projections of NH_3 emissions

Source: Ekonerg Ltd, Ref. 58

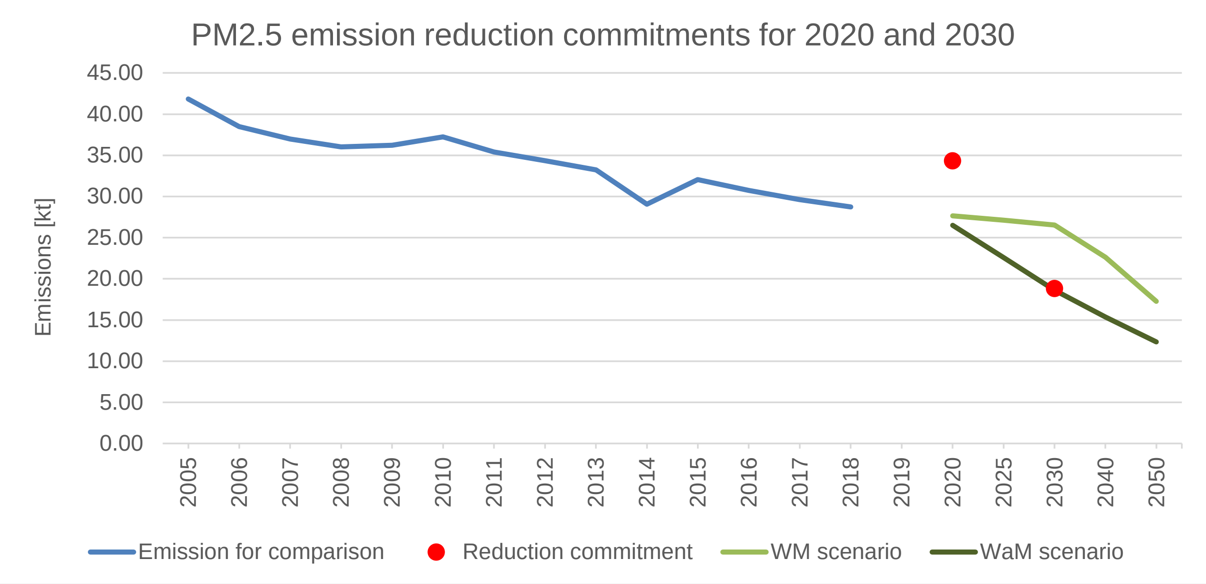


Figure 9.4-5 Trend and projections of $PM_{2.5}$ emissions

Source: Ekonerg Ltd, Ref. 58

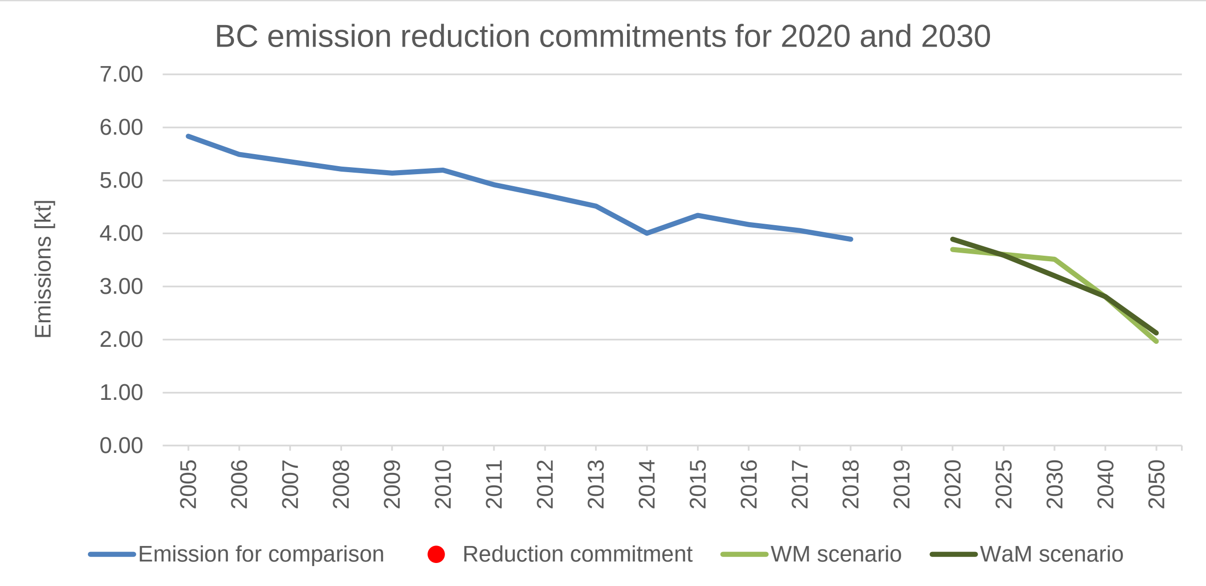


Figure 9.4-6 Trend and projections of BC emissions

Source: Ekonerg Ltd, Ref. 58

Stationary energy and road transport (NFR 1.A.1, 1.A.2, 1.A.3.b, 1.A.4)

For the period up to 2030, the reduction in primary consumption will be 1% according to scenario S2 and 6% according to scenario S1, compared to 2017.

The transition of the energy sector by 2050 will significantly change the structure of electricity sources in order to reduce the consumption of fossil fuels in all energy transformations as well as increase the use of available energy potential. Over the next 30 years, it is planned to multiply the installed capacity from RES compared to the production facilities built in the previous 100 years. Depending on the results of the analysis on the need for energy recovery of waste in the Republic of Croatia for energy production, it is possible to use fuel from waste / waste at locations for which the analyses show environmental, economic and technical feasibility. A significant increase in distributed electricity production is expected, as well as the transformation of the distribution network through the application of advanced technologies in management and control (digitalization, automation, expert systems). It is planned to build technologically different energy tanks (reversible HPPs, batteries, HV boilers in combination with heat accumulators) to support the variability of RES production (WPPs and PV plants).

A fundamental component of the transition of the energy sector is to increase energy efficiency. A significant contribution to increasing energy efficiency will be made possible by the construction of high-efficiency cogeneration plants and integrated heat pumps in district heating systems of large cities. The second component is renewables that will encourage the transition from the use of fossil fuels to electricity. Natural gas will play a significant role in the transition to a low-carbon economy as the fossil fuel with the lowest emission of both CO_2 and other pollutants.

Accordingly, in the period from 2020 to 2030 in the observed sectors (except for 1.A.4.b.i) a slight reduction in emissions of most pollutants is expected, while in the case of SO2 and PM2.5 an increase in emissions is expected. Only in the period after 2030 can we expect again reductions in SO2 and PM2 emissions and more significant reductions in emissions of other pollutants, because a stronger impact of measures in the stationary energy and road transport sector is expected after 2030 (projected after 2030). increase in electricity use and decrease in fossil fuel use). The use of solid fuels is expected in the Electricity and Heat Production sector. In the Electricity and Heat Production sector, the use of solid fuels is expected to cease.

In the Residential sector (NFR 1.A.4.b.i), which is a key source of $PM_{2.5}$, BC, NMVOC and NOx emissions, an increase in the use of wood biomass is expected by 2030, resulting in a slight reduction in emissions of these pollutants (except NOx which even slightly growing in the WM scenario), which are the result of the influence of new technologies for wood biomass combustion and replacement of old ones (except for NOx, for which FEs in new technologies are slightly higher than in old ones). Only in the period after 2030 can significant reductions in the mentioned emissions be expected, primarily due to the assumed reduction of wood biomass consumption in Residential in both scenarios, which is more significant in the WAM scenario. In the period after 2030, the same intensity of the impact of new wood biomass combustion technologies was assumed as in 2030, which is more intense in the WAM scenario compared to WM.

Emissions of the observed sectors in the WAM scenario will be lower than in the WM scenario due to the more intensive influence of new wood biomass combustion techniques in Residential, additional energy efficiency measures and additional increase in electricity consumption and reduction of fossil fuel and wood biomass consumption in households in the WAM scenario.

Fugitive emissions from fossil fuel (NFR 1.B)

The Fugitive Emissions from Fuel (NFR 1.B) subsector is one of the key sources of emissions with regard to SO2 emissions, both in 2018 and in the period 2020-2050. years. The reduction in SO2 emissions is primarily the result of the expected reduction in emissions from sulphur production plants (Claus plants), based on energy balance flows and production capacity in refineries. Fugitive emissions from fuels have not been identified as a key source for other pollutants. Based on the energy parameters by scenarios, applying existing and additional measures within this subsector, the total emissions for each pollutant are lower in the WAM scenario compared to the WM scenario for the entire projection period after 2020.

Industrial processes and product use (NFR 2)

The WM scenario assumes that production in industrial processes in the period up to 2035 will reach the planned, maximum values, which will affect the increase in emissions. The implementation of process measures is prescribed by sectoral legislation.

The WAM scenario involves the application of cost-effective measures to reduce process emissions. Emissions from fuel combustion are included in the Energy sector. Measures include gradually reducing the share of clinker in cement production by increasing additives in the final product. The share of additives in cement depends on the composition of the raw material, the availability of additives of appropriate composition on the market and the market requirements for individual types of cement. Consequently, by reducing the need for clinker, there is a reduction in production, and thus a reduction in emissions from this activity.

Accordingly, in the sector Industrial Processes and Product Use, the emission trend in the observed period is the same in both scenarios, except for NFR activity 2.A.1 Cement production where emission decreases due to reduced projected values of activity data (lower produced amount of clinker relative to WM). This reduction occurs in the projections of $PM_{2.5}$ and BC emissions in the period after 2020.

Agriculture - Crops and Soils (NFR 3.D)

In the WM scenario in the Agriculture - Crops and Soils sector, NOx emissions will increase due to projections of an increase in the number of animals crucial for NOx emissions (pigs and cattle) in the periods 2020-2030 and after 2030, while due to the implementation of facility or housing improvements and manure removal systems to reduce emissions in the period 2018-2020. In the WAM scenario, NOx emissions will increase due to projections of an increase in the number of animals crucial for NOx emissions (pigs and cattle) in the periods 2020-2030 and after 2030. Compared to the WM scenario, this growth will be lower due to projections of lower consumption mineral nitrogen fertilizers.

In the WM scenario in the Agriculture - Crops and Soils sector, a slight increase in NH3 emissions is expected in the period from 2020 to 2030 due to projections of an increase in the number of pigs and cattle. For the same reason, an increase in emissions from agriculture is expected in the period after 2030. In the WAM scenario, there is a decrease in emissions in both observed periods. Compared to the WM scenario in which a slight increase in emissions is expected, the reduction was achieved by introducing measures to reduce Urea consumption and replacing it with a fertilizer that emits lower NH3 emissions.

Agriculture – Animals (NFR 3.B)

In the WM scenario in the Agriculture - Animals sector, due to the implementation of measures to improve facilities or housing and manure removal systems and the projection of the decline in the total number of animals, NMVOC emissions are expected to decrease in the periods from 2018 to 2020 and from 2020 to 2030. no further emission reductions are expected in the period after 2030. There are no changes in the WAM scenario compared to the WM scenario for this pollutant.

In the WM scenario, a slight increase in NH_3 emissions is expected in the period from 2020 to 2030 due to projections of an increase in the number of pigs and cattle. For the same reason, an increase in emissions from agriculture is expected in the period after 2030. In the WAM scenario, a significant decrease in NH_3 emissions is expected in both observed periods. Compared to the WM scenario, the reduction was achieved by introducing additional NH_3 reduction techniques in animal housing, animal manure storage and application of animal manure to the soil, and increased application of existing techniques.

Waste (NFR 5)

The WM scenario, which is equal to the WAM scenario, includes measures to reduce emissions of greenhouse gases and pollutants from solid waste landfills, which affects the reduction of NMVOC and PM emissions throughout the reporting period until 2050. Reducing the amount of disposed biodegradable waste results in an increase in the amount of biodegradable waste that is referred to biological treatment processes, such as composting and anaerobic digestion in biogas plants. Due to the application of the measures, there is an increase in NH3 emissions from composting processes, during the entire reporting period until 2050.

Projections of emissions from waste incineration (NFR 5.C), wastewater management (NFR 5.D) and other waste - fires on vehicles and facilities (NFR 5.E) for the period up to 2050 are calculated based on emissions from the last historical (2018), using projections of macroeconomic parameters, annual GDP growth rate and population and number of vehicles. In line with the trend of the macroeconomic parameter by which activity data are estimated, pollutant emissions from NFR 5.C, 5.D and 5.E have an increasing or decreasing trend in the reporting period until 2050. Measures to reduce greenhouse gas and pollutant emissions have not been identified in these NFR categories.

9.5. Sensitivity

This subsection analysis the sensitivity of the projections to several selected quantities, which largely determine the budget uncertainty. Sensitivity will be commented on qualitatively and, where possible, quantitatively. The impact was observed:

- economic development rates,
- the impact of temperature change on heating and cooling energy,
- hydrology in electricity production of hydropower plants,
- agricultural development.

The influence of a factor can be significant from the point of view of the emission trend and / or from the point of view of variability around the mean value. The trend refers to sequences of longer duration, while variability refers to one or several years.

The emission is calculated as the product of the activity and the emission factor. Some factors affect activity more, such as fuel consumption, mileage, number of animals, etc. Others affect emission factors more, e.g. t CO_2 / MWh, t NOx / km, etc. The dependence of emissions on baseline budgets is mostly of the linear type, with some quantities having an impact across numerous sectors, which is discussed below.

Economic development rate

The rate of economic development has an impact on all sectors, more on activities, and relatively less on emission factors. The impact on emission factors is reflected over the long term, so for example, reduced economic potential will result in weaker technological progress in the long run, and this is reflected in the budget through emission factors. Croatia has relatively low emissions, so individual disturbances can have a strong impact on overall emissions. The period of war, the transition to a market economy, the economic crisis, are strong factors that make it impossible to establish reliable correlations from the historical data set. The assumption in the emissions projections is that energy consumption will grow with GDP, but the correlation between GDP and energy consumption will be smaller.

In all analysed scenarios, GDP growth is assumed by 2040, on average 1.4% by 2040, which is a nominal increase compared to 2010 by 63%.

For such economic growth, it is expected that emissions in 2030 could be about 7.1% higher, and in 2040 by 12.3% compared to the presented scenarios, assuming the same carbon intensity of the economy. However, the implementation of measures to reduce emissions reduces and, in the long run, breaks the link between GDP and emissions. Therefore, GDP growth will also contribute to reducing emissions when it comes through investments in low-carbon technologies, industry and services.

Influence of temperature change on heating and cooling energy

A change in temperature will reduce heating needs, but on the other hand cooling needs will increase. The goal of climate policy is to keep global temperature rise within 2°C. In the Republic of Croatia, the temperature increase has been determined since the measurements were carried out. Here it is assumed to increase by 2050 by about 1°C.

Heating needs. The internal design temperature in buildings in most cases is 20°C, but realistically the temperatures of heated spaces are maintained at temperatures up to 24°C. In addition to the above assumptions, the reduction of heat required for heating in the continental part of the Republic of Croatia could be between 7.7 and 11.3%, and in the coastal part of Croatia between 12.7 and 24.2%.

Cooling needs. Unlike the need for heating, there is no such pronounced dependence of the need for comfortable cooling on the outside air temperature, since the influence of heat gains due to solar radiation is dominant here. At this time, it is not possible to provide an estimate of the impact of changes in outdoor temperature on refrigeration needs. It can only be estimated that the impact will be less pronounced than is the case with heating needs.

Other impacts on energy. Changes in temperature, precipitation, wind energy will affect the production of renewable energy sources. These impacts need to be quantified and incorporated into operational planning, especially at the regional and local levels where large differences are possible.

Hydrology in electricity generation of hydropower plants

Depending on the hydrology, production from large hydropower plants varies from 4 TWh to 8 TWh. This is from 20 to 40% of the total electricity production of the Republic of Croatia. Cycles of dry and wet years can last for several years, and in this regard, emissions from the electricity sector can vary considerably.

The lack of production from hydropower plants is compensated by increased production from thermal power plants or increased imports. In the extreme case of drought, the increase in emissions could be in 2030, in the scenario of 'additional measures' around 4.2% of Croatia's total emissions.

Agricultural development

Small farms are characteristic of agriculture in Croatia. The average family farm is only 2 hectares in size. According to the 2003 Census of Agriculture, only 20% of cultivated land is privately owned with an average of 159 hectares. The situation is similar in the field of cattle breeding: 96% of all milk producers own only 15 cows, while 90% of pigs are located on 200,000 small farms, with 170,000 farms owning less than 10 pigs. Such fragmentation and old populations prevent faster development. Agriculture will therefore change slowly, which will be a challenge from an emissions point of view.

9.6. Clarifications related to the reporting format

The Annex IV-A emission projection table shows the aggregate category 5 Waste, while subcategories 5A - 5E are not shown. For aggregate category 5, for pollutant BC, the notation key NE was used, although the notation keys are different depending on subcategories 5A - 5E: NA, NE, IE and NO.

10. Reporting of gridded emissions and LPS

This chapter is included in the IIR for the first time in accordance with TERT recommendations. The chapter contains concise descriptions of the methodology used in the preparation of spatially disaggregated emissions of the Republic of Croatia. A detailed description of the network preparation methodology and the methods used for the production of spatially disaggregated emissions are given in the documents: *Mapping methodology in the EMEP grid* and *Methodology for the development of the register of air pollutants for small and diffuse sources*. The documents are in Croatian and are not publicly available.

Spatially disaggregated emissions of the Republic of Croatia in the 0.1 ° x 0.1 ° EMEP network were first reported on 1 May 2017 for years: 1990, 1995, 2000, 2005, 2010 and 2015. Spatially disaggregated emissions of the following pollutants were submitted: NOx, NMVOC, SOx, NH_3, $PM_{2.5}$, PM_{10}, BC, CO, Pb, Cd, Hg, PCDD / PCDF, PAHs, HCBs and PCBs, which are also and mandatory for spatially disaggregated emissions reporting. Submitted spatially disaggregated emissions of the Republic of Croatia are aggregated into GNFR sectors (source names): A_PublicPower, B_Industry, C_OtherStationaryComb, D_Fugitive, E_Solvents, F_RoadTransport, G_Shipping, H_Aviation, I_Offroad, J_Waste, K_AgriLivestock, L_AgriOther, N_Natural, O_AviCruise, P_IntShipping. The submission in 2017 also included emissions from LPSs by source categories (GNFR) for the relevant pollutants and for the years: 1990, 1995, 2000, 2005, 2010 and 2015.

Submitted spatially disaggregated emissions for the Republic of Croatia (Annex V of the Reporting Guidelines 2014) also include LPS emissions, which are also submitted separately in Annex VI of the Reporting Guidelines 2014.

This year's submission on 1 May 2021 will include spatially disaggregated emissions for 1990, 1995, 2000, 2005, 2010, 2015 and 2019, all mandatory pollutants and GNFR sectors, identical to the submission in 2017. It will also include LPS emissions for 2019 by source category (GNFR) for relevant pollutants (see Table 1.1-6). LPS emissions submitted in 2017 will not be updated, and TERT recommendations and incentives related to the reporting of LPS emissions will be included in the reporting of their emissions in 2019.

Spatially disaggregated shows of the Republic of Croatia are available on the Internet link: https://emep.haop.hr/. Spatially disaggregated emissions for five air quality zones in the Republic of Croatia in the same resolution are also available at this link, as well as spatially disaggregated emissions for four air quality agglomerations and one city of interest in a finer resolution of 500 m x 500 m based on EMEP resolution.

Spatially disaggregated emissions of the Republic of Croatia were prepared in accordance with the Guidelines 2014 and Annexes V and VI to the Guidelines and the EMEP / EEA methodology. Spatially disaggregated emissions of the Republic of Croatia reported in 2017 are available on the website of the central database EIONET at web link: http://cdr.eionet.europa.eu/hr/un/clrtap/gridded/ and on the CEIP website at web link: https://www.ceip.at/ms/ceip_home1/ceip_home/status_reporting/2017_submissions/.

Spatially disaggregated emissions to be reported on 1 May 2021 are in line with the set of proxy data used in the preparation of spatially disaggregated emissions submitted in 2017 and pollutant emissions for the period 1990 - 2019 reported on 15 February 2021. Also, they include all the improvements made until the submission of the inventory in 2021, and in that sense, the addition of a set of proxy data and spatially disaggregated emissions.

Spatial disaggregated emissions for the territory of the Republic of Croatia was carried out by using the EkoReGis model, which is based on numerous national geographical data sets. As the model is very complex and includes many spatial data, only the most important input data and descriptions of the methodology are included in the IIR report. More details on the applied methodology and model can be found in the document: „*Izvješće o prostorno raščlanjenim emisijama za područje republike hrvatske i pripadajuće zona kvalitete zraka*“ (Lit. 57). The document is not publicly available and is in Croatian language.

10.1. Summary of main changes

This chapter summarizes the main changes and improvements in the methodology for individual GNFR application categories in 2021 compared to those reported in 2017. Implemented changes / improvements are as follows:

- Updated national emissions of air pollutants for 1990, 1995, 2000, 2005, 2010 and 2015 according to the submission in 2021 for the period (1990-2019).
- Within the category NFR 2.D.3.i, 2.G Other solvent and product use, a new activity is included - Use of fireworks.
- Inclusion of a new NFR category 3.D.a.3 Urine and dung deposited by grazing animals for the following animals (dairy cows, other cattle, sheep, goats, horses, mules/asses).
- Inclusion of a new category NFR 3.D.a.2.a Animal manure applied to soils.
- Inclusion of a new category NFR 3.D.a.2.b Sewage sludge applied to soils.
- Inclusion of a new category NFR 5.B.1 Biological treatment of waste - composting.
- For NFR category 2.D.3.e Degreasing the activity data has been changed.
- Inclusion of a new category NFR 3.D.c Farm-level agricultural operations including storage, handling and transport of agricultural products and PM emission calculation.
- Inclusion of a new NFR category 3.D.e Cultivated crops and NMVOC emission calculation.
- Inclusion of new categories NFR 1.A.2 Manufacturing industries and construction for 1990, 1995 and 2000, namely 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 and 1.A.2.f Non-metallic minerals.
- Within the category NFR 2.D.3.g Chemical products, a new activity is included - Asphalt blowing.
- Inclusion of a new NFR category 3.D.f Use of pesticides and HBC emission calculation.
- Inclusion of a new NFR category 3.F Field burning of agricultural residues.
- Emissions from category NFR 5.D.1 Domestic wastewater handling sector is transferred to NFR 5.D.2 Industrial wastewater handling, and from NFR 5.D.3 Other wastewater - Latrines in NFR 5.D.1 Domestic wastewater handling.
- Included emissions for 2019 of all LPS by source categories (GNFR) for relevant pollutants reported in the EPR and HLAP database.
- Included emissions for 2019 of LPS from the Agriculture (farms) sector by source categories (GNFR) for relevant pollutants calculated by the manufacturer based on the number of heads per species and existing NH_3 emission reduction techniques.

10.2. Methodology and models

An EkoReGis model has been developed for the preparation of spatially disaggregated emissions for the Republic of Croatia. The methodology built into the EkoReGis model follows the prescribed EMEP / EEA methodology in accordance with GB2019. The EkoReGis model was developed by EKONERG d.o.o. as part of the project: "*Development of a pollutant emission register with spatial distribution of emissions in the high-resolution EMEP network*" (Lit 59).

The EkoReGis model was developed according to the requirements for reporting on gridded emissions according to the EMEP / EEA methodology and includes all emission sources that exist or have existed in the reporting years: 1990, 1995, 2000, 2005, 2010, 2015. and 2019 on the territory of the Republic of Croatia, for those pollutants for which there is an obligation to report disaggregated emissions. The result of the model is a spatially disaggregated emissions and their visual representation in the EMEP grid in the resolution 0.1° x 0.1°, including the spatial disaggregation for five air quality zones, as well as in the grid in resolution 500 m x 500 m for four air quality agglomerations and one city of interest. Emissions for the agglomeration area were not updated in 2021 and the latest available data are from 2017.

The results of this model are spatial emission data that represent the input for air quality modeling, and which are the input data for estimating atmospheric concentrations and precipitation. EkoReGis was primarily developed to be applicable for mandatory reporting of network emissions under CLRTAP.

For this year's submission, the views of spatially disaggregated inventories for the years 1990, 1995, 2000, 2005, 2010 and 2015 have been updated, and a new spatially disaggregated inventory for 2019 has been prepared.

10.2.1. Purpose and components of the model

EkoReGis was developed for the purpose of obtaining improved quality of spatial emissions data (higher resolution) and further application of these data in air quality modelling to assess the current state of air quality, air quality forecasting, air quality planning, source division and air pollution exposure studies.

Prior to the establishment of the EkoReGis model, the Republic of Croatia has reported on national gridded emissions in the EMEP grid, the resolution of 50 km x 50 km.

The EkoReGis model incorporates four key components for the full application of the EMEP / EEA methodology for spatial emissions disaggregation:

- national pollutant emissions officially submitted in accordance with UNECE CLRTAP and NECD;
- prepared geocoded networks for the Republic of Croatia, 5 air quality zones, 4 agglomerations and one city of interest;
- available proxy data sets;
- engineering models by air pollutant emission categories (NFR, SNAP).

All four components were used to describe each of the quadrants belonging to the Republic of Croatia, Croatian zones, agglomerations and one city. Each of the quadrants of the prepared geocoded grid is defined by a unique number (quadrant ID) and associated attributes, different proxy data. Ultimately, the national emission according to the defined engineering model via proxy data is associated in each of the quadrants.

A simplified view of the methodology that includes all of the above is shown in Figure 10.2-1.

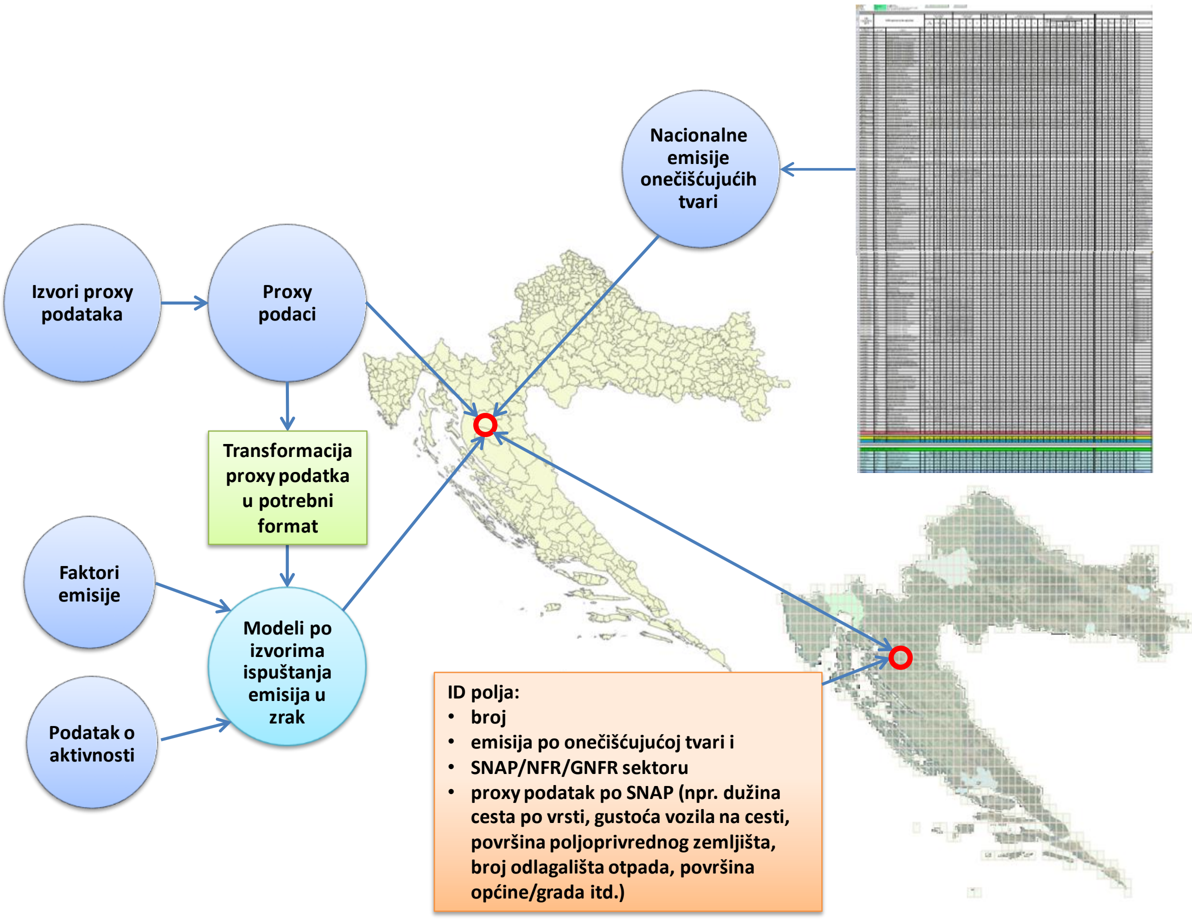


Figure 10.2-1 Simplified presentation of the methodology for spatial disaggregation of air pollutant emissions in the Republic of Croatia

Source: Ekoneg d.o.o.

10.2.2. Preparation of geocoded grid

The first step in creating the EkoReGis model was to prepare the grid. In doing so, Croatia specific data defining the grid cells and fraction of grid cells[40] was used (available at the link: https://www.ceip.at/ms/ceip_home1/ceip_home/new_emep-grid/grid_definition/), which is overlapped with the Central Register of Territorial Units (Figure 10.2-2 left). Overlaps identified nonconformities, so the assigned Croatia specific data was corrected (Figure 10.2-2 on the right) by removing the red-marked cells and adding the green ones. In the original, the EMEP grid for the Republic of Croatia contains 927 quadrants, and the corrected network contains 926. Information on the correction was sent to the CEIP - Center on Emission Inventories and Projections (Emep.Emissions emep.emissions@umweltbundesamt.at).

[40] SRI shapefile file specific to the Republic of Croatia with a network definition of 0.1 ° x0.1 ° (long-lat)

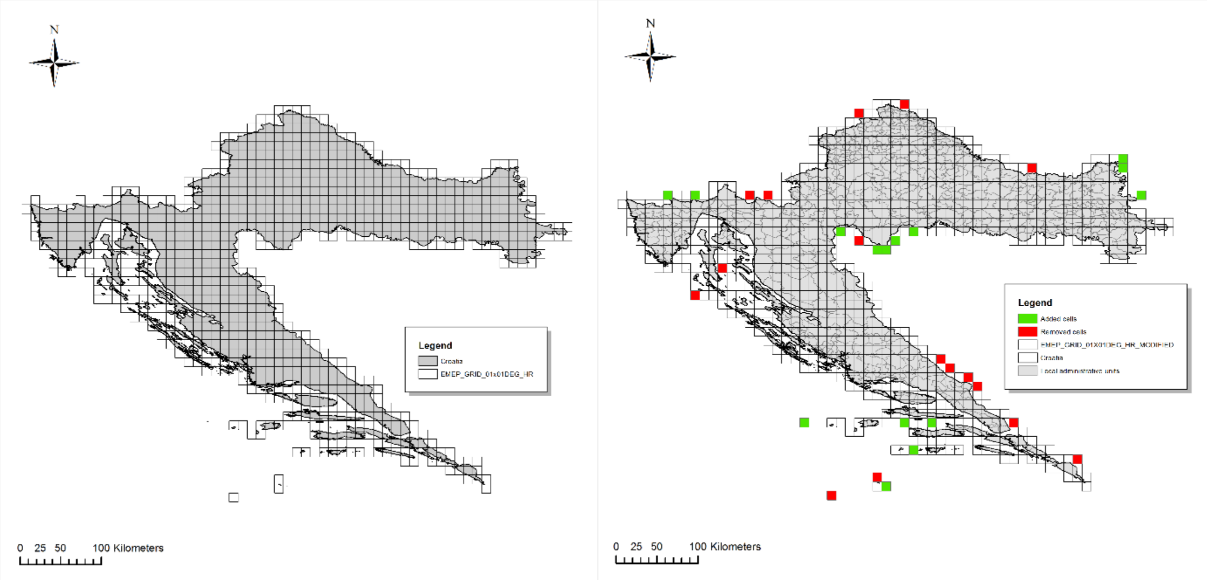


Figure 10.2-2 Original EMEP grid for the Republic of Croatia (left) and cross-section of the modified EMEP grid with the Central Register of Territorial Units of the Republic of Croatia (right)

Source: „Metodologija kartiranja u EMEP mreži“, Contractor: CEA (now MESD), Executor: Ekonerg Ltd.

10.2.3. Geospatial coverage of the EkoReGis model

The EkoReGis model covers the area defined by the national land and sea border (Figure 10.2-3 left) and the Register of Spatial Units of the Republic of Croatia (20 counties and the City of Zagreb with county status) (Figure 10.2-3 right) and the areas of five zones and four agglomerations defined by the Zone and agglomeration according to the levels of air pollution in the territory of the Republic of Croatia (OG 24/14) (Figure 10.2-4).

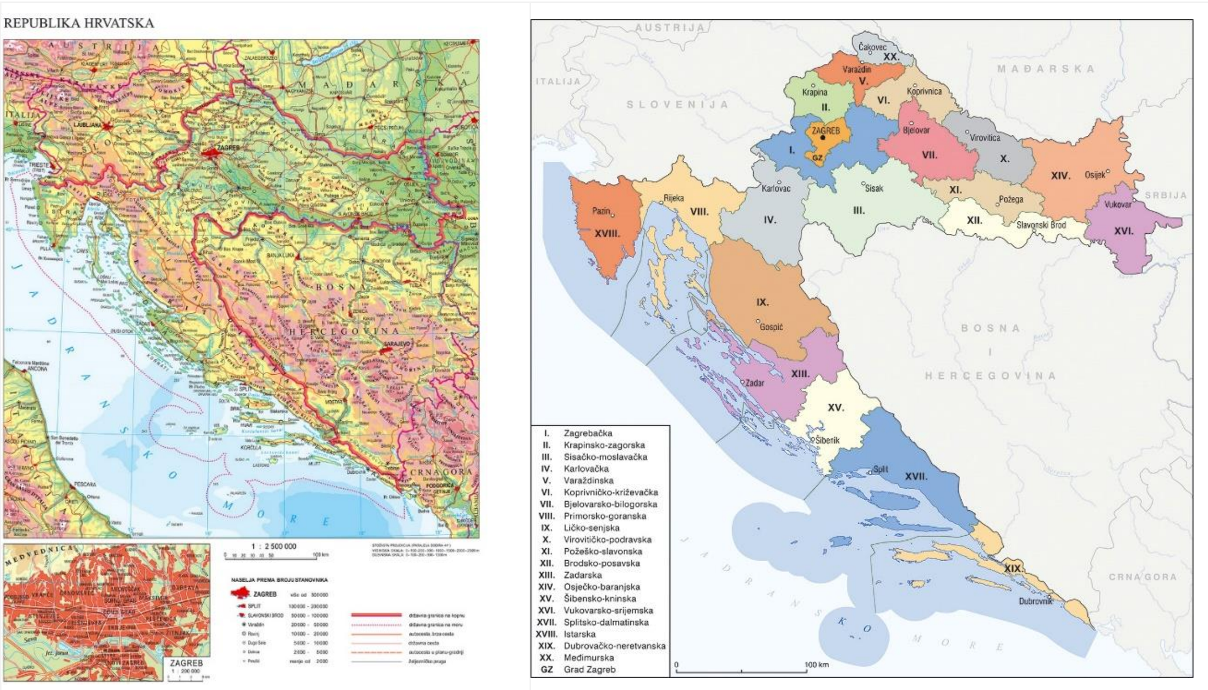


Figure 10.2-3 Border of the Republic of Croatia (left) and the Register of Spatial Units of the Republic of Croatia (right)

Source: Figure left: https://www.e-sfera.hr/dodatni-digitalni-sadrzaji/df78e11f-04a6-4cee-bd08-17c1abeb572e/; Figure right: https://commons.wikimedia.org/wiki/File:Counties_of_Croatia-fr.svg

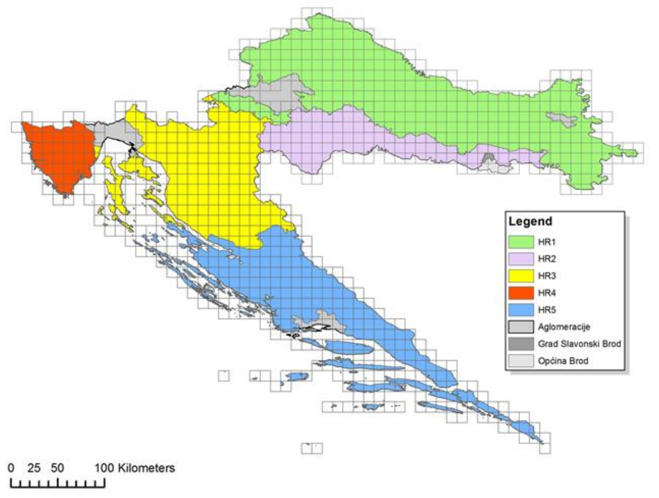


Figure 10.2-4 Cross-section of the modified EMEP network for the Republic of Croatia with Croatian areas of five air quality zones and four agglomerations

Source: „Metodologija kartiranja u EMEP mreži", Contractor: CEA (now MESD), Executor: Ekonerg Ltd.

There are three main climatic regions in Croatia: continental, central (mountainous) and coastal (maritime). These three climatic regions are conditioned by extremely diverse relief with three main types: lowland - Pannonian Croatia, mountainous - Mountainous Croatia and coastal Primorska Croatia (Figure 10.2-5). The central part of Croatia is the coldest with a mountain climate, and the continental part is somewhat milder with a continental climate than in the central part. The coastal part of Croatia has a mild Mediterranean climate. Climatic characteristics were one of the parameters used for the spatial analysis of emissions from the category NFR 1.A.4.b.i Residential.

Figure 10.2-5 Climatic regions of the Republic of Croatia

Source: https://www.e-sfera.hr/dodatni-digitalni-sadrzaji/df78e11f-04a6-4cee-bd08-17c1abeb572e/

10.2.4. Quantification and spatial distribution of diffuse sources in the territory of the Republic of Croatia in the EkoReGis model

Spatial distribution of emissions into grid quadrants with multi-country, zone, agglomeration, municipality and city boundaries uses Equation 2:

$$EM_{pi_K} = EM_{pi_{HR}} \times f \times \left(PROXY_{pi_K} / PROXY_{pi_{HR}}\right) \quad (2)$$

Where is:

EM_{pi_K}	= emission of pollutant pi, in quadrant K
$EM_{pi_{HR}}$	= total pollutant emission p_i for the territory of the Republic of Croatia
f	= fraction of grid quadrant K (1 or <1)
$PROXY_{pi_K}$	= data associated with the pollutant pi, within quadrant K (e.g. population in that quadrant)
$PROXY_{pi_{HR}}$	= proxy data associated with the pollutant pi, total for the territory of the Republic of Croatia (e.g. total population in the Republic of Croatia)

For EMEP grid cells that 100% belong to the territory of the Republic of Croatia, zone, agglomeration, municipality or city, Equation 2 is used for the distribution of emissions in that specific cell, where the fraction of that cell (f) is equal to number one.

For EMEP grid cells belonging to the territory of the Republic of Croatia, zone, agglomeration, municipality or city in a percentage less than 100%, Equation 2 is also used for emission distribution in this specific cell, where the fraction of that cell (f) is less than number one. This is the situation in many quadrants, and each state, zone, agglomeration, municipality or city has an assigned percentage if it shares an area with a neighbouring state, zone, agglomeration, municipality or city.

After preparing the necessary grid for the Republic of Croatia and allocating the amount of fractions to each quadrant, the LPS and other point sources were defined and their emission was subtracted from the national emission according to the corresponding GNFR / NFR / SNAP category. With the method of subtracting point sources emissions from the national total emissions, the values of diffuse source emissions were obtained, which were further processed.

Following the basic methodological approach for spatial mapping of emissions, in the EkoReGis model, emissions of LPS and other point sources are considered separately and their emissions are assigned to the grid quadrant exactly where they are located using the coordinates of each object. The object coordinate represents the proxy data for the point source allocation. LPS emissions are included in the Annex V Annex together with diffuse sources and other point sources, but are also reported separately in Annex VI of the Reporting Guidelines 2014. Details related to LPS and their spatial allocation are given in Subchapter 10.4.

Emissions from Small combustion, unreported or unregulated point sources and other diffuse sources (eg. polygons) are shown in the EkoReGis model in the area of the quadrant to which its x and y coordinates belong and are not represented according to their exact position as is the case with LPS. In the EkoReGis model, these emissions are quantified and spatially distributed by using nationally calculated emissions for a specific source category and linking them through the model with "proxy" statistics, such as the number of employees, number of inhabitants, etc.

Following the emission classification process, different spatial forms were managed in the next stage, including different sizes of grids, polygons, lines, each determined by the spatial characteristics of the source data.

The EkoReGis model combines a large number of geographical and statistical data sets (so-called proxy data), which needed to be adapted, combined and incorporated into a unifying format. The application of different sets of proxy data results in different patterns of spatial disaggregation of emissions in each of GNFR / NFR / SNAP category. To obtain a map of spatially disaggregated diffuse emissions, the EkoReGis model has combined and adapted the spatial data of different spatial projections such as WGS84, HTRS96, GK5 and GK6 to a common EMEP grid with a resolution of 0.1 ° x 0.1 °. This needed to be done so that different sectors / sources could be combined and linked. In this way, any future change, improvement or correction is much simpler. The sets of national proxy data used in the EkoReGis model are listed by sector in following Chapter 10.2.5.

The spatial distribution of emissions in the EkoReGis model was performed at the SNAP level of source categorization, i.e. at the most detailed level of the emission calculation in order to ensure the most detailed distribution of emissions. The SNAP level was applied for all sectors from SNAP 01 to 10. To meet the prescribed format according to ECE/EB.AIR.125[41] emission sources at the SNAP level were aggregated to the NFR level and then the NFR level to the required GNFR level.

10.2.5. Datasets (Proxy data)

A large number of national geographic data sets have been implemented in the EkoReGis model in the preparation of different distribution keys. The application of these data sets results in different patterns of spatial breakdown of national emissions in each GNFR category. The detail of the emission allocation, in addition to the emission calculation methodology, also depends on the detail of the available proxy data.

The data sets used and also available for the allocation of national emissions to the EMEP grid are listed in Tables 10.2-1 - 10.2-5, together with the data owners and the link to GNFR / NFR. Table 10.2-6 shows the data sets for the allocation of emissions from categories NFR 11.B, 1.A.3.ai (ii), 1.A.3.a.ii (ii) and 1.A.3.di (i) which do not enter the national total emissions.

The same proxy data sets were used for the 2021 submission as for the 2017 submission, but also supplemented for new category sources (see Chapter 10.1).

Table 10.2-1 General datasets for the allocation of national emissions to the EMEP network and links to GNFR and NFR

Dataset for emissions allocation	**Source**
EMEP grid for CRO	EMEP
Register of Spatial Units of the Republic of Croatia (RPJ)	MESD (originally DGU)
Digital orthophoto map (DOF) at a scale of 1: 5000	MESD (originally DGU)
Area of county, municipality / city, settlements in defined quadrants of networks: 0.1˚ x 0.1˚ and 500 m x 500 m	Calculated by overlapping the EMEP grid, RPJ and DOF for the Republic of Croatia by the Executor
Number of inhabitants of the county, municipality / city, settlement	CBS, Census 2011

[41] Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution prepared by TFEIP and published by the CLRTAP Executive Body

Table 10.2-2 Data sets for the allocation of national emissions from the Energy sector to the EMEP grid

GNFR	NFR	Dataset for emissions allocation	Source
A_PublicPower	1.A.1.a a. Public electricity and heat production	Geographical locations and drain height for thermal power plants, heating plants, public heating plants The amount of CO_2 emissions per public heating plant	MESD – EPR, Google maps
B_Industry	1.A.1.b Refineries	Geographical locations and drain height for refineries, heating devices and process furnaces heating devices	MESD – EPR, Google maps
B_Industry	1.A.1.c Manufacture of solid fuels and other energy industries	Geographical locations of coke ovens and flares in hydrocarbon fields The amount of CO_2 emissions during coke processing and during the oil and gas extraction process	INA Ltd. MESD - NEB MESD – EPR, ETS NIR Google maps
B_Industry	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 tobacco1.A.2.f Non-metallic minerals	Geographical locations of the plant, employees in that industry	MESD - NEB MESD – EPR, ETS Google maps CBS
B_Industry	1.A.2.g.vii Mobile Combustion in manufacturing industries and construction	Number of employees in construction sector in the Republic of Croatia, distribution by municipalities	CBS
H_Aviation	1.A.3.Aviation (civil) - LTO	Number of LTO cycles in domestic and international transport by airports and the air landing places, Geographical locations of airports and the air landing places, Area of airports and the air landing places, Length of routes in the Republic of Croatia for domestic transport Length of routes in the Republic of Croatia for international transport to the Croatian border	Airports in the Republic of Croatia, Air landing places of the Republic of Croatia, CCAA, Google maps, DOF, AirlineRouteMapper The Global Airport Database
F_RoadTransport	1.A.3.b (i-vii) Road transport	Georeferenced road network, Counting traffic on public roads by type of vehicle, Counting traffic on motorways by type of vehicle, Counting traffic on unclassified roads by type of vehicle, Number of vehicles by type and by county with the corresponding registration number, Distance travelled by vehicle type	Croatian roads, Croatian Motorways Ltd. (interactive map) MI vehicle database

GNFR	NFR	Dataset for emissions allocation	Source
I_Offroad	1.A.3.c Railways	Geo-referenced railway network with marked non-electrified and electrified rail sections and Marshalling Yards, Passenger transport by Marshalling Yard, Transport of goods by Marshalling Yards in the Republic of Croatia	HŽ Infrastruktura d.o.o., CBS
G_Shipping	1.A.3.d National navigation (shipping)	Geo-referenced network of inland waterways, geo-referenced network of sea routes, Geographical locations of the Harbour Master's Offices and Statistical ports, Maritime transport density, Maritime transport: transport of ships, passengers and goods by the Harbour Master's Offices and Statistical ports, Inland waterways transport: Transport of goods by the Harbour Master's Offices on inland waterways	MPPI - GIS database of the inland waterways and harbours, Real time ship maps - AIS Marine Traffic_files CBS
C_OtherStationaryComb	1.A.4.a Commercial/institutional	Number of employees in service activities in the Republic of Croatia, distribution by municipalities	CBS
C_OtherStationaryComb	1.A.4.b.i Residential	Number of Housing units: − distribution by municipalities - for zones of the Republic of Croatia − distribution by settlements - for agglomerations of the Republic of Croatia − distribution by city districts - for the City of Zagreb Information on the method of heating and the type of energy used: − distribution by municipalities - for zones of the Republic of Croatia − distribution by settlements - for agglomerations of the Republic of Croatia − distribution by city districts - for the City of Zagreb	CBS
C_OtherStationaryComb	1.A.4.c.i c. Agriculture/forestry/fishing	Number of animals (cattle, pigs and poultry) in the Republic of Croatia, distribution by municipalities	CBS
I_Offroad	1.A.4.b.ii Residential	Number of households in municipalities / cities	CBS
I_Offroad	1.A.4.c.ii Agriculture / Forestry / Fishing	Geographical locations of arable land and areas under forests in municipalities / cities	MESD - CLC
D_Fugitive	1.B.1.a Fugitive emissions from solid fuels: Coal mining and handling	Geographic location of coal mines	MESD
D_Fugitive	1.B.1.b Fugitive emissions from solid fuels: Solid fuel transformation	Geographic location of coke plant	MESD

GNFR	NFR	Dataset for emissions allocation	Source
D_Fugitive	1.B.2.a.i Oil - Exploration, production, transport	Geographic locations of active oil fields, Area of each oil field, Amount of crude oil extracted in oil fields	INA Ltd.
D_Fugitive	1.B.2.b Natural gas - Exploration, production, transport	Geographic locations of active gas fields, Area of each gas field, Amount of gas extracted from fields, Natural gas transmission network	INA Ltd.
D_Fugitive	1.B.2.a.iv Refining, storage	Geographic locations of the plants for Fluid coking, Catalytic reforming, Catalytic Cracking, Sulphur recovery, and areas for Storage and handling of petroleum products	MESD – EPR, Google maps
D_Fugitive	1.B.2.a.v Distribution of oil products	Geographic locations of dispatch stations, gasoline terminals and service stations	MESD – service stations database
D_Fugitive	1.B.2.c Venting and flaring (oil, gas)	Geographic locations of flares in gas extraction and Geographic locations of flares in oil refineries Quantities of gas flared by locations of the flares	INA Ltd.

Table 10.2-3 Datasets for allocation of national emissions from the IPPU sector to the EMEP network

GNFR	NFR	Dataset for emissions allocation	Source
B_Industry	2.A.1 Cement production	Geographic locations of plants (coordinates), height of stacks	MESD – EPR
B_Industry	2.A.2 Lime production	Geographic locations of plants (coordinates), amount of produced lime per plant, total produced lime in Croatia, height of stacks	MESD – EPR, MESD - ETS CBS
B_Industry	2.A.3 Glass production	Geographic locations of plants (coordinates), amount of produced glass/mineral wool per plant, total produced glass in Croatia, height of stacks	MESD - ETS CBS
B_Industry	2.A.5.a Quarrying and mining of minerals other than coal	Geographic locations of quarries, surface area	MESD - Exploitation and exploration fields of mineral resources in Croatia
B_Industry	2.A.5.b Construction and demolition	Number of employees by economic activities	CBS
B_Industry	2.B.1 Ammonia production	Geographic location of plant (coordinates), height of stack	MESD – EPR, Google maps
B_Industry	2.B.2 Nitric acid production	Geographic locations of plants (coordinates), height of stacks	MESD – EPR Google maps
B_Industry	2.B.10.a Other	Geographic locations of plants (coordinates), number of employees by economic activities	MESD – EPR, CBS, Google maps
B_Industry	2.C.1.1. Steel production in OHF	Geographic location of plant (coordinates), height of stack	MESD – EPR, Google maps
B_Industry	2.C.1.1. Steel production in EAF	Geographic locations of plants (coordinates), amount of produced steel	MESD – EPR, MESD – ETS, Google maps

GNFR	NFR	Dataset for emissions allocation	Source
		per plant, total produced steel in Croatia, height of stacks	
B_Industry	2.C.1.2 Pig iron production	Geographic location of plant (coordinates), height of stack	MESD – EPR, Google maps
B_Industry	2.C.1.5 Rolling mills	Geographic locations of plants (coordinates), amount of rolled steel per plant, total rolled steel in Croatia	MESD – EPR CBS Google maps
B_Industry	2.C.2 Ferroalloys production	Geographic locations of plants (coordinates)	Google maps
B_Industry	2.C.3 Aluminium production	Geographic locations of plants (coordinates)	Google maps
E_Solvents	2.D.3.a Domestic solvent use including fungicides	Population, Surface area by counties, municipalities, cities	CBS
B_Industry	2.D.3.b Road paving with asphalt	Georeferenced road network	Hrvatske ceste
B_Industry	2.D.3.c Asphalt roofing	Number of employees by economic activities	CBS
E_Solvents	2.D.3.d Coating applications	Number of employees in economic activities that use coating applications in municipalities/cities (*Industrial and other coating applications*), population in municipalities/cities (*Decorative coating application*)	CBS
E_Solvents	2.D.3.e Degreasing	Number of employees in economic activities that use degreasing (e.g. shipyards, metal processing),	CBS
E_Solvents	2.D.3.f Dry cleaning	Number of employees in accommodation and food service activities (e.g. hotels)	CBS
E_Solvents	2.D.3.g Chemical products	Number of employees in chemical industry	CBS
E_Solvents	2.D.3.h Printing	Number of employees in printing industry	CBS
E_Solvents	2.D.3.i Other solvent use	Number of employees in manufacturing industry, by county and municipality / city	CBS
E_Solvents	2.G Other product use	Population, population density, urban and rural areas	CBS
B_Industry	2.H.1 Pulp and paper industry	Geographic locations of plants (coordinates), height of stacks	CBS, MESD – EPR
B_Industry	2.H.2 Food and beverages industry	Number of employees in food and beverages industry, by county and municipality / city	CBS
B_Industry	2.I Wood processing	Number of employees in wood processing industry, by county and municipality / city	CBS
B_Industry	2.K Consumption of POPs and heavy metals	Population in counties, municipalities, cities	CBS

Table 10.2-4 Datasets for the allocation of national emissions from the Agriculture sector to the EMEP grid

GNFR	NFR	Data set for emission allocation	Source
K_AgriLivestock	3.B.1 Dairy cattle and other cattle	Number and distribution of dairy cows and other cattle by counties and municipalities Number and distribution of dairy cows and other cattle by farms, geographical locations of farms	Ministry of Agriculture, CBS, CAA
K_AgriLivestock	3.B.2 Sheep	Number and distribution of sheep by counties and municipalities	Ministry of Agriculture, CBS, CAA
K_AgriLivestock	3.B.3 Swine	Number and distribution of swine categories by counties and municipalities Number and distribution of swine categories by farms, geographical locations of farms	Ministry of Agriculture, CBS, CAA
K_AgriLivestock	3.B.4.d Goats	Number and distribution of goats by counties and municipalities	Ministry of Agriculture, CBS,
K_AgriLivestock	3.B.4.e Horses	Number and distribution of horses by counties and municipalities	Ministry of Agriculture, CBS,
K_AgriLivestock	3.B..4.f Mules and asses	Number and distribution of mules and asses by counties and municipalities	Ministry of Agriculture, CAA
K_AgriLivestock	3.B.g.i Poultry	Number and distribution of poultry categories by counties and municipalities Number and distribution of poultry categories by farms, geographical locations of farms	Ministry of Agriculture, CAA
L_AgriOther	3.D.1.a Mineral N fertilizers	Utilized agricultural area and crop yields by counties and municipalities, CLC Croatia (agricultural areas)	Ministry of Agriculture, APPRR - ARKOD, CBS
L_AgriOther	3.D.a.2.a	Number and distribution of animal categories by counties and municipalities	Ministry of Agriculture, CBS, CAA
L_AgriOther	3.D.a.2.b	Applied sewage sludge by counties and municipalities	MESD
L_AgriOther	3.D.a.3	Number and distribution of animal categories by counties and municipalities	Ministry of Agriculture, CBS, CAA
L_AgriOther	3.D.c	Utilized agricultural area by counties and municipalities	Ministry of Agriculture, CBS
L_AgriOther	3.D.e	Grassland area and area of cropland, CLC Croatia: Area under crops (wheat, rye, rape) by counties and municipalities	Ministry of Agriculture, CBS, MESD
L_AgriOther	3.D.f	Utilized agricultural area by counties and municipalities	Ministry of Agriculture, CBS
L_AgriOther	3.F	Area under crops (wheat, barley, maize, oats, rye, peas, beans, soybeans) and crop yields	Ministry of Agriculture, CBS

Table 10.2-5 The data sets for the allocation of national emissions from the Waste sector to the EMEP grid

GNFR	NFR	Dataset for emissions allocation	Source
J_Waste	5.A Biological treatment of waste - solid waste disposal on land	Geographical locations of landfills, mass of waste per landfills, total mass of landfilled waste in the Republic of Croatia.	MESD – EPR and Waste Management Information System

GNFR	NFR	Dataset for emissions allocation	Source
J_Waste	5.B.1 Biological treatment of waste - composting	Geographical locations of composting plants, mass of composted waste per composting plant, total mass of composted waste in the Republic of Croatia.	MESD – EPR/ROO
J_Waste	5.C.1.b.i Industrial waste incineration	Geographical locations of the installations in which the waste is incinerated without energy recovery, mass of waste incinerated in the installation, total mass of incinerated industrial waste in the Republic of Croatia.	MESD – EPR/ROO
J_Waste	5.C.1.b.iii Clinical waste incineration	Geographical locations of hospitals in which the waste is incinerated without energy recovery, mass of waste incinerated in the hospital, total mass of incinerated clinical waste in the Republic of Croatia.	MESD – EPR/ROO
J_Waste	5.C.1.b.v Cremation	Geographical location of the crematorium.	MESD – EPR/ROO
J_Waste	5.D.1 Domestic wastewater handling	Geographical locations of central wastewater treatment plants, quantity of treated wastewater by counties or municipalities. Number of inhabitants by counties, municipalities and cities of the Republic of Croatia. Number of persons in occupied dwellings with sewerage installations by city/municipality of the Republic of Croatia.	MESD – EPR/ROO, Croatian Bureau of Statistics (CBS)
J_Waste	5.D.1 Domestic wastewater handling - latrine	Number of inhabitants with latrine, by counties and municipalities.	CBS
J_Waste	5.D.2 Industrial wastewater handling	Quantity of treated industrial wastewater, according to NKD 2007., by counties or municipalities.	CBS
J_Waste	5.E Other waste - Fires on vehicles and buildings	Number of fires by categories (eg vehicles, industrial and other buildings), by counties. Geographical location of the fire.	Ministry of the Interior

Table 10.2-6 Datasets for allocation of national emissions to the EMEP network from categories that are not included in total national emissions

GNFR	NFR	Dataset for emissions allocation	Source
N_Natural	11.B Forest fire	Vectorized data in the database - Number and locations of forest fires and forest area affected by fire	DUZS, Corine Land Cover
O_AviCruise	1.A.3.a. (ii) Aviation cruise	Number of LTO cycles in domestic and international traffic at airports and ports, Geographical locations of airports and ports, Area of airports and piers, Length of routes in the Republic of Croatia for domestic traffic Length of routes in the Republic of Croatia for international traffic to the border of the Republic of Croatia	Airports and ports of the Republic of Croatia, CCAA, Google Maps, DOF, AirlineRouteMapper The Global Airport Database
P_IntShipping	1.A.3.d.i(i) International maritime traffic (ship bunkers)	Location of the port for receiving bunker fuel (Port of Rijeka)	Bunker Ports News Worldwide

10.2.6. Allocation indicators by GNFR categories

This subchapter provides a summary overview of allocation indicators by all GNFR categories.

The relationship between the GNFR category and the spatial disaggregation patterns is given in Table 10.2-7. This method of spatial distribution is applied to all observed pollutants.

Table 10.2-7 GNFR categories and associated allocation indicators

GNFR	Allocation indicators
A_PublicPower	For 1.A.1.a - Thermal power plants (TPP), Public cogeneration plants (PCP) - Geographic locations, direct emissions. For 1.A.1.a - Heating plants (PHP) - Geographic locations and share in proportion to CO_2 emissions per Public heating plant.
B_Industry	For 1.A.1.b Refineries, 2.A.1 Cement production, 2.A.2 Lime production, 2.C.1 Iron and steel production, 2.C.2 Ferroalloys production, 2.C.3 Aluminium production, 2.H.1 Pulp and paper production, 2.B Chemical industry (2.B.1 Ammonia, 2.B.2 Nitric acid, 2.B.10.a - Sulfuric acid, NPK fertilizers, Urea, Black carbon, Ammonium phosphate, polyethylene LD, Ethylene, Propylene, 1,2 dichloroethane, Vinyl chloride, Polyvinyl chloride, Styrene, Polystyrene, Formaldehyde, Ethyl benzene) emissions are distributed at a specific point at the plant site. For Polyethylene LD, emissions are evenly distributed at two locations. For 2.B.1 Ammonia, 2.B.2 Nitric acid, 2.B.10.a - Sulfuric acid, NPK fertilizers, Urea, Black carbon, Ammonium phosphate emissions are showed at the same location (one company). For 2.H.1 Pulp and paper industry, emission was evenly distributed to three production sites for 1990 and to one site for other years. For 1.A.1.c.i- Geographic location of the point source (Coke plant) and share of CO_2 emission. For1.A.1.c.iii - Process of extracting oil and gas (hydrocarbons) in proportion to the mass of gas flared on flares at geospatial locations of flares in hydrocarbon fields. For 1.A.2, 2.B.10.a (Formaldehyde), 2.H.2, 2.I in proportion to number of employees (NKD 2007) in the category C= MANUFACTURING INDUSTRY in the city/municipality. For 2.A.5.a in proportion to the area of each exploitation field (except hydrocarbons) to the geospatial location of the individual exploitation field. For 2.A.5.b and 2.D.3.c in proportion to number of employees (NKD 2007) in the category F=CONSTRUCTION in city/municipality. For 2.D.3.b in proportion to road section length in a quadrant. For 2.K in proportion to population in the city/municipality.
C_OtherStationaryComb	For 1.A.4.a.i Commercial / institutional: Stationary in proportion to the number of employees (NKD 2007) in the category of I so S, i.e. in the SERVICES sector in the city / municipality. For 1.A.4.b.i Residential: stationary combustion in proportion to the data on the number of household units, their area, the method of units heating and the type of energy used, in the city / municipality. Details on the specific energy consumption by type and unit of area and their purpose (cooking, heating and preparation of hot water) were obtained by conducting a detailed survey conducted in 2014 for the territory of the Republic of Croatia. The results of the survey were matched with the census (2001 and 2011) with the inclusion of climatic conditions present in the territory of the Republic of Croatia (Figure 10.2-5) through the degree-day function for individual heating methods. In the last step, the pairing results were linked to the national energy balance.

GNFR	Allocation indicators
	For 1.A.4.c.i Agriculture / Forestry / Fishing: Stationary in proportion to the number of animals (cattle, pigs and poultry) in the municipality / city.
D_Fugitive	For 1.B.1.a Coal mines: uniformly to all geospatial mine locations (1990 only) For 1.B.1.b Coke plant: to the geospatial location of one source. For 1.B.2.a.i Oil exploration, production, transport: in proportion to the amount of oil produced (in tonnes) and the area of the oilfield polygon to the geospatial location of the oilfield area. For 1.B.2.a.iv Refining / storage (Fluid coking unit, Catalytic reforming unit, Catalytic cracking unit regenerator, Claus plant, Storage and handling of petroleum products): proportional to emissions from relevant sources to the geospatial locations of these sources. For 1.B.2.a.v Gasoline transport: for refinery dispatch stations a uniform distribution to the geographical locations of the dispatcher, for gasoline terminals a uniform distribution to the geographical locations of the terminals, and for gasoline stations a uniform distribution to all geographical locations of petrol stations. For 1.B.2.b Natural gas exploration/production: in proportion to the amount of natural gas produced and the area of the natural gas exploitation field polygon to the geospatial locations of the natural gas exploitation field. For 1.B.2.b Natural gas transmission in proportion to the length of the transmission line section in the network quadrant. For 1.B.2.c Flares: for combustion in gas fields in proportion to the amount of gas flared at geospatial locations of flares in gas fields, for combustion in refineries in proportion to the amount of gas flared on flares at locations in refineries.
E_Solvents	For 2.D.3.a, 2.G in proportion to population in the city/municipality. For 2.D.3.d in proportion to the average value of the number of employees (NKD 2007) in category C= MANUFACTURING INDUSTRY and population in the city/municipality. For 2.D.3.e, 2.D.3.g, 2.D.3.h and 2.D.3.i, 2.G in proportion to number of employees (NKD 2007) in category C= MANUFACTURING INDUSTRY in the city/municipality. For 2.D.3.f in proportion to number of employees (NKD 2007) in category I= ACOMMODATION ACTIVITIES in the city/municipality.
F_RoadTransport	For 1.A.3.b.(i-iv): • for Highways in proportion to the average annual daily traffic at toll stations by type of vehicle and motorway length in quadrant (proportional to PGDP (section of each road type from one automatic counting point to the first following automatic counting point for each type of road: motorway, state road or county road) and a section of motorway length in the grid quadrant). • for Urban roads in proportion to the number of registered vehicles (90% - for 21 cities) of the same registration number in the city / municipality and the section of the length of the city road in the grid quadrant. • for Rural roads in proportion to the number of registered vehicles (10% - 14 cities) of the same registration number in the city / municipality and the section of rural road length in the grid quadrant. For 1.A.3.b.v, 1.A.3.b.vi, 1.A.3.b.vii proportional to the length of the section of all types of roads in the grid quadrant.
G_Shipping	For 1.A.3.d National navigation (maritime) proportional to the transport intensity of ships, passengers and goods on sea routes and at the locations of the Harbour Master's Offices and Statistical ports.

GNFR	Allocation indicators
	For 1.A.3.d National navigation (river - inland navigation) proportional to the traffic intensity of goods by the Harbour Master's Offices on inland waterways and in proportion to the length of the navigable part of the river (waterway section) in a quadrant.
H_Aviation	For 1.A.3.a Aviation (Civil) (LTO) on areas of the polygons, geospatial locations of the airport and the air landing places locations in proportion to transport intensity of passengers and goods and LTO cycles in domestic and international transport.
I_Offroad	For 1.A.3.c Railway proportional to the intensity of passenger and freight traffic on non-electrified and electrified lines and at 13 Marshalling Yards to the georeferenced rail network and geospatial locations of Marshalling Yards. For 1.A.4.b.ii Residential: Household and gardening (mobile) in proportion to the number of households in the municipality / city. For 1.A.4.c.ii Agriculture / Forestry / Fishing; Off road vehicles and other machinery - Agriculture (SNAP 080600) in proportion to the size of arable agricultural land in the municipality / city. For 1.A.4.c.ii Agriculture / Forestry / Fishing; Off road vehicles and other machinery - Forestry (SNAP 080700) in proportion to the size of the area under forests in the municipality / city. For 1.A.2.g.vii Mobile Combustion in manufacturing industries and construction: mobile sources in proportion to the number of employees (NKD 2007) in category F = CONSTRUCTION in the city / municipality.
J_Waste	For 5.A Biological treatment of waste - solid waste disposal on land in proportion to the mass of landfilled solid waste to geospatial locations of active landfills. For 5.B1 Biological treatment of waste - composting in proportion to the mass of composted waste to geospatial locations of composting plants. For 5.C.1.b.i Industrial waste incineration in proportion to the mass of incinerated industrial waste without energy recovery to geospatial locations of installations for industrial waste incineration. For 5.C.1.b.iii Clinical waste incineration in proportion to the mass of incinerated clinical waste without energy recovery to geospatial locations of installations for clinical waste incineration. For 5.C.1.b.v Cremation: emissions are distributed at a point at the location of the crematorium. For 5.D.1 Domestic wastewater handling by locations of central municipal wastewater treatment systems in the Republic of Croatia in proportion to the number of persons in occupied dwellings/buildings with sewerage installation in the city/municipality. For 5.D.1 Domestic wastewater handling – latrine in proportion to the number of dwellings for permanent and occasional residence with a toilet without flusher, without a toilet in the dwelling and unknown in the municipality/city. For 5.D.2 Industrial wastewater handling in proportion to the number of employees (NKD 2007.) in category C = MANUFACTURING in the city/municipality. For 5.E Other waste uniform distribution to geospatial locations of fires on vehicles and buildings in the Republic of Croatia.
K_AgriLivestock	For 3.B Manure management: in proportion to the animal number by species in the county/ city/ municipality/ on the farm, and uniformly per segment of agricultural area in the county/ city/ municipality/ on the farm.
L_AgriOther	For 3.D Crop production and agricultural soils,: in proportion to the pasture areas and area under crops in the county/ city/ municipality.

GNFR	Allocation indicators
O_AviCruise	For 1.A.3.a Aviation (Civil) (cruise) in proportion to the intensity (density) of the air route on the length of routes in the Republic of Croatia for domestic traffic and the length of routes in the Republic of Croatia for international traffic to the Croatian border.
P_IntShipping	For 1.A.3.d.ii (080404) International maritime navigation, in proportion to the traffic intensity of ships, passengers and goods in ports of international importance.
N_Natural	For 11.B Forest fires evenly on geospatial locations of forest fires.

11.3 Results of spatial distribution of emissions (visualization)

A visualized view of the results of the spatial disaggregation of emissions is available at the link: https://emep.haop.hr/, from which the representations in Figures 11.3-1 - 11.3-4 for NOx, SO_2, NH_3, NMVOC and $PM_{2.5}$ are taken. The Figures are related to emissions in 2015. In addition to the above, the link also provides views for 1990, 1995, 2000, 2010, 2015 for all observed pollutants for which there is an obligation to spatial disaggregation of emissions. Pictures of the results of the spatial disaggregated emissions in the territory of the Republic of Croatia include LPS emissions.

For the submission in 2021, the results of the spatial disaggregated emissions for 2019 will be presented, as well as the updated results of the spatial disaggregated emissions for 1990, 1995, 2000, 2010 and 2015, whose obligation to report is 1 May 2021, when the updated spatial disaggregated emissions in the territory of the Republic of Croatia will be available and updated.

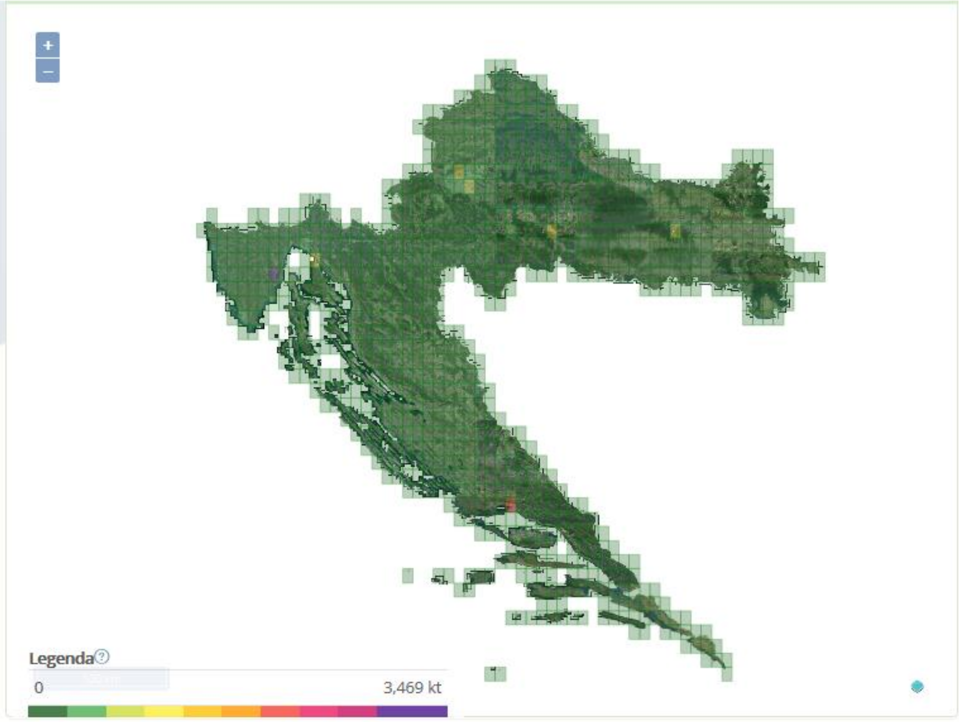


Figure 10.3-1 Spatially disaggregated NOx emissions in the Republic of Croatia, 2015

Source: https://emep.haop.hr/

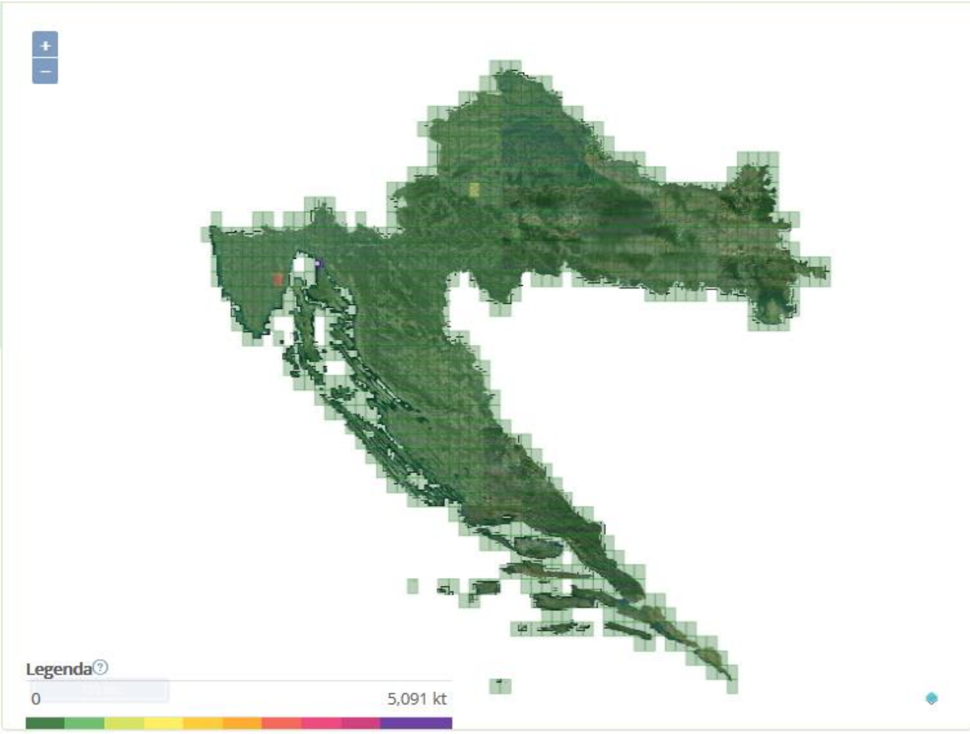


Figure 10.3-2 Spatially disaggregated SO_2 emissions in the Republic of Croatia, 2015
Source: https://emep.haop.hr/

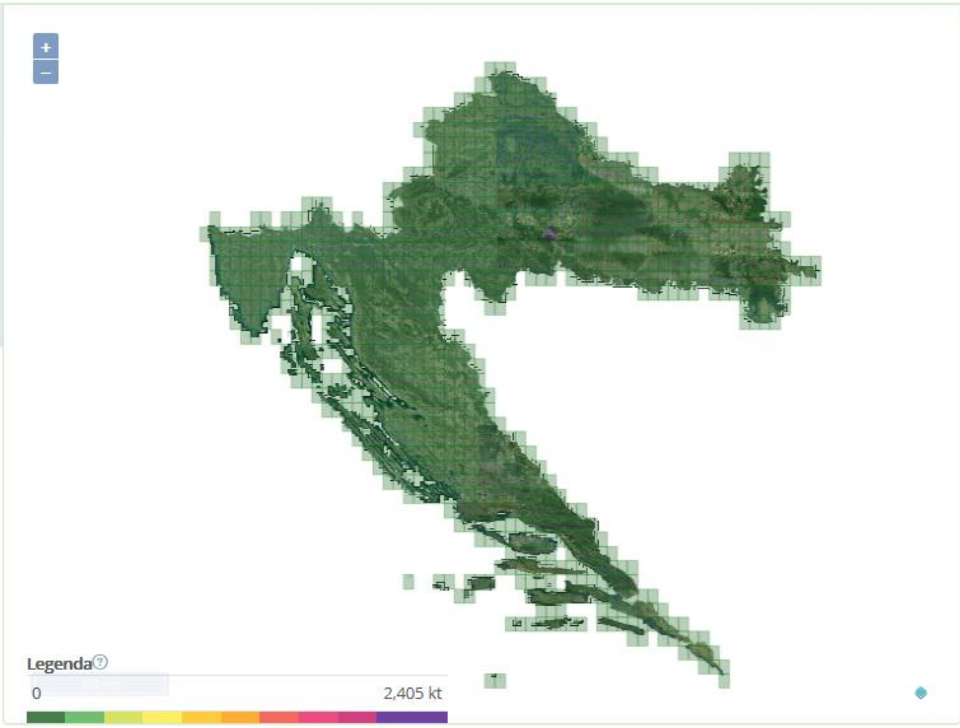


Figure 10.3-3 Spatially disaggregated NH_3 emissions in the Republic of Croatia, 2015
Source: https://emep.haop.hr/

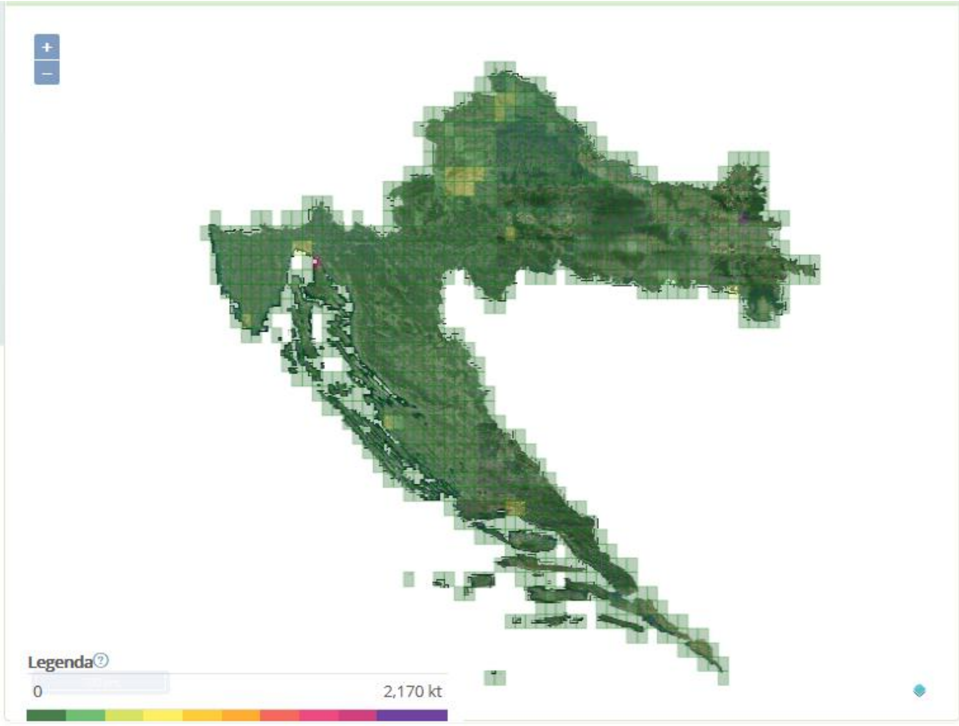


Figure 10.3-4 Spatially disaggregated NMVOC emissions in the Republic of Croatia, 2015
Source: https://emep.haop.hr/

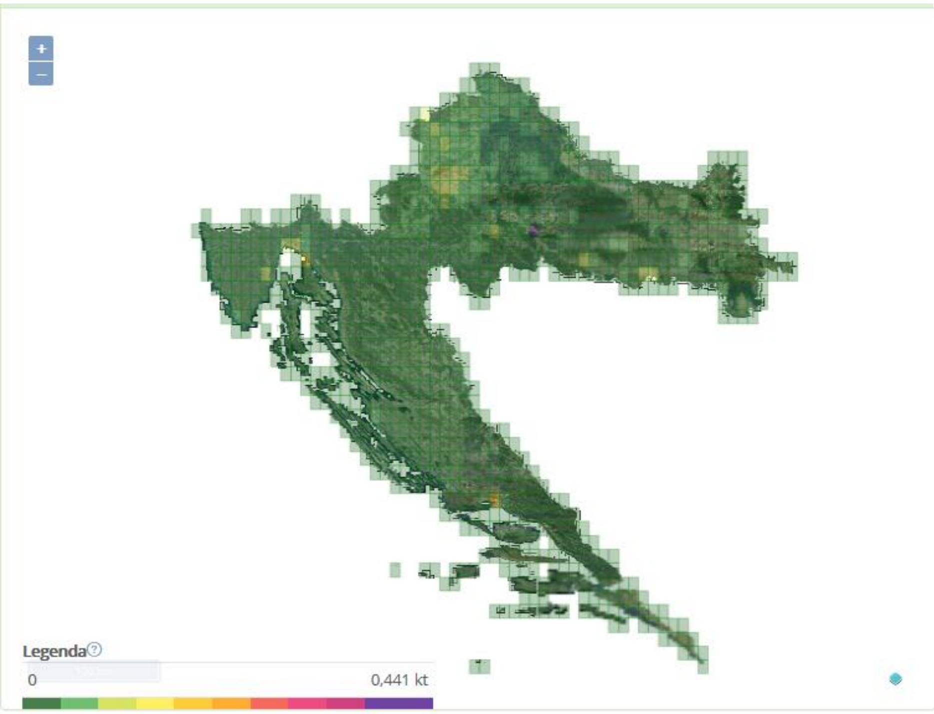


Figure 10.3-5 Spatially disaggregated $PM_{2.5}$ emissions in the Republic of Croatia, 2015
Source: https://emep.haop.hr/

11.4 Large point sources (LPS)

Large point sources (LPS) are reported according to the definitions of the ECE Guidelines (ECE 2014). LPS are defined as facilities or installations whose emissions of at least one of the 14 pollutants exceed the defined limit value given (see Chapter 1.5.3 and Figure 1.5-1).

In 2019, the list of Croatian LPSa includes 103 plants (see Chapter 1.5.4 and Table 1.5-3). Of these, 23 are plants from the Energy and Industrial Processes sector, for which emissions were reported to the EPR database, 6 plants from the Product Use sector (Solvents) for which emissions are reported to the HLAP database. The rest are farms, which belong to the GNFR category K_AgricultureLivestock and which were calculated by the Executor, based on the number of animals on each farm in 2019 and data on installed NH_3 emission reduction techniques, as there are no publicly available emission data for them yet.

Information related to the physical height of the stack is reported with height classes, and LPSs locations are given in WGS 84 decimal coordinates.

The plants that reported the emission to the E-PRTR in 2017 (the latest data available at the time of writing the IIR) were assigned a unique ID in line with the encouragement of TERT.

In accordance with the given criterion that the set of LPS, GNFR and altitude class must appear only once (according to Annex VI of the Reporting Guidelines 2014), for LPS where there is more than one hight class at the site (e.g. refineries), for the needs the class with the highest stack height was assigned to the reporting.

As part of the LPS emissions application in 2017, for the years 1990, 1995, 2000, 2010 and 2015 for which there are several GNFRs at the site in the inventory (e.g. for refineries: GNFR B_Industry for NFR 1.A.1.b Refineries, D_Fugitive for NFR 1.B.2.a.iv Fugitive oil emissions: Refining / storage and 1.B.2.c Flares (oil, gas, combined oil and gas) for categorization of LPS emission reporting associated is the corresponding GNFR (non-compliance with the given criterion). The mentioned application included, in addition to emissions reported in the EPR database, emissions calculated by the manufacturer and for which the EPR obligor has no obligation to report. LPS emissions reported in 2017 will not be updated in the 2021 submission.

LPS emissions for 2019 that will be reported in 2021 contain only reported emissions (in the EPR database) and do not include emissions calculated by the manufacturer, for which the EPR obligor has no obligation to report. For the categorization of LPS emission reporting, the GNFR is determined as follows: in accordance with the classification of the organizational unit on site (LPS) in E-PRTR: Facility Details, Main activity (NACE) and using the Mapping Table[42] linking the categories of different reporting formats (NACE, SNAP, NFR, CRF, E-PRTR, GAINS / RAINS) determined a single LPS GNFR.

LPSs in 2019 are plants for the production of electricity and heat, production of other non-metallic mineral products (cement, glass, other), sugar factories, plant for the production of mineral fertilizers and other chemicals, plants for the production of refined petroleum products (refineries) and cow, pig and poultry farms.

An overview of LPSs locations in accordance with the last submission in 2017 can be seen in Figure 10.4-1. The view will be updated for the next submission in IIR 2022.

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[42] The table was prepared by a team of Finnish and Estonian broadcast experts (last updated on December 6, 2019) and is available at: https://www.ceip.at/fileadmin/inhalte/ceip/00_pdf_other/2019/06122019_conversiontablereportingcodes_.xlsx

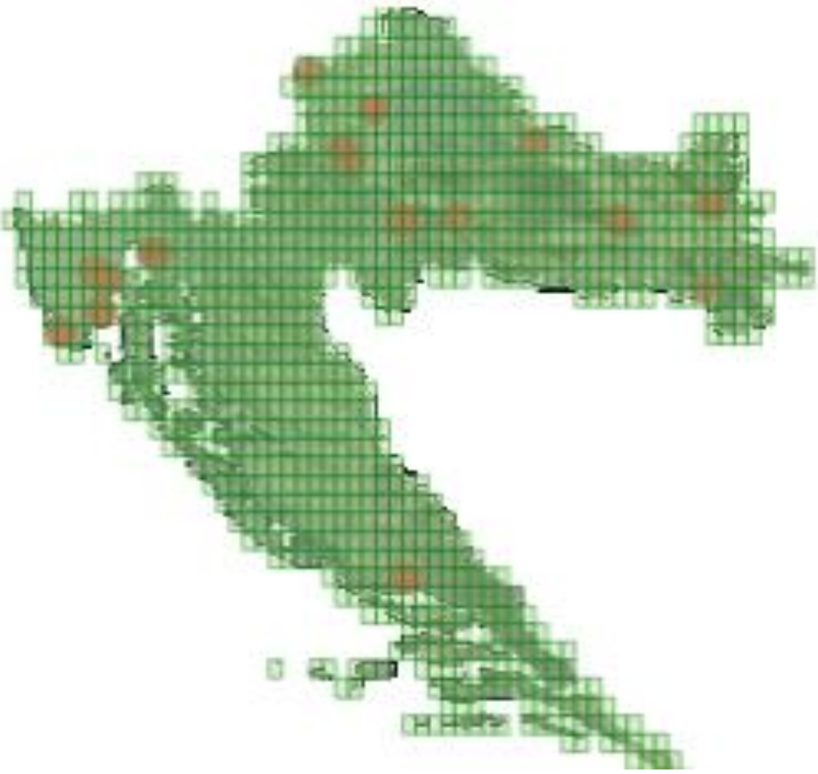

Figure 10.4-1 Locations of LPSs, submission 2017
Source: https://emep.haop.hr/

11. Adjustments

There are no adjustments in Croatia’s air pollutant emission inventory.

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IIR Appendices

APPENDIX 1: QA/QC activities

APPENDIX 2: Description of SNAP97 sectors

APPENDIX 3: NFR and correspond SNAP codes

APPENDIX 4: Emission factors – 2018

APPENDIX 5: National energy balance for 2018

APPENDIX 6: NFR 2018

APPENDIX 7: Uncertainty analysis

APPENDIX 8: Influence of recalculations 1990 – 2017 in respect to pollutant and SNAP97 sector

APPENDIX 9: Inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors

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	Deadline
DATA COLLECTION ACTIVITIES				
Checks all input data for emission calculations properly referenced	Mirela Poljanac	Until the beginning of December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check availability of literature material	Mirela Poljanac	=	Vladimir Jelavić, Valentina Delija-Ružić	December
Confirm that bibliographical data references are properly cited	Mirela Poljanac	=	Vladimir Jelavić, Valentina Delija-Ružić	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, Valentina Delija-Ružić	December
Cross-check descriptions of input data and the emission factors with information about categories	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check the correctness of interpretation and use of activity data and emission factors	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check that the parameters and units are accurately recorded	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check that used appropriate conversion factors	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check whether the unit is properly marked in the worksheets	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check the consistency of data between the categories	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Identified e.g. activity data common to several categories	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check the consistency of the activity data	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check the consistency of time series of input activity data for each category	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	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, Valentina Delija-Ružić	December
Check whether there is double counting, i.e. duplication of entries	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December

Activity	QC checks / reviews		QC others (Correction)	
	Expert name	Period / deadline	QA / QC manager	Deadline
Check out the use of units and all necessary conversions of the same	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Used to check the consistency of data on activities for each pollutant within each category.	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
DATABASES ITEMS				
Check the correctness of the emissions calculation	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check the consistency of trends	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	December
Check *Tier 2* method for emissions calculation by using *Tier 1*	Mirela Poljanac	December	Vladimir Jelavić, Valentina Delija-Ružić	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	Hana Mesić, Vladimir Jelavić	week before the 15th February
Check NFR national totals	Mirela Poljanac	beginning February	Hana Mesić, Vladimir Jelavić	week before the 15th February
Check for major changes compared to previous year	Mirela Poljanac	beginning February	Hana Mesić, Vladimir Jelavić	week before the 15th February
Check totals in NFR codes with totals in SNAP codes	Mirela Poljanac	beginning February	Hana Mesić, 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	Hana Mesić Jasna Kufrin Andrina Crnjak Thavenet Martina Beuk Tatjana Obučina Tamara Embreuš Vladimir Jelavić	the 14th March
Check out the Figures	Mirela Poljanac	10. February to 14th March	Hana Mesić, Vladimir Jelavić	the 14th March
ARCHIVING				
Production of *"hard"* copies of the database	Mirela Poljanac	from April -…	-	-

Activity	QC checks / reviews		QC others (Correction)	
	Expert name	Period / deadline	QA / QC manager	Deadline
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 -…	-	-

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.

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	
1 B 2 a i	Exploration Production, Transport	
1 B 2 a iv	Refining / Storage	04 01

NFR Code	Long name	SNAP code
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	
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

NFR Code	Long name	SNAP code
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

Appendix 4. Emission factors – 2019

Table A4-1 Emission factors for the year 2019 – export from CollectER database

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
1	Plomin	1.A.1.a	NMVOC	3	g/GJ
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
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
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
98	Bread (white bread)	2.D.2	NMVOC	2	kg/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
104	Mineral Production, Road Paving with Asphalt	2.A.6	NMVOC	15	g/t
104	Mineral Production, Road Paving with Asphalt	2.A.6	TSP	13000	g/t

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
104	Mineral Production, Road Paving with Asphalt	2.A.6	PM25	700	g/t
104	Mineral Production, Road Paving with Asphalt	2.A.6	PM10	3000	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
120	Polyester processing	3.C	NMVOC	10	kg/t
4842	2.D.3.i Fat, edible and non-edible oil extraction	3.D.3	NMVOC	1,57	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
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
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	NOX	1,4	kg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	NMVOC	1,8	kg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	CO	6,3	kg/t
4842	2.D.3.i Fat, edible and non-edible oil extraction	3.D.3	TSP	1,1	kg/t
4842	2.D.3.i Fat, edible and non-edible oil extraction	3.D.3	PM25	0,6	kg/t
4842	2.D.3.i Fat, edible and non-edible oil extraction	3.D.3	PM10	0,9	kg/t
4843	2.D.3.i Creosote preservative type	3.D.3	NMVOC	105	kg/t
4843	2.D.3.i Creosote preservative type	3.D.3	Benzo(a)	1,05	g/t
4843	2.D.3.i Creosote preservative type	3.D.3	Benzo(b)	0,53	g/t
4843	2.D.3.i Creosote preservative type	3.D.3	Benzo(k)	0,53	g/t
4843	2.D.3.i Creosote preservative type	3.D.3	Indeno	0,53	g/t
4844	2.D.3.i Organic solventborne preservative	3.D.3	NMVOC	945	kg/t
4846	2.G Tabacco combustion	3.D.3	Ni	2,7	g/t
4846	2.G Tabacco combustion	3.D.3	Cd	5,4	g/t

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
4846	2.G Tabacco combustion	3.D.3	Zn	2,7	g/t
4846	2.G Tabacco combustion	3.D.3	Benzo(b)	0,045	g/t
6431	Degreasing - Vapour cleaning	3.B.1	NMVOC	710	caput
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	ng/GJ
3701	1.A.2.a_301A	1.A.2.c	NMVOC	7	g/GJ
3813	2.D.1_Paper pulp: Neutral Sulphite Semi-Chemical process	2.D.1	NMVOC	0,05	kg/t
3815	White wine	2.D.2	NMVOC	0,035	hl product
3816	Wine (unspecified color)	2.D.2	NMVOC	0,08	hl product
3817	2.D.2_Beer	2.D.2	NMVOC	35	g/hl product
3818	2.D.2_Spirits	2.D.2	NMVOC	15000	g/hl product
3824	1.B.2.a.1_201A	1.B.2.a.1	NMVOC	0,095	kg/t
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
3836	3.C_PVC process.	3.C	NMVOC	10	kg/t
6430	Printing industry	3.D.1	NMVOC	500	t
3840	3.C_Rubber manufac.	3.C	NMVOC	8	kg/t
3841	3.C_Pharmaceuticals products manufac.	3.C	NMVOC	300	g/kg solvent
3842	3.C_Paints manufac.	3.C	NMVOC	11	kg/t
3843	3.C_Inks manufac.	3.C	NMVOC	11	kg/t
3844	3.C_Glues manufac.	3.C	NMVOC	11	kg/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
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
4436	Ammonium phosphate production	2.B.5.a	TSP	300	g/t

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
4436	Ammonium phosphate production	2.B.5.a	PM25	180	g/t
4436	Ammonium phosphate production	2.B.5.a	PM10	240	g/t
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
4449	Consumption of POPs and HMs	2.F.8	Hg	0,01	g/caput
4449	Consumption of POPs and HMs	2.F.8	PCBs	0,1	g/caput
4470	Latrines	6.B.2	NH3	1,6	kg/inhabitant
4471	Waste water treatment in industry	6.B.1	NMVOC	15	g/1000m3
4472	Waste water treatment in residental / commercial sector	6.B.2	NMVOC	15	g/1000m3
4487	Rolling mills - cold	2.C.1.5	TSP	96	g/t
4488	Meat, fish etc. frying / curing	2.D.2	NMVOC	0,3	kg/t
4489	Sugar	2.D.2	NMVOC	10	kg/t
4490	Margarine and solid cooking fats	2.D.2	NMVOC	10	kg/t
4492	Animal feed	2.D.2	NMVOC	1	kg/t
4493	Coffee roasting	2.D.2	NMVOC	0,55	kg/t
4494	Cakes, biscuits and breakfast cereals	2.D.2	NMVOC	1	kg/t
4500	040620_wood processing	2.D.3	TSP	1	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 without CO boiler	1.B.2.a.4	CO	39	kg/m3
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	PM10	0,55	kg/m3
4504	Sulphur recovery plants	1.B.2.a.4	SO2	140	kg/t product
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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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
4506	Diffuse NMVOC emissions	1.B.2.a.4	NMVOC	0,2	kg/t crude
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	12,1	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
4647	Decorative coating application	3.A.1	NMVOC	150	g/kg product
4649	Industrial coating application	3.A.2	NMVOC	400	g/kg product
4650	Other coating application	3.A.3	NMVOC	200	g/kg product
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
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
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
4797	Expandible PS	3.C	NMVOC	60	kg/t
4503	Catalytic Cracking unit regenerators-Partial burn without CO boiler	1.B.2.a.4	TSP	0,7	kg/m3
4505	Fluid coking units	1.B.2.a.4	TSP	1,5	kg/m3
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
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
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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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	µg/GJ
4833	coke oven coke from browe coal	1.A.2.f.1	Indeno	18,5	µg/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
4836	CPS I, II, III_2011	1.B.2.b.1	Hg	0,041	kg
4837	Detached house fire	6.D	As	1,35	g/fire
4837	Detached house fire	6.D	Cd	0,85	g/fire
4837	Detached house fire	6.D	Cr	1,29	g/fire
4837	Detached house fire	6.D	Cu	2,99	g/fire
4837	Detached house fire	6.D	Hg	0,85	g/fire
4837	Detached house fire	6.D	Pb	0,42	g/fire
4837	Detached house fire	6.D	DIOX	1,44	mg/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	g/fire
4838	Undetached house fire	6.D	Cd	0,36	g/fire
4838	Undetached house fire	6.D	Cr	0,55	g/fire
4838	Undetached house fire	6.D	Cu	1,28	g/fire
4838	Undetached house fire	6.D	Hg	0,36	g/fire
4838	Undetached house fire	6.D	Pb	0,18	g/fire
4838	Undetached house fire	6.D	DIOX	0,62	mg/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	g/fire
4839	Apartment building fire	6.D	Cd	0,26	g/fire
4839	Apartment building fire	6.D	Cr	0,39	g/fire

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
4839	Apartment building fire	6.D	Cu	0,91	g/fire
4839	Apartment building fire	6.D	Hg	0,26	g/fire
4839	Apartment building fire	6.D	Pb	0,13	g/fire
4839	Apartment building fire	6.D	DIOX	0,44	mg/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	g/fire
4840	Industrial building fire	6.D	Cd	0,16	g/fire
4840	Industrial building fire	6.D	Cr	0,24	g/fire
4840	Industrial building fire	6.D	Cu	0,57	g/fire
4840	Industrial building fire	6.D	Hg	0,16	g/fire
4840	Industrial building fire	6.D	Pb	0,08	g/fire
4840	Industrial building fire	6.D	DIOX	0,27	mg/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
4841	Car fire	6.D	DIOX	0,048	mg/fire
4841	Car fire	6.D	TSP	2,3	kg/fire
4841	Car fire	6.D	PM25	2,3	kg/fire
4841	Car fire	6.D	PM10	2,3	kg/fire
4846	2.G Tabacco combustion	3.D.3	NMVOC	4,84	kg/t
4846	2.G Tabacco combustion	3.D.3	TSP	27	kg/t
4846	2.G Tabacco combustion	3.D.3	PM25	27	kg/t
4846	2.G Tabacco combustion	3.D.3	PM10	27	kg/t
4846	2.G Tabacco combustion	3.D.3	NOX	1,8	kg/t
4846	2.G Tabacco combustion	3.D.3	CO	55,1	kg/t
4846	2.G Tabacco combustion	3.D.3	Cu	5,4	g/t
4846	2.G Tabacco combustion	3.D.3	DIOX	0,1	µg/t
4846	2.G Tabacco combustion	3.D.3	Benzo(k)	0,045	g/t
4846	2.G Tabacco combustion	3.D.3	Benzo(a)	0,111	g/t
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
5361	5.C.1.b.v Cremation	6.C.d	Hg	1,49	g/caput
5361	5.C.1.b.v Cremation	6.C.d	SO2	0,113	kg/caput
5361	5.C.1.b.v Cremation	6.C.d	NOX	0,825	kg/caput

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5361	5.C.1.b.v Cremation	6.C.d	CO	0,14	kg/caput
5361	5.C.1.b.v Cremation	6.C.d	TSP	38,56	kg/caput
5361	5.C.1.b.v Cremation	6.C.d	PM25	34,7	kg/caput
5361	5.C.1.b.v Cremation	6.C.d	PM10	34,7	kg/caput
5361	5.C.1.b.v Cremation	6.C.d	NMVOC	0,013	kg/caput
5361	5.C.1.b.v Cremation	6.C.d	Pb	30,03	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	Cd	5,03	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	As	13,61	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	Cr	13,56	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	Cu	12,43	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	Ni	17,33	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	Se	19,78	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	Zn	160,12	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	PCBs	0,41	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	DIOX	0,027	µg/caput
5361	5.C.1.b.v Cremation	6.C.d	HCB	0,15	mg/caput
5361	5.C.1.b.v Cremation	6.C.d	Benzo(a)	13,2	µg/caput
5361	5.C.1.b.v Cremation	6.C.d	Benzo(b)	7,21	µg/caput
5361	5.C.1.b.v Cremation	6.C.d	Benzo(k)	6,44	µg/caput
5361	5.C.1.b.v Cremation	6.C.d	Indeno	6,99	µg/caput
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
5427	Petroleum coke	1.A.1.b	Zn	49,3	mg/GJ
5427	Petroleum coke	1.A.1.b	DIOX	2,5	ng/GJ
6808	High-efficiency stoves	1.A.4.b.1	Pb	27	mg/GJ
6808	High-efficiency stoves	1.A.4.b.1	Se	0,5	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	µg/GJ
5154	Open fireplaces	1.A.4.b.1	Benzo(k)	42	µg/GJ
5154	Open fireplaces	1.A.4.b.1	Benzo(a)	121	µg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5154	Open fireplaces	1.A.4.b.1	Indeno	71	µg/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
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	µg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Benzo(k)	42	µg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Benzo(a)	121	µg/GJ
5155	Single house boilers <50kWth	1.A.4.b.1	Indeno	71	µg/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
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
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	µg/GJ
5156	Domestic stoves	1.A.4.b.1	Benzo(k)	42	µg/GJ
5156	Domestic stoves	1.A.4.b.1	Benzo(a)	121	µg/GJ
5156	Domestic stoves	1.A.4.b.1	Indeno	71	µg/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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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
5128	2.A.2_Tier 2	2.A.2	TSP	400	g/t
5128	2.A.2_Tier 2	2.A.2	PM25	30	g/t
5128	2.A.2_Tier 2	2.A.2	PM10	200	g/t
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	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
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	7,60E-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
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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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
5240	Gaseous fuels	1.A.2.f.1	Pb	0,011	mg/GJ
5240	Gaseous fuels	1.A.2.c	Pb	0,011	mg/GJ
5240	Gaseous fuels	1.A.2.b	Pb	0,011	mg/GJ
5240	Gaseous fuels	1.A.2.d	Pb	0,011	mg/GJ
5240	Gaseous fuels	1.A.2.e	Pb	0,011	mg/GJ
5240	Gaseous fuels	1.A.2.a	Pb	0,011	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Se	0,058	mg/GJ
5240	Gaseous fuels	1.A.2.c	Se	0,058	mg/GJ
5240	Gaseous fuels	1.A.2.b	Se	0,058	mg/GJ
5240	Gaseous fuels	1.A.2.d	Se	0,058	mg/GJ
5240	Gaseous fuels	1.A.2.e	Se	0,058	mg/GJ
5240	Gaseous fuels	1.A.2.a	Se	0,058	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Zn	0,73	mg/GJ
5240	Gaseous fuels	1.A.2.c	Zn	0,73	mg/GJ
5240	Gaseous fuels	1.A.2.b	Zn	0,73	mg/GJ
5240	Gaseous fuels	1.A.2.d	Zn	0,73	mg/GJ
5240	Gaseous fuels	1.A.2.e	Zn	0,73	mg/GJ
5240	Gaseous fuels	1.A.2.a	Zn	0,73	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	DIOX	0,52	ng/GJ
5240	Gaseous fuels	1.A.2.c	DIOX	0,52	ng/GJ
5240	Gaseous fuels	1.A.2.b	DIOX	0,52	ng/GJ
5240	Gaseous fuels	1.A.2.d	DIOX	0,52	ng/GJ
5240	Gaseous fuels	1.A.2.e	DIOX	0,52	ng/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5240	Gaseous fuels	1.A.2.a	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.c	Benzo(b)	2,9	µg/GJ
5240	Gaseous fuels	1.A.2.b	Benzo(b)	2,9	µg/GJ
5240	Gaseous fuels	1.A.2.d	Benzo(b)	2,9	µg/GJ
5240	Gaseous fuels	1.A.2.e	Benzo(b)	2,9	µg/GJ
5240	Gaseous fuels	1.A.2.a	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.c	Benzo(k)	1,1	µg/GJ
5240	Gaseous fuels	1.A.2.b	Benzo(k)	1,1	µg/GJ
5240	Gaseous fuels	1.A.2.d	Benzo(k)	1,1	µg/GJ
5240	Gaseous fuels	1.A.2.e	Benzo(k)	1,1	µg/GJ
5240	Gaseous fuels	1.A.2.a	Benzo(k)	1,1	µg/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
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
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
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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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
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
5240	Gaseous fuels	1.A.2.f.1	Benzo(a)	0,72	µg/GJ
5240	Gaseous fuels	1.A.2.c	Benzo(a)	0,72	µg/GJ
5240	Gaseous fuels	1.A.2.b	Benzo(a)	0,72	µg/GJ
5240	Gaseous fuels	1.A.2.d	Benzo(a)	0,72	µg/GJ
5240	Gaseous fuels	1.A.2.e	Benzo(a)	0,72	µg/GJ
5240	Gaseous fuels	1.A.2.a	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.c	Indeno	1,08	µg/GJ
5240	Gaseous fuels	1.A.2.b	Indeno	1,08	µg/GJ
5240	Gaseous fuels	1.A.2.d	Indeno	1,08	µg/GJ
5240	Gaseous fuels	1.A.2.e	Indeno	1,08	µg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5240	Gaseous fuels	1.A.2.a	Indeno	1,08	µg/GJ
5240	Gaseous fuels	1.A.2.f.1	SO2	0,67	g/GJ
5240	Gaseous fuels	1.A.2.c	SO2	0,67	g/GJ
5240	Gaseous fuels	1.A.2.b	SO2	0,67	g/GJ
5240	Gaseous fuels	1.A.2.d	SO2	0,67	g/GJ
5240	Gaseous fuels	1.A.2.e	SO2	0,67	g/GJ
5240	Gaseous fuels	1.A.2.a	SO2	0,67	g/GJ
5240	Gaseous fuels	1.A.2.f.1	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.c	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.b	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.d	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.e	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.a	NOX	74	g/GJ
5240	Gaseous fuels	1.A.2.f.1	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.c	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.b	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.d	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.e	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.a	NMVOC	23	g/GJ
5240	Gaseous fuels	1.A.2.f.1	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.c	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.b	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.d	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.e	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.a	CO	29	g/GJ
5240	Gaseous fuels	1.A.2.f.1	TSP	0,78	g/GJ
5240	Gaseous fuels	1.A.2.c	TSP	0,78	g/GJ
5240	Gaseous fuels	1.A.2.b	TSP	0,78	g/GJ
5240	Gaseous fuels	1.A.2.d	TSP	0,78	g/GJ
5240	Gaseous fuels	1.A.2.e	TSP	0,78	g/GJ
5240	Gaseous fuels	1.A.2.a	TSP	0,78	g/GJ
5240	Gaseous fuels	1.A.2.f.1	PM25	0,78	g/GJ
5240	Gaseous fuels	1.A.2.c	PM25	0,78	g/GJ
5240	Gaseous fuels	1.A.2.b	PM25	0,78	g/GJ
5240	Gaseous fuels	1.A.2.d	PM25	0,78	g/GJ
5240	Gaseous fuels	1.A.2.e	PM25	0,78	g/GJ
5240	Gaseous fuels	1.A.2.a	PM25	0,78	g/GJ
5240	Gaseous fuels	1.A.2.f.1	PM10	0,78	g/GJ
5240	Gaseous fuels	1.A.2.c	PM10	0,78	g/GJ
5240	Gaseous fuels	1.A.2.b	PM10	0,78	g/GJ
5240	Gaseous fuels	1.A.2.d	PM10	0,78	g/GJ
5240	Gaseous fuels	1.A.2.e	PM10	0,78	g/GJ
5240	Gaseous fuels	1.A.2.a	PM10	0,78	g/GJ
5240	Gaseous fuels	1.A.2.f.1	BC	0,0312	g/GJ
5240	Gaseous fuels	1.A.2.c	BC	0,0312	g/GJ
5240	Gaseous fuels	1.A.2.b	BC	0,0312	g/GJ
5240	Gaseous fuels	1.A.2.d	BC	0,0312	g/GJ
5240	Gaseous fuels	1.A.2.e	BC	0,0312	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5240	Gaseous fuels	1.A.2.a	BC	0,0312	g/GJ
5240	Gaseous fuels	1.A.2.f.1	As	0,1	mg/GJ
5240	Gaseous fuels	1.A.2.c	As	0,1	mg/GJ
5240	Gaseous fuels	1.A.2.b	As	0,1	mg/GJ
5240	Gaseous fuels	1.A.2.d	As	0,1	mg/GJ
5240	Gaseous fuels	1.A.2.e	As	0,1	mg/GJ
5240	Gaseous fuels	1.A.2.a	As	0,1	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Cd	0,0009	mg/GJ
5240	Gaseous fuels	1.A.2.c	Cd	0,0009	mg/GJ
5240	Gaseous fuels	1.A.2.b	Cd	0,0009	mg/GJ
5240	Gaseous fuels	1.A.2.d	Cd	0,0009	mg/GJ
5240	Gaseous fuels	1.A.2.e	Cd	0,0009	mg/GJ
5240	Gaseous fuels	1.A.2.a	Cd	0,0009	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Cr	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.c	Cr	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.b	Cr	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.d	Cr	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.e	Cr	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.a	Cr	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Cu	0,0026	mg/GJ
5240	Gaseous fuels	1.A.2.c	Cu	0,0026	mg/GJ
5240	Gaseous fuels	1.A.2.b	Cu	0,0026	mg/GJ
5240	Gaseous fuels	1.A.2.d	Cu	0,0026	mg/GJ
5240	Gaseous fuels	1.A.2.e	Cu	0,0026	mg/GJ
5240	Gaseous fuels	1.A.2.a	Cu	0,0026	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Hg	0,54	mg/GJ
5240	Gaseous fuels	1.A.2.c	Hg	0,54	mg/GJ
5240	Gaseous fuels	1.A.2.b	Hg	0,54	mg/GJ
5240	Gaseous fuels	1.A.2.d	Hg	0,54	mg/GJ
5240	Gaseous fuels	1.A.2.e	Hg	0,54	mg/GJ
5240	Gaseous fuels	1.A.2.a	Hg	0,54	mg/GJ
5240	Gaseous fuels	1.A.2.f.1	Ni	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.c	Ni	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.b	Ni	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.d	Ni	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.e	Ni	0,013	mg/GJ
5240	Gaseous fuels	1.A.2.a	Ni	0,013	mg/GJ
5287	Biomass	1.A.2.c	PM25	140	g/GJ
5287	Biomass	1.A.2.d	PM25	140	g/GJ
5287	Biomass	1.A.2.f.1	PM25	140	g/GJ
5287	Biomass	1.A.2.a	PM25	140	g/GJ
5287	Biomass	1.A.2.b	PM25	140	g/GJ
5287	Biomass	1.A.2.e	PM25	140	g/GJ
5287	Biomass	1.A.2.c	PM10	143	g/GJ
5287	Biomass	1.A.2.d	PM10	143	g/GJ
5287	Biomass	1.A.2.f.1	PM10	143	g/GJ
5287	Biomass	1.A.2.a	PM10	143	g/GJ
5287	Biomass	1.A.2.b	PM10	143	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5287	Biomass	1.A.2.e	PM10	143	g/GJ
5287	Biomass	1.A.2.c	BC	39,2	g/GJ
5287	Biomass	1.A.2.d	BC	39,2	g/GJ
5287	Biomass	1.A.2.f.1	BC	39,2	g/GJ
5287	Biomass	1.A.2.a	BC	39,2	g/GJ
5287	Biomass	1.A.2.b	BC	39,2	g/GJ
5287	Biomass	1.A.2.e	BC	39,2	g/GJ
5287	Biomass	1.A.2.c	PCBs	0,06	µg/GJ
5287	Biomass	1.A.2.d	PCBs	0,06	µg/GJ
5287	Biomass	1.A.2.f.1	PCBs	0,06	µg/GJ
5287	Biomass	1.A.2.a	PCBs	0,06	µg/GJ
5287	Biomass	1.A.2.b	PCBs	0,06	µg/GJ
5287	Biomass	1.A.2.e	PCBs	0,06	µg/GJ
5287	Biomass	1.A.2.c	HCB	5	µg/GJ
5287	Biomass	1.A.2.d	HCB	5	µg/GJ
5287	Biomass	1.A.2.f.1	HCB	5	µg/GJ
5287	Biomass	1.A.2.a	HCB	5	µg/GJ
5287	Biomass	1.A.2.b	HCB	5	µg/GJ
5287	Biomass	1.A.2.e	HCB	5	µg/GJ
5287	Biomass	1.A.2.c	As	0,19	mg/GJ
5287	Biomass	1.A.2.d	As	0,19	mg/GJ
5287	Biomass	1.A.2.f.1	As	0,19	mg/GJ
5287	Biomass	1.A.2.a	As	0,19	mg/GJ
5287	Biomass	1.A.2.b	As	0,19	mg/GJ
5287	Biomass	1.A.2.e	As	0,19	mg/GJ
5287	Biomass	1.A.2.c	Cd	13	mg/GJ
5287	Biomass	1.A.2.d	Cd	13	mg/GJ
5287	Biomass	1.A.2.f.1	Cd	13	mg/GJ
5287	Biomass	1.A.2.a	Cd	13	mg/GJ
5287	Biomass	1.A.2.b	Cd	13	mg/GJ
5287	Biomass	1.A.2.e	Cd	13	mg/GJ
5287	Biomass	1.A.2.c	Cr	23	mg/GJ
5287	Biomass	1.A.2.d	Cr	23	mg/GJ
5287	Biomass	1.A.2.f.1	Cr	23	mg/GJ
5287	Biomass	1.A.2.a	Cr	23	mg/GJ
5287	Biomass	1.A.2.b	Cr	23	mg/GJ
5287	Biomass	1.A.2.e	Cr	23	mg/GJ
5287	Biomass	1.A.2.c	Cu	6	mg/GJ
5287	Biomass	1.A.2.d	Cu	6	mg/GJ
5287	Biomass	1.A.2.f.1	Cu	6	mg/GJ
5287	Biomass	1.A.2.a	Cu	6	mg/GJ
5287	Biomass	1.A.2.b	Cu	6	mg/GJ
5287	Biomass	1.A.2.e	Cu	6	mg/GJ
5287	Biomass	1.A.2.c	Hg	0,56	mg/GJ
5287	Biomass	1.A.2.d	Hg	0,56	mg/GJ
5287	Biomass	1.A.2.f.1	Hg	0,56	mg/GJ
5287	Biomass	1.A.2.a	Hg	0,56	mg/GJ
5287	Biomass	1.A.2.b	Hg	0,56	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5287	Biomass	1.A.2.e	Hg	0,56	mg/GJ
5287	Biomass	1.A.2.c	Ni	2	mg/GJ
5287	Biomass	1.A.2.d	Ni	2	mg/GJ
5287	Biomass	1.A.2.f.1	Ni	2	mg/GJ
5287	Biomass	1.A.2.a	Ni	2	mg/GJ
5287	Biomass	1.A.2.b	Ni	2	mg/GJ
5287	Biomass	1.A.2.e	Ni	2	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	PM25	108	g/GJ
5288	Solid fuels (coals)	1.A.2.a	PM25	108	g/GJ
5288	Solid fuels (coals)	1.A.2.c	PM25	108	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	PM25	108	g/GJ
5288	Solid fuels (coals)	1.A.2.e	PM10	117	g/GJ
5288	Solid fuels (coals)	1.A.2.a	PM10	117	g/GJ
5288	Solid fuels (coals)	1.A.2.c	PM10	117	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	PM10	117	g/GJ
5288	Solid fuels (coals)	1.A.2.e	BC	6,912	g/GJ
5288	Solid fuels (coals)	1.A.2.a	BC	6,912	g/GJ
5288	Solid fuels (coals)	1.A.2.c	BC	6,912	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	BC	6,912	g/GJ
5288	Solid fuels (coals)	1.A.2.e	PCBs	170	µg/GJ
5288	Solid fuels (coals)	1.A.2.a	PCBs	170	µg/GJ
5288	Solid fuels (coals)	1.A.2.c	PCBs	170	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	PCBs	170	µg/GJ
5288	Solid fuels (coals)	1.A.2.e	HCB	0,62	µg/GJ
5288	Solid fuels (coals)	1.A.2.a	HCB	0,62	µg/GJ
5288	Solid fuels (coals)	1.A.2.c	HCB	0,62	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	HCB	0,62	µg/GJ
5288	Solid fuels (coals)	1.A.2.e	As	4	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	As	4	mg/GJ
5288	Solid fuels (coals)	1.A.2.c	As	4	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	As	4	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Cd	1,8	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Cd	1,8	mg/GJ
5288	Solid fuels (coals)	1.A.2.c	Cd	1,8	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	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.a	Cr	13,5	mg/GJ
5288	Solid fuels (coals)	1.A.2.c	Cr	13,5	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	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.a	Cu	17,5	mg/GJ
5288	Solid fuels (coals)	1.A.2.c	Cu	17,5	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	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.a	Hg	0,56	mg/GJ
5288	Solid fuels (coals)	1.A.2.c	Hg	0,56	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Hg	0,56	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Ni	13	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5288	Solid fuels (coals)	1.A.2.a	Ni	13	mg/GJ
5288	Solid fuels (coals)	1.A.2.c	Ni	13	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Ni	13	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Pb	27	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Pb	27	mg/GJ
5288	Solid fuels (coals)	1.A.2.c	Pb	27	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Pb	27	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Se	1,8	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Se	1,8	mg/GJ
5288	Solid fuels (coals)	1.A.2.c	Se	1,8	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Se	1,8	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	Zn	200	mg/GJ
5288	Solid fuels (coals)	1.A.2.a	Zn	200	mg/GJ
5288	Solid fuels (coals)	1.A.2.c	Zn	200	mg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Zn	200	mg/GJ
5288	Solid fuels (coals)	1.A.2.e	DIOX	203	ng/GJ
5288	Solid fuels (coals)	1.A.2.a	DIOX	203	ng/GJ
5288	Solid fuels (coals)	1.A.2.c	DIOX	203	ng/GJ
5288	Solid fuels (coals)	1.A.2.f.1	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.a	Benzo(b)	58,9	µg/GJ
5288	Solid fuels (coals)	1.A.2.c	Benzo(b)	58,9	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	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.a	Benzo(k)	23,7	µg/GJ
5288	Solid fuels (coals)	1.A.2.c	Benzo(k)	23,7	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	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.a	Benzo(a)	45,5	µg/GJ
5288	Solid fuels (coals)	1.A.2.c	Benzo(a)	45,5	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	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.a	Indeno	18,5	µg/GJ
5288	Solid fuels (coals)	1.A.2.c	Indeno	18,5	µg/GJ
5288	Solid fuels (coals)	1.A.2.f.1	Indeno	18,5	µg/GJ
5288	Solid fuels (coals)	1.A.2.e	SO2	900	g/GJ
5288	Solid fuels (coals)	1.A.2.a	SO2	900	g/GJ
5288	Solid fuels (coals)	1.A.2.c	SO2	900	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	SO2	900	g/GJ
5288	Solid fuels (coals)	1.A.2.e	NOX	173	g/GJ
5288	Solid fuels (coals)	1.A.2.a	NOX	173	g/GJ
5288	Solid fuels (coals)	1.A.2.c	NOX	173	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	NOX	173	g/GJ
5288	Solid fuels (coals)	1.A.2.e	NMVOC	88,8	g/GJ
5288	Solid fuels (coals)	1.A.2.a	NMVOC	88,8	g/GJ
5288	Solid fuels (coals)	1.A.2.c	NMVOC	88,8	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	NMVOC	88,8	g/GJ
5288	Solid fuels (coals)	1.A.2.e	CO	931	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5288	Solid fuels (coals)	1.A.2.a	CO	931	g/GJ
5288	Solid fuels (coals)	1.A.2.c	CO	931	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	CO	931	g/GJ
5288	Solid fuels (coals)	1.A.2.e	TSP	124	g/GJ
5288	Solid fuels (coals)	1.A.2.a	TSP	124	g/GJ
5288	Solid fuels (coals)	1.A.2.c	TSP	124	g/GJ
5288	Solid fuels (coals)	1.A.2.f.1	TSP	124	g/GJ
5289	Petroleum coke	1.A.2.a	Pb	0,08	mg/GJ
5289	Petroleum coke	1.A.2.c	Pb	0,08	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Pb	0,08	mg/GJ
5289	Petroleum coke	1.A.2.a	Se	0,11	mg/GJ
5289	Petroleum coke	1.A.2.c	Se	0,11	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Se	0,11	mg/GJ
5289	Petroleum coke	1.A.2.a	Zn	29	mg/GJ
5289	Petroleum coke	1.A.2.c	Zn	29	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Zn	29	mg/GJ
5289	Petroleum coke	1.A.2.a	DIOX	1,4	ng/GJ
5289	Petroleum coke	1.A.2.c	DIOX	1,4	ng/GJ
5289	Petroleum coke	1.A.2.f.1	DIOX	1,4	ng/GJ
5289	Petroleum coke	1.A.2.a	Benzo(b)	15	µg/GJ
5289	Petroleum coke	1.A.2.c	Benzo(b)	15	µg/GJ
5289	Petroleum coke	1.A.2.f.1	Benzo(b)	15	µg/GJ
5289	Petroleum coke	1.A.2.a	Benzo(k)	1,7	µg/GJ
5289	Petroleum coke	1.A.2.c	Benzo(k)	1,7	µg/GJ
5289	Petroleum coke	1.A.2.f.1	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.c	Benzo(a)	1,9	µg/GJ
5289	Petroleum coke	1.A.2.f.1	Benzo(a)	1,9	µg/GJ
5289	Petroleum coke	1.A.2.a	Indeno	1,5	µg/GJ
5289	Petroleum coke	1.A.2.c	Indeno	1,5	µg/GJ
5289	Petroleum coke	1.A.2.f.1	Indeno	1,5	µg/GJ
5289	Petroleum coke	1.A.2.a	SO2	47	g/GJ
5289	Petroleum coke	1.A.2.c	SO2	47	g/GJ
5289	Petroleum coke	1.A.2.f.1	SO2	47	g/GJ
5289	Petroleum coke	1.A.2.a	NOX	513	g/GJ
5289	Petroleum coke	1.A.2.c	NOX	513	g/GJ
5289	Petroleum coke	1.A.2.f.1	NOX	513	g/GJ
5289	Petroleum coke	1.A.2.a	NMVOC	25	g/GJ
5289	Petroleum coke	1.A.2.c	NMVOC	25	g/GJ
5289	Petroleum coke	1.A.2.f.1	NMVOC	25	g/GJ
5289	Petroleum coke	1.A.2.a	CO	66	g/GJ
5289	Petroleum coke	1.A.2.c	CO	66	g/GJ
5289	Petroleum coke	1.A.2.f.1	CO	66	g/GJ
5289	Petroleum coke	1.A.2.a	TSP	20	g/GJ
5289	Petroleum coke	1.A.2.c	TSP	20	g/GJ
5289	Petroleum coke	1.A.2.f.1	TSP	20	g/GJ
5289	Petroleum coke	1.A.2.a	PM25	20	g/GJ
5289	Petroleum coke	1.A.2.c	PM25	20	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5289	Petroleum coke	1.A.2.f.1	PM25	20	g/GJ
5289	Petroleum coke	1.A.2.a	PM10	20	g/GJ
5289	Petroleum coke	1.A.2.c	PM10	20	g/GJ
5289	Petroleum coke	1.A.2.f.1	PM10	20	g/GJ
5289	Petroleum coke	1.A.2.a	BC	11,2	g/GJ
5289	Petroleum coke	1.A.2.c	BC	11,2	g/GJ
5289	Petroleum coke	1.A.2.f.1	BC	11,2	g/GJ
5289	Petroleum coke	1.A.2.a	As	0,03	mg/GJ
5289	Petroleum coke	1.A.2.c	As	0,03	mg/GJ
5289	Petroleum coke	1.A.2.f.1	As	0,03	mg/GJ
5289	Petroleum coke	1.A.2.a	Cd	0,006	mg/GJ
5289	Petroleum coke	1.A.2.c	Cd	0,006	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Cd	0,006	mg/GJ
5289	Petroleum coke	1.A.2.a	Cr	0,2	mg/GJ
5289	Petroleum coke	1.A.2.c	Cr	0,2	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Cr	0,2	mg/GJ
5289	Petroleum coke	1.A.2.a	Cu	0,22	mg/GJ
5289	Petroleum coke	1.A.2.c	Cu	0,22	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Cu	0,22	mg/GJ
5289	Petroleum coke	1.A.2.a	Hg	0,12	mg/GJ
5289	Petroleum coke	1.A.2.c	Hg	0,12	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Hg	0,12	mg/GJ
5289	Petroleum coke	1.A.2.a	Ni	0,008	mg/GJ
5289	Petroleum coke	1.A.2.c	Ni	0,008	mg/GJ
5289	Petroleum coke	1.A.2.f.1	Ni	0,008	mg/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	µg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Benzo(k)	23,7	µg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Benzo(a)	45,5	µg/GJ
5290	sub-bituminous coal	1.A.4.a.1	Indeno	18,5	µg/GJ
5290	sub-bituminous coal	1.A.4.a.1	SO2	2469,14	g/GJ
5287	Biomass	1.A.2.c	Pb	27	mg/GJ
5287	Biomass	1.A.2.d	Pb	27	mg/GJ
5287	Biomass	1.A.2.f.1	Pb	27	mg/GJ
5287	Biomass	1.A.2.a	Pb	27	mg/GJ
5287	Biomass	1.A.2.b	Pb	27	mg/GJ
5287	Biomass	1.A.2.e	Pb	27	mg/GJ
5287	Biomass	1.A.2.c	Se	0,5	mg/GJ
5287	Biomass	1.A.2.d	Se	0,5	mg/GJ
5287	Biomass	1.A.2.f.1	Se	0,5	mg/GJ
5287	Biomass	1.A.2.a	Se	0,5	mg/GJ
5287	Biomass	1.A.2.b	Se	0,5	mg/GJ
5287	Biomass	1.A.2.e	Se	0,5	mg/GJ
5287	Biomass	1.A.2.c	Zn	512	mg/GJ
5287	Biomass	1.A.2.d	Zn	512	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5287	Biomass	1.A.2.f.1	Zn	512	mg/GJ
5287	Biomass	1.A.2.a	Zn	512	mg/GJ
5287	Biomass	1.A.2.b	Zn	512	mg/GJ
5287	Biomass	1.A.2.e	Zn	512	mg/GJ
5287	Biomass	1.A.2.c	DIOX	100	ng/GJ
5287	Biomass	1.A.2.d	DIOX	100	ng/GJ
5287	Biomass	1.A.2.f.1	DIOX	100	ng/GJ
5287	Biomass	1.A.2.a	DIOX	100	ng/GJ
5287	Biomass	1.A.2.b	DIOX	100	ng/GJ
5287	Biomass	1.A.2.e	DIOX	100	ng/GJ
5287	Biomass	1.A.2.c	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.d	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.f.1	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.a	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.b	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.e	Benzo(b)	16	µg/GJ
5287	Biomass	1.A.2.c	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.d	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.f.1	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.a	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.b	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.e	Benzo(k)	5	µg/GJ
5287	Biomass	1.A.2.c	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.d	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.f.1	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.a	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.b	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.e	Benzo(a)	10	µg/GJ
5287	Biomass	1.A.2.c	Indeno	4	µg/GJ
5287	Biomass	1.A.2.d	Indeno	4	µg/GJ
5287	Biomass	1.A.2.f.1	Indeno	4	µg/GJ
5287	Biomass	1.A.2.a	Indeno	4	µg/GJ
5287	Biomass	1.A.2.b	Indeno	4	µg/GJ
5287	Biomass	1.A.2.e	Indeno	4	µg/GJ
5287	Biomass	1.A.2.c	SO2	11	g/GJ
5287	Biomass	1.A.2.d	SO2	11	g/GJ
5287	Biomass	1.A.2.f.1	SO2	11	g/GJ
5287	Biomass	1.A.2.a	SO2	11	g/GJ
5287	Biomass	1.A.2.b	SO2	11	g/GJ
5287	Biomass	1.A.2.e	SO2	11	g/GJ
5287	Biomass	1.A.2.c	NOX	91	g/GJ
5287	Biomass	1.A.2.d	NOX	91	g/GJ
5287	Biomass	1.A.2.f.1	NOX	91	g/GJ
5287	Biomass	1.A.2.a	NOX	91	g/GJ
5287	Biomass	1.A.2.b	NOX	91	g/GJ
5287	Biomass	1.A.2.e	NOX	91	g/GJ
5287	Biomass	1.A.2.c	NH3	37	g/GJ
5287	Biomass	1.A.2.d	NH3	37	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5287	Biomass	1.A.2.f.1	NH3	37	g/GJ
5287	Biomass	1.A.2.a	NH3	37	g/GJ
5287	Biomass	1.A.2.b	NH3	37	g/GJ
5287	Biomass	1.A.2.e	NH3	37	g/GJ
5287	Biomass	1.A.2.c	NMVOC	300	g/GJ
5287	Biomass	1.A.2.d	NMVOC	300	g/GJ
5287	Biomass	1.A.2.f.1	NMVOC	300	g/GJ
5287	Biomass	1.A.2.a	NMVOC	300	g/GJ
5287	Biomass	1.A.2.b	NMVOC	300	g/GJ
5287	Biomass	1.A.2.e	NMVOC	300	g/GJ
5287	Biomass	1.A.2.c	CO	570	g/GJ
5287	Biomass	1.A.2.d	CO	570	g/GJ
5287	Biomass	1.A.2.f.1	CO	570	g/GJ
5287	Biomass	1.A.2.a	CO	570	g/GJ
5287	Biomass	1.A.2.b	CO	570	g/GJ
5287	Biomass	1.A.2.e	CO	570	g/GJ
5287	Biomass	1.A.2.c	TSP	150	g/GJ
5287	Biomass	1.A.2.d	TSP	150	g/GJ
5287	Biomass	1.A.2.f.1	TSP	150	g/GJ
5287	Biomass	1.A.2.a	TSP	150	g/GJ
5287	Biomass	1.A.2.b	TSP	150	g/GJ
5287	Biomass	1.A.2.e	TSP	150	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
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	µg/GJ
5291	lignit	1.A.4.a.1	Benzo(k)	23,7	µg/GJ
5291	lignit	1.A.4.a.1	Benzo(a)	45,5	µg/GJ
5291	lignit	1.A.4.a.1	Indeno	18,5	µg/GJ
5291	lignit	1.A.4.a.1	SO2	1648,35	g/GJ
5291	lignit	1.A.4.a.1	NOX	173	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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
5294	gaseous fuel	1.A.4.a.1	Pb	0,011	mg/GJ
5294	gaseous fuel	1.A.1.c	Pb	0,011	mg/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.4.c.1	Se	0,058	mg/GJ
5294	gaseous fuel	1.A.1.c	Se	0,058	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Zn	0,73	mg/GJ
5294	gaseous fuel	1.A.1.c	Zn	0,73	mg/GJ
5294	gaseous fuel	1.A.1.a	Zn	0,73	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Zn	0,73	mg/GJ
5294	gaseous fuel	1.A.4.a.1	DIOX	0,52	ng/GJ
5294	gaseous fuel	1.A.1.a	DIOX	0,52	ng/GJ
5294	gaseous fuel	1.A.4.c.1	DIOX	0,52	ng/GJ
5294	gaseous fuel	1.A.1.c	DIOX	0,52	ng/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(b)	2,9	µg/GJ
5294	gaseous fuel	1.A.1.c	Benzo(b)	2,9	µg/GJ
5294	gaseous fuel	1.A.1.a	Benzo(b)	2,9	µg/GJ
5294	gaseous fuel	1.A.4.a.1	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.a	Benzo(k)	1,1	µg/GJ
5294	gaseous fuel	1.A.4.a.1	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.a	Benzo(a)	0,72	µg/GJ
5294	gaseous fuel	1.A.4.a.1	Benzo(a)	0,72	µg/GJ
5294	gaseous fuel	1.A.1.c	Indeno	1,08	µg/GJ
5294	gaseous fuel	1.A.1.a	Indeno	1,08	µg/GJ
5294	gaseous fuel	1.A.4.a.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.a.1	SO2	0,67	g/GJ
5294	gaseous fuel	1.A.1.c	SO2	0,67	g/GJ
5294	gaseous fuel	1.A.1.a	SO2	0,67	g/GJ
5294	gaseous fuel	1.A.4.a.1	NOX	74	g/GJ
5294	gaseous fuel	1.A.1.c	NOX	74	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5294	gaseous fuel	1.A.1.a	NOX	74	g/GJ
5294	gaseous fuel	1.A.4.a.1	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.4.c.1	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.1.c	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.1.a	NMVOC	23	g/GJ
5294	gaseous fuel	1.A.4.c.1	CO	29	g/GJ
5294	gaseous fuel	1.A.4.a.1	CO	29	g/GJ
5294	gaseous fuel	1.A.1.c	CO	29	g/GJ
5294	gaseous fuel	1.A.1.a	CO	29	g/GJ
5294	gaseous fuel	1.A.4.c.1	TSP	0,78	g/GJ
5294	gaseous fuel	1.A.1.c	TSP	0,78	g/GJ
5294	gaseous fuel	1.A.1.a	TSP	0,78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM25	0,78	g/GJ
5294	gaseous fuel	1.A.1.c	PM25	0,78	g/GJ
5294	gaseous fuel	1.A.1.a	PM25	0,78	g/GJ
5294	gaseous fuel	1.A.4.c.1	PM25	0,78	g/GJ
5294	gaseous fuel	1.A.1.c	PM10	0,78	g/GJ
5294	gaseous fuel	1.A.1.a	PM10	0,78	g/GJ
5294	gaseous fuel	1.A.4.a.1	PM10	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.a.1	BC	0,0312	g/GJ
5294	gaseous fuel	1.A.1.c	BC	0,0312	g/GJ
5294	gaseous fuel	1.A.1.a	BC	0,0312	g/GJ
5294	gaseous fuel	1.A.4.a.1	As	0,1	mg/GJ
5294	gaseous fuel	1.A.1.c	As	0,1	mg/GJ
5294	gaseous fuel	1.A.1.a	As	0,1	mg/GJ
5294	gaseous fuel	1.A.4.c.1	As	0,1	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cd	0,0009	mg/GJ
5294	gaseous fuel	1.A.1.c	Cd	0,0009	mg/GJ
5294	gaseous fuel	1.A.1.a	Cd	0,0009	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cr	0,013	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Cr	0,013	mg/GJ
5294	gaseous fuel	1.A.1.c	Cr	0,013	mg/GJ
5294	gaseous fuel	1.A.1.a	Cr	0,013	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Cu	0,0026	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Cu	0,0026	mg/GJ
5294	gaseous fuel	1.A.1.c	Cu	0,0026	mg/GJ
5294	gaseous fuel	1.A.1.a	Cu	0,0026	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Hg	0,1	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Hg	0,1	mg/GJ
5294	gaseous fuel	1.A.1.c	Hg	0,1	mg/GJ
5294	gaseous fuel	1.A.1.a	Hg	0,1	mg/GJ
5294	gaseous fuel	1.A.4.a.1	Ni	0,013	mg/GJ
5294	gaseous fuel	1.A.1.c	Ni	0,013	mg/GJ
5294	gaseous fuel	1.A.1.a	Ni	0,013	mg/GJ
5294	gaseous fuel	1.A.4.c.1	Ni	0,013	mg/GJ
5295	biomass	1.A.4.a.1	Pb	27	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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	µg/GJ
5295	biomass	1.A.4.a.1	Benzo(k)	5	µg/GJ
5295	biomass	1.A.4.a.1	Benzo(a)	10	µg/GJ
5295	biomass	1.A.4.a.1	Indeno	4	µg/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	NH3	0,15	g/GJ
5294	gaseous fuel	1.A.4.c.1	NH3	0,15	g/GJ
5294	gaseous fuel	1.A.1.c	NH3	0,15	g/GJ
5294	gaseous fuel	1.A.4.c.1	NH3	0,15	g/GJ
5294	gaseous fuel	1.A.1.a	NH3	0,15	g/GJ
5347	Household products	3.D.2	NMVOC	16	g/kg product
5348	Car care product	3.D.2	NMVOC	180	g/kg product
5349	DIY/buildings, Paint/varnish removers and solvents	3.D.2	NMVOC	950	g/kg solvent
5350	DIY/buildings, Sealants, filling agents	3.D.2	NMVOC	45	g/kg product
5352	Cosmetics and toiletries	3.D.2	NMVOC	127	g/kg product
5353	Pharmaceutical products	3.D.2	NMVOC	48	g/caput
4846	2.G Tabacco combustion	3.D.3	BC	12,15	kg/t
4846	2.G Tabacco combustion	3.D.3	NH3	4,15	kg/t
4846	2.G Tabacco combustion	3.D.3	Indeno	0,045	g/t
5354	2.G Use of shoes	3.D.3	NMVOC	60	g/pair
5355	Various_Pesticide use incl. fungicides	3.D.2	NMVOC	150	kg/t
5356	Car dewaxing	3.D.3	NMVOC	1	kg/vehicle
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
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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5410	N from fertilizers use	4.D.1.a	NOX	0,026	kg/kg fertilizer
5411	KAN	4.D.1.a	NH3	0,017145714	kg/kg fertilizer
5412	Urea Amonij nitrat	4.D.1.a	NH3	0,195645714	kg/kg fertilizer
5413	Urea	4.D.1.a	NH3	0,195645714	kg/kg fertilizer
5414	Amonij nitrat	4.D.1.a	NH3	0,032251429	kg/kg fertilizer
5415	NPK	4.D.1.a	NH3	0,094568571	kg/kg fertilizer
5128	2.A.2_Tier 2	2.A.2	BC	0,138	g/t
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
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
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
4436	Ammonium phosphate production	2.B.5.a	BC	9	g/t product
5422	Formaldehid	2.B.5.a	NMVOC	7	kg/t
5422	Formaldehid	2.B.5.a	CO	12	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
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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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
4507	Petroleum refining	1.A.1.b	BC	0,1638	g/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
6808	High-efficiency stoves	1.A.4.b.1	Zn	512	mg/GJ
6808	High-efficiency stoves	1.A.4.b.1	DIOX	250	ng/GJ
6808	High-efficiency stoves	1.A.4.b.1	Benzo(b)	111	µg/GJ
6808	High-efficiency stoves	1.A.4.b.1	Benzo(k)	42	µg/GJ
6808	High-efficiency stoves	1.A.4.b.1	Benzo(a)	121	µg/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	7,60E-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	89	g/GJ
5452	Natural gas	1.A.1.b	NMVOC	2,6	g/GJ
5452	Natural gas	1.A.1.b	CO	39	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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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
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
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
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
6441	Horses,mules and asses - housing	4.D.1.b	NH3	5,946138634	kg/animal
6441	Horses,mules and asses - housing	4.D.1.b	NH3	5,946138634	kg/animal
6442	Sewage sludge applied to soil - faktor za stvarni mulj	4.D.4	NH3	0,13	kg/kg product
6442	Sewage sludge applied to soil - faktor za stvarni mulj	4.D.4	NOX	0,04	kg/kg product
6443	Mules and asses grazing	4.D.2.c	NH3	5,37795	kg/animal
6443	Mules and asses grazing	4.D.2.c	NOX	2,383286286	kg/animal
6808	High-efficiency stoves	1.A.4.b.1	Indeno	71	µg/GJ
6808	High-efficiency stoves	1.A.4.b.1	SO2	11	g/GJ
6587	Geese	4.D.1.b	NH3	0,102630405	kg/animal
5825	Pellete stoves and boilers	1.A.4.b.1	Pb	27	mg/GJ
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	µg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Benzo(k)	5	µg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Benzo(a)	10	µg/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	Indeno	4	µg/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	62	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	PM25	60	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	PM10	60	g/GJ
5825	Pellete stoves and boilers	1.A.4.b.1	BC	9	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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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
1	Plomin	1.A.1.a	PCBs	170	µg/GJ
1	Plomin	1.A.1.a	HCB	0,62	µg/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	µg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Benzo(k)	5	µg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Benzo(a)	10	µg/GJ
5878	Advanced/ecolabelled stoves and boilers	1.A.4.b.1	Indeno	4	µg/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 and boilers	1.A.4.b.1	PM10	95	g/GJ
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
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
104	Mineral Production, Road Paving with Asphalt	2.A.6	BC	39,9	g/t
108	2.A.7.d_glass production	2.A.7.1	BC	0,1488	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
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
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
196	Incineration of industrial waste	6.C.b	BC	0,00014	kg/t
6808	High-efficiency stoves	1.A.4.b.1	NOX	80	g/GJ
5974	1.A.1.b_GF_LPG	1.A.1.b	As	0,12	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5974	1.A.1.b_GF_LPG	1.A.1.b	Cd	0,00025	mg/GJ
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	7,60E-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
5975	1.B.2.b.1	1.B.2.b.1	NMVOC	0,1	kg/1000 m3
5977	ships using bunker fuel oil	1.A.3.d.1	As	16,92	mg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Hg	0,5	mg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Pb	4,48	mg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	HCB	3,48	µg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	PCBs	14,18	µg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	DIOX	11,69	ng/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Cd	0,5	mg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Cr	17,91	mg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Cu	31,1	mg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Ni	796,22	mg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Se	5,23	mg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Zn	29,86	mg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Benzo(b)	1244,091	µg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	Benzo(a)	746,454	µg/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	SO2	746,45	g/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	NOX	1973,13	g/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	NH3	0,174	g/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	NMVOC	67,18	g/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	CO	184,13	g/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	TSP	154,27	g/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	PM10	154,27	g/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	PM25	139,34	g/GJ
5977	ships using bunker fuel oil	1.A.3.d.1	BC	0,167	g/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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
5980	International navigation	1.A.3.d.1	HCB	1,87	µg/GJ
5980	International navigation	1.A.3.d.1	DIOX	3,04	ng/GJ
5980	International navigation	1.A.3.d.1	PCBs	0,89	µg/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
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	SO2	0,013	kg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	TSP	2,6	kg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	PM25	2,6	kg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	PM10	2,6	kg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	BC	0,624	kg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Pb	4,9	mg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Cd	20	mg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Hg	4,7	mg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	As	3,8	mg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Cr	1,3	mg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Cu	1,6	mg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Ni	38	mg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Zn	520	mg/t
198	1.B.2.c.2_Venting and flaring (gas)	1.B.2.c.2	Se	0,43	mg/t
6122	Road tanker, top loading	1.B.2.a.5	NMVOC	12,33	kg/kt*kPa
6123	Road tanker, bottom loading, VRU	1.B.2.a.5	NMVOC	0,247	kg/kt*kPa
6123	Road tanker, bottom loading, VRU	1.B.2.a.5	NMVOC	0,247	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
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
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
6132	INA-RNS	1.B.2.c.1	NOX	29,2	g/GJ
6132	INA-RNS	1.B.2.c.1	CO	133	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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	0,352	mg/GJ
6132	INA-RNS	1.B.2.c.1	Cd	2,19	mg/GJ
6132	INA-RNS	1.B.2.c.1	Cr	6,69	mg/GJ
6133	INA-RNS	1.B.2.c.1	SO2	77	g/GJ
6133	INA-RNS	1.B.2.c.1	NMVOC	2	g/GJ
6132	INA-RNS	1.B.2.c.1	Hg	0,372	mg/GJ
6134	INA-RNR	1.B.2.c.1	SO2	77	g/GJ
6134	INA-RNR	1.B.2.c.1	NMVOC	2	g/GJ
6135	INA-RNR	1.B.2.c.1	NOX	29,2	g/GJ
6135	INA-RNR	1.B.2.c.1	CO	133	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	0,352	mg/GJ
6135	INA-RNR	1.B.2.c.1	Cd	2,19	mg/GJ
6135	INA-RNR	1.B.2.c.1	Cr	6,69	mg/GJ
6135	INA-RNR	1.B.2.c.1	Hg	0,372	mg/GJ
6135	INA-RNR	1.B.2.c.1	Cu	3,29	mg/GJ
6135	INA-RNR	1.B.2.c.1	Ni	7,37	mg/GJ
6135	INA-RNR	1.B.2.c.1	Pb	1,61	mg/GJ
6135	INA-RNR	1.B.2.c.1	Zn	17	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
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
6132	INA-RNS	1.B.2.c.1	Cu	3,29	mg/GJ
6132	INA-RNS	1.B.2.c.1	Ni	7,37	mg/GJ
6132	INA-RNS	1.B.2.c.1	Pb	1,61	mg/GJ
6132	INA-RNS	1.B.2.c.1	Zn	17	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
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

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
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
6148	Adhesive tape manufacturing	3.C	NMVOC	3	g/m2
6159	Compost production	6.D	NH3	0,24	kg/t waste
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	µg/GJ
6408	biomass	1.A.1.a	Benzo(k)	0,0155	µg/GJ
6408	biomass	1.A.1.a	Benzo(a)	1,12	µg/GJ
6408	biomass	1.A.1.a	Indeno	0,0374	µg/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
6429	Dry cleaning	3.B.2	NMVOC	400	caput
6587	Geese	4.D.1.b	NOX	0,057048666	kg/animal
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
6808	High-efficiency stoves	1.A.4.b.1	NH3	37	g/GJ
6808	High-efficiency stoves	1.A.4.b.1	NMVOC	350	g/GJ
6808	High-efficiency stoves	1.A.4.b.1	CO	4000	g/GJ
6808	High-efficiency stoves	1.A.4.b.1	TSP	400	g/GJ
6808	High-efficiency stoves	1.A.4.b.1	PM25	370	g/GJ
6808	High-efficiency stoves	1.A.4.b.1	PM10	380	g/GJ
6808	High-efficiency stoves	1.A.4.b.1	BC	59,2	g/GJ
6808	High-efficiency stoves	1.A.4.b.1	PCBs	0,03	µg/GJ
6808	High-efficiency stoves	1.A.4.b.1	HCB	5	µg/GJ
6808	High-efficiency stoves	1.A.4.b.1	As	0,19	mg/GJ
6808	High-efficiency stoves	1.A.4.b.1	Cd	13	mg/GJ
6808	High-efficiency stoves	1.A.4.b.1	Cr	23	mg/GJ
6808	High-efficiency stoves	1.A.4.b.1	Cu	6	mg/GJ
6808	High-efficiency stoves	1.A.4.b.1	Hg	0,56	mg/GJ
6808	High-efficiency stoves	1.A.4.b.1	Ni	2	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
6818	Polyurethane foam	3.C	NMVOC	120	kg/t
6135	INA-RNR	1.B.2.c.1	Se	1,56	mg/GJ
6132	INA-RNS	1.B.2.c.1	Se	1,56	mg/GJ
6967	AS+ASN	4.D.1.a	NH3	0,171214286	kg/kg fertilizer
7016	Field burning of agricultural wastes	4.F.5	SO2	0,0005	kg/kg product
7016	Field burning of agricultural wastes	4.F.5	NOX	0,0023	kg/kg product
7016	Field burning of agricultural wastes	4.F.5	NMVOC	0,0005	kg/kg product
7016	Field burning of agricultural wastes	4.F.5	CO	0,0667	kg/kg product
7016	Field burning of agricultural wastes	4.F.5	NH3	0,0024	kg/kg product
7016	Field burning of agricultural wastes	4.F.5	TSP	0,0058	kg/kg product
7016	Field burning of agricultural wastes	4.F.5	PM10	0,0057	kg/kg product
7016	Field burning of agricultural wastes	4.F.5	PM25	0,0054	kg/kg product
7016	Field burning of agricultural wastes	4.F.5	Pb	0,11	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Cd	0,88	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Hg	0,14	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	As	0,0064	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Cr	0,08	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Cu	0,073	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Ni	0,052	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Se	0,02	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Zn	0,56	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	DIOX	0,5	µg/kg product
7016	Field burning of agricultural wastes	4.F.5	Benzo(a)	0,393	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Benzo(b)	1,097	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Benzo(k)	0,468	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	Indeno	0,336	mg/kg product
7016	Field burning of agricultural wastes	4.F.5	BC	500	kg/kg product
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Pb	8	mg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Se	0,1	mg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Zn	18	mg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	DIOX	1,4	ng/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Benzo(b)	15	µg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Benzo(k)	1,7	µg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Benzo(a)	1,9	µg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Indeno	1,5	µg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	SO2	34,65	g/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	NOX	306	g/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	NMVOC	20	g/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	CO	93	g/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	TSP	21	g/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	HCB	0,22	µg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	PCBs	0,13	µg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	PM25	18	g/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	PM10	21	g/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	BC	10,08	g/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	As	0,5	mg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Cd	0,15	mg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Cr	10	mg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Cu	3	mg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Hg	0,1	mg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	Ni	125	mg/GJ
7060	1.A.4.a_LF-gas oil_2019	1.A.4.c.1	NH3	0	g/GJ
7064	3Df Use of Clopyralid - from 2010	4.G	HCB	2,5	mg/kg
7068	3Df Use of Chlorothalonil - from 2010	4.G	HCB	40	mg/kg
7069	3Df Use of Picloram- from 1990	4.G	HCB	50	mg/kg
7092	LF-GO_2019	1.A.4.b.1	TSP	1,9	g/GJ
7092	LF-GO_2019	1.A.4.b.1	PM25	1,9	g/GJ
7092	LF-GO_2019	1.A.4.b.1	PM10	1,9	g/GJ
7092	LF-GO_2019	1.A.4.b.1	BC	0,16	g/GJ
7092	LF-GO_2019	1.A.4.b.1	As	0,002	mg/GJ
7092	LF-GO_2019	1.A.4.b.1	Cd	0,001	mg/GJ
7092	LF-GO_2019	1.A.4.b.1	Cr	0,2	mg/GJ
7092	LF-GO_2019	1.A.4.b.1	Cu	0,13	mg/GJ
7092	LF-GO_2019	1.A.4.b.1	Hg	0,12	mg/GJ
7092	LF-GO_2019	1.A.4.b.1	Ni	0,005	mg/GJ
7092	LF-GO_2019	1.A.4.b.1	Pb	0,012	mg/GJ
7092	LF-GO_2019	1.A.4.b.1	Se	0,002	mg/GJ
7092	LF-GO_2019	1.A.4.b.1	Zn	0,42	mg/GJ
7092	LF-GO_2019	1.A.4.b.1	DIOX	5,9	ng/GJ
7092	LF-GO_2019	1.A.4.b.1	Benzo(b)	40	µg/GJ
7092	LF-GO_2019	1.A.4.b.1	Benzo(k)	70	µg/GJ
7092	LF-GO_2019	1.A.4.b.1	Benzo(a)	80	µg/GJ
7092	LF-GO_2019	1.A.4.b.1	Indeno	160	µg/GJ
7092	LF-GO_2019	1.A.4.b.1	SO2	34,42	g/GJ
7092	LF-GO_2019	1.A.4.b.1	NOX	51	g/GJ
7092	LF-GO_2019	1.A.4.b.1	NMVOC	0,69	g/GJ
7092	LF-GO_2019	1.A.4.b.1	CO	57	g/GJ
7093	1.B.2.b.ii_NG transmission	1.B.2.b.2	NMVOC	0,01992434	kg/1000 m3
7094	Rockwool_2019	2.A.7.1	NH3	86,806012	t
7094	Rockwool_2019	2.A.7.1	NMVOC	24,152	t

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7094	Rockwool_2019	2.A.7.1	TSP	24,35960801	t
7094	Rockwool_2019	2.A.7.1	PM25	18,89753096	t
7094	Rockwool_2019	2.A.7.1	PM10	21,440222	t
7094	Rockwool_2019	2.A.7.1	BC	0,377950619	t
7095	Ammonia-2019	2.B.1	NOX	1,435523855	kg/t
7095	Ammonia-2019	2.B.1	NH3	0,05	kg/t
7095	Ammonia-2019	2.B.1	CO	0,006	kg/t
7095	Ammonia-2019	2.B.1	NMVOC	0,09	kg/t
7096	Nitric acid-2019	2.B.2	NOX	0,181495213	kg/t
7097	Sulfuric acid-2019	2.B.5.a	SO2	2,383407033	kg/t
7098	NPK-2019	2.B.5.a	NOX	0,097166651	kg/t
7098	NPK-2019	2.B.5.a	NH3	6,437813407	kg/t
7098	NPK-2019	2.B.5.a	TSP	0,479983932	kg/t
7099	Urea-2019	2.B.5.a	NH3	0,365633177	kg/t
7099	Urea-2019	2.B.5.a	TSP	1,5	kg/t
7099	Urea-2019	2.B.5.a	PM25	0,9	kg/t
7099	Urea-2019	2.B.5.a	PM10	1,2	kg/t
7099	Urea-2019	2.B.5.a	BC	0,0162	kg/t
7100	Application of glues_2019	3.D.3	NMVOC	134341,06	g/t
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Cu	60,555	mg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Ni	0,77	mg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Pb	6140,899	mg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Se	0,072	mg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Zn	71,602	mg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Benzo(b)	226,509	µg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Benzo(a)	137,657	µg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	SO2	0,203993551	g/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	NOX	89,706	g/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	NH3	7,04	g/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	NMVOC	426,105	g/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	CO	26911,864	g/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	TSP	6,099	g/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	PM25	3,626	g/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	PM10	6,099	g/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Benzo(k)	92,881	µg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Indeno	261,54	µg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	DIOX	0,006	ng/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Cd	0,276	mg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	Cr	3,008	mg/GJ
7102	1.A.3.a_gasoline_2019	1.A.3.a.2.1	BC	0,544	g/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	As	0,03	mg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Cd	0,006	mg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Cr	0,2	mg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Cu	0,22	mg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Ni	0,008	mg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Pb	0,08	mg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Se	0,11	mg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Zn	29	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	BC	2,18	g/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Benzo(b)	15	µg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Benzo(a)	1,9	µg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	SO2	30,6047777	g/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	NOX	234,3	g/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	NMVOC	2,27	g/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	CO	45,5	g/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	TSP	4,55	g/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	PM25	4,55	g/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	PM10	4,55	g/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Benzo(k)	1,7	µg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Indeno	1,5	µg/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	DIOX	1,4	ng/GJ
7103	1.A.3.a_kerosene_cruise1_2019	1.A.3.a.2.2	Hg	0,12	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	PM25	1,93	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	PM25	1,93	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	PM10	1,93	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	PM10	1,93	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Benzo(k)	1,7	µg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Benzo(k)	1,7	µg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Indeno	1,5	µg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Indeno	1,5	µg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	DIOX	1,4	ng/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	DIOX	1,4	ng/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Hg	0,12	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Hg	0,12	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	As	0,03	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	As	0,03	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Cd	0,006	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Cd	0,006	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Cr	0,2	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Cr	0,2	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Cu	0,22	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Cu	0,22	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Ni	0,008	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Ni	0,008	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Pb	0,08	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Pb	0,08	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Se	0,11	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Se	0,11	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Zn	29	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Zn	29	mg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Benzo(b)	15	µg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Benzo(b)	15	µg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	BC	0,93	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	BC	0,93	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	Benzo(a)	1,9	µg/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	Benzo(a)	1,9	µg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	SO2	30,6047777	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	SO2	30,6047777	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	NOX	228,86	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	NOX	228,86	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	NMVOC	13,79	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	NMVOC	13,79	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	CO	325,36	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	CO	325,36	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.2.1	TSP	1,93	g/GJ
7104	1.A.3.a_kerosene_LTO1_2019	1.A.3.a.1.1	TSP	1,93	g/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Cu	0,22	mg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Ni	0,008	mg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Pb	0,08	mg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Se	0,11	mg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Zn	29	mg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Benzo(b)	15	µg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	BC	0,93	g/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Benzo(a)	1,9	µg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	SO2	30,6047777	g/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	NOX	228,86	g/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	NMVOC	13,79	g/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	CO	325,36	g/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	TSP	1,93	g/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	PM25	1,93	g/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	PM10	1,93	g/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Benzo(k)	1,7	µg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Indeno	1,5	µg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	DIOX	1,4	ng/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Hg	0,12	mg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	As	0,03	mg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Cd	0,006	mg/GJ
7105	1.A.3.a_kerosene_LTO2_2019	1.A.3.a.1.1	Cr	0,2	mg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Se	0,11	mg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Zn	29	mg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Benzo(b)	15	µg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Benzo(a)	1,9	µg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	SO2	30,6047777	g/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	NOX	291,17	g/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	NMVOC	11,37	g/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	CO	25,02	g/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	TSP	4,55	g/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	PM25	4,55	g/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	PM10	4,55	g/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Benzo(k)	1,7	µg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Indeno	1,5	µg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	DIOX	1,4	ng/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	BC	2,18	g/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Hg	0,12	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	As	0,03	mg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Cd	0,006	mg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Cr	0,2	mg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Cu	0,22	mg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Ni	0,008	mg/GJ
7106	1.A.3.a_kerosene_cruise2_2019	1.A.3.a.1.2	Pb	0,08	mg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Ni	1,64	mg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	NH3	0,16	g/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Pb	0,08	mg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Se	0,23	mg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Zn	23,41	mg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	DIOX	1,4	ng/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Benzo(b)	1,17	µg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Benzo(k)	1,7	µg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Benzo(a)	0,7	µg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Indeno	1,5	µg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	SO2	0,291431116	g/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	NOX	1226,88	g/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	NMVOC	108,87	g/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	CO	250,53	g/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	TSP	35,59	g/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	PM25	32,08	g/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	PM10	33,72	g/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	BC	0,21	g/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	As	0,03	mg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Cd	0,23	mg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Cr	1,17	mg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Cu	39,8	mg/GJ
7107	1.A.3.c_diesel-2019	1.A.3.c	Hg	0,12	mg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	Zn	28,096	mg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	SO2	0,291431116	g/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	NOX	1837,977	g/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	NH3	0,164	g/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	NMVOC	65,558	g/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	CO	173,262	g/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	TSP	35,121	g/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	PM10	35,121	g/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	PM25	32,779	g/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	Hg	0,7	mg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	Pb	3,04	mg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	HCB	1,87	µg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	DIOX	3,04	ng/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	PCBs	0,89	µg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	As	0,94	mg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	Cd	0,234	mg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	Cr	1,171	mg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	Cu	20,604	mg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	Ni	23,414	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	Se	2,341	mg/GJ
7108	1.A.3.d.ii_gas oil/diesel_2019	1.A.3.d.2	BC	0,102	g/GJ
7110	SWDS-2019	6.A.1	NMVOC	0,477907404	kg/t
7110	SWDS-2019	6.A.1	TSP	0,463	g/t
7110	SWDS-2019	6.A.1	PM25	0,033	g/t
7110	SWDS-2019	6.A.1	PM10	0,219	g/t
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Hg	0,5	mg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Pb	4,48	mg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	HCB	3,48	µg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	PCBs	14,18	µg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	DIOX	11,69	ng/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Cd	0,5	mg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Cr	17,91	mg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Cu	31,1	mg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Ni	796,22	mg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Se	5,23	mg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Zn	29,86	mg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Benzo(b)	1244,091	µg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	Benzo(a)	746,454	µg/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	SO2	1016,155467	g/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	NOX	1973,13	g/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	NH3	0,174	g/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	NMVOC	67,18	g/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	CO	184,13	g/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	TSP	154,27	g/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	PM10	154,27	g/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	PM25	139,34	g/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	BC	0,167	g/GJ
7111	1.A.3.d.ii_ fuel oil_2019	1.A.3.d.2	As	16,92	mg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	As	0,94	mg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Cd	0,234	mg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Cr	1,171	mg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Cu	39,803	mg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Ni	1,639	mg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Se	0,234	mg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Zn	23,414	mg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Benzo(b)	1170,686	µg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Benzo(a)	702,412	µg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	SO2	0,289286666	g/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	NOX	1837,977	g/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	NH3	163,9	g/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	NMVOC	65,558	g/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	CO	173,262	g/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	TSP	35,121	g/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	PM10	35,121	g/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	PM25	32,779	g/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Hg	0,7	mg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	Pb	3,04	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	HCB	1,87	µg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	DIOX	3,04	ng/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	PCBs	8,9	µg/GJ
7112	1.A.3.d.2_diesel_2019	1.A.3.d.2	BC	0,102	g/GJ
7114	Dairy cattle	4.B.01.a	NH3	14,47211607	kg/animal
7114	Dairy cattle	4.B.01.a	TSP	1,38	kg/animal
7114	Dairy cattle	4.B.01.a	PM25	0,41	kg/animal
7114	Dairy cattle	4.B.01.a	NOX	0,129041408	kg/animal
7114	Dairy cattle	4.B.01.a	NMVOC	18,67218662	kg/animal
7114	Dairy cattle	4.B.01.a	PM10	0,63	kg/animal
7115	Non-dairy cattle	4.B.01.b	NH3	5,093768212	kg/animal
7115	Non-dairy cattle	4.B.01.b	TSP	0,59	kg/animal
7115	Non-dairy cattle	4.B.01.b	PM25	0,18	kg/animal
7115	Non-dairy cattle	4.B.01.b	NOX	0,084427677	kg/animal
7115	Non-dairy cattle	4.B.01.b	NMVOC	10,37069305	kg/animal
7115	Non-dairy cattle	4.B.01.b	PM10	0,27	kg/animal
7116	Calves (telad)	4.B.01.b	TSP	0,34	kg/animal
7116	Calves (telad)	4.B.01.b	PM25	0,1	kg/animal
7116	Calves (telad)	4.B.01.b	NOX	0,084427677	kg/animal
7116	Calves (telad)	4.B.01.b	NMVOC	10,37069305	kg/animal
7116	Calves (telad)	4.B.01.b	PM10	0,16	kg/animal
7116	Calves (telad)	4.B.01.b	NH3	5,093768212	kg/animal
7117	Sheep	4.B.03	NH3	0,379192366	kg/animal
7117	Sheep	4.B.03	TSP	0,139	kg/animal
7117	Sheep	4.B.03	PM25	0,0167	kg/animal
7117	Sheep	4.B.03	NOX	0,007774052	kg/animal
7117	Sheep	4.B.03	NMVOC	0,076583598	kg/animal
7117	Sheep	4.B.03	PM10	0,0556	kg/animal
7118	Goats	4.B.04	NH3	0,453301002	kg/animal
7118	Goats	4.B.04	TSP	0,139	kg/animal
7118	Goats	4.B.04	PM25	0,0167	kg/animal
7118	Goats	4.B.04	NOX	0,007774052	kg/animal
7118	Goats	4.B.04	NMVOC	0,057480327	kg/animal
7118	Goats	4.B.04	PM10	0,0556	kg/animal
7119	Horses	4.B.06	NH3	4,579825549	kg/animal
7119	Horses	4.B.06	TSP	0,48	kg/animal
7119	Horses	4.B.06	PM25	0,14	kg/animal
7119	Horses	4.B.06	NOX	0,135433936	kg/animal
7119	Horses	4.B.06	NMVOC	2,312860471	kg/animal
7119	Horses	4.B.06	PM10	0,22	kg/animal
7120	Mules and asses	4.B.07	NH3	4,579825549	kg/animal
7120	Mules and asses	4.B.07	TSP	0,34	kg/animal
7120	Mules and asses	4.B.07	PM25	0,1	kg/animal
7120	Mules and asses	4.B.07	NOX	0,135433936	kg/animal
7120	Mules and asses	4.B.07	NMVOC	0,277173711	kg/animal
7120	Mules and asses	4.B.07	PM10	0,16	kg/animal
7121	Swine: Sows	4.B.08	NH3	10,77940485	kg/animal
7121	Swine: Sows	4.B.08	TSP	0,62	kg/animal

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7121	Swine: Sows	4.B.08	PM25	0,01	kg/animal
7121	Swine: Sows	4.B.08	NOX	0,259415322	kg/animal
7121	Swine: Sows	4.B.08	NMVOC	3,152934519	kg/animal
7121	Swine: Sows	4.B.08	PM10	0,17	kg/animal
7122	Swine: Fattng pigs	4.B.08	NH3	3,429325989	kg/animal
7122	Swine: Fattng pigs	4.B.08	TSP	1,05	kg/animal
7122	Swine: Fattng pigs	4.B.08	PM25	0,006	kg/animal
7122	Swine: Fattng pigs	4.B.08	NOX	0,077343643	kg/animal
7122	Swine: Fattng pigs	4.B.08	NMVOC	0,46352491	kg/animal
7122	Swine: Fattng pigs	4.B.08	PM10	0,14	kg/animal
7123	Laying hnse	4.B.09.a	NMVOC	0,079116829	kg/animal
7123	Laying hnse	4.B.09.a	PM10	0,04	kg/animal
7123	Laying hnse	4.B.09.a	NH3	0,221237499	kg/animal
7123	Laying hnse	4.B.09.a	TSP	0,19	kg/animal
7123	Laying hnse	4.B.09.a	PM25	0,003	kg/animal
7123	Laying hnse	4.B.09.a	NOX	0,004577509	kg/animal
7124	Briolers	4.B.09.b	NMVOC	0,08369016	kg/animal
7124	Briolers	4.B.09.b	PM10	0,02	kg/animal
7124	Briolers	4.B.09.b	NH3	0,099643725	kg/animal
7124	Briolers	4.B.09.b	TSP	0,04	kg/animal
7124	Briolers	4.B.09.b	PM25	0,002	kg/animal
7124	Briolers	4.B.09.b	NOX	0,003067756	kg/animal
7125	Turkeys	4.B.09.c	NMVOC	0,283035076	kg/animal
7125	Turkeys	4.B.09.c	PM10	0,11	kg/animal
7125	Turkeys	4.B.09.c	NH3	0,658796473	kg/animal
7125	Turkeys	4.B.09.c	TSP	0,11	kg/animal
7125	Turkeys	4.B.09.c	PM25	0,02	kg/animal
7125	Turkeys	4.B.09.c	NOX	0,013873513	kg/animal
7126	Other poultry	4.B.09.d	NMVOC	0,05475894	kg/animal
7126	Other poultry	4.B.09.d	PM10	0,24	kg/animal
7126	Other poultry	4.B.09.d	NH3	0,419591007	kg/animal
7126	Other poultry	4.B.09.d	TSP	0,24	kg/animal
7126	Other poultry	4.B.09.d	PM25	0,03	kg/animal
7126	Other poultry	4.B.09.d	NOX	0,004039064	kg/animal
7127	Other poultry	4.B.09.d	NMVOC	0,108630857	kg/animal
7127	Other poultry	4.B.09.d	PM10	0,14	kg/animal
7127	Other poultry	4.B.09.d	NH3	0,230227452	kg/animal
7127	Other poultry	4.B.09.d	TSP	0,14	kg/animal
7127	Other poultry	4.B.09.d	PM25	0,02	kg/animal
7127	Other poultry	4.B.09.d	NOX	0,007147624	kg/animal
7128	Other poultry	4.B.09.d	NMVOC	0,05475894	kg/animal
7128	Other poultry	4.B.09.d	PM10	0,24	kg/animal
7128	Other poultry	4.B.09.d	NH3	0,419591007	kg/animal
7128	Other poultry	4.B.09.d	TSP	0,24	kg/animal
7128	Other poultry	4.B.09.d	PM25	0,03	kg/animal
7128	Other poultry	4.B.09.d	NOX	0,004039064	kg/animal
7129	Sheep	4.D.1.b	NH3	0,358614674	kg/animal
7129	Sheep	4.D.1.b	NOX	0,158057767	kg/animal

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7130	Sows	4.D.1.b	NH3	9,550777296	kg/animal
7130	Sows	4.D.1.b	NOX	2,803357929	kg/animal
7131	Goats	4.D.1.b	NH3	0,428764352	kg/animal
7132	Layers	4.D.1.b	NOX	0,053236192	kg/animal
7132	Layers	4.D.1.b	NH3	0,180858063	kg/animal
7133	Boilers	4.D.1.b	NH3	0,113586399	kg/animal
7133	Boilers	4.D.1.b	NOX	0,032878187	kg/animal
7134	Turkeys	4.D.1.b	NH3	0,400903502	kg/animal
7134	Turkeys	4.D.1.b	NOX	0,152773055	kg/animal
7136	Ducks	4.D.1.b	NH3	0,206544054	kg/animal
7136	Ducks	4.D.1.b	NOX	0,073665002	kg/animal
7137	Fatting pigs	4.D.1.b	NH3	2,847699891	kg/animal
7137	Fatting pigs	4.D.1.b	NOX	0,857270839	kg/animal
7138	Non dairy (young) - housing	4.D.1.b	NH3	4,121852731	kg/animal
7139	Non dairy (other) - husing	4.D.1.b	NH3	4,121852731	kg/animal
7140	Dairy cows - housing	4.D.1.b	NH3	11,14414326	kg/animal
7141	Horses - grazing	4.D.2.c	NH3	5,37795	kg/animal
7141	Horses - grazing	4.D.2.c	NOX	2,383286286	kg/animal
7142	Knaufinsulation_2019	2.A.7.1	NH3	37,173315	t
7142	Knaufinsulation_2019	2.A.7.1	NMVOC	0	t
7142	Knaufinsulation_2019	2.A.7.1	TSP	17,70554605	t
7142	Knaufinsulation_2019	2.A.7.1	PM25	13,74161783	t
7142	Knaufinsulation_2019	2.A.7.1	PM10	15,591451	t
7142	Knaufinsulation_2019	2.A.7.1	BC	0,274832357	t
7143	Grassland	4.D.1.c	NMVOC	0,41	kg/ha
7144	cropland	4.D.1.c	NMVOC	0,796696293	kg/ha
7145	Goats - grazing	4.D.2.c	NH3	0,803580103	kg/animal
7145	Goats - grazing	4.D.2.c	NOX	2,12633344	kg/animal
7146	Dairy cows - grazing	4.D.2.c	NH3	2,475164237	kg/animal
7146	Dairy cows - grazing	4.D.2.c	NOX	4,92647304	kg/animal
7147	Non dairy (young) - grazing	4.D.2.c	NOX	2,358976448	kg/animal
7147	Non dairy (young) - grazing	4.D.2.c	NH3	0,995649147	kg/animal
7148	Non dairy (other) - grazing	4.D.2.c	NH3	0,995649147	kg/animal
7148	Non dairy (other) - grazing	4.D.2.c	NOX	2,358976448	kg/animal
7149	Sheep - grazing	4.D.2.c	NH3	0,3946635	kg/animal
7149	Sheep - grazing	4.D.2.c	NOX	1,7787763	kg/animal
7150	TE-TO Zg 2019	1.A.1.a	Cd	0	kg
7150	TE-TO Zg 2019	1.A.1.a	Hg	1,68	mg/GJ
7150	TE-TO Zg 2019	1.A.1.a	Ni	0	mg/GJ
7150	TE-TO Zg 2019	1.A.1.a	Pb	0	mg/GJ
7150	TE-TO Zg 2019	1.A.1.a	SO2	9,4	t
7150	TE-TO Zg 2019	1.A.1.a	NOX	205,55	t
7150	TE-TO Zg 2019	1.A.1.a	CO	57,02	t
7150	TE-TO Zg 2019	1.A.1.a	TSP	5,2	t
7150	TE-TO Zg 2019	1.A.1.a	PM25	1,3	t
7150	TE-TO Zg 2019	1.A.1.a	PM10	2,6	t
7150	TE-TO Zg 2019	1.A.1.a	BC	0,03248	t
7151	EL-TO Zg 2019	1.A.1.a	Cd	0	kg

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7151	EL-TO Zg 2019	1.A.1.a	Hg	0,536	mg/GJ
7151	EL-TO Zg 2019	1.A.1.a	Ni	0	mg/GJ
7151	EL-TO Zg 2019	1.A.1.a	Pb	0	mg/GJ
7151	EL-TO Zg 2019	1.A.1.a	SO2	0	t
7151	EL-TO Zg 2019	1.A.1.a	NOX	462,2764	t
7151	EL-TO Zg 2019	1.A.1.a	CO	25,8394	t
7151	EL-TO Zg 2019	1.A.1.a	TSP	2,61948	t
7151	EL-TO Zg 2019	1.A.1.a	PM25	0,65487	t
7151	EL-TO Zg 2019	1.A.1.a	PM10	1,30974	t
7151	EL-TO Zg 2019	1.A.1.a	BC	0,01637	t
7152	KTE Jertovec 2019	1.A.1.a	Hg	0,025	mg/GJ
7152	KTE Jertovec 2019	1.A.1.a	SO2	0	t
7152	KTE Jertovec 2019	1.A.1.a	NOX	3,79	t
7152	KTE Jertovec 2019	1.A.1.a	CO	0	t
7152	KTE Jertovec 2019	1.A.1.a	TSP	0	t
7152	KTE Jertovec 2019	1.A.1.a	PM25	0	t
7152	KTE Jertovec 2019	1.A.1.a	PM10	0	t
7152	KTE Jertovec 2019	1.A.1.a	Cd	0	kg
7152	KTE Jertovec 2019	1.A.1.a	Pb	0	kg
7152	KTE Jertovec 2019	1.A.1.a	Ni	0	kg
7152	KTE Jertovec 2019	1.A.1.a	BC	0	t
7153	TE Sisak 2019	1.A.1.a	Cd	0	kg
7153	TE Sisak 2019	1.A.1.a	Hg	0,738	no unit
7153	TE Sisak 2019	1.A.1.a	BC	0,01501	t
7153	TE Sisak 2019	1.A.1.a	Ni	0	mg/GJ
7153	TE Sisak 2019	1.A.1.a	Pb	0	mg/GJ
7153	TE Sisak 2019	1.A.1.a	SO2	4,34	t
7153	TE Sisak 2019	1.A.1.a	NOX	177,96	t
7153	TE Sisak 2019	1.A.1.a	CO	16,9	t
7153	TE Sisak 2019	1.A.1.a	TSP	2,402	t
7153	TE Sisak 2019	1.A.1.a	PM25	0,6005	t
7153	TE Sisak 2019	1.A.1.a	PM10	1,2	t
7154	Petrokemija_2019	1.A.2.c	SO2	0	t
7154	Petrokemija_2019	1.A.2.c	NOX	196,26	t
7154	Petrokemija_2019	1.A.2.c	CO	191,97	t
7155	TE Plomin2-2019	1.A.1.a	Cd	2,756	mg/GJ
7155	TE Plomin2-2019	1.A.1.a	Hg	98,42	mg/GJ
7155	TE Plomin2-2019	1.A.1.a	Ni	133,85	mg/GJ
7155	TE Plomin2-2019	1.A.1.a	Pb	112,2	mg/GJ
7155	TE Plomin2-2019	1.A.1.a	SO2	369,55	t
7155	TE Plomin2-2019	1.A.1.a	NOX	536,78	t
7155	TE Plomin2-2019	1.A.1.a	CO	0	t
7155	TE Plomin2-2019	1.A.1.a	TSP	0,3	t
7155	TE Plomin2-2019	1.A.1.a	PM25	0,075	t
7155	TE Plomin2-2019	1.A.1.a	PM10	0,075	t
7155	TE Plomin2-2019	1.A.1.a	BC	1,52328	t
7156	TE Rijeka-2019	1.A.1.a	Cd	0	mg/GJ
7156	TE Rijeka-2019	1.A.1.a	Hg	0	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7156	TE Rijeka-2019	1.A.1.a	Ni	0	mg/GJ
7156	TE Rijeka-2019	1.A.1.a	Pb	0	mg/GJ
7156	TE Rijeka-2019	1.A.1.a	SO2	0	t
7156	TE Rijeka-2019	1.A.1.a	NOX	0	t
7156	TE Rijeka-2019	1.A.1.a	CO	0	t
7156	TE Rijeka-2019	1.A.1.a	TSP	0	t
7156	TE Rijeka-2019	1.A.1.a	PM25	0	t
7156	TE Rijeka-2019	1.A.1.a	PM10	0	t
7156	TE Rijeka-2019	1.A.1.a	BC	0	t
7157	TE-TO Os-2019	1.A.1.a	Cd	0	mg/GJ
7157	TE-TO Os-2019	1.A.1.a	Hg	0,172	mg/GJ
7157	TE-TO Os-2019	1.A.1.a	Ni	0	mg/GJ
7157	TE-TO Os-2019	1.A.1.a	Pb	0	mg/GJ
7157	TE-TO Os-2019	1.A.1.a	SO2	0	t
7157	TE-TO Os-2019	1.A.1.a	NOX	63,16	t
7157	TE-TO Os-2019	1.A.1.a	CO	3,36	t
7157	TE-TO Os-2019	1.A.1.a	TSP	31,764	t
7157	TE-TO Os-2019	1.A.1.a	PM25	7,941	t
7157	TE-TO Os-2019	1.A.1.a	PM10	15,88	t
7157	TE-TO Os-2019	1.A.1.a	BC	0,1985	t
7158	Našicecement_2019	1.A.2.f.1	Pb	0,098	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Cd	0,008	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Hg	0,049	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	As	0,0265	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Cr	0,041	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Cu	0,0647	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Ni	0,049	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Se	0,0253	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Zn	0,424	µg/ t clinker
7158	Našicecement_2019	1.A.2.f.1	HCB	4,6	µg/ t clinker
7158	Našicecement_2019	1.A.2.f.1	PCBs	103	ng/ t clinker
7158	Našicecement_2019	1.A.2.f.1	DIOX	4,1	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Benzo(a)	6,50E-05	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Benzo(b)	0,00028	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Benzo(k)	7,70E-05	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	Indeno	4,30E-05	g/t clinker
7158	Našicecement_2019	1.A.2.f.1	SO2	664,7	t
7158	Našicecement_2019	1.A.2.f.1	NOX	1066,3	t
7169	HFO_2019	1.A.1.b	Cr	2,55	ng/GJ
7169	HFO_2019	1.A.1.b	Cu	5,31	mg/GJ
7169	HFO_2019	1.A.1.b	Hg	0,341	mg/GJ
7169	HFO_2019	1.A.1.b	Ni	255	mg/GJ
7169	HFO_2019	1.A.1.b	Pb	4,56	mg/GJ
7169	HFO_2019	1.A.1.b	Benzo(b)	4,5	mg/GJ
7169	HFO_2019	1.A.1.b	Benzo(k)	4,5	mg/GJ
7169	HFO_2019	1.A.1.b	Indeno	6,92	mg/GJ
7169	HFO_2019	1.A.1.b	SO2	423,24	µg/GJ
7169	HFO_2019	1.A.1.b	NOX	142	µg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7169	HFO_2019	1.A.1.b	NMVOC	2,3	µg/GJ
7169	HFO_2019	1.A.1.b	CO	15,1	g/GJ
7169	HFO_2019	1.A.1.b	TSP	35,4	g/GJ
7169	HFO_2019	1.A.1.b	PM25	19,3	g/GJ
7169	HFO_2019	1.A.1.b	PM10	25,2	g/GJ
7169	HFO_2019	1.A.1.b	BC	1,0808	g/GJ
7169	HFO_2019	1.A.1.b	Se	2,06	g/GJ
7169	HFO_2019	1.A.1.b	Zn	87,8	g/GJ
7158	Našicecement_2019	1.A.2.f.1	NMVOC	373,36	t
7158	Našicecement_2019	1.A.2.f.1	CO	4446,51	t
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Cd	0,008	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Hg	0,049	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	As	0,0265	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Cr	0,041	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Cu	0,0647	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Ni	0,049	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Se	0,0253	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Zn	0,424	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	HCB	4,6	µg/ t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	PCBs	103	µg/ t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	DIOX	4,1	ng/ t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Benzo(a)	6,50E-05	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Benzo(b)	0,00028	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Benzo(k)	7,70E-05	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Indeno	4,30E-05	g/t clinker
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	SO2	17,29796	t
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	NOX	940,35012	t
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	NMVOC	18	t
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	CO	2154,42501	t
7161	Cemex:Dalmacijacement_2019	1.A.2.f.1	Pb	0,098	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Cd	0,008	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Hg	0,049	g/t clinker
7162	Holcim_2019	1.A.2.f.1	As	0,0265	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Cr	0,041	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Cu	0,0647	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Ni	0,049	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Se	0,0253	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Zn	0,424	g/t clinker
7162	Holcim_2019	1.A.2.f.1	HCB	4,6	µg/ t clinker
7162	Holcim_2019	1.A.2.f.1	PCBs	103	µg/ t clinker
7162	Holcim_2019	1.A.2.f.1	DIOX	4,1	ng/ t clinker
7162	Holcim_2019	1.A.2.f.1	Benzo(a)	6,50E-05	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Benzo(b)	0,00028	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Benzo(k)	7,70E-05	g/t clinker
7162	Holcim_2019	1.A.2.f.1	Indeno	4,30E-05	g/t clinker
7162	Holcim_2019	1.A.2.f.1	SO2	94,2	t
7162	Holcim_2019	1.A.2.f.1	NOX	899,8	t
7162	Holcim_2019	1.A.2.f.1	NMVOC	54,3	t

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7162	Holcim_2019	1.A.2.f.1	CO	1448,6	t
7162	Holcim_2019	1.A.2.f.1	Pb	0,098	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Pb	0,098	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Cd	0,008	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Hg	0,049	g/t clinker
7163	Calucem_2019	1.A.2.f.1	As	0,0265	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Cr	0,041	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Cu	0,0647	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Ni	0,049	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Se	0,0253	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Zn	0,424	μg/ t clinker
7163	Calucem_2019	1.A.2.f.1	HCB	4,6	μg/ t clinker
7163	Calucem_2019	1.A.2.f.1	PCBs	103	ng/ t clinker
7163	Calucem_2019	1.A.2.f.1	DIOX	4,1	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Benzo(a)	6,50E-05	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Benzo(b)	0,00028	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Benzo(k)	7,70E-05	g/t clinker
7163	Calucem_2019	1.A.2.f.1	Indeno	4,30E-05	g/t clinker
7163	Calucem_2019	1.A.2.f.1	SO2	2142	t
7163	Calucem_2019	1.A.2.f.1	NOX	3101,69	t
7163	Calucem_2019	1.A.2.f.1	NMVOC	18	t
7163	Calucem_2019	1.A.2.f.1	CO	1956,011	t
7164	Rockwool_2019	1.A.2.f.1	NOX	86,07	t
7164	Rockwool_2019	1.A.2.f.1	CO	3,31	t
7164	Rockwool_2019	1.A.2.f.1	SO2	389,1	t
7165	gas oil_2019	1.A.4.a.1	Pb	8	mg/GJ
7165	gas oil_2019	1.A.1.a	Pb	8	mg/GJ
7165	gas oil_2019	1.A.4.a.1	Se	0,1	mg/GJ
7165	gas oil_2019	1.A.1.a	Se	0,1	mg/GJ
7165	gas oil_2019	1.A.4.a.1	Zn	18	mg/GJ
7165	gas oil_2019	1.A.1.a	Zn	18	mg/GJ
7165	gas oil_2019	1.A.4.a.1	DIOX	1,4	ng/GJ
7165	gas oil_2019	1.A.1.a	DIOX	1,4	ng/GJ
7165	gas oil_2019	1.A.4.a.1	Benzo(b)	15	μg/GJ
7165	gas oil_2019	1.A.1.a	Benzo(b)	15	μg/GJ
7165	gas oil_2019	1.A.4.a.1	Benzo(k)	1,7	μg/GJ
7165	gas oil_2019	1.A.1.a	Benzo(k)	1,7	μg/GJ
7165	gas oil_2019	1.A.4.a.1	Benzo(a)	1,9	μg/GJ
7165	gas oil_2019	1.A.1.a	Benzo(a)	1,9	μg/GJ
7165	gas oil_2019	1.A.4.a.1	Indeno	1,5	μg/GJ
7165	gas oil_2019	1.A.1.a	Indeno	1,5	μg/GJ
7165	gas oil_2019	1.A.4.a.1	SO2	34,42	g/GJ
7165	gas oil_2019	1.A.1.a	SO2	34,42	g/GJ
7165	gas oil_2019	1.A.4.a.1	NOX	306	g/GJ
7165	gas oil_2019	1.A.1.a	NOX	306	g/GJ
7165	gas oil_2019	1.A.4.a.1	NMVOC	20	g/GJ
7165	gas oil_2019	1.A.1.a	NMVOC	20	g/GJ
7165	gas oil_2019	1.A.4.a.1	CO	93	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7165	gas oil_2019	1.A.1.a	CO	93	g/GJ
7165	gas oil_2019	1.A.4.a.1	TSP	21	g/GJ
7165	gas oil_2019	1.A.1.a	TSP	21	g/GJ
7165	gas oil_2019	1.A.4.a.1	HCB	0,22	µg/GJ
7165	gas oil_2019	1.A.1.a	HCB	0,22	µg/GJ
7165	gas oil_2019	1.A.4.a.1	PCBs	0,13	µg/GJ
7165	gas oil_2019	1.A.1.a	PCBs	0,13	µg/GJ
7165	gas oil_2019	1.A.4.a.1	PM25	18	g/GJ
7165	gas oil_2019	1.A.1.a	PM25	18	g/GJ
7165	gas oil_2019	1.A.4.a.1	PM10	21	g/GJ
7165	gas oil_2019	1.A.1.a	PM10	21	g/GJ
7165	gas oil_2019	1.A.4.a.1	BC	10,08	g/GJ
7165	gas oil_2019	1.A.1.a	BC	10,08	g/GJ
7165	gas oil_2019	1.A.4.a.1	As	0,5	mg/GJ
7165	gas oil_2019	1.A.1.a	As	0,5	mg/GJ
7165	gas oil_2019	1.A.4.a.1	Cd	0,15	mg/GJ
7165	gas oil_2019	1.A.1.a	Cd	0,15	mg/GJ
7165	gas oil_2019	1.A.4.a.1	Cr	10	mg/GJ
7165	gas oil_2019	1.A.1.a	Cr	10	mg/GJ
7165	gas oil_2019	1.A.4.a.1	Cu	3	mg/GJ
7165	gas oil_2019	1.A.1.a	Cu	3	mg/GJ
7165	gas oil_2019	1.A.4.a.1	Hg	0,1	mg/GJ
7165	gas oil_2019	1.A.1.a	Hg	0,1	mg/GJ
7165	gas oil_2019	1.A.4.a.1	Ni	125	mg/GJ
7165	gas oil_2019	1.A.1.a	Ni	125	mg/GJ
7165	gas oil_2019	1.A.4.a.1	NH3	0	g/GJ
7165	gas oil_2019	1.A.1.a	NH3	0	g/GJ
7166	residual fuel_2019	1.A.4.a.1	HCB	0,22	µg/GJ
7166	residual fuel_2019	1.A.1.a	HCB	0,22	µg/GJ
7166	residual fuel_2019	1.A.4.a.1	PCBs	0,13	µg/GJ
7166	residual fuel_2019	1.A.1.a	PCBs	0,13	µg/GJ
7166	residual fuel_2019	1.A.4.a.1	Pb	8	mg/GJ
7166	residual fuel_2019	1.A.1.a	Pb	8	mg/GJ
7166	residual fuel_2019	1.A.4.a.1	Se	0,1	mg/GJ
7166	residual fuel_2019	1.A.1.a	Se	0,1	mg/GJ
7166	residual fuel_2019	1.A.4.a.1	Zn	18	mg/GJ
7166	residual fuel_2019	1.A.1.a	Zn	18	mg/GJ
7166	residual fuel_2019	1.A.4.a.1	DIOX	6	ng/GJ
7166	residual fuel_2019	1.A.1.a	DIOX	6	ng/GJ
7166	residual fuel_2019	1.A.4.a.1	Benzo(b)	15	µg/GJ
7166	residual fuel_2019	1.A.1.a	Benzo(b)	15	µg/GJ
7166	residual fuel_2019	1.A.4.a.1	Benzo(k)	1,7	µg/GJ
7166	residual fuel_2019	1.A.1.a	Benzo(k)	1,7	µg/GJ
7166	residual fuel_2019	1.A.4.a.1	Benzo(a)	1,9	µg/GJ
7166	residual fuel_2019	1.A.1.a	Benzo(a)	1,9	µg/GJ
7166	residual fuel_2019	1.A.4.a.1	Indeno	1,5	µg/GJ
7166	residual fuel_2019	1.A.1.a	Indeno	1,5	µg/GJ
7166	residual fuel_2019	1.A.4.a.1	SO2	423,24	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7166	residual fuel_2019	1.A.1.a	SO2	423,24	g/GJ
7166	residual fuel_2019	1.A.4.a.1	NOX	306	g/GJ
7166	residual fuel_2019	1.A.1.a	NOX	306	g/GJ
7166	residual fuel_2019	1.A.4.a.1	NMVOC	20	g/GJ
7166	residual fuel_2019	1.A.1.a	NMVOC	20	g/GJ
7166	residual fuel_2019	1.A.4.a.1	CO	93	g/GJ
7166	residual fuel_2019	1.A.1.a	CO	93	g/GJ
7166	residual fuel_2019	1.A.4.a.1	TSP	21	g/GJ
7166	residual fuel_2019	1.A.1.a	TSP	21	g/GJ
7166	residual fuel_2019	1.A.4.a.1	PM25	18	g/GJ
7166	residual fuel_2019	1.A.1.a	PM25	18	g/GJ
7166	residual fuel_2019	1.A.4.a.1	PM10	21	g/GJ
7166	residual fuel_2019	1.A.1.a	PM10	21	g/GJ
7166	residual fuel_2019	1.A.4.a.1	BC	10,08	g/GJ
7166	residual fuel_2019	1.A.1.a	BC	10,08	g/GJ
7166	residual fuel_2019	1.A.4.a.1	As	0,5	mg/GJ
7166	residual fuel_2019	1.A.1.a	As	0,5	mg/GJ
7166	residual fuel_2019	1.A.4.a.1	Cd	0,15	mg/GJ
7166	residual fuel_2019	1.A.1.a	Cd	0,15	mg/GJ
7166	residual fuel_2019	1.A.4.a.1	Cr	10	mg/GJ
7166	residual fuel_2019	1.A.1.a	Cr	10	mg/GJ
7166	residual fuel_2019	1.A.4.a.1	Cu	3	mg/GJ
7166	residual fuel_2019	1.A.1.a	Cu	3	mg/GJ
7166	residual fuel_2019	1.A.4.a.1	Hg	0,1	mg/GJ
7166	residual fuel_2019	1.A.1.a	Hg	0,1	mg/GJ
7166	residual fuel_2019	1.A.4.a.1	Ni	125	mg/GJ
7166	residual fuel_2019	1.A.1.a	Ni	125	mg/GJ
7166	residual fuel_2019	1.A.4.a.1	NH3	0	g/GJ
7166	residual fuel_2019	1.A.1.a	NH3	0	g/GJ
7167	LF-HFO_2019	1.A.2.b	Pb	0,08	mg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Pb	0,08	mg/GJ
7167	LF-HFO_2019	1.A.2.c	Pb	0,08	mg/GJ
7167	LF-HFO_2019	1.A.2.d	Pb	0,08	mg/GJ
7167	LF-HFO_2019	1.A.2.a	Pb	0,08	mg/GJ
7167	LF-HFO_2019	1.A.2.e	Pb	0,08	mg/GJ
7167	LF-HFO_2019	1.A.2.b	Se	0,11	mg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Se	0,11	mg/GJ
7167	LF-HFO_2019	1.A.2.c	Se	0,11	mg/GJ
7167	LF-HFO_2019	1.A.2.d	Se	0,11	mg/GJ
7167	LF-HFO_2019	1.A.2.a	Se	0,11	mg/GJ
7167	LF-HFO_2019	1.A.2.e	Se	0,11	mg/GJ
7167	LF-HFO_2019	1.A.2.b	Zn	29	mg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Zn	29	mg/GJ
7167	LF-HFO_2019	1.A.2.c	Zn	29	mg/GJ
7167	LF-HFO_2019	1.A.2.d	Zn	29	mg/GJ
7167	LF-HFO_2019	1.A.2.a	Zn	29	mg/GJ
7167	LF-HFO_2019	1.A.2.e	Zn	29	mg/GJ
7167	LF-HFO_2019	1.A.2.b	DIOX	1,4	ng/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7167	LF-HFO_2019	1.A.2.f.1	DIOX	1,4	ng/GJ
7167	LF-HFO_2019	1.A.2.c	DIOX	1,4	ng/GJ
7167	LF-HFO_2019	1.A.2.d	DIOX	1,4	ng/GJ
7167	LF-HFO_2019	1.A.2.a	DIOX	1,4	ng/GJ
7167	LF-HFO_2019	1.A.2.e	DIOX	1,4	ng/GJ
7167	LF-HFO_2019	1.A.2.b	Benzo(b)	15	µg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Benzo(b)	15	µg/GJ
7167	LF-HFO_2019	1.A.2.c	Benzo(b)	15	µg/GJ
7167	LF-HFO_2019	1.A.2.d	Benzo(b)	15	µg/GJ
7167	LF-HFO_2019	1.A.2.a	Benzo(b)	15	µg/GJ
7167	LF-HFO_2019	1.A.2.e	Benzo(b)	15	µg/GJ
7167	LF-HFO_2019	1.A.2.b	Benzo(k)	1,7	µg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Benzo(k)	1,7	µg/GJ
7167	LF-HFO_2019	1.A.2.c	Benzo(k)	1,7	µg/GJ
7167	LF-HFO_2019	1.A.2.d	Benzo(k)	1,7	µg/GJ
7167	LF-HFO_2019	1.A.2.a	Benzo(k)	1,7	µg/GJ
7167	LF-HFO_2019	1.A.2.e	Benzo(k)	1,7	µg/GJ
7167	LF-HFO_2019	1.A.2.b	Benzo(a)	1,9	µg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Benzo(a)	1,9	µg/GJ
7167	LF-HFO_2019	1.A.2.c	Benzo(a)	1,9	µg/GJ
7167	LF-HFO_2019	1.A.2.d	Benzo(a)	1,9	µg/GJ
7167	LF-HFO_2019	1.A.2.a	Benzo(a)	1,9	µg/GJ
7167	LF-HFO_2019	1.A.2.e	Benzo(a)	1,9	µg/GJ
7167	LF-HFO_2019	1.A.2.b	Indeno	1,5	µg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Indeno	1,5	µg/GJ
7167	LF-HFO_2019	1.A.2.c	Indeno	1,5	µg/GJ
7167	LF-HFO_2019	1.A.2.d	Indeno	1,5	µg/GJ
7167	LF-HFO_2019	1.A.2.a	Indeno	1,5	µg/GJ
7167	LF-HFO_2019	1.A.2.e	Indeno	1,5	µg/GJ
7167	LF-HFO_2019	1.A.2.b	SO2	423,24	g/GJ
7167	LF-HFO_2019	1.A.2.f.1	SO2	423,24	g/GJ
7167	LF-HFO_2019	1.A.2.c	SO2	423,24	g/GJ
7167	LF-HFO_2019	1.A.2.d	SO2	423,24	g/GJ
7167	LF-HFO_2019	1.A.2.a	SO2	423,24	g/GJ
7167	LF-HFO_2019	1.A.2.e	SO2	423,24	g/GJ
7167	LF-HFO_2019	1.A.2.b	NOX	513	g/GJ
7167	LF-HFO_2019	1.A.2.f.1	NOX	513	g/GJ
7167	LF-HFO_2019	1.A.2.c	NOX	513	g/GJ
7167	LF-HFO_2019	1.A.2.d	NOX	513	g/GJ
7167	LF-HFO_2019	1.A.2.a	NOX	513	g/GJ
7167	LF-HFO_2019	1.A.2.e	NOX	513	g/GJ
7167	LF-HFO_2019	1.A.2.b	NMVOC	25	g/GJ
7167	LF-HFO_2019	1.A.2.f.1	NMVOC	25	g/GJ
7167	LF-HFO_2019	1.A.2.c	NMVOC	25	g/GJ
7167	LF-HFO_2019	1.A.2.d	NMVOC	25	g/GJ
7167	LF-HFO_2019	1.A.2.a	NMVOC	25	g/GJ
7167	LF-HFO_2019	1.A.2.e	NMVOC	25	g/GJ
7167	LF-HFO_2019	1.A.2.b	CO	66	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7167	LF-HFO_2019	1.A.2.f.1	CO	66	g/GJ
7167	LF-HFO_2019	1.A.2.c	CO	66	g/GJ
7167	LF-HFO_2019	1.A.2.d	CO	66	g/GJ
7167	LF-HFO_2019	1.A.2.a	CO	66	g/GJ
7167	LF-HFO_2019	1.A.2.e	CO	66	g/GJ
7167	LF-HFO_2019	1.A.2.b	TSP	20	g/GJ
7167	LF-HFO_2019	1.A.2.f.1	TSP	20	g/GJ
7167	LF-HFO_2019	1.A.2.c	TSP	20	g/GJ
7167	LF-HFO_2019	1.A.2.d	TSP	20	g/GJ
7167	LF-HFO_2019	1.A.2.a	TSP	20	g/GJ
7167	LF-HFO_2019	1.A.2.e	TSP	20	g/GJ
7167	LF-HFO_2019	1.A.2.b	PM25	20	g/GJ
7167	LF-HFO_2019	1.A.2.f.1	PM25	20	g/GJ
7167	LF-HFO_2019	1.A.2.c	PM25	20	g/GJ
7167	LF-HFO_2019	1.A.2.d	PM25	20	g/GJ
7167	LF-HFO_2019	1.A.2.a	PM25	20	g/GJ
7167	LF-HFO_2019	1.A.2.e	PM25	20	g/GJ
7167	LF-HFO_2019	1.A.2.b	PM10	20	g/GJ
7167	LF-HFO_2019	1.A.2.f.1	PM10	20	g/GJ
7167	LF-HFO_2019	1.A.2.c	PM10	20	g/GJ
7167	LF-HFO_2019	1.A.2.d	PM10	20	g/GJ
7167	LF-HFO_2019	1.A.2.a	PM10	20	g/GJ
7167	LF-HFO_2019	1.A.2.e	PM10	20	g/GJ
7167	LF-HFO_2019	1.A.2.b	BC	11,2	g/GJ
7167	LF-HFO_2019	1.A.2.f.1	BC	11,2	g/GJ
7167	LF-HFO_2019	1.A.2.c	BC	11,2	g/GJ
7167	LF-HFO_2019	1.A.2.d	BC	11,2	g/GJ
7167	LF-HFO_2019	1.A.2.a	BC	11,2	g/GJ
7167	LF-HFO_2019	1.A.2.e	BC	11,2	g/GJ
7167	LF-HFO_2019	1.A.2.b	As	0,03	mg/GJ
7167	LF-HFO_2019	1.A.2.f.1	As	0,03	mg/GJ
7167	LF-HFO_2019	1.A.2.c	As	0,03	mg/GJ
7167	LF-HFO_2019	1.A.2.d	As	0,03	mg/GJ
7167	LF-HFO_2019	1.A.2.a	As	0,03	mg/GJ
7167	LF-HFO_2019	1.A.2.e	As	0,03	mg/GJ
7167	LF-HFO_2019	1.A.2.b	Cd	0,006	mg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Cd	0,006	mg/GJ
7167	LF-HFO_2019	1.A.2.c	Cd	0,006	mg/GJ
7167	LF-HFO_2019	1.A.2.d	Cd	0,006	mg/GJ
7167	LF-HFO_2019	1.A.2.a	Cd	0,006	mg/GJ
7167	LF-HFO_2019	1.A.2.e	Cd	0,006	mg/GJ
7167	LF-HFO_2019	1.A.2.b	Cr	0,2	mg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Cr	0,2	mg/GJ
7167	LF-HFO_2019	1.A.2.c	Cr	0,2	mg/GJ
7167	LF-HFO_2019	1.A.2.d	Cr	0,2	mg/GJ
7167	LF-HFO_2019	1.A.2.a	Cr	0,2	mg/GJ
7167	LF-HFO_2019	1.A.2.e	Cr	0,2	mg/GJ
7167	LF-HFO_2019	1.A.2.b	Cu	0,22	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7167	LF-HFO_2019	1.A.2.f.1	Cu	0,22	mg/GJ
7167	LF-HFO_2019	1.A.2.c	Cu	0,22	mg/GJ
7167	LF-HFO_2019	1.A.2.d	Cu	0,22	mg/GJ
7167	LF-HFO_2019	1.A.2.a	Cu	0,22	mg/GJ
7167	LF-HFO_2019	1.A.2.e	Cu	0,22	mg/GJ
7167	LF-HFO_2019	1.A.2.b	Hg	0,12	mg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Hg	0,12	mg/GJ
7167	LF-HFO_2019	1.A.2.c	Hg	0,12	mg/GJ
7167	LF-HFO_2019	1.A.2.d	Hg	0,12	mg/GJ
7167	LF-HFO_2019	1.A.2.a	Hg	0,12	mg/GJ
7167	LF-HFO_2019	1.A.2.e	Hg	0,12	mg/GJ
7167	LF-HFO_2019	1.A.2.b	Ni	0,008	mg/GJ
7167	LF-HFO_2019	1.A.2.f.1	Ni	0,008	mg/GJ
7167	LF-HFO_2019	1.A.2.c	Ni	0,008	mg/GJ
7167	LF-HFO_2019	1.A.2.d	Ni	0,008	mg/GJ
7167	LF-HFO_2019	1.A.2.a	Ni	0,008	mg/GJ
7167	LF-HFO_2019	1.A.2.e	Ni	0,008	mg/GJ
7168	LF-GO_2019	1.A.2.b	As	4,2	mg/GJ
7168	LF-GO_2019	1.A.2.c	As	4,2	mg/GJ
7168	LF-GO_2019	1.A.2.a	As	4,2	mg/GJ
7168	LF-GO_2019	1.A.2.f.1	As	4,2	mg/GJ
7168	LF-GO_2019	1.A.2.d	As	4,2	mg/GJ
7168	LF-GO_2019	1.A.2.e	As	4,2	mg/GJ
7168	LF-GO_2019	1.A.2.b	Cd	0,4	mg/GJ
7168	LF-GO_2019	1.A.2.c	Cd	0,4	mg/GJ
7168	LF-GO_2019	1.A.2.a	Cd	0,4	mg/GJ
7168	LF-GO_2019	1.A.2.f.1	Cd	0,4	mg/GJ
7168	LF-GO_2019	1.A.2.d	Cd	0,4	mg/GJ
7168	LF-GO_2019	1.A.2.e	Cd	0,4	mg/GJ
7168	LF-GO_2019	1.A.2.b	Cr	3,1	mg/GJ
7168	LF-GO_2019	1.A.2.c	Cr	3,1	mg/GJ
7168	LF-GO_2019	1.A.2.a	Cr	3,1	mg/GJ
7168	LF-GO_2019	1.A.2.f.1	Cr	3,1	mg/GJ
7168	LF-GO_2019	1.A.2.d	Cr	3,1	mg/GJ
7168	LF-GO_2019	1.A.2.e	Cr	3,1	mg/GJ
7168	LF-GO_2019	1.A.2.b	Cu	2	mg/GJ
7168	LF-GO_2019	1.A.2.c	Cu	2	mg/GJ
7168	LF-GO_2019	1.A.2.a	Cu	2	mg/GJ
7168	LF-GO_2019	1.A.2.f.1	Cu	2	mg/GJ
7168	LF-GO_2019	1.A.2.d	Cu	2	mg/GJ
7168	LF-GO_2019	1.A.2.e	Cu	2	mg/GJ
7168	LF-GO_2019	1.A.2.b	Hg	4,4	mg/GJ
7168	LF-GO_2019	1.A.2.c	Hg	4,4	mg/GJ
7168	LF-GO_2019	1.A.2.a	Hg	4,4	mg/GJ
7168	LF-GO_2019	1.A.2.f.1	Hg	4,4	mg/GJ
7168	LF-GO_2019	1.A.2.d	Hg	4,4	mg/GJ
7168	LF-GO_2019	1.A.2.e	Hg	4,4	mg/GJ
7168	LF-GO_2019	1.A.2.b	Ni	3,9	mg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7168	LF-GO_2019	1.A.2.c	Ni	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.a	Ni	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.f.1	Ni	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.d	Ni	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.e	Ni	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.b	Pb	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.c	Pb	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.a	Pb	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.f.1	Pb	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.d	Pb	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.e	Pb	3,9	mg/GJ
7168	LF-GO_2019	1.A.2.b	Se	1,8	mg/GJ
7168	LF-GO_2019	1.A.2.c	Se	1,8	mg/GJ
7168	LF-GO_2019	1.A.2.a	Se	1,8	mg/GJ
7168	LF-GO_2019	1.A.2.f.1	Se	1,8	mg/GJ
7168	LF-GO_2019	1.A.2.d	Se	1,8	mg/GJ
7168	LF-GO_2019	1.A.2.e	Se	1,8	mg/GJ
7168	LF-GO_2019	1.A.2.b	Zn	10,4	mg/GJ
7168	LF-GO_2019	1.A.2.c	Zn	10,4	mg/GJ
7168	LF-GO_2019	1.A.2.a	Zn	10,4	mg/GJ
7168	LF-GO_2019	1.A.2.f.1	Zn	10,4	mg/GJ
7168	LF-GO_2019	1.A.2.d	Zn	10,4	mg/GJ
7168	LF-GO_2019	1.A.2.e	Zn	10,4	mg/GJ
7168	LF-GO_2019	1.A.2.b	DIOX	9,07	ng/GJ
7168	LF-GO_2019	1.A.2.c	DIOX	9,07	ng/GJ
7168	LF-GO_2019	1.A.2.a	DIOX	9,07	ng/GJ
7168	LF-GO_2019	1.A.2.f.1	DIOX	9,07	ng/GJ
7168	LF-GO_2019	1.A.2.d	DIOX	9,07	ng/GJ
7168	LF-GO_2019	1.A.2.e	DIOX	9,07	ng/GJ
7168	LF-GO_2019	1.A.2.b	Benzo(b)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.c	Benzo(b)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.a	Benzo(b)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.f.1	Benzo(b)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.d	Benzo(b)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.e	Benzo(b)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.b	Benzo(k)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.c	Benzo(k)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.a	Benzo(k)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.f.1	Benzo(k)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.d	Benzo(k)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.e	Benzo(k)	1285,71	µg/GJ
7168	LF-GO_2019	1.A.2.b	Benzo(a)	32,2	µg/GJ
7168	LF-GO_2019	1.A.2.c	Benzo(a)	32,2	µg/GJ
7168	LF-GO_2019	1.A.2.a	Benzo(a)	32,2	µg/GJ
7168	LF-GO_2019	1.A.2.f.1	Benzo(a)	32,2	µg/GJ
7168	LF-GO_2019	1.A.2.d	Benzo(a)	32,2	µg/GJ
7168	LF-GO_2019	1.A.2.e	Benzo(a)	32,2	µg/GJ
7168	LF-GO_2019	1.A.2.b	Indeno	967,03	µg/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7168	LF-GO_2019	1.A.2.c	Indeno	967,03	µg/GJ
7168	LF-GO_2019	1.A.2.a	Indeno	967,03	µg/GJ
7168	LF-GO_2019	1.A.2.f.1	Indeno	967,03	µg/GJ
7168	LF-GO_2019	1.A.2.d	Indeno	967,03	µg/GJ
7168	LF-GO_2019	1.A.2.e	Indeno	967,03	µg/GJ
7168	LF-GO_2019	1.A.2.b	SO2	34,42	g/GJ
7168	LF-GO_2019	1.A.2.c	SO2	34,42	g/GJ
7168	LF-GO_2019	1.A.2.a	SO2	34,42	g/GJ
7168	LF-GO_2019	1.A.2.f.1	SO2	34,42	g/GJ
7168	LF-GO_2019	1.A.2.d	SO2	34,42	g/GJ
7168	LF-GO_2019	1.A.2.e	SO2	34,42	g/GJ
7168	LF-GO_2019	1.A.2.b	NOX	155	g/GJ
7168	LF-GO_2019	1.A.2.c	NOX	155	g/GJ
7168	LF-GO_2019	1.A.2.a	NOX	155	g/GJ
7168	LF-GO_2019	1.A.2.f.1	NOX	155	g/GJ
7168	LF-GO_2019	1.A.2.d	NOX	155	g/GJ
7168	LF-GO_2019	1.A.2.e	NOX	155	g/GJ
7168	LF-GO_2019	1.A.2.b	NH3	0,31	g/GJ
7168	LF-GO_2019	1.A.2.c	NH3	0,31	g/GJ
7168	LF-GO_2019	1.A.2.a	NH3	0,31	g/GJ
7168	LF-GO_2019	1.A.2.f.1	NH3	0,31	g/GJ
7168	LF-GO_2019	1.A.2.d	NH3	0,31	g/GJ
7168	LF-GO_2019	1.A.2.e	NH3	0,31	g/GJ
7168	LF-GO_2019	1.A.2.b	NMVOC	20	g/GJ
7168	LF-GO_2019	1.A.2.c	NMVOC	20	g/GJ
7168	LF-GO_2019	1.A.2.a	NMVOC	20	g/GJ
7168	LF-GO_2019	1.A.2.f.1	NMVOC	20	g/GJ
7168	LF-GO_2019	1.A.2.d	NMVOC	20	g/GJ
7168	LF-GO_2019	1.A.2.e	NMVOC	20	g/GJ
7168	LF-GO_2019	1.A.2.b	CO	73	g/GJ
7168	LF-GO_2019	1.A.2.c	CO	73	g/GJ
7168	LF-GO_2019	1.A.2.a	CO	73	g/GJ
7168	LF-GO_2019	1.A.2.f.1	CO	73	g/GJ
7168	LF-GO_2019	1.A.2.d	CO	73	g/GJ
7168	LF-GO_2019	1.A.2.e	CO	73	g/GJ
7168	LF-GO_2019	1.A.2.b	TSP	100	g/GJ
7168	LF-GO_2019	1.A.2.c	TSP	100	g/GJ
7168	LF-GO_2019	1.A.2.a	TSP	100	g/GJ
7168	LF-GO_2019	1.A.2.f.1	TSP	100	g/GJ
7168	LF-GO_2019	1.A.2.d	TSP	100	g/GJ
7168	LF-GO_2019	1.A.2.e	TSP	100	g/GJ
7168	LF-GO_2019	1.A.2.b	PM25	35	g/GJ
7168	LF-GO_2019	1.A.2.c	PM25	35	g/GJ
7168	LF-GO_2019	1.A.2.a	PM25	35	g/GJ
7168	LF-GO_2019	1.A.2.f.1	PM25	35	g/GJ
7168	LF-GO_2019	1.A.2.d	PM25	35	g/GJ
7168	LF-GO_2019	1.A.2.e	PM25	35	g/GJ
7168	LF-GO_2019	1.A.2.b	PM10	60	g/GJ

Tech_ID	Technology Name	Category	Pollutant	Emission Factor	Unit
7168	LF-GO_2019	1.A.2.c	PM10	60	g/GJ
7168	LF-GO_2019	1.A.2.a	PM10	60	g/GJ
7168	LF-GO_2019	1.A.2.f.1	PM10	60	g/GJ
7168	LF-GO_2019	1.A.2.d	PM10	60	g/GJ
7168	LF-GO_2019	1.A.2.e	PM10	60	g/GJ
7168	LF-GO_2019	1.A.2.b	HCB	0,62	µg/GJ
7168	LF-GO_2019	1.A.2.c	HCB	0,62	µg/GJ
7168	LF-GO_2019	1.A.2.a	HCB	0,62	µg/GJ
7168	LF-GO_2019	1.A.2.f.1	HCB	0,62	µg/GJ
7168	LF-GO_2019	1.A.2.d	HCB	0,62	µg/GJ
7168	LF-GO_2019	1.A.2.e	HCB	0,62	µg/GJ
7169	HFO_2019	1.A.1.b	DIOX	2,5	ng/GJ
7169	HFO_2019	1.A.1.b	As	3,98	mg/GJ
7169	HFO_2019	1.A.1.b	Cd	1,2	mg/GJ

Appendix 5. The energy balance for the Republic of Croatia - 2019

Table A5-1: National Energy balance for 2019, natural units

ENERGY BALANCE 2019 *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					705.7	1028.9
Import	1.6	711.0	25.6	5.1	2006.0	2003.4
Export		3.1			121.6	72.3
Import-processing						
Export-processing						
Stock change		-51.2			46.2	-52.0
Bunkers						
Energy supplied	**1.6**	**656.7**	**25.6**	**5.1**	**2636.3**	**2908.0**
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		579.8				0.5
public cogeneration plants						636.1
public heating plants						51.8
industrial cogeneration plants			22.8			319.8
– in rafineries						65.3
– in gas production						57.2
Industrial heating plants						70.6
Petroleum refineries					2594.6	79.9
NGL-plant					41.7	13.4
Coke plant						
Gas works						
Total transformation sector		**579.8**	**22.8**		**2636.3**	**1172.1**
Energy sector own use						
Oil and gas extraction						18.7
Coal production						
Electric energy supply industry						
hydro power plants						
thermal power plants						
public cogeneration plants						
industrial cogeneration plants						
Wind power						
Petroleum refineries						52.2
NGL-plant						50.0
Gas works						
Total energy sector own use						**120.9**
Losses						**31.5**
Final energy demand	**1.6**	**76.9**	**2.8**	**5.1**		**1583.5**
Non energy use						**500.6**
Energy sector						
Petrochemical industry						500.6
Other industry						
Construction						
Transport						
Agriculture						
Energy consumption	**1.6**	**76.9**	**2.8**	**5.1**		**1082.9**
Industry	**1.6**	**76.9**	**1.1**			**244.7**
Iron and steel	1.6					15.6
Non-ferrous metals						12.5
Non-metallic minerals						50.2
Chemical						12.2
Construction materials		76.9	1.1			58.0
Pulp and paper						8.2
Food production						47.9
Not elsewhere specified						40.1
Transport						**4.8**
Rail						
Road						0.2
Air						
– international						
– domestic						
Sea and River						
Public transport						4.6
Not elsewhere specified						
Other sectors			**1.7**	**5.1**		**833.4**
Households			1.7	5.1		554.9
Services						251.8
Agriculture						26.7
Construction						

Table A5-1: National Energy balance for 2019, natural units, cont.

ENERGY BALANCE 2019 *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	51535.8	4936.3	12746.3	1368.7	1942.7	192093.3	0.3	18368.1
Import		59.0					73.0	1617.7
Export		548.9						5553.7
Import-processing								
Export-processing								
Stock change							-1.8	-269.9
Bunkers								
Energy supplied	**51535.8**	**4446.4**	**12746.3**	**1368.7**	**1942.7**	**192093.3**	**71.5**	**14162.2**
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	51535.8							
– small HPP	999.0							
Wind power plants			12746.3					
Solar power plants				721.9				
Geothermal power plants					1641.9			
thermal power plants						20175.1		
public cogeneration plants						164161.2		8984.2
public heating plants								2.8
industrial cogeneration plants						7757.0		
– in rafineries								
– in gas production								
Industrial heating plants								232.1
Petroleum refineries								
NGL-plant								
Coke plant								
Gas works								
Total transformation sector	**51535.8**		**12746.3**	**721.9**	**1641.9**	**192093.3**		**9219.1**
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		**4446.4**		**646.8**	**300.8**	**0.0**	**71.5**	**4943.1**
Non energy use								
Energy sector								
Petrochemical industry								
Other industry								
Construction								
Transport								
Agriculture								
Energy consumption		**4446.4**		**646.8**	**300.8**	**0.0**	**71.5**	**4943.1**
Industry		**40.0**						**1884.3**
Iron and steel		0.2						2.2
Non-ferrous metals		0.3						
Non-metallic minerals								0.6
Chemical								0.2
Construction materials		4.6						1201.4
Pulp and paper								72.5
Food production		2.1						188.8
Not elsewhere specified		32.8						418.6
Transport							**71.5**	
Rail								
Road							71.5	
Air								
– international								
– domestic								
Sea and River								
Public transport								
Not elsewhere specified								
Other sectors		**4406.4**		**646.8**	**300.8**			**3058.8**
Households		4394.4		452.8				2649.1
Services		12.0		194.0	162.7			409.7
Agriculture					138.1			
Construction								

Table A5-1: National Energy balance for 2019, natural units, cont.

ENERGY BALANCE 2019 *natural units*	Coke oven coke	Liquefied petroleum	Unleaded motor	Standard motor	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		195.9	711.5			158.3	1069.5	169.5	31.3	365.9
Import	29.5	74.5	154.5	0.5	1.6	47.2	1895.4	28.1	41.0	
Export	1.5	135.4	425.0			15.9	1037.7	85.1	20.5	329.8
Import-processing										
Export-processing										
Stock change	3.4	-0.8	35.6			10.2	-102.3	-1.9	-1.8	6.8
Bunkers							19.9			4.8
Energy supplied	**31.4**	**134.2**	**476.6**	**0.5**	**1.6**	**199.8**	**1805.0**	**110.6**	**50.0**	**38.1**
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		156.2	711.5			158.3	1069.5	169.5	31.3	365.9
NGL-plant		39.7								
Coke plant										
Gas works										
Total production		**195.9**	**711.5**			**158.3**	**1069.5**	**169.5**	**31.3**	**365.9**
Transformation sector										
hydro power plants										
– small HPP										
Wind power plants										
Solar power plants										
Geothermal power plants										
thermal power plants								0.8		
public cogeneration plants								0.2		
public heating plants								2.3	1.9	
industrial cogeneration plants									31.3	
– in rafineries									31.3	
– in gas production										
Industrial heating plants									6.4	34.0
Petroleum refineries										
NGL-plant										
Coke plant										
Gas works										
Total transformation sector								**3.3**	**39.6**	**34.0**
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									6.8	
NGL-plant										
Gas works										
Total energy sector own use									**6.8**	
Losses										
Final energy demand	**31.4**	**134.2**	**476.6**	**0.5**	**1.6**	**199.8**	**1805.0**	**107.3**	**3.6**	**4.1**
Non energy use										
Energy sector										
Petrochemical industry										
Other industry										
Construction										
Transport										
Agriculture										
Energy consumption	**31.4**	**134.2**	**476.6**	**0.5**	**1.6**	**199.8**	**1805.0**	**107.3**	**3.6**	**4.1**
Industry	**31.4**	**7.7**	**0.2**		**1.6**		**13.1**	**15.3**	**3.6**	**4.1**
Iron and steel	0.3	0.7						0.6		
Non-ferrous metals		0.7						0.2		
Non-metallic minerals		0.2								
Chemical					1.6			0.4		
Construction materials	28.7	1.2	0.1				13.1	2.7	2.1	0.7
Pulp and paper		0.2								
Food production	2.4	0.9						6.4	1.2	3.2
Not elsewhere specified		3.8	0.1					5.0	0.3	0.2
Transport		**66.0**	**465.2**	**0.5**		**199.8**	**1526.9**			
Rail							14.3			
Road		66.0	465.2				1439.0			
Air				0.5		199.8				
– international				0.1		190.0				
– domestic				0.4		9.8				
Sea and River							49.1			
Public transport							24.5			
Not elsewhere specified										
Other sectors		**60.5**	**11.2**				**265.0**	**92.0**		
Households		43.5						50.8		
Services		12.2						26.8		
Agriculture		2.6	7.7				175.9	9.4		
Construction		2.2	3.5				89.1	5.0		

Table A5-1: National Energy balance for 2019, natural units, cont.

ENERGY BALANCE 2019 *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	33.2			10.4		67.2		24.6
Import		3.3	134.9	33.8	6.2	119.6		
Export	12.9	0.2	0.9	8.9	0.2	19.9		74.1
Import-processing								
Export-processing								
Stock change	-7.1					-4.7		57.3
Bunkers								
Energy supplied	**13.2**	**3.1**	**134.0**	**35.3**	**6.0**	**162.2**		**7.8**
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	14.0			10.4		67.2		24.6
NGL-plant	19.2							
Coke plant								
Gas works								
Total production	**33.2**			**10.4**		**67.2**		**24.6**
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	13.2							
NGL-plant								
Coke plant								
Gas works								
Total transformation sector	**13.2**							
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						19.7		
NGL-plant								
Gas works								
Total energy sector own use						**19.7**		
Losses								
Final energy demand	**0.0**	**3.1**	**134.0**	**35.3**	**6.0**	**142.5**		**7.8**
Non energy use		**3.1**	**134.0**	**35.3**	**6.0**			**7.8**
Energy sector				2.4				
Petrochemical industry								7.8
Other industry		3.1	14.1	6.8	6.0			
Construction			119.9	1.5				
Transport				23.2				
Agriculture				1.4				
Energy consumption	**0.0**					**142.5**		
Industry						**142.5**		
Iron and steel								
Non-ferrous metals								
Non-metallic minerals								
Chemical								
Construction materials						142.5		
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 2019, natural units, cont.

ENERGY BALANCE 2019 *natural units*	Refinery gas	Refinery semiproducts	Aditives	Gas works gas	Electricity	Steam and hot water	Industrial waste, non
	103 t	103 t	103 t	103 m3	GWh	TJ	
Production	129.2				12760.3	27120.0	1128.9
Import		226.6	40.7		9158.3		
Export					3025.3		
Import-processing							
Export-processing							
Stock change		2.8	0.5				
Bunkers							
Energy supplied	**129.2**	**229.4**	**41.2**		**18893.3**	**27120.0**	**1128.9**
Production							
hydro power plants					5932.6		
– small HPP					115.0		
Wind power plants					1467.3		
Solar power plants					83.1		
Geothermal power plants					91.9		
thermal power plants					1666.6		
public cogeneration plants					3149.3	11526.5	
public heating plants						1655.1	
industrial cogeneration plants					369.5	9114.0	
– in rafineries					83.8	2800.0	
– in gas production					147.3	637.0	
Industrial heating plants						4218.6	
Petroleum refineries	129.2						
NGL-plant							
Coke plant							
Gas works							
Total production	**129.2**				**12760.3**	**26514.2**	
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	6.5						
– in rafineries	6.5						
– in gas production							
Industrial heating plants	17.0						
Petroleum refineries		229.4	41.2				
NGL-plant							
Coke plant							
Gas works							
Total transformation sector	**23.5**	**229.4**	**41.2**				
Energy sector own use							
Oil and gas extraction					132.3	451.0	
Coal production						297.5	
Electric energy supply industry					61.5		
hydro power plants					230.6		
thermal power plants					152.6		
public cogeneration plants					236.3	1186.1	
industrial cogeneration plants							
Wind power					24.3		
Petroleum refineries	105.7				246.7	4583.4	
NGL-plant					49.2	186.0	
Gas works							
Total energy sector own use	**105.7**				**1133.5**	**6704.0**	
Losses					**1659.0**	**1700.3**	
Final energy demand					**16100.8**	**18715.7**	**1128.9**
Non energy use							
Energy sector							
Petrochemical industry							
Other industry							
Construction							
Transport							
Agriculture							
Energy consumption					**16100.8**	**18715.7**	**1128.9**
Industry					**3539.8**	**11683.8**	**1128.9**
Iron and steel					322.9	164.2	
Non-ferrous metals					101.9		
Non-metallic minerals					156.1	8.5	
Chemical					322.7	4547.4	
Construction materials					563.5	5.6	1128.9
Pulp and paper					190.5	1196.0	
Food production					666.9	3011.6	
Not elsewhere specified					1215.3	2750.5	
Transport					**332.3**		
Rail					179.1		
Road					1.6		
Air					37.4		
– international							
– domestic					37.4		
Sea and River					22.0		
Public transport					60.7		
Not elsewhere specified					31.5		
Other sectors					**12228.7**	**7031.9**	
Households					6205.9	5195.6	
Services					5880.0	1567.4	
Agriculture					64.0	268.9	
Construction					78.8		

Table A5-2: National Energy balance for 2019, energy units

PJ	Anthracite	Hard coal	Brown coal	Lignite	Crude oil	Natural gas
Production	-	-	-	-	30.13	36.128
Import	0.05	17.66	0.49	0.06	85.66	69.398
Export	-	0.08	-	-	5.19	2.504
Import-processing	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-
Stock change	-	-1.27	-	-	1.97	-1.801
Bunkers	-	-	-	-	-	-
Energy supplied	**0.05**	**16.31**	**0.49**	**0.06**	**112.57**	**101.22**
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	**0.05**	**16.31**	**0.49**	**0.06**	**112.57**	**101.22**
Transformation sector	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-
– small HPP	-	-	-	-	-	-
Wind power plants	-	-	-	-	-	-
Solar power plants	-	-	-	-	-	-
Geothermal power plants	-	-	-	-	-	-
thermal power plants	-	14.08	-	-	-	0.02
public cogeneration plants	-	-	-	-	-	22.03
public heating plants	-	-	-	-	-	1.79
industrial cogeneration plants	-	-	0.43	-	-	11.08
– in rafineries	-	-	-	-	-	2.26
– in gas production	-	-	-	-	-	1.98
Industrial heating plants	-	-	-	-	-	2.45
Petroleum refineries	-	-	-	-	110.79	2.77
NGL-plant	-	-	-	-	1.78	0.95
Coke plant	-	-	-	-	-	-
Gas works	-	-	-	-	-	-
Total transformation sector	**-**	**14.08**	**0.43**	**-**	**112.57**	**41.09**
Energy sector own use	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	0.65
Coal production	-	-	-	-	-	-
Electric energy supply industry	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	1.81
NGL-plant	-	-	-	-	-	1.73
Gas works	-	-	-	-	-	-
Total energy sector own use	**-**	**-**	**-**	**-**	**-**	**4.19**
Losses	-	-	-	-	-	1.09
Final energy demand	**0.05**	**2.23**	**0.05**	**0.06**	**0.00**	**54.85**
Non energy use	**-**	**-**	**-**	**-**	**-**	**17.34**
Energy sector	-	-	-	-	-	-
Petrochemical industry	-	-	-	-	-	17.34
Other industry	-	-	-	-	-	-
Construction	-	-	-	-	-	-
Transport	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-
Energy consumption	**0.05**	**2.23**	**0.05**	**0.06**	**0.00**	**37.51**
Industry	**0.05**	**2.23**	**0.02**	**-**	**-**	**8.48**
Iron and steel	0.05	-	-	-	-	0.54
Non-ferrous metals	-	-	-	-	-	0.43
Non-metallic minerals	-	-	-	-	-	1.74
Chemical	-	-	-	-	-	0.42
Construction materials	-	2.23	0.02	-	-	2.01
Pulp and paper	-	-	-	-	-	0.28
Food production	-	-	-	-	-	1.66
Not elsewhere specified	-	-	-	-	-	1.39
Transport	**-**	**-**	**-**	**-**	**-**	**0.17**
Rail	-	-	-	-	-	-
Road	-	-	-	-	-	0.01
Air	-	-	-	-	-	-
– international	-	-	-	-	-	-
– domestic	-	-	-	-	-	-
Sea and River	-	-	-	-	-	-
Public transport	-	-	-	-	-	0.16
Not elsewhere specified	-	-	-	-	-	-
Other sectors	**-**	**-**	**0.03**	**0.06**	**-**	**28.87**
Households	-	-	0.03	0.06	-	19.22
Services	-	-	-	-	-	8.72
Agriculture	-	-	-	-	-	0.92
Construction	-	-	-	-	-	-

Table A5-2: National Energy balance for 2019, energy units, cont.

PJ	Hydro energy	Fuel wood	Wind energy	Solar energy	Geothermal energy	Landfill gas	Biofuels	Other biomass
Production	51.54	44.427	12.746	1.369	1.943	3.4418	0.011	18.368
Import	-	0.53	-	-	-	-	2.68	1.62
Export	-	4.94	-	-	-	-	-	5.55
Import-processing	-	-	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-	-	-
Stock change	-	-	-	-	-	-	-0.07	-0.27
Bunkers	-	-	-	-	-	-	-	-
Energy supplied	**51.54**	**40.02**	**12.75**	**1.37**	**1.94**	**3.4418**	**2.62**	**14.16**
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	**51.54**	**40.02**	**12.75**	**1.37**	**1.94**	**3.4418**	**2.62**	**14.16**
Transformation sector	-	-	-	-	-	-	-	-
hydro power plants	51.54	-	-	-	-	-	-	-
– small HPP	1.00	-	-	-	-	-	-	-
Wind power plants	-	-	12.75	-	-	-	-	-
Solar power plants	-	-	-	0.72	-	-	-	-
Geothermal power plants	-	-	-	-	1.64	-	-	-
thermal power plants	-	-	-	-	-	0.3485	-	-
public cogeneration plants	-	-	-	-	-	2.9355	-	8.98
public heating plants	-	-	-	-	-	-	-	0.00
industrial cogeneration plants	-	-	-	-	-	0.1578	-	-
– in rafineries	-	-	-	-	-	-	-	-
– in gas production	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	0.23
Petroleum refineries	-	-	-	-	-	-	-	-
NGL-plant	-	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total transformation sector	**51.54**	**-**	**12.75**	**0.72**	**1.64**	**3.4418**	**-**	**9.22**
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	**-**	**40.02**	**-**	**0.65**	**0.30**	**-**	**2.62**	**4.94**
Non energy use	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Energy sector	-	-	-	-	-	-	-	-
Petrochemical industry	-	-	-	-	-	-	-	-
Other industry	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-
Transport	-	-	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-	-	-
Energy consumption	**-**	**40.02**	**-**	**0.65**	**0.30**	**-**	**2.62**	**4.94**
Industry	**-**	**0.36**	**-**	**-**	**-**	**-**	**-**	**1.88**
Iron and steel	-	0.00	-	-	-	-	-	0.00
Non-ferrous metals	-	0.00	-	-	-	-	-	-
Non-metallic minerals	-	-	-	-	-	-	-	0.00
Chemical	-	-	-	-	-	-	-	0.00
Construction materials	-	0.04	-	-	-	-	-	1.20
Pulp and paper	-	-	-	-	-	-	-	0.07
Food production	-	0.02	-	-	-	-	-	0.19
Not elsewhere specified	-	0.30	-	-	-	-	-	0.42
Transport	**-**	**-**	**-**	**-**	**-**	**-**	**2.62**	**-**
Rail	-	-	-	-	-	-	-	-
Road	-	-	-	-	-	-	2.62	-
Air	-	-	-	-	-	-	-	-
– international	-	-	-	-	-	-	-	-
– domestic	-	-	-	-	-	-	-	-
Sea and River	-	-	-	-	-	-	-	-
Public transport	-	-	-	-	-	-	-	-
Not elsewhere specified	-	-	-	-	-	-	-	-
Other sectors	**-**	**39.66**	**-**	**0.65**	**0.30**	**-**	**-**	**3.06**
Households	-	39.55	-	0.45	-	-	-	2.65
Services	-	0.11	-	0.19	0.16	-	-	0.41
Agriculture	-	-	-	-	0.14	-	-	-
Construction	-	-	-	-	-	-	-	-

Table A5-2: National Energy balance for 2019, 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	200.10	-	-	-	-	-	-	-	-	-
Import	178.13	0.86	3.49	6.89	0.02	0.07	2.07	80.95	1.20	1.65
Export	18.27	0.04	6.35	18.95	-	-	0.70	44.32	3.63	0.82
Import-processing	-	-	-	-	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-	-	-	-	-
Stock change	- 1.44	0.10	- 0.04	1.59	-	-	0.45	- 4.37	- 0.08	- 0.07
Bunkers	-	-	-	-	-	-	-	0.85	-	-
Energy supplied	**358.53**	**0.92**	**- 2.89**	**- 10.47**	**0.02**	**0.07**	**1.82**	**31.41**	**- 2.52**	**0.75**
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	-	-	7.32	31.73	-	-	6.96	45.68	7.24	1.26
NGL-plant	-	-	1.86	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-	-	-
Total production	**-**	**-**	**9.19**	**31.73**	**-**	**-**	**6.96**	**45.68**	**7.24**	**1.26**
Gross production	**358.53**	**0.92**	**6.29**	**21.25**	**0.02**	**0.07**	**8.78**	**77.09**	**4.72**	**2.01**
Transformation sector	-	-	-	-	-	-	-	-	-	-
hydro power plants	51.54	-	-	-	-	-	-	-	-	-
– small HPP	1.00	-	-	-	-	-	-	-	-	-
Wind power plants	12.75	-	-	-	-	-	-	-	-	-
Solar power plants	0.72	-	-	-	-	-	-	-	-	-
Geothermal power plants	1.64	-	-	-	-	-	-	-	-	-
thermal power plants	14.44	-	-	-	-	-	-	-	0.03	-
public cogeneration plants	33.95	-	-	-	-	-	-	-	0.01	-
public heating plants	1.80	-	-	-	-	-	-	-	0.10	0.08
industrial cogeneration plants	11.67	-	-	-	-	-	-	-	-	1.26
– in rafineries	2.26	-	-	-	-	-	-	-	-	1.26
– in gas production	1.98	-	-	-	-	-	-	-	-	-
Industrial heating plants	2.68	-	-	-	-	-	-	-	-	0.26
Petroleum refineries	113.56	-	-	-	-	-	-	-	-	-
NGL-plant	2.73	-	-	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-	-	-
Total transformation sector	**247.48**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.14**	**1.59**
Energy sector own use	-	-	-	-	-	-	-	-	-	-
Oil and gas extraction	0.65	-	-	-	-	-	-	-	-	-
Coal production	-	-	-	-	-	-	-	-	-	-
Electric energy supply industry	-	-	-	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	-	-	-	-	-
thermal power plants	-	-	-	-	-	-	-	-	-	-
public cogeneration plants	-	-	-	-	-	-	-	-	-	-
industrial cogeneration plants	-	-	-	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	1.81	-	-	-	-	-	-	-	-	0.27
NGL-plant	1.73	-	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-	-	-
Total energy sector own use	**4.19**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.27**
Losses	1.09	-	-	-	-	-	-	-	-	-
Final energy demand	**105.78**	**0.92**	**6.29**	**21.25**	**0.02**	**0.07**	**8.78**	**77.09**	**4.58**	**0.14**
Non energy use	**17.34**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Energy sector	-	-	-	-	-	-	-	-	-	-
Petrochemical industry	17.34	-	-	-	-	-	-	-	-	-
Other industry	-	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-	-
Transport	-	-	-	-	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-	-	-	-	-
Energy consumption	**88.43**	**0.92**	**6.29**	**21.25**	**0.02**	**0.07**	**8.78**	**77.09**	**4.58**	**0.14**
Industry	**13.02**	**0.92**	**0.36**	**0.01**	**-**	**0.07**	**-**	**0.56**	**0.65**	**0.14**
Iron and steel	0.59	0.01	0.03	-	-	-	-	-	0.03	-
Non-ferrous metals	0.44	-	0.03	-	-	-	-	-	0.01	-
Non-metallic minerals	1.74	-	0.01	-	-	-	-	-	-	-
Chemical	0.42	-	-	-	-	0.07	-	-	0.02	-
Construction materials	5.50	0.84	0.06	0.00	-	-	-	0.56	0.12	0.08
Pulp and paper	0.36	-	0.01	-	-	-	-	-	-	-
Food production	1.87	0.07	0.04	-	-	-	-	-	0.27	0.05
Not elsewhere specified	2.10	-	0.18	0.00	-	-	-	-	0.21	0.01
Transport	**2.79**	**-**	**3.09**	**20.74**	**0.02**	**-**	**8.78**	**65.21**	**-**	**-**
Rail	-	-	-	-	-	-	-	0.61	-	-
Road	2.63	-	3.09	20.74	-	-	-	61.46	-	-
Air	-	-	-	-	0.02	-	8.78	-	-	-
– international	-	-	-	-	0.00	-	8.35	-	-	-
– domestic	-	-	-	-	0.02	-	0.43	-	-	-
Sea and River	-	-	-	-	-	-	-	2.10	-	-
Public transport	0.16	-	-	-	-	-	-	1.05	-	-
Not elsewhere specified	-	-	-	-	-	-	-	-	-	-
Other sectors	**72.63**	**-**	**2.84**	**0.50**	**-**	**-**	**-**	**11.32**	**3.93**	**-**
Households	61.97	-	2.04	-	-	-	-	-	2.17	-
Services	9.60	-	0.57	-	-	-	-	-	1.14	-
Agriculture	1.06	-	0.12	0.34	-	-	-	7.51	0.40	-
Construction	-	-	0.10	0.16	-	-	-	3.81	0.21	-

Table A5-2: National Energy balance for 2019, energy units, cont.

PJ	Naphta	White spirit	Bitumen	Lubricants	Paraffin and wax	Petroleum coke	Etan	Other derivates
Production	-	-	-	-	-	-	-	-
Import	-	-	0.11	4.52	1.13	0.21	3.71	-
Export	13.25	0.58	0.01	0.03	0.30	0.01	0.62	-
Import-processing	-	-	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-	-	-
Stock change	0.27	- 0.32	-	-	-	-	- 0.15	-
Bunkers	0.19	-	-	-	-	-	-	-
Energy supplied	**- 13.17**	**- 0.89**	**0.10**	**4.49**	**0.83**	**0.20**	**2.95**	**-**
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	14.71	0.62	-	-	0.35	-	2.08	-
NGL-plant	-	0.86	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total production	**14.71**	**1.48**	**-**	**-**	**0.35**	**-**	**2.08**	**-**
Gross production	**1.53**	**0.59**	**0.10**	**4.49**	**1.18**	**0.20**	**5.03**	**-**
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	1.37	-	-	-	-	-	-	-
Petroleum refineries	-	0.59	-	-	-	-	-	-
NGL-plant	-	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total transformation sector	**1.37**	**0.59**	**-**	**-**	**-**	**-**	**-**	**-**
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	-	-	-	-	-	-	0.61	-
NGL-plant	-	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-	-
Total energy sector own use	**-**	**-**	**-**	**-**	**-**	**-**	**0.61**	**-**
Losses	-	-	-	-	-	-	-	-
Final energy demand	**0.16**	**-**	**0.10**	**4.49**	**1.18**	**0.20**	**4.42**	**-**
Non energy use	**-**	**-**	**0.1039**	**4.4890**	**1.1826**	**0.2010**	**-**	**-**
Energy sector	-	-	-	-	0.08	-	-	-
Petrochemical industry	-	-	-	-	-	-	-	-
Other industry	-	-	0.10	0.47	0.23	0.20	-	-
Construction	-	-	-	4.02	0.05	-	-	-
Transport	-	-	-	-	0.78	-	-	-
Agriculture	-	-	-	-	0.05	-	-	-
Energy consumption	**0.16**	**-**	**-**	**-**	**-**	**-**	**4.42**	**-**
Industry	**0.16**	**-**	**-**	**-**	**-**	**-**	**4.42**	**-**
Iron and steel	-	-	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-	-	-
Non-metallic minerals	-	-	-	-	-	-	-	-
Chemical	-	-	-	-	-	-	-	-
Construction materials	0.03	-	-	-	-	-	4.42	-
Pulp and paper	-	-	-	-	-	-	-	-
Food production	0.13	-	-	-	-	-	-	-
Not elsewhere specified	0.01	-	-	-	-	-	-	-
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 2019, energy units, cont.

PJ	Refinery gas	Refinery semiproducts	Aditives	Gas works gas	Electricity	Steam and hot water	Industrial waste, non renewable
Production	-	-	-	-	-	-	0.61
Import	-	-	9.68	1.74	-	32.97	-
Export	2.98	-	-	-	-	10.89	-
Import-processing	-	-	-	-	-	-	-
Export-processing	-	-	-	-	-	-	-
Stock change	2.30	-	0.12	0.02	-	-	-
Bunkers	-	-	-	-	-	-	-
Energy supplied	**-0.68**	**-**	**9.80**	**1.76**	**-**	**22.08**	**0.61**
Production	-	-	-	-	-	-	-
hydro power plants	-	-	-	-	-	21.36	-
– small HPP	-	-	-	-	-	0.41	-
Wind power plants	-	-	-	-	-	5.28	-
Solar power plants	-	-	-	-	-	0.30	-
Geothermal power plants	-	-	-	-	-	0.33	-
thermal power plants	-	-	-	-	-	6.00	-
public cogeneration plants	-	-	-	-	-	11.34	11.53
public heating plants	-	-	-	-	-	-	1.66
industrial cogeneration plants	-	-	-	-	-	1.33	9.11
– in rafineries	-	-	-	-	-	0.30	2.80
– in gas production	-	-	-	-	-	0.53	0.64
Industrial heating plants	-	-	-	-	-	-	4.22
Petroleum refineries	0.99	5.50	-	-	-	-	-
NGL-plant	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-
Total production	**0.99**	**5.50**	**-**	**-**	**-**	**45.94**	**26.51**
Gross production	**0.31**	**5.50**	**9.80**	**1.76**	**-**	**68.02**	**27.12**
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	-	0.28	-	-	-	-	-
– in rafineries	-	0.28	-	-	-	-	-
– in gas production	-	-	-	-	-	-	-
Industrial heating plants	-	0.72	-	-	-	-	-
Petroleum refineries	-	-	9.80	1.76	-	-	-
NGL-plant	-	-	-	-	-	-	-
Coke plant	-	-	-	-	-	-	-
Gas works	-	-	-	-	-	-	-
Total transformation sector	**-**	**1.00**	**9.80**	**1.76**	**-**	**-**	**-**
Energy sector own use	-	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	0.48	0.45
Coal production	-	-	-	-	-	-	0.30
Electric energy supply industry	-	-	-	-	-	0.22	-
hydro power plants	-	-	-	-	-	0.83	-
thermal power plants	-	-	-	-	-	0.55	-
public cogeneration plants	-	-	-	-	-	0.85	1.19
industrial cogeneration plants	-	-	-	-	-	-	-
Industrial heating plants	-	-	-	-	-	0.09	-
Petroleum refineries	-	4.50	-	-	-	0.89	4.58
NGL-plant	-	-	-	-	-	0.18	0.19
Gas works	-	-	-	-	-	-	-
Total energy sector own use	**-**	**4.50**	**-**	**-**	**-**	**4.08**	**6.70**
Losses	-	-	-	-	-	5.97	1.70
Final energy demand	**0.31**	**-**	**-0.00**	**0.00**	**-**	**57.96**	**18.72**
Non energy use	**0.31**	**-**	**-**	**-**	**-**	**-**	**-**
Energy sector	-	-	-	-	-	-	-
Petrochemical industry	0.31	-	-	-	-	-	-
Other industry	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-
Transport	-	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-	-
Energy consumption	**-**	**-**	**-0.00**	**0.00**	**-**	**57.96**	**18.72**
Industry	**-**	**-**	**-**	**-**	**-**	**12.74**	**11.68**
Iron and steel	-	-	-	-	-	1.16	0.16
Non-ferrous metals	-	-	-	-	-	0.37	-
Non-metallic minerals	-	-	-	-	-	0.56	0.01
Chemical	-	-	-	-	-	1.16	4.55
Construction materials	-	-	-	-	-	2.03	0.01
Pulp and paper	-	-	-	-	-	0.69	1.20
Food production	-	-	-	-	-	2.40	3.01
Not elsewhere specified	-	-	-	-	-	4.38	2.75
Transport	**-**	**-**	**-**	**-**	**-**	**1.20**	**-**
Rail	-	-	-	-	-	0.64	-
Road	-	-	-	-	-	0.01	-
Air	-	-	-	-	-	0.13	-
– international	-	-	-	-	-	-	-
– domestic	-	-	-	-	-	0.13	-
Sea and River	-	-	-	-	-	0.08	-
Public transport	-	-	-	-	-	0.22	-
Not elsewhere specified	-	-	-	-	-	0.11	-
Other sectors	**-**	**-**	**-**	**-**	**-**	**44.02**	**7.03**
Households	-	-	-	-	-	22.34	5.20
Services	-	-	-	-	-	21.17	1.57
Agriculture	-	-	-	-	-	0.23	0.27
Construction	-	-	-	-	-	0.28	-

Appendix 6. NFR 2019

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 2019-1

COUNTRY:	HR	(as ISO2 code)
DATE:	26.1.2021	(as DD.MM.YYYY)
YEAR:	2019	(as YYYY, year of emissions and activity data)
Version:	v1.0	(as v1.0 for the initial submission)

HR: 26.1.2021: 2019	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	Long name	Notes	kt	kt	kt	kt	kt	kt	kt	kt
A_PublicPower	1A1a	Public electricity and heat production		2,60646	0,31451	0,51942	0,00844	1,21257	1,42124	1,5952	0,04314
B_Industry	1A1b	Petroleum refining		1,20647	0,03296	1,49471	NE	0,06864	0,08898	0,12085	0,00458
B_Industry	1A1c	Manufacture of solid fuels and other energy industries		0,32426	0,10078	0,00294	0,00066	0,00342	0,00342	0,00342	0,00014
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel		0,05818	0,0204	0,05145	0,00016	0,00794	0,00909	0,01053	0,00056
B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals		0,03604	0,01169	0,00064	0,0001	0,00104	0,00126	0,00162	0,00012
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals		0,2821	0,05302	0,00366	2,7E-05	0,00382	0,00601	0,0095	3E-05
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print		0,16461	0,06893	0,01407	0,00293	0,01317	0,01341	0,01396	0,00348
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco		0,6521	0,2386	0,61983	0,01017	0,11258	0,12476	0,14113	0,01831
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals		3,33587	0,81208	1,97271	0,03651	0,22807	0,24157	0,26014	0,04605
I_Offroad	1A2gvii	Mobile combustion in manufacturing industries and construction (please specify in the IIR)		1,28451	0,22388	0,00145	0,00082	0,06338	0,06338	0,06338	0,04591
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)		0,28254	0,01702	0,03778	NE	0,00238	0,00238	0,00238	0,00115
H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)		0,02914	0,01114	0,00363	0,00016	0,00031	0,00036	0,00036	0,00012
F_RoadTransport	1A3bi	Road transport: Passenger cars		10,22	1,64915	1,2E-06	0,31007	0,4862	0,4862	0,4862	0,36432
F_RoadTransport	1A3bii	Road transport: Light duty vehicles		3,0167	0,17272	1,8E-07	0,01173	0,12433	0,12433	0,12433	0,09292
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses		9,79825	0,42533	5,4E-07	0,03895	0,18511	0,18511	0,18511	0,1195
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles		0,1339	1,417	2E-08	0,0014	0,02455	0,02455	0,02455	0,0044
F_RoadTransport	1A3bv	Road transport: Gasoline evaporation		NA	0,90956	NA	NA	NA	NA	NA	NA
F_RoadTransport	1A3bvi	Road transport: Automobile tyre and brake wear		NA	NA	NA	NA	0,35103	0,66755	0,86385	0,03427
F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion		NA	NA	NA	NA	0,17461	0,32336	0,64672	0,00686
I_Offroad	1A3c	Railways		0,74932	0,06649	0,00018	9,8E-05	0,01959	0,02059	0,02174	0,00013
G_Shipping	1A3di(ii)	International inland waterways		IE	IE	IE	IE	IE	IE	IE	IE
G_Shipping	1A3dii	National navigation (shipping)		3,85435	0,13748	0,00061	0,00034	0,06874	0,07365	0,07365	0,00021
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		1,09929	0,39577	0,05483	0,02057	0,1006	0,10561	0,10923	0,03221
I_Offroad	1A4aii	Commercial/Institutional: Mobile		IE	IE	IE	IE	IE	IE	IE	IE
C_OtherStationaryComb	1A4bi	Residential: Stationary		4,10956	18,3452	0,72462	2,41444	21,546	22,0932	23,1989	2,55956
I_Offroad	1A4bii	Residential: Household and gardening (mobile)		0,04196	0,24779	5,1E-05	2,8E-05	0,00679	0,00679	0,00679	0,00034
C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary		0,20031	0,03211	0,01461	0,00016	0,00804	0,00925	0,00925	0,00408
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery		2,19794	0,20952	0,00259	0,0014	0,08281	0,08281	0,08281	0,05323
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

HR: 26.1.2021: 2019	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
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
D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport		NA	0,06704	NE	NA	NA	NA	NA	NA
D_Fugitive	1B2aiv	Fugitive emissions oil: Refining and storage		0,07841	0,79552	2,20179	0,06273	0,13841	0,31904	0,47587	0,00012
D_Fugitive	1B2av	Distribution of oil products		NA	1,9806	NE	NA	NA	NA	NA	NA
D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)		NA	0,16083	NE	NA	NA	NA	NA	NA
D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)		0,03397	0,0286	0,24297	NE	0,03271	0,03271	0,03271	0,00773
D_Fugitive	1B2d	Other fugitive emissions from energy production		NO	NO	NO	NO	NO	NO	NO	NO
B_Industry	2A1	Cement production		IE	IE	IE	IE	0,17725	0,35095	0,04136	0,00886
B_Industry	2A2	Lime production		IE	IE	IE	IE	0,00438	0,02922	0,05844	2E-05
B_Industry	2A3	Glass production		IE	0,02415	IE	0,12398	0,10088	0,1138	0,12736	0,0007
B_Industry	2A5a	Quarrying and mining of minerals other than coal		NA	NA	NA	NA	0,13291	1,32913	2,71142	NA
B_Industry	2A5b	Construction and demolition		NA	NA	NA	NA	0,02119	0,21191	0,42278	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		0,69001	0,04326	NE	0,02403	NE	NA	NA	NA
B_Industry	2B2	Nitric acid production		0,05482	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)		0,01891	0	0,17916	1,4183	0,40723	0,54298	0,77213	0,00733
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		0,00899	0,00325	0,00415	IE	0,00145	0,00166	0,00216	5,2E-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	7,91611	NA	NA	NA	NA	NA	NA
B_Industry	2D3b	Road paving with asphalt		NE	0,0393	NE	NA	1,834	7,86	34,06	0,10454
B_Industry	2D3c	Asphalt roofing		NE	0,00246	NA	NA	0,00151	0,00756	0,03025	2E-07
E_Solvents	2D3d	Coating applications		NA	14,0145	NA	NA	NA	NA	NA	NA
E_Solvents	2D3e	Degreasing		NA	0,08023	NA	NA	NE	NA	NA	NA
E_Solvents	2D3f	Dry cleaning		NA	0,03308	NA	NA	NE	NA	NA	NA
E_Solvents	2D3g	Chemical products		NE	2,32004	NE	NE	NE	NE	NE	NE

HR: 26.1.2021: 2019	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
E_Solvents	2D3h	Printing		NA	2,33331	NA	NA	NE	NA	NA	NE
E_Solvents	2D3i	Other solvent use (please specify in the IIR)		NE	4,46642	NE	NE	0,02745	0,04117	0,05032	NE
E_Solvents	2G	Other product use (please specify in the IIR)		0,02173	0,92086	0,00522	0,04907	0,40898	0,49189	0,50902	0,14365
B_Industry	2H1	Pulp and paper industry		NE	0,00234	NE	NE	NE	NE	NE	NE
B_Industry	2H2	Food and beverages industry		NA	4,00568	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	0,10026	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		0,01678	2,42785	NA	1,88174	0,05331	0,08192	0,17943	NA
K_AgriLivestock	3B1b	Manure management - Non-dairy cattle		0,0245	3,00972	NA	1,47828	0,03158	0,04995	0,10666	NA
K_AgriLivestock	3B2	Manure management - Sheep		0,00511	0,05033	NA	0,2492	0,01098	0,03654	0,09135	NA
K_AgriLivestock	3B3	Manure management - Swine		0,11072	0,9193	NA	4,79357	0,00697	0,15248	1,03878	NA
K_AgriLivestock	3B4a	Manure management - Buffalo		NO	NO	NA	NO	NO	NO	NO	NA
K_AgriLivestock	3B4d	Manure management - Goats		0,00063	0,00469	NA	0,03696	0,00136	0,00453	0,01133	NA
K_AgriLivestock	3B4e	Manure management - Horses		0,00335	0,05713	NA	0,11312	0,00346	0,00543	0,01186	NA
K_AgriLivestock	3B4f	Manure management - Mules and asses		0,00056	0,00114	NA	0,01878	0,00041	0,00066	0,00139	NA
K_AgriLivestock	3B4gi	Manure management - Laying hens		0,01275	0,22045	NA	0,61645	0,00836	0,11145	0,52941	NA
K_AgriLivestock	3B4gii	Manure management - Broilers		0,02729	0,74447	NA	0,88638	0,01779	0,17791	0,35582	NA
K_AgriLivestock	3B4giii	Manure management - Turkeys		0,00709	0,14471	NA	0,33684	0,01023	0,05624	0,05624	NA
K_AgriLivestock	3B4giv	Manure management - Other poultry		0,0024	0,03312	NA	0,22239	0,01609	0,12764	0,12764	NA
K_AgriLivestock	3B4h	Manure management - Other animals (please specify in the IIR)		NO	NO	NA	NO	NO	NO	NO	NA
L_AgriOther	3Da1	Inorganic N-fertilizers (includes also urea application)		2,53551	NA	NA	10,9957	NA	NA	NA	NA
L_AgriOther	3Da2a	Animal manure applied to soils		1,84327	NA	NA	8,89542	NA	NA	NA	NA
L_AgriOther	3Da2b	Sewage sludge applied to soils		0,00097	NA	NA	0,00316	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		2,7362	NA	NA	1,09057	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	0,09027	2,34693	2,34693	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		NA	1,68961	NA	NE	NA	NA	NA	NA
L_AgriOther	3Df	Use of pesticides		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3F	Field burning of agricultural residues		0,00352	0,00076	0,00076	0,00367	0,00826	0,00872	0,00887	0,00076
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	0,7615	NA	NE	5,3E-05	0,00035	0,00074	NA
J_Waste	5B1	Biological treatment of waste - Composting		NE	NE	NE	0,01191	NE	NE	NE	NE
J_Waste	5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities		IE	IE	IE	IE	IE	IE	IE	IE
J_Waste	5C1a	Municipal waste incineration		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bi	Industrial waste incineration		IE	IE	IE	IE	IE	IE	IE	IE
J_Waste	5C1bii	Hazardous waste incineration		NO	NO	NO	NO	NO	NO	NO	NO

HR: 26.1.2021: 2019	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
J_Waste	5C1biii	Clinical waste incineration		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biv	Sewage sludge incineration		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bv	Cremation		0,00548	8,6E-05	0,00075	NA	0,00023	0,00023	0,00026	NE
J_Waste	5C1bvi	Other waste incineration (please specify in the IIR)		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	0,00452	NA	0,5902	NE	NE	NE	NE
J_Waste	5D2	Industrial wastewater handling		NA	0,00025	NA	NE	NE	NE	NE	NE
J_Waste	5D3	Other wastewater handling		NA	NO	NA	NO	NO	NO	NO	NO
J_Waste	5E	Other waste (please specify in the IIR)		NE	NE	NE	NE	0,15745	0,15745	0,15745	NE
M_Other	6A	Other (included in national total for entire territory) (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
	NATIONAL TOTAL	National total (based on fuel sold)	(a)	53,93	75,22	8,15	36,76	28,60	40,83	72,47	3,71
	1A3bi(fu)	Road transport: Passenger cars (fuel used)	(b)								
	1A3bii(fu)	Road transport: Light duty vehicles (fuel used)	(b)								
	1A3biii(fu)	Road transport: Heavy duty vehicles and buses (fuel used)	(b)								
	1A3biv(fu)	Road transport: Mopeds & motorcycles (fuel used)	(b)								
	1A3bv(fu)	Road transport: Gasoline evaporation (fuel used)	(b)								
	1A3bvi(fu)	Road transport: Automobile tyre and brake wear (fuel used)	(b)								
	1A3bvii(fu)	Road transport: Automobile road abrasion (fuel used)	(b)								
	ADJUSTMENTS	Sum of approved adjustments (negative value) from Annex VII (CLRTAP)									
	COMPLIANCE TOTAL (CLRTAP)	National total for compliance calculations and checks (CLRTAP)	(c)	53,93	75,22	8,15	36,76	28,60	40,83	72,47	3,71
	ADJUSTMENTS AND FLEXIBILITIES	Sum of approved adjustments from Annex VII and other flexibilities (negative value) (NECD)	(d)								
	COMPLIANCE TOTAL (NECD)	National total for compliance calculations and checks (NECD)	(e)	53,93	75,22	8,15	36,76	28,60	40,83	72,47	3,71
MEMO ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS											
O_AviCruise	1A3ai(ii)	International aviation cruise (civil)		2,07251	0,08093	0,21784	NE	0,03239	0,03239	0,03239	0,01552
O_AviCruise	1A3aii(ii)	Domestic aviation cruise (civil)		0,07315	0,00071	0,00955	NE	0,00142	0,00142	0,00142	0,00068
P_IntShipping	1A3di(i)	International maritime navigation		1,94279	0,06868	0,1838	0,00017	0,05474	0,05961	0,05961	0,00012
z_Memo	1A5c	Multilateral operations		NA	NA	NA	NA	NA	NA	NA	NA
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		0,218	0,654	0,0436	0,0436	NE	NE	NE	NE
N_Natural	11C	Other natural emissions (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO

Note (a): Sum of NFR categories (rows 14-140). The geographic area of the National Total corresponds to the geographical scope of EMEP, which is identical with the NECD territory, except for Portugal (EMEP domain includes emissions of Madeira and the Azores, but the NECD territory does not cover emissions of Madeira and the Azores). The geographical scope of EMEP means the area within which, co-ordinated by the centres of the EMEP, monitoring is carried out (see EMEP Protocol, Article 1/4).

Note (b): UNECE reporting guidelines 2014, paragraph 23: The Parties Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands, Switzerland and the United Kingdom of Great Britain and Northern Ireland may choose to use the national emission total calculated on the basis of fuels used in the geographic area of the Party as a basis for compliance with their respective emission ceilings.
If one Party has chosen to report emission on the basis of fuel used for compliance, it shall report those information for all the related NFR categories available in the reporting template (row 143-149).

Note (c): The 'National Total for Compliance (CLRTAP)' includes the 'National Total (based on fuel sold)' (row 141) corrected for i) approved adjustments to national totals (row 151) and, if applicable, ii) national totals based on transport fuel used (rows 143-149).

Note (d): Reporting of adjustments and additional flexibilities according to the NEC Directive, Article 5/2-4. Should only include approved items from Annex VII and should be reported as a negative value.

Note (e): The 'National Total for Compliance (NECD)' includes the 'National Total (based on fuel sold)' (row 141) corrected for i) approved adjustments and flexibilities to national totals (row 153) and, if applicable, ii) national totals based on transport fuel used (rows 143-149) as well as iii) the subtraction of sectors 3B + 3D for NOx and NMVOC (only from 2020 onwards and for the year 2005 as a basis for emission reduction commitment calculations), according to the NEC Directive, Article 4/3(d).

Table A6-2 Emissions data for the CO and heavy metals according to NFR categories

HR: 26.1.2021: 2019	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	Long name	Notes	kt	t	t	t	t	t	t	t	t	t
A_PublicPower	1A1a	Public electricity and heat production		1,07521	0,29873	0,0186	0,10713	0,11648	0,10541	0,24794	0,28332	0,015	1,77618
B_Industry	1A1b	Petroleum refining		0,28135	0,02555	0,00804	0,00204	0,01606	0,03133	0,03449	1,3693	0,00946	0,41853
B_Industry	1A1c	Manufacture of solid fuels and other energy industries		0,12707	4,8E-05	3,9E-06	0,00044	0,00044	5,7E-05	1,1E-05	5,7E-05	0,00025	0,0032
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel		0,07332	0,00172	0,00016	0,00047	0,00039	0,00093	0,00105	0,00084	0,00018	0,01389
B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals		0,01567	0,00011	3,9E-05	0,00029	8,3E-05	9,5E-05	3,4E-05	4,5E-05	4,4E-05	0,00181
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals		0,22668	0,00035	3,6E-05	0,00342	0,00046	0,00028	0,00018	0,00035	0,00021	0,00162
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print		0,10308	0,00216	0,00103	0,00109	0,00021	0,00185	0,00049	0,00018	0,00015	0,04283
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco		0,79092	0,0221	0,00457	0,00397	0,00365	0,01404	0,01108	0,00822	0,00182	0,2566
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals		7,70107	0,33641	0,03329	0,11996	0,06649	0,13281	0,17446	0,12982	0,06079	1,72246
I_Offroad	1A2gvii	Mobile combustion in manufacturing industries and construction (please specify in the IIR)		2,92814	0,012	0,00106	NE	NE	0,00529	0,17969	0,0074	0,00106	0,1057
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)		0,40167	9,9E-05	7,4E-06	0,00015	3,7E-05	0,00025	0,00027	9,9E-06	0,00014	0,0358
H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)		0,63859	0,13692	6,9E-06	1,4E-05	3,6E-06	9,1E-05	0,00138	1,8E-05	1,5E-05	0,00504
F_RoadTransport	1A3bi	Road transport: Passenger cars		17,486	0,00101	0,00012	0,00735	0,00019	0,00863	0,0059	0,00109	0,00015	0,02637
F_RoadTransport	1A3bii	Road transport: Light duty vehicles		1,06933	8,2E-05	8,5E-06	0,00082	1,6E-05	0,00125	0,00084	4,5E-05	1,6E-05	0,0028
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses		2,38347	0,00022	2,2E-05	0,0023	4,3E-05	0,00369	0,00247	8,8E-05	4,3E-05	0,00782
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles		3,83512	3,5E-05	4,4E-06	0,00019	6,6E-06	0,00014	9,9E-05	5E-05	4,4E-06	0,00072
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	0,9649	0,00436	0,0118	0,01109	0,35869	7,86346	0,056	0,00702	2,79982
F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion		NA	NE	NE	NE	NE	NE	NE	NE	NE	NE
I_Offroad	1A3c	Railways		0,15301	4,9E-05	0,00014	7,3E-05	1,8E-05	0,00071	0,02431	0,001	0,00014	0,0143
G_Shipping	1A3di(ii)	International inland waterways		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
G_Shipping	1A3dii	National navigation (shipping)		0,36334	0,00638	0,00049	0,00147	0,00197	0,00246	0,04566	0,04632	0,00464	0,05832
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		0,6764	0,0233	0,00691	0,00135	0,00162	0,02356	0,00659	0,14524	0,00092	0,29271
I_Offroad	1A4aii	Commercial/Institutional: Mobile		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
C_OtherStationaryComb	1A4bi	Residential: Stationary		152,888	1,15217	0,54879	0,03885	0,01083	0,97212	0,25568	0,08569	0,02152	21,6287
I_Offroad	1A4bii	Residential: Household and gardening (mobile)		5,59422	0,0285	7,7E-05	NE	NE	0,00039	0,01309	0,00054	7,7E-05	0,0077
C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary		0,06769	0,00322	6,1E-05	0,00014	0,00031	0,00403	0,00121	0,0502	0,0001	0,00799
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery		1,22004	NA	0,00176	NE	NE	0,0088	0,29903	0,01231	0,00176	0,1759
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 and storage		15,3198	0,1315	0,0247	0,03147	0,30091	0,12938	0,0569	0,3157	0,00952	0,05309
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

HR: 26.1.2021: 2019	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**	**Long name**	**Notes**	**kt**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**
D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)		0,15376	0,00098	0,00149	0,00027	0,00025	0,00383	0,00189	0,00467	0,00089	0,01612
D_Fugitive	1B2d	Other fugitive emissions from energy production		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
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	0,48336	0,03696	0,00085	0,05402	0,0654	0,00199	0,13932	0,22746	0,1052
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		0,00288	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)		0	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		0,11751	0,17973	0,01383	0,00346	0,00104	0,00691	0,00138	0,04839	IE	0,24885
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	NA	NA	NA	NA	NA	NA	NA
B_Industry	2D3b	Road paving with asphalt		NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
B_Industry	2D3c	Asphalt roofing		0,00018	NE	NE	NE	NA	NA	NA	NA	NA	NA
E_Solvents	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		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
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)		0,66382	1,35475	0,0664	9,8E-05	0,0023	0,02696	0,83108	0,08376	NE	0,4812
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	0,04065	NE	NE	NE	NE	NE	NE
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

HR: 26.1.2021: 2019	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**	**Long name**	**Notes**	**kt**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**
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 management - Laying hens		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4gii	Manure management - Broilers		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4giii	Manure management - 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 the 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		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		0,10201	0,00017	0,00135	0,00021	9,8E-06	0,00012	0,00011	8E-05	3,1E-05	0,00086
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		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
J_Waste	5C1a	Municipal waste incineration		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bi	Industrial waste incineration		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
J_Waste	5C1bii	Hazardous waste incineration		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biii	Clinical waste incineration		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biv	Sewage sludge incineration		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bv	Cremation		0,00093	0,0002	3,3E-05	0,00991	9E-05	9E-05	8,3E-05	0,00012	0,00013	0,00106
J_Waste	5C1bvi	Other waste incineration (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
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	NO	NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5E	Other waste (please specify in the IIR)		NE	0,00046	0,00092	0,00092	0,00146	0,0014	0,00325	NE	NE	NE
M_Other	6A	Other (included in national total for entire territory) (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	NATIONAL TOTAL	National total (based on fuel sold)	(a)	216,46	5,17	0,78	0,39	0,59	1,91	10,07	2,79	0,36	30,31

HR: 26.1.2021: 2019	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	Long name	Notes	kt	t	t	t	t	t	t	t	t	t
	1A3bi(fu)	Road transport: Passenger cars (fuel used)	(b)										
	1A3bii(fu)	Road transport: Light duty vehicles (fuel used)	(b)										
	1A3biii(fu)	Road transport: Heavy duty vehicles and buses (fuel used)	(b)										
	1A3biv(fu)	Road transport: Mopeds & motorcycles (fuel used)	(b)										
	1A3bv(fu)	Road transport: Gasoline evaporation (fuel used)	(b)										
	1A3bvi(fu)	Road transport: Automobile tyre and brake wear (fuel used)	(b)										
	1A3bvii(fu)	Road transport: Automobile road abrasion (fuel used)	(b)										
	ADJUSTMENTS	Sum of approved adjustments (negative value) from Annex VII (CLRTAP)											
	COMPLIANCE TOTAL (CLRTAP)	National total for compliance calculations and checks (CLRTAP)	(c)	216,46	5,17	0,78	0,39	0,59	1,91	10,07	2,79	0,36	30,31
	ADJUSTMENTS AND FLEXIBILITIES	Sum of approved adjustments from Annex VII and other flexibilities (negative value) (NECD)	(d)										
	COMPLIANCE TOTAL (NECD)	National total for compliance calculations and checks (NECD)	(e)	216,46	5,17	0,78	0,39	0,59	1,91	10,07	2,79	0,36	30,31
MEMO ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS													
O_AviCruise	1A3ai(ii)	International aviation cruise (civil)		0,17809	0,00057	4,3E-05	0,00085	0,00021	0,00142	0,00157	5,7E-05	0,00078	0,20642
O_AviCruise	1A3aii(ii)	Domestic aviation cruise (civil)		0,01421	2,5E-05	1,9E-06	3,7E-05	9,4E-06	6,2E-05	6,9E-05	2,5E-06	3,4E-05	0,00905
P_IntShipping	1A3di(i)	International maritime navigation		0,18278	0,00345	0,0003	0,00069	0,00406	0,00445	0,02351	0,1735	0,003	0,02964
z_Memo	1A5c	Multilateral operations		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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		6,54	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

Note (a): Sum of NFR categories (rows 14-140). The geographic area of the National Total corresponds to the geographical scope of EMEP, which is identical with the NECD territory, except for Portugal (EMEP domain includes emissions of Madeira and the Azores, but the NECD territory does not cover emissions of Madeira and the Azores). The geographical scope of EMEP means the area within which, co-ordinated by the centres of the EMEP, monitoring is carried out (see EMEP Protocol, Article 1/4).

Note (b): UNECE reporting guidelines 2014, paragraph 23: The Parties Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands, Switzerland and the United Kingdom of Great Britain and Northern Ireland may choose to use the national emission total calculated on the basis of fuels used in the geographic area of the Party as a basis for compliance with their respective emission ceilings.
If one Party has chosen to report emission on the basis of fuel used for compliance, it shall report those information for all the related NFR categories available in the reporting template (row 143-149).

Note (c): The 'National Total for Compliance (CLRTAP)' includes the 'National Total (based on fuel sold)' (row 141) corrected for i) approved adjustments to national totals (row 151) and, if applicable, ii) national totals based on transport fuel used (rows 143-149).

Note (d): Reporting of adjustments and additional flexibilities according to the NEC Directive, Article 5/2-4. Should only include approved items from Annex VII and should be reported as a negative value.

Note (e): The 'National Total for Compliance (NECD)' includes the 'National Total (based on fuel sold)' (row 141) corrected for i) approved adjustments and flexibilities to national totals (row 153) and, if applicable, ii) national totals based on transport fuel used (rows 143-149) as well as iii) the subtraction of sectors 3B + 3D for NOx and NMVOC (only from 2020 onwards and for the year 2005 as a basis for emission reduction commitment calculations), according to the NEC Directive, Article 4/3(d).

Table A6-3 Emissions data for POPs according to NFR categories

HR: 26.1.2021: 2019	NFR sectors to be reported			POPs (from 1990)							
					PAHs						
				PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthe ne	benzo(k) fluoranth ene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Long name**	**Notes**	**g I-TEQ**	**t**	**t**	**t**	**t**	**t**	**kg**	**kg**
A_PublicPower	1A1a	Public electricity and heat production		0,60797	0,01009	0,000442	0,00017	0,00037	0,01107	0,05394	2,49382
B_Industry	1A1b	Petroleum refining		0,01068	6,4E-06	2,48E-05	2E-05	2,7E-05	7,8E-05	NE	NE
B_Industry	1A1c	Manufacture of solid fuels and other energy industries		0,00228	3,2E-06	1,27E-05	4,8E-06	4,7E-06	2,5E-05	NE	NE
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel		0,01225	0,003	0,00511	0,00203	0,00172	0,01186	7E-05	0,00947
B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals		0,00059	0,00036	0,001405	0,00054	0,00052	0,00283	1,9E-05	1,6E-07
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals		0,00142	0,00071	0,002945	0,00119	0,00114	0,00598	5,4E-05	NE
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print		0,00897	0,00224	0,007293	0,00257	0,00245	0,01455	0,0004	4,8E-06
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco		0,13467	0,02938	0,052055	0,01893	0,01579	0,11616	0,00184	0,08562
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals		0,35715	0,06914	0,106421	0,04022	0,03269	0,24847	0,01623	0,43881
I_Offroad	1A2gvii	Mobile combustion in manufacturing industries and construction (please specify in the IIR)		NE	0,00321	0,00525	NE	NE	0,00846	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)		0,00173	0,00235	0,018518	0,0021	0,00185	0,02481	NA	NA
H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)		0,0003	0,00023	0,001784	0,0002	0,00018	0,0024	NA	NA
F_RoadTransport	1A3bi	Road transport: Passenger cars		0,64997	0,02637	0,029988	0,02288	0,02596	0,1052	0,00065	0,00013
F_RoadTransport	1A3bii	Road transport: Light duty vehicles		0,10465	0,00509	0,005809	0,00444	0,00492	0,02027	0,0001	2,1E-05
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses		0,14076	0,00291	0,01764	0,01971	0,00453	0,0448	0,00012	2,4E-05
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles		0,01015	0,00019	0,000231	0,00015	0,00025	0,00082	1E-05	3,3E-06
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	0,16288	0,014743	0,02176	NE	0,19939	NE	NE
F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion		NE	NE	NE	NE	NE	NE	NE	NE
I_Offroad	1A3c	Railways		0,00086	0,00043	0,000715	1E-06	9,2E-07	0,00114	NE	NE
G_Shipping	1A3di(ii)	International inland waterways		IE	IE	IE	IE	IE	IE	IE	IE
G_Shipping	1A3dii	National navigation (shipping)		0,39423	9E-05	0,00015	NE	NE	0,00024	0,00392	0,00289
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		0,05834	0,00519	0,008328	0,0026	0,00208	0,0182	0,00284	3,1E-05
I_Offroad	1A4aii	Commercial/Institutional: Mobile		IE	IE	IE	IE	IE	IE	IE	IE
C_OtherStationaryComb	1A4bi	Residential: Stationary		21,9442	4,35718	4,062188	1,54092	2,55068	12,511	0,21105	0,01765
I_Offroad	1A4bii	Residential: Household and gardening (mobile)		NE	0,00031	0,000308	NE	NE	0,00062	NE	NE
C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary		0,00111	1,5E-06	9,06E-06	1,8E-06	1,7E-06	1,4E-05	8,8E-05	5,2E-08
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery		NE	0,00528	0,008795	NE	NE	0,01407	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
D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport		NE	NA	NA	NA	NA	NA	NA	NA
D_Fugitive	1B2aiv	Fugitive emissions oil: Refining and storage		0,00745	0,00028	0,00047	0,00032	0,00024	0,00131	NA	NA
D_Fugitive	1B2av	Distribution of oil products		NE	NA	NA	NA	NA	NA	NA	NA

HR: 26.1.2021: 2019	NFR sectors to be reported			POPs (from 1990)							
					PAHs						
				PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Long name**	**Notes**	**g I-TEQ**	**t**	**t**	**t**	**t**	**t**	**kg**	**kg**
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	3,8E-07	6,49E-07	3,6E-07	3,6E-07	1,7E-06	NA	NA
D_Fugitive	1B2d	Other fugitive emissions from energy production		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		0,20738	IE	IE	IE	IE	0,03318	IE	0,17281
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
B_Industry	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
E_Solvents	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		NE	NE	NE	NE	NE	NE	NE	NE
E_Solvents	2D3h	Printing		NA	NA	NA	NA	NA	NA	NA	NA
E_Solvents	2D3i	Other solvent use (please specify in the IIR)		NE	0,00045	0,000226	0,00023	0,00023	0,00113	NE	NE
E_Solvents	2G	Other product use (please specify in the IIR)		0,00118	0,00131	0,000532	0,00053	0,00053	0,00291	NE	NE

HR: 26.1.2021: 2019	NFR sectors to be reported			POPs (from 1990)							
					PAHs						
				PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Long name**	**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	406,525
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 management - Laying hens		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4gii	Manure management - Broilers		NA	NA	NA	NA	NA	NA	NA	NA
K_AgriLivestock	3B4giii	Manure management - 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 the 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		NA	NA	NA	NA	NA	NA	NA	NA
L_AgriOther	3Df	Use of pesticides		NA	NA	NA	NA	NA	NA	0,31089	NA
L_AgriOther	3F	Field burning of agricultural residues		0,7647	0,0006	0,001678	0,00072	0,00051	0,00351	NE	NE
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		IE	IE	IE	IE	IE	IE	IE	IE
J_Waste	5C1a	Municipal waste incineration		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bi	Industrial waste incineration		IE	IE	IE	IE	IE	IE	IE	IE
J_Waste	5C1bii	Hazardous waste incineration		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1biii	Clinical waste incineration		NO	NO	NO	NO	NO	NO	NO	NO

HR: 26.1.2021: 2019	NFR sectors to be reported			POPs (from 1990)							
					PAHs						
				PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
NFR Aggregation for Gridding and LPS (GNFR)	**NFR Code**	**Long name**	**Notes**	**g I-TEQ**	**t**	**t**	**t**	**t**	**t**	**kg**	**kg**
J_Waste	5C1biv	Sewage sludge incineration		NO	NO	NO	NO	NO	NO	NO	NO
J_Waste	5C1bv	Cremation		0,00018	8,8E-08	4,79E-08	4,3E-08	4,6E-08	2,2E-07	0,001	0,00273
J_Waste	5C1bvi	Other waste incineration (please specify in the IIR)		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 the IIR)		1,58686	NE	NE	NE	NE	NE	NE	NE
M_Other	6A	Other (included in national total for entire territory) (please specify in the IIR)		NO	NO	NO	NO	NO	NO	NO	NO
	NATIONAL TOTAL	National total (based on fuel sold)	(a)	27,01	4,69	4,35	1,68	2,65	13,40	0,60	409,75
	1A3bi(fu)	Road transport: Passenger cars (fuel used)	(b)								
	1A3bii(fu)	Road transport: Light duty vehicles (fuel used)	(b)								
	1A3biii(fu)	Road transport: Heavy duty vehicles and buses (fuel used)	(b)								
	1A3biv(fu)	Road transport: Mopeds & motorcycles (fuel used)	(b)								
	1A3bv(fu)	Road transport: Gasoline evaporation (fuel used)	(b)								
	1A3bvi(fu)	Road transport: Automobile tyre and brake wear (fuel used)	(b)								
	1A3bvii(fu)	Road transport: Automobile road abrasion (fuel used)	(b)								
	ADJUSTMENTS	Sum of approved adjustments (negative value) from Annex VII (CLRTAP)									
	COMPLIANCE TOTAL (CLRTAP)	National total for compliance calculations and checks (CLRTAP)	(c)	27,01	4,69	4,35	1,68	2,65	13,40	0,60	409,75
	ADJUSTMENTS AND FLEXIBILITIES	Sum of approved adjustments from Annex VII and other flexibilities (negative value) (NECD)	(d)								
	COMPLIANCE TOTAL (NECD)	National total for compliance calculations and checks (NECD)	(e)	27,01	4,69	4,35	1,68	2,65	13,40	0,60	409,75
MEMO ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS											
O_AviCruise	1A3ai(ii)	International aviation cruise (civil)		0,00997	0,01352	0,106768	0,0121	0,01068	0,14307	NE	NE
O_AviCruise	1A3aii(ii)	Domestic aviation cruise (civil)		0,00044	0,00059	0,004683	0,00053	0,00047	0,00628	NE	NE
P_IntShipping	1A3di(i)	International maritime navigation		0,00484	0,00074	0,001235	NE	NE	0,00198	0,00226	0,00349
z_Memo	1A5c	Multilateral operations		NA	NA	NA	NA	NA	NA	NA	NA
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

Note (a): Sum of NFR categories (rows 14-140). The geographic area of the National Total corresponds to the geographical scope of EMEP, which is identical with the NECD territory, except for Portugal (EMEP domain includes emissions of Madeira and the Azores, but the NECD territory does not cover emissions of Madeira and the Azores). The geographical scope of EMEP means the area within which, co-ordinated by the centres of the EMEP, monitoring is carried out (see EMEP Protocol, Article 1/4).

Note (b): UNECE reporting guidelines 2014, paragraph 23: The Parties Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands, Switzerland and the United Kingdom of Great Britain and Northern Ireland may choose to use the national emission total calculated on the basis of fuels used in the geographic area of the Party as a basis for compliance with their respective emission ceilings.
If one Party has chosen to report emission on the basis of fuel used for compliance, it shall report those information for all the related NFR categories available in the reporting template (row 143-149).

Note (c): The 'National Total for Compliance (CLRTAP)' includes the 'National Total (based on fuel sold)' (row 141) corrected for i) approved adjustments to national totals (row 151) and, if applicable, ii) national totals based on transport fuel used (rows 143-149).

Note (d): Reporting of adjustments and additional flexibilities according to the NEC Directive, Article 5/2-4. Should only include approved items from Annex VII and should be reported as a negative value.

Note (e): The 'National Total for Compliance (NECD)' includes the 'National Total (based on fuel sold)' (row 141) corrected for i) approved adjustments and flexibilities to national totals (row 153) and, if applicable, ii) national totals based on transport fuel used (rows 143-149) as well as iii) the subtraction of sectors 3B + 3D for NOx and NMVOC (only from 2020 onwards and for the year 2005 as a basis for emission reduction commitment calculations), according to the NEC Directive, Article 4/3(d).

Table A6-4 Activity data according to NFR categories

HR: 26.1.2021: 2019	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	Long name	Notes	TJ NCV	TJ NCV	TJ NCV	TJ NCV	TJ NCV		
A_PublicPower	1A1a	Public electricity and heat production		246,398	14484,6	23039,7	12268,2	NO	NA	TJ NCV
B_Industry	1A1b	Petroleum refining		8939,98	NA	4177,58	NO	NO	NA	TJ NCV
B_Industry	1A1c	Manufacture of solid fuels and other energy industries		NO	NO	4361,18	20,7061	NO	NA	TJ NCV
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel		25,626	55,689	597,455	4	NO	NA	TJ NCV
B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals		8,542	NO	465,823	2,7	NO	NA	TJ NCV
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals		87,42	NO	5092,08	NO	NO	NA	TJ NCV
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print		28,133	NO	1931,9	79,3	NO	NA	TJ NCV
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco		631,035	503,544	4247,5	272,6	NO	NA	TJ NCV
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals		5205,08	3092,2	5757,75	985,408	271,007	NA	TJ NCV
I_Offroad	1A2gvii	Mobile combustion in manufacturing industries and construction (please specify in the IIR)		4521,03	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)		140,9	NA	NO	NO	NA	NA	TJ NCV
H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)		1234,54	NA	NO	NO	NA	NA	TJ NCV
F_RoadTransport	1A3bi	Road transport: Passenger cars		54035,6	NA	15,2559	2932,53	NA	NA	TJ NCV
F_RoadTransport	1A3bii	Road transport: Light duty vehicles		6784,78	NA	NO	462,155	NA	NA	TJ NCV
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses		19722,8	NA	151,208	1373,58	NA	NA	TJ NCV
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles		997,007	NA	NO	36,5698	NA	NA	TJ NCV
F_RoadTransport	1A3bv	Road transport: Gasoline evaporation		42,2014	NA	NA	NA	NA	NA	TJ NCV
F_RoadTransport	1A3bvi	Road transport: Automobile tyre and brake wear		NA	NA	NA	NA	NA	30486,9	Mileage [10^6 km]
F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion		NA	NA	NA	NA	NA	30486,9	Mileage [10^6 km]
I_Offroad	1A3c	Railways		610,753	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)		2097,06	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		1724,72	NO	8743,14	654,771	NO	NA	TJ NCV
I_Offroad	1A4aii	Commercial/Institutional: Mobile		IE	IE	IE	IE	IE	IE	TJ NCV
C_OtherStationaryComb	1A4bi	Residential: Stationary		4209,38	92,735	19221,7	42198,7	NO	NA	TJ NCV
I_Offroad	1A4bii	Residential: Household and gardening (mobile)		343,343	NA	NO	NO	NA	NA	TJ NCV
C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary		523,388	NO	924,888	NO	NO	NA	TJ NCV
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery		7512,69	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 and/or provide details in the IIR
D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport		NA	NA	NA	NA	NA	705,7	Crude oil produced [Mt]
D_Fugitive	1B2aiv	Fugitive emissions oil: Refining and storage		NA	NA	NA	NA	NA	2711,7	Crude oil refined [Mt]
D_Fugitive	1B2av	Distribution of oil products		NA	NA	NA	NA	NA	5194,3	Oil consumed [Mt]

HR: 26.1.2021: 2019	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	Long name	Notes	TJ NCV	TJ NCV	TJ NCV	TJ NCV	TJ NCV		
D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)		NA	NA	NA	NA	NA	0,13735	Gas throughput [TJ]
D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)		NA	NA	NA	NA	NA	576566	Gas vented flared [TJ]
D_Fugitive	1B2d	Other fugitive emissions from energy production		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR
B_Industry	2A1	Cement production		NA	NA	NA	NA	NA	2272,42	Clinker produced [kt]
B_Industry	2A2	Lime production		NA	NA	NA	NA	NA	146,093	Lime produced [kt]
B_Industry	2A3	Glass production		NA	NA	NA	NA	NA	452,494	Glass produced [kt]
B_Industry	2A5a	Quarrying and mining of minerals other than coal		NA	NA	NA	NA	NA	26,5826	Material quarried [kt]
B_Industry	2A5b	Construction and demolition		NA	NA	NA	NA	NA	2609758	Floor space constructed/demolished [m2]
B_Industry	2A5c	Storage, handling and transport of mineral products		NA	NA	NA	NA	NA	IE	Amount [kt]
B_Industry	2A6	Other mineral products (please specify in the IIR)		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR
B_Industry	2B1	Ammonia production		NA	NA	NA	NA	NA	480,665	Ammonia produced [kt]
B_Industry	2B2	Nitric acid production		NA	NA	NA	NA	NA	302,067	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	722,26	Please specify and/or provide details in the IIR
B_Industry	2B10b	Storage, handling and transport of chemical products (please specify in the IIR)		NA	NA	NA	NA	NA	IE	Please specify and/or provide details in the IIR
B_Industry	2C1	Iron and steel production		NA	NA	NA	NA	NA	69,1259	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 and/or provide details in the IIR
B_Industry	2C7d	Storage, handling and transport of metal products (please specify in the IIR)		NA	NA	NA	NA	NA	IE	Amount (kt)
E_Solvents	2D3a	Domestic solvent use including fungicides		NA	NA	NA	NA	NA	NA	Solvents used [kt]
B_Industry	2D3b	Road paving with asphalt		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
B_Industry	2D3c	Asphalt roofing		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
E_Solvents	2D3d	Coating applications		NA	NA	NA	NA	NA	56,0581	Paint applied [kt]
E_Solvents	2D3e	Degreasing		NA	NA	NA	NA	NA	0,113	Solvents used [kt]
E_Solvents	2D3f	Dry cleaning		NA	NA	NA	NA	NA	0,0827	Solvents used [kt]
E_Solvents	2D3g	Chemical products		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
E_Solvents	2D3h	Printing		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
E_Solvents	2D3i	Other solvent use (please specify in the IIR)		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
E_Solvents	2G	Other product use (please specify in the IIR)		NA	NA	NA	NA	NA	IE	Please specify and/or provide details in the IIR
B_Industry	2H1	Pulp and paper industry		NA	NA	NA	NA	NA	46,8519	Pulp production [kt]
B_Industry	2H2	Food and beverages industry		NA	NA	NA	NA	NA	1311,25	Bread, Wine, Beer, Spirits production [kt]
B_Industry	2H3	Other industrial processes (please specify in the IIR)		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR

HR: 26.1.2021: 2019	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	Long name	Notes	TJ NCV	TJ NCV	TJ NCV	TJ NCV	TJ NCV		
B_Industry	2I	Wood processing		NA	NA	NA	NA	NA	100,264	Please specify and/or provide details in the IIR
B_Industry	2J	Production of POPs		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
B_Industry	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
B_Industry	2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
K_AgriLivestock	3B1a	Manure management - Dairy cattle		NA	NA	NA	NA	NA	130,025	Population size (1000 head)
K_AgriLivestock	3B1b	Manure management - Non-dairy cattle		NA	NA	NA	NA	NA	290,214	Population size (1000 head)
K_AgriLivestock	3B2	Manure management - Sheep		NA	NA	NA	NA	NA	657,197	Population size (1000 head)
K_AgriLivestock	3B3	Manure management - Swine		NA	NA	NA	NA	NA	1054,85	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	81,54	Population size (1000 head)
K_AgriLivestock	3B4e	Manure management - Horses		NA	NA	NA	NA	NA	24,7	Population size (1000 head)
K_AgriLivestock	3B4f	Manure management - Mules and asses		NA	NA	NA	NA	NA	4,1	Population size (1000 head)
K_AgriLivestock	3B4gi	Manure management - Laying hens		NA	NA	NA	NA	NA	2786,36	Population size (1000 head)
K_AgriLivestock	3B4gii	Manure management - Broilers		NA	NA	NA	NA	NA	8895,5	Population size (1000 head)
K_AgriLivestock	3B4giii	Manure management - Turkeys		NA	NA	NA	NA	NA	511,289	Population size (1000 head)
K_AgriLivestock	3B4giv	Manure management - Other poultry		NA	NA	NA	NA	NA	553,541	Population size (1000 head)
K_AgriLivestock	3B4h	Manure management - Other animals (please specify in the 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	9,8E+07	Use of inorganic fertilizers (kg N)
L_AgriOther	3Da2a	Animal manure applied to soils		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
L_AgriOther	3Da2b	Sewage sludge applied to soils		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
L_AgriOther	3Da2c	Other organic fertilisers applied to soils (including compost)		NA	NA	NA	NA	NA	NE	Please specify and/or provide details in the IIR
L_AgriOther	3Da3	Urine and dung deposited by grazing animals		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
L_AgriOther	3Da4	Crop residues applied to soils		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
L_AgriOther	3Db	Indirect emissions from managed soils		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
L_AgriOther	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
L_AgriOther	3Dd	Off-farm storage, handling and transport of bulk agricultural products		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
L_AgriOther	3De	Cultivated crops		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
L_AgriOther	3Df	Use of pesticides		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
L_AgriOther	3F	Field burning of agricultural residues		NA	NA	NA	NA	NA	NE	Area burned [ha]
L_AgriOther	3I	Agriculture other (please specify in the IIR)		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR
J_Waste	5A	Biological treatment of waste - Solid waste disposal on land		NA	NA	NA	NA	NA	1593,4	Deposition [kt]
J_Waste	5B1	Biological treatment of waste - Composting		NA	NA	NA	NA	NA	49,61	Organic domestic waste [kt]
J_Waste	5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities		NA	NA	NA	NA	NA	IE	N in feedstock [kt]
J_Waste	5C1a	Municipal waste incineration		NA	NA	NA	NA	NA	NO	Waste incinerated [kt]
J_Waste	5C1bi	Industrial waste incineration		NA	NA	NA	NA	NA	IE	Waste incinerated [kt]
J_Waste	5C1bii	Hazardous waste incineration		NA	NA	NA	NA	NA	NO	Waste incinerated [kt]
J_Waste	5C1biii	Clinical waste incineration		NA	NA	NA	NA	NA	NO	Waste incinerated [kt]
J_Waste	5C1biv	Sewage sludge incineration		NA	NA	NA	NA	NA	NO	Sludge incinerated [kt]
J_Waste	5C1bv	Cremation		NA	NA	NA	NA	NA	6648	Corpses [Number]
J_Waste	5C1bvi	Other waste incineration (please specify in the IIR)		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR
J_Waste	5C2	Open burning of waste		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR

HR: 26.1.2021: 2019	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	Long name	Notes	TJ NCV	TJ NCV	TJ NCV	TJ NCV	TJ NCV		
J_Waste	5D1	Domestic wastewater handling		NA	NA	NA	NA	NA	NE	Total organic product [kt DC]
J_Waste	5D2	Industrial wastewater handling		NA	NA	NA	NA	NA	NE	Total organic product [kt DC]
J_Waste	5D3	Other wastewater handling		NA	NA	NA	NA	NA	NO	Total organic product [kt DC]
J_Waste	5E	Other waste (please specify in the IIR)		NA	NA	NA	NA	NA	NA	Please specify and/or provide details in the IIR
M_Other	6A	Other (included in national total for entire territory) (please specify in the IIR)		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR
	NATIONAL TOTAL	National total (based on fuel sold)	(a)	#######	18228,73	78727,24	61291,21	271,01	NA	
	1A3bi(fu)	Road transport: Passenger cars (fuel used)	(b)							TJ NCV
	1A3bii(fu)	Road transport: Light duty vehicles (fuel used)	(b)							TJ NCV
	1A3biii(fu)	Road transport: Heavy duty vehicles and buses (fuel used)	(b)							TJ NCV
	1A3biv(fu)	Road transport: Mopeds & motorcycles (fuel used)	(b)							TJ NCV
	1A3bv(fu)	Road transport: Gasoline evaporation (fuel used)	(b)							TJ NCV
	1A3bvi(fu)	Road transport: Automobile tyre and brake wear (fuel used)	(b)							Mileage [10^6 km]
	1A3bvii(fu)	Road transport: Automobile road abrasion (fuel used)	(b)							Mileage [10^6 km]
	ADJUSTMENTS	Sum of approved adjustments (negative value) from Annex VII (CLRTAP)								
	COMPLIANCE TOTAL (CLRTAP)	National total for compliance calculations and checks (CLRTAP)	(c)							
	ADJUSTMENTS AND FLEXIBILITIES	Sum of approved adjustments from Annex VII and other flexibilities (negative value) (NECD)	(d)							
	COMPLIANCE TOTAL (NECD)	National total for compliance calculations and checks (NECD)	(e)							
MEMO ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS										
O_AviCruise	1A3ai(ii)	International aviation cruise (civil)		7117,86	NA	NO	NO	NA	NA	TJ NCV
O_AviCruise	1A3aii(ii)	Domestic aviation cruise (civil)		312,203	NA	NO	NO	NA	NA	TJ NCV
P_IntShipping	1A3di(i)	International maritime navigation		1042,84	NO	NO	NO	NA	NA	TJ NCV
z_Memo	1A5c	Multilateral operations		NA	NA	NA	NA	NA	NA	TJ NCV
z_Memo	6B	Other not included in national total of the entire territory (please specify in the IIR)		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR
N_Natural	11A	Volcanoes		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR
N_Natural	11B	Forest fires		NA	NA	NA	NA	NA	2180	Area of forest burned [ha]
N_Natural	11C	Other natural emissions (please specify in the IIR)		NA	NA	NA	NA	NA	NO	Please specify and/or provide details in the IIR

Note (a): Sum of NFR categories (rows 14-140). The geographic area of the National Total corresponds to the geographical scope of EMEP, which is identical with the NECD territory, except for Portugal (EMEP domain includes emissions of Madeira and the Azores, but the NECD territory does not cover emissions of Madeira and the Azores). The geographical scope of EMEP means the area within which, co-ordinated by the centres of the EMEP, monitoring is carried out (see EMEP Protocol, Article 1/4).

Note (b): UNECE reporting guidelines 2014, paragraph 23: The Parties Austria, Belgium, Ireland, Lithuania, Luxembourg, the Netherlands, Switzerland and the United Kingdom of Great Britain and Northern Ireland may choose to use the national emission total calculated on the basis of fuels used in the geographic area of the Party as a basis for compliance with their respective emission ceilings.
If one Party has chosen to report emission on the basis of fuel used for compliance, it shall report those information for all the related NFR categories available in the reporting template (row 143-149).

Note (c): The 'National Total for Compliance (CLRTAP)' includes the 'National Total (based on fuel sold)' (row 141) corrected for i) approved adjustments to national totals (row 151) and, if applicable, ii) national totals based on transport fuel used (rows 143-149).

Note (d): Reporting of adjustments and additional flexibilities according to the NEC Directive, Article 5/2-4. Should only include approved items from Annex VII and should be reported as a negative value.

Note (e): The 'National Total for Compliance (NECD)' includes the 'National Total (based on fuel sold)' (row 141) corrected for i) approved adjustments and flexibilities to national totals (row 153) and, if applicable, ii) national totals based on transport fuel used (rows 143-149) as well as iii) the subtraction of sectors 3B + 3D for NOx and NMVOC (only from 2020 onwards and for the year 2005 as a basis for emission reduction commitment calculations), according to the NEC Directive, Article 4/3(d).

Appendix 7. Uncertainty analysis

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	SO2	99,3234264	2,01707205	3,0	10,0	10,44	2,58245	-0,01646	0,01197	-0,16459	0,05079	0,17225
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	SO2	35,2457811	2,66380988	3,0	10,0	10,44	3,41047	0,00567	0,01581	0,05674	0,06707	0,08785
1 A 3 b Road Transport	1 A 3 b Cestovni promet	SO2	4,39545638	1,9827E-06	3,0	20,0	20,22	0,00000	-0,00126	0,00000	-0,02524	0,00000	0,02524
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	SO2	1,27455525	0,04220615	3,0	20,0	20,22	0,10467	-0,00012	0,00025	-0,00231	0,00106	0,00254
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	SO2	6,89342072	0,05482782	5,0	20,0	20,62	0,13861	-0,00165	0,00033	-0,03308	0,00230	0,03316
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	SO2	17,8215901	0,74187027	3,0	20,0	20,22	1,83987	-0,00072	0,00440	-0,01430	0,01868	0,02353
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	SO2	0,61496454	0,24296685	10,0	50,0	50,99	1,51926	0,00127	0,00144	0,06326	0,02039	0,06647
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	SO2	1,80036063	2,20179206	3,0	50,0	50,09	13,52460	0,01255	0,01307	0,62743	0,05544	0,62987
2 B 10 a, 2 H Chemical industry: Other, Pulp and Paper industry	2 B 10 a Kemijska industrija: ostalo i 2H Industrija papira	SO2	0,74568753	0,17916166	3,0	20,0	20,22	0,44433	0,00085	0,00106	0,01698	0,00451	0,01757
2 C Metal production	2 C Industrija metala	SO2	0,38150828	0,00414756	7,5	20,0	21,36	0,01086	-0,00008	0,00002	-0,00170	0,00026	0,00172
2 G Other product use	2 G Ostala uporaba proizvoda	SO2	0,00214118	0,00521856	10,0	20,0	22,36	0,01431	0,00003	0,00003	0,00061	0,00044	0,00075
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	SO2	0,0008255	0,0007647	50,0	50,0	70,71	0,00663	0,00000	0,00000	0,00022	0,00032	0,00039
5 C Waste incineration	5 C Termička obrada otpada	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	5 C 1 b v Kremiranje	SO2	0,00016543	0,00075122	50,0	20,0	53,85	0,00496	0,00000	0,00000	0,00009	0,00032	0,00033
TOTAL	TOTAL		168,50	8,15	% Uncertainty in total inventory			14,39			Trend uncertainty:		0,66

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	NO2	16,6402352	4,13719085	3,0	20,0	20,22	1,55154	-0,03523	0,03718	-0,70461	0,15773	0,72204
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	NO2	22,9407573	5,81340822	3,0	20,0	20,22	2,18015	-0,04756	0,05224	-0,95116	0,22163	0,97664
1 A 3 b Road Transport	1 A 3 b Cestovni promet	NO2	37,2920868	23,1688753	3,0	20,0	20,22	8,68883	0,04565	0,20820	0,91309	0,88330	1,27041
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	NO2	5,4813239	4,91535152	3,0	100,0	100,04	9,11895	0,02029	0,04417	2,02909	0,18739	2,03773
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	NO2	2,48002058	1,09929413	5,0	50,0	50,25	1,02433	-0,00092	0,00988	-0,04604	0,06985	0,08366
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	NO2	12,6905509	6,54978015	3,0	50,0	50,09	6,08376	0,00359	0,05886	0,17956	0,24971	0,30757
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	NO2	0,07078659	0,03396579	10,0	50,0	50,99	0,03212	0,00000	0,00031	-0,00015	0,00432	0,00432
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	NO2	0,25627738	0,0784134	3,0	50,0	50,09	0,07283	-0,00041	0,00070	-0,02057	0,00299	0,02078
2 B 10 a Chemical industry: Other; H Pulp and Paper industry	2 B 10 a Kemijska industrija: ostalo i 2H Industrija papira	NO2	0,52730198	0,01890956	3,0	50,0	50,09	0,01756	-0,00213	0,00017	-0,10631	0,00072	0,10631
2 B 1, 2 B 2 Ammonia and Nitric acid production	3 B 1, 2 B 2 Proizvodnja amonijaka i nitratne kiseline	NO2	2,09103104	0,74482973	3,0	50,0	50,09	0,69183	-0,00241	0,00669	-0,12059	0,02840	0,12389
2 C Metal production	2 C Industrija metala	NO2	0,09649594	0,00898637	7,5	50,0	50,56	0,00843	-0,00034	0,00008	-0,01697	0,00086	0,01699
2 G Other product use	2 G Ostala uporaba proizvoda	NO2	0,02194814	0,02173132	10,0	30,0	31,62	0,01274	0,00010	0,00020	0,00299	0,00276	0,00407
3 D a, b, c, d, e	3 D a, b, c, d, e	NO2	10,3458873	7,11595209	5,0	100,0	100,12	13,21204	0,01888	0,06394	1,88753	0,45215	1,94093
3B1, 3B2, 3B4d, 3B4e, 3B4f,	3B1, 3B2, 3B4d, 3B4e, 3B4f,	NO2	0,10271383	0,05092418	10,0	100,0	100,50	0,09490	0,00001	0,00046	0,00103	0,00647	0,00655
3B3, 3B4g	3B3, 3B4g	NO2	0,24129873	0,16025562	50,0	100,0	111,80	0,33225	0,00039	0,00144	0,03893	0,10183	0,10902
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	NO2	0,00379728	0,00351761	50,0	50,0	70,71	0,00461	0,00002	0,00003	0,00075	0,00224	0,00236
5 C 1 b v Cremation	5 C 1 b v Kremiranje	NO2	0,0012078	0,0054846	50,0	20,0	53,85	0,00548	0,00004	0,00005	0,00088	0,00348	0,00359
5 C Waste incineration	5 C Termička obrada otpada	NO2	0,0005395	0	5,0	20,0	20,62	0,00000	0,00000	0,00000	-0,00005	0,00000	0,00005
TOTAL			111,28	53,93	% Uncertainty in total inventory			19,47			Trend uncertainty:		3,34

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	NMVOC	0,96061597	0,44825918	3,0	50,0	50,09	0,29850	0,00014	0,00263	0,00700	0,01117	0,01318
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	NMVOC	4,34420928	1,42860912	3,0	50,0	50,09	0,95132	-0,00288	0,00839	-0,14410	0,03560	0,14844
1 A 3 b Road Transport	1 A 3 b Cestovni promet	NMVOC	34,2582764	4,57376291	3,0	20,0	20,22	1,22970	-0,06192	0,02687	-1,23835	0,11398	1,24359
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	NMVOC	0,36262725	0,2321317	3,0	100,0	100,04	0,30874	0,00042	0,00136	0,04224	0,00578	0,04263
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	NMVOC	0,28713358	0,39576542	5,0	50,0	50,25	0,26438	0,00158	0,00232	0,07897	0,01644	0,08066
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	NMVOC	25,3678198	18,8346398	3,0	50,0	50,09	12,54215	0,04473	0,11063	2,23646	0,46937	2,28518
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	NMVOC	4,25736175	2,23706513	10,0	50,0	50,99	1,51646	0,00209	0,01314	0,10454	0,18583	0,21321
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	NMVOC	2,17941373	0,79551927	3,0	50,0	50,09	0,52974	-0,00098	0,00467	-0,04916	0,01982	0,05301
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	2 B 1, 2 B 10 a, 2 H 1, 2 H 2 Proizvodnja amonijaka, Kemijska industrija: ostalo, Industrija papira, Industrija hrane i pića	NMVOC	23,3997289	4,05128298	3,0	50,0	50,09	2,69778	-0,03688	0,02380	-1,84401	0,10096	1,84677
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	2 A 1, 2 A 2, 2 A 3 Proizvodnja cementa, vapna i stakla	NMVOC	0	0,024152	3,0	20,0	20,22	0,00649	0,00014	0,00014	0,00284	0,00060	0,00290
2 C Metal production	2 C Industrija metala	NMVOC	0,00963595	0,00324905	7,5	50,0	50,56	0,00218	-0,00001	0,00002	-0,00030	0,00020	0,00036
2D3b, 2D3c, 2D3g, 2D3h	2D3b, 2D3c, 2D3g, 2D3h	NMVOC	5,34462318	4,69510594	30	20,0	36,06	2,25051	0,01370	0,02758	0,27407	1,17004	1,20171
2D3a, 2D3i, 2G, 2D3e, 2D3f, 2D3d	2D3a, 2D3i, 2G, 2D3e, 2D3f, 2D3d	NMVOC	58,4385948	27,4312188	10	20,0	22,36	8,15445	0,00943	0,16113	0,18865	2,27866	2,28645
3B	3B	NMVOC	9,140066	7,61290278	10,0	100	100,50	10,17127	0,02098	0,04472	2,09849	0,63239	2,19171
3 D a, b, c, d, e	3 D a, b, c, d, e	NMVOC	1,68589051	1,68960969	5	100,0	100,12	2,24902	0,00555	0,00992	0,55486	0,07018	0,55928
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	NMVOC	0,0008255	0,0007647	50,0	50,0	70,71	0,00072	0,00000	0,00000	0,00012	0,00032	0,00034
5 A Biological treatment of waste - Solid waste disposal on land	5 A Biološka obrada otpada -Odlagališta otpada	NMVOC	0,20655981	0,76149856	50	50	70,71	0,71584	0,00394	0,00447	0,19684	0,31628	0,37253
5 C 1 b v Cremation	5 C 1 b v Kremiranje	NMVOC	1,9032E-05	8,6424E-05	50,0	50	70,71	0,00008	0,00000	0,00000	0,00002	0,00004	0,00004
5 C Waste incineration	5 C Termička obrada otpada	NMVOC	0,001948	0	5,0	50	50,25	0,00000	-0,00001	0,00000	-0,00025	0,00000	0,00025
5D1, 5D2	5D1, 5D3	NMVOC	2,38E-03	4,77E-03	5,0	50	50,25	0,00319	0,00002	0,00003	0,00109	0,00020	0,00111
TOTAL			170,25	75,22	% Uncertainty in total inventory			18,72			Trend uncertainty:		4,71

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	CO	2,66710433	1,48362785	3,0	20,0	20,22	0,13861	0,00078	0,00271	0,01569	0,01149	0,01945
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	CO	21,6254803	11,8388853	3,0	20,0	20,22	1,10610	0,00601	0,02161	0,12021	0,09169	0,15118
1 A 3 b Road Transport	1 A 3 b Cestovni promet	CO	229,564208	24,7738832	3,0	20,0	20,22	2,31461	-0,11986	0,04522	-2,39726	0,19187	2,40493
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	CO	2,74062082	1,55661252	3,0	100,0	100,04	0,71944	0,00086	0,00284	0,08646	0,01206	0,08730
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	CO	1,55960095	0,67640263	5,0	50,0	50,25	0,15702	0,00011	0,00123	0,00549	0,00873	0,01031
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	CO	198,341765	159,770293	3,0	50,0	50,09	36,97154	0,14805	0,29166	7,40259	1,23739	7,50530
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	CO	0,57464789	0,15375718	10,0	50,0	50,99	0,03622	-0,00013	0,00028	-0,00669	0,00397	0,00778
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	CO	50,0414877	15,3197721	3,0	50,0	50,09	3,54506	-0,00812	0,02797	-0,40614	0,11865	0,42311
2 B 10 a, 2 H Chemical industry: Other, Pulp and Paper industry, 2 B 1 Ammonia production	2 B 10 a Kemijska industrija: ostalo i 2H Industrija papira, 2 B 1 Proizvodnja amonijaka	CO	30,7066832	0,00288399	3,0	50,0	50,09	0,00067	-0,02213	0,00001	-1,10658	0,00002	1,10658
2 C Metal production	2 C Industrija metala	CO	9,2006946	0,11751409	7,5	50,0	50,56	0,02745	-0,00642	0,00021	-0,32105	0,00228	0,32106
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	2D3b, 2D3c, 2D3d, 2D3g, 2D3h	CO	0,00023289	0,00017958	30	100,0	104,40	0,00009	0,00000	0,00000	0,00002	0,00001	0,00002
2 G Other product use	2 G Ostala uporaba proizvoda	CO	0,67128345	0,66382223	5	100,0	100,12	0,30705	0,00073	0,00121	0,07276	0,00857	0,07326
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	CO	0,11012103	0,10201058	50,0	17,0	52,81	0,02489	0,00011	0,00019	0,00182	0,01317	0,01329
5 C Waste incineration	5 C Termička obrada otpada	CO	0,0000441	0	50,0	100,0	111,80	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
5 C 1 b v Cremation	5 C 1 b v Kremiranje	CO	0,00020496	0,00093072	50,0	50,0	70,71	0,00030	0,00000	0,00000	0,00008	0,00012	0,00014
TOTAL			547,80	216,46	% Uncertainty in total inventory			37,24			Trend uncertainty:		7,98

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	NH3	0,00893257	0,00909642	3,0	1000,00	1000,00	0,24744	0,00006	0,00016	0,05792	0,00069	0,05792
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	NH3	0,13420015	0,05072084	3,0	1000,00	1000,00	1,37973	-0,00066	0,00090	-0,65818	0,00383	0,65819
1 A 3 b Road Transport	1 A 3 b Cestovni promet	NH3	0,06169499	0,36215809	3,0	400	400,01	3,94072	0,00572	0,00644	2,28923	0,02732	2,28939
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	NH3	0,00098152	0,00059858	3,0	1000,00	1000,00	0,01628	0,00000	0,00001	-0,00077	0,00005	0,00077
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	NH3	0,00073058	0,02057274	5,0	1000,00	1000,01	0,55963	0,00036	0,00037	0,35736	0,00259	0,35737
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	NH3	3,02517547	2,41602673	3,0	1000,00	1000,00	65,72170	0,00779	0,04297	7,79086	0,18229	7,79299
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	NH3	0,0020572	0	10,0	1000,00	1000,05	0,00000	-0,00002	0,00000	-0,02392	0,00000	0,02392
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	NH3	0,2050219	0,06273072	3,0	1000,00	1000,00	1,70643	-0,00127	0,00112	-1,26793	0,00473	1,26794
2 B 10 a Chemical industry: Other, 2 H 1 Pulp and Paper industry, 2 H 2 Food and beverages industry	2 B 10 a Kemijska industrija: ostalo, 2 H 1 Industrija papira, 2 H 2 Industrija hrane i pića	NH3	3,48320198	1,41830199	3,0	400	400,01	15,43285	-0,01526	0,02522	-6,10531	0,10701	6,10625
2 A 3 Glass production, 2 B 1 Ammonia production	2 A 3 Proizvodnja stakla, 2 B 1 Proizvodnja amonijaka	NH3	0,01724735	0,14801258	3,0	400	400,01	1,61056	0,00243	0,00263	0,97265	0,01117	0,97272
2D3a, 2D3i, 2G	2D3a, 2D3i, 2G	NH3	0,05017765	0,04906694	10	400	400,12	0,53406	0,00029	0,00087	0,11569	0,01234	0,11634
3B1, 3B2, 3B4d, 3B4e, 3B4f	3B1, 3B2, 3B4d, 3B4e, 3B4f	NH3	8,99565799	3,77808496	10,0	100	100,50	10,32851	-0,03733	0,06719	-3,73347	0,95017	3,85248
3B3, 3B4g	3B3, 3B4g	NH3	11,566414	6,85562276	50,0	100	111,80	20,85005	-0,01253	0,12192	-1,25268	8,62075	8,71129
3 D a, b, c, d, e	3 D a, b, c, d, e	NH3	27,98	20,98	5	100	100,12	57,15493	0,04761	0,37318	4,76127	2,63879	5,44361
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	NH3	0,00396238	0,00367055	50,0	100	111,80	0,01116	0,00002	0,00007	0,00192	0,00462	0,00500
5B1	5B1	NH3	0,00	0,0119064	50	400	403,11	0,13056	0,00021	0,00021	0,08469	0,01497	0,08601
5D1	5D1	NH3	0,69	0,59	30,0	1000,00	1000,45	16,06187	0,00244	0,01050	2,43534	0,44529	2,47571
TOTAL			56,23	36,76	% Uncertainty in total inventory			92,99			Trend uncertainty:		15,26

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	BC	0,11611067	0,04785703	3,0	50,0	50,09	0,64625	-0,00577	0,00880	-0,28834	0,03735	0,29075
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	BC	0,77	0,11445593	3,0	50,0	50,09	1,54559	-0,07491	0,02105	-3,74531	0,08932	3,74638
1 A 3 b Road Transport	1 A 3 b Cestovni promet	BC	0,57849059	0,62226256	3,0	100,0	100,04	16,78319	0,04181	0,11445	4,18150	0,48558	4,20960
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	BC	0,00327043	0,00161271	3,0	500,0	500,01	0,21739	-0,00011	0,00030	-0,05689	0,00126	0,05690
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	BC	0,07563552	0,03220762	5,0	78,0	78,16	0,67866	-0,00357	0,00592	-0,27822	0,04189	0,28135
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	BC	3,66637722	2,61720708	3,0	76,0	76,06	53,66550	0,02116	0,48138	1,60784	2,04234	2,59929
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	BC	0,0267969	0,00772758	10,0	50,0	50,99	0,10623	-0,00194	0,00142	-0,09706	0,02010	0,09912
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	BC	0,00039979	0,00012232	3,0	50,0	50,09	0,00165	-0,00003	0,00002	-0,00138	0,00010	0,00139
2 B 10 a, 2 H 1, 2 H 2 Chemical industry: Other, Pulp and Paper industry, Food and beverages industry	2 B 10 a Kemijska industrija: ostalo, 2 H 1 Industrija papira, 2 H 2 Industrija hrane i pića	BC	0,00621899	0,00733018	3,0	50,0	50,09	0,09899	0,00057	0,00135	0,02839	0,00572	0,02896
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	2 A 1, 2 A 2, 2 A 3 Proizvodnja cementa, vapna i stakla	BC	0,00811471	0,00957769	3,0	50,0	50,09	0,12934	0,00074	0,00176	0,03717	0,00747	0,03791
2 C Metal production	2 C Industrija metala	BC	0,01841216	5,2259E-06	7,5	50,0	50,56	0,00007	-0,00231	0,00000	-0,11547	0,00001	0,11547
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	2D3b, 2D3c, 2D3d, 2D3g, 2D3h	BC	0,02370653	0,1045382	30	50,0	58,31	1,64331	0,01625	0,01923	0,81261	0,81576	1,15143
2D3a, 2D3i, 2G	2D3a, 2D3i, 2G	BC	0,14690565	0,1436538	10	100,0	100,50	3,89209	0,00799	0,02642	0,79853	0,37367	0,88163
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	BC	0,0008255	0,0007647	50,0	25,0	55,90	0,01152	0,00004	0,00014	0,00093	0,00995	0,00999
5 C Waste incineration	5 C Termička obrada otpada	BC	0,000055	0,000000	5,0	50,0	50,25	0,00000	-0,00001	0,00000	-0,00034	0,00000	0,00034
TOTAL			5,44	3,71	% Uncertainty in total inventory			56,42			Trend uncertainty:		6,39

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	PM2.5	1,0440582	1,28463423	3,0	50,0	50,09	2,24983	0,01326	0,03314	0,66320	0,14060	0,67794
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	PM2.5	2,72787738	0,42999768	3,0	50,0	50,09	0,75307	-0,04080	0,01109	-2,04008	0,04706	2,04062
1 A 3 b Road Transport	1 A 3 b Cestovni promet	PM2.5	1,37895027	1,34583263	3,0	100,0	100,04	4,70768	0,00847	0,03472	0,84688	0,14730	0,85960
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	PM2.5	0,14372272	0,09102493	3,0	500,0	500,01	1,59132	-0,00039	0,00235	-0,19371	0,00996	0,19397
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	PM2.5	0,2224452	0,10059875	5,0	78,0	78,16	0,27491	-0,00164	0,00260	-0,12783	0,01835	0,12914
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	PM2.5	30,1570459	21,6436603	3,0	76,0	76,06	57,55763	-0,01554	0,55835	-1,18129	2,36889	2,64709
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	PM2.5	0,07863937	0,03270505	10,0	50,0	50,99	0,05831	-0,00065	0,00084	-0,03266	0,01193	0,03477
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	PM2.5	0,30753285	0,13840975	3,0	50,0	50,09	0,24240	-0,00228	0,00357	-0,11414	0,01515	0,11514
2 B 10 a, 2 H 1, 2 H 2 Chemical industry: Other, Pulp and Paper industry, Food and beverages industry	2 B 10 a Kemijska industrija: ostalo, 2 H 1 Industrija papira, 2 H 2 Industrija hrane i pića	PM2.5	0,28536899	0,407232	3,0	50,0	50,09	0,71320	0,00507	0,01051	0,25367	0,04457	0,25756
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	2 A 1, 2 A 2, 2 A 3 Proizvodnja cementa, vapna i stakla	PM2.5	0,24101446	0,28250975	3,0	50,0	50,09	0,49477	0,00270	0,00729	0,13502	0,03092	0,13851
2 A 5 a, 2 A 5 b Quarrying and mining of mineral products, Construction and demolition	2 A 5 a, 2 A 5 b Vađenje kamen, Građenje i rušenje objekata	PM2.5	0,1580463	0,15410416	5,0	50,0	50,25	0,27075	0,00097	0,00398	0,04836	0,02811	0,05594
2 C Metal production	2 C Industrija metala	PM2.5	0,2683954	0,00145164	7,5	50,0	50,56	0,00257	-0,00507	0,00004	-0,25355	0,00040	0,25355
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	2D3b, 2D3c, 2D3d, 2D3g, 2D3h	PM2.5	0,41786073	1,83551229	30	50,0	58,31	3,74212	0,03939	0,04735	1,96969	2,00896	2,81347
2D3a, 2D3i, 2G	2D3a, 2D3i, 2G	PM2.5	0,43597726	0,43642819	10	100,0	100,50	1,53354	0,00296	0,01126	0,29599	0,15922	0,33610
3B1, 3B2, 3B4d, 3B4e, 3B4f,	3B1, 3B2, 3B4d, 3B4e, 3B4f,	PM2.5	0,2519867	0,10109184	10,0	100,0	100,50	0,35522	-0,00219	0,00261	-0,21883	0,03688	0,22192
3B3, 3B4g	3B3, 3B4g	PM2.5	0,17833608	0,05943011	50,0	100,0	111,80	0,23232	-0,00186	0,00153	-0,18613	0,10841	0,21540
3 D a, b, c, d, e	3 D a, b, c, d, e	PM2.5	0,18358398	0,0902667	5	50,0	50,25	0,15859	-0,00117	0,00233	-0,05828	0,01647	0,06057
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	PM2.5	0,00891535	0,00825873	50,0	25,0							
5 A Biological treatment of waste - Solid waste disposal on land	5 A Biološka obrada otpada -Odlagališta otpada	PM2.5	3,4664E-05	5,2582E-05	50	100,0	111,80	0,00021	0,00000	0,00000	0,00007	0,00010	0,00012
5 C 1 b v Cremation	5 C 1 b v Kremiranje	PM2.5	5,0801E-05	0,00023069	50,0	80,0	94,34	0,00076	0,00000	0,00001	0,00040	0,00042	0,00058
5 C Waste incineration	5 C Termička obrada otpada	PM2.5	0,000001	0	5,0	50,0	50,25	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	PM2.5	0,2735262	0,15745372	10,0	700,0	700,07	3,85404	-0,00114	0,00406	-0,80106	0,05744	0,80312
TOTAL			38,76	28,60	% Uncertainty in total inventory			58,10			Trend uncertainty:		4,62

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	PM10	1,63595337	1,51363765	3,0	50,0	50,09	1,85695	0,00377	0,02999	0,18839	0,12724	0,22733
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	PM10	2,8407079	0,45947573	3,0	50,0	50,09	0,56369	-0,03641	0,00910	-1,82032	0,03862	1,82073
1 A 3 b Road Transport	1 A 3 b Cestovni promet	PM10	1,62320596	1,81109976	3,0	100,0	100,04	4,43778	0,00986	0,03588	0,98637	0,15224	0,99805
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	PM10	0,15354436	0,09699302	3,0	500,0	500,01	1,18781	-0,00054	0,00192	-0,26962	0,00815	0,26975
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	PM10	0,25106859	0,10560985	5,0	78,0	78,16	0,20217	-0,00193	0,00209	-0,15066	0,01480	0,15139
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	PM10	30,9153443	22,1920785	3,0	76,0	76,06	41,34065	-0,05547	0,43969	-4,21606	1,86546	4,61033
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	PM10	0,13232627	0,03270505	10,0	50,0	50,99	0,04084	-0,00147	0,00065	-0,07364	0,00916	0,07421
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	PM10	0,70476278	0,31903541	3,0	50,0	50,09	0,39140	-0,00497	0,00632	-0,24870	0,02682	0,25015
2 B 10 a, 2 H 1, 2 H 2 Chemical industry: Other, Pulp and Paper industry, Food and beverages industry	2 B 10 a Kemijska industrija: ostalo, 2 H 1 Industrija papira, 2 H 2 Industrija hrane i pića	PM10	0,38872364	0,542976	3,0	50,0	50,09	0,66613	0,00453	0,01076	0,22636	0,04564	0,23092
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	2 A 1, 2 A 2, 2 A 3 Proizvodnja cementa, vapna i stakla	PM10	0,44815586	0,49397177	3,0	50,0	50,09	0,60601	0,00260	0,00979	0,13019	0,04152	0,13666
2 A 5 a, 2 A 5 b Quarrying and mining of mineral products, Construction and demolition	2 A 5 a, 2 A 5 b Vađenje kamen, Građenje i rušenje objekata	PM10	1,58046303	1,5410416	5,0	50,0	50,25	1,89659	0,00520	0,03053	0,25998	0,21590	0,33794
2 C Metal production	2 C Industrija metala	PM10	0,36259418	0,00165902	7,5	50,0	50,56	0,00205	-0,00578	0,00003	-0,28892	0,00035	0,28892
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	2D3b, 2D3c, 2D3d, 2D3g, 2D3h	PM10	1,79223254	7,86756146	30	50,0	58,31	11,23588	0,12711	0,15588	6,35549	6,61345	9,17224
2D3a, 2D3i, 2G	2D3a, 2D3i, 2G	PM10	0,50634248	0,53306023	10	100,0	100,50	1,31209	0,00245	0,01056	0,24457	0,14936	0,28657
3B1, 3B2, 3B4d, 3B4e, 3B4f,	3B1, 3B2, 3B4d, 3B4e, 3B4f,	PM10	0,41683651	0,17902728	10,0	100,0	100,50	0,44066	-0,00313	0,00355	-0,31337	0,05016	0,31736
3B3, 3B4g	3B3, 3B4g	PM10	1,66304968	0,62572386	50,0	100,0	111,80	1,71343	-0,01425	0,01240	-1,42530	0,87664	1,67331
3 D a, b, c, d, e	3 D a, b, c, d, e	PM10	4,77318348	2,3469342	5	50,0	50,25	2,88841	-0,02998	0,04650	-1,49879	0,32880	1,53443
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	PM10	0,00941064	0,00871755	50,0	25,0	55,90	0,01194	0,00002	0,00017	0,00055	0,01221	0,01223
5 A Biological treatment of waste - Solid waste disposal on land	5 A Biološka obrada otpada -Odlagališta otpada	PM10	0,00023005	0,00034896	50	100,0	111,80	0,00096	0,00000	0,00001	0,00032	0,00049	0,00059
5 C 1 b v Cremation	5 C 1 b v Kremiranje	PM10	5,0801E-05	0,00023069	50,0	80,0	94,34	0,00053	0,00000	0,00000	0,00030	0,00032	0,00044
5 C Waste incineration	5 C Termička obrada otpada	PM10	0,00000175	0	5,0	50,0	50,25	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	PM10	0,2735262	0,15745372	10,0	700,0	700,07	2,69975	-0,00126	0,00312	-0,88503	0,04412	0,88613
TOTAL			50,47	40,83	% Uncertainty in total inventory			**43,42**			Trend uncertainty:		**10,78**

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	TSP	2,7455401	1,71946198	3,0	50,0	50,09	1,18840	-0,02068	0,02647	-1,03380	0,11230	1,03988
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	TSP	2,94526497	0,50027209	3,0	50,0	50,09	0,34576	-0,04286	0,00770	-2,14320	0,03267	2,14345
1 A 3 b Road Transport	1 A 3 b Cestovni promet	TSP	1,88804047	2,33075181	3,0	100,0	100,04	3,21744	0,00345	0,03588	0,34520	0,15223	0,37728
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	TSP	0,15801533	0,09813513	3,0	500,0	500,01	0,67705	-0,00120	0,00151	-0,60158	0,00641	0,60162
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	TSP	0,25733132	0,10923375	5,0	78,0	78,16	0,11780	-0,00274	0,00168	-0,21356	0,01189	0,21389
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	TSP	32,5166366	23,2977639	3,0	76,0	76,06	24,45032	-0,19883	0,35865	-15,11079	1,52162	15,18720
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	TSP	0,25224617	0,03270505	10,0	50,0	50,99	0,02301	-0,00383	0,00050	-0,19144	0,00712	0,19157
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	TSP	0,89697081	0,47587266	3,0	50,0	50,09	0,32890	-0,00808	0,00733	-0,40393	0,03108	0,40513
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	2 B 10 a Kemijska industrija: ostalo, 2 H 1 Industrija papira, 2 H 2 Industrija hrane i pića, 2 I Prerada drva	TSP	0,8354831	0,87239318	3,0	50,0	50,09	0,60295	-0,00092	0,01343	-0,04597	0,05698	0,07321
2 A 1, 2 A 2, 2 A 3 Cement, Lime and glass production	2 A 1, 2 A 2, 2 A 3 Proizvodnja cementa, vapna i stakla	TSP	0,24253308	0,22715924	3,0	50,0	50,09	0,15700	-0,00067	0,00350	-0,03343	0,01484	0,03657
2 A 5 a, 2 A 5 b Quarrying and mining of mineral products, Construction and demolition	2 A 5 a, 2 A 5 b Vađenje kamen, Građenje i rušenje objekata	TSP	3,21383302	3,13420447	5,0	50,0	50,25	2,17308	-0,00695	0,04825	-0,34727	0,34117	0,48682
2 C Metal production	2 C Industrija metala	TSP	0,48292718	0,00216282	7,5	50,0	50,56	0,00151	-0,00826	0,00003	-0,41302	0,00035	0,41302
2D3b, 2D3c, 2D3d, 2D3g, 2D3h	2D3b, 2D3c, 2D3d, 2D3g, 2D3h	TSP	7,76307233	34,0902458	30	50,0	58,31	27,42762	0,39099	0,52479	19,54972	22,26504	29,62977
2D3a, 2D3i, 2G	2D3a, 2D3i, 2G	TSP	0,53760027	0,5593331	10	100,0	100,50	0,77562	-0,00062	0,00861	-0,06227	0,12177	0,13677
3B1, 3B2, 3B4d, 3B4e, 3B4f	3B1, 3B2, 3B4d, 3B4e, 3B4f,	TSP	0,92532961	0,40202695	10,0	100,0	100,50	0,55749	-0,00970	0,00619	-0,97022	0,08752	0,97416
3B3, 3B4g	3B3, 3B4g	TSP	4,239498	2,1078903	50,0	100,0	111,80	3,25178	-0,04034	0,03245	-4,03376	2,29451	4,64069
3 D a, b, c, d, e	3 D a, b, c, d, e	TSP	4,77318348	2,3469342	5	50,0	50,25	1,62723	-0,04582	0,03613	-2,29082	0,25547	2,30502
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	TSP	0,00957574	0,00887049	50,0	25,0	55,90	0,00684	-0,00003	0,00014	-0,00070	0,00966	0,00968
5 A Biological treatment of waste - Solid waste disposal on land	5 A Biološka obrada otpada -Odlagališta otpada	TSP	0,00048635	0,00073775	50	100,0	111,80	0,00114	0,00000	0,00001	0,00030	0,00080	0,00086
5 C 1 b v Cremation	5 C 1 b v Kremiranje	TSP	5,6452E-05	0,00025635	50,0	80,0	94,34	0,00033	0,00000	0,00000	0,00024	0,00028	0,00037
5 C Waste incineration	5 C Termička obrada otpada	TSP	0,0023825	0	5,0	50,0	50,25	0,00000	-0,00004	0,00000	-0,00205	0,00000	0,00205
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	TSP	0,2735262	0,15745372	10,0	700,0	700,07	1,52095	-0,00227	0,00242	-1,59168	0,03428	1,59205
TOTAL			64,96	72,47	% Uncertainty in total inventory			37,20			Trend uncertainty:		33,85

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	PAH	0,02584834	0,01116906	3,0	100,0	100,04	0,08336	-0,00021	0,00051	-0,02120	0,00216	0,02131
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	PAH	2,34971717	0,40829816	3,0	100,0	100,04	3,04736	-0,04692	0,01863	-4,69237	0,07906	4,69304
1 A 3 b Road Transport	1 A 3 b Cestovni promet	PAH	0,17241472	0,37047786	3,0	400,0	400,01	11,05568	0,01209	0,01691	4,83745	0,07174	4,83798
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	PAH	0,05749444	0,02859753	3,0	400,0	400,01	0,85340	-0,00030	0,00131	-0,12006	0,00554	0,12019
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	PAH	0,13131512	0,01819749	5,0	400,0	400,03	0,54307	-0,00284	0,00083	-1,13435	0,00587	1,13437
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	PAH	18,2501537	12,5256672	3,0	400,0	400,01	373,78695	0,06158	0,57168	24,63262	2,42542	24,75174
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	PAH	0,29468499	1,7482E-06	10,0	400,0	400,12	0,00005	-0,00823	0,00000	-3,29081	0,00000	3,29081
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	PAH	0,00429265	0,00131342	3,0	400,0	400,01	0,03919	-0,00006	0,00006	-0,02397	0,00025	0,02397
2 C Metal production	2 C Industrija metala	PAH	0,61685761	0,03318045	7,5	400,0	400,07	0,99031	-0,01571	0,00151	-6,28205	0,01606	6,28207
2 D 3 i, 2G	3 D 3 i, 2G	PAH	0,00385834	0,00403668	10,0	400,0	400,12	0,12050	0,00008	0,00018	0,03060	0,00261	0,03071
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	PAH	0,00378737	0,00350843	50,0	100,0	111,80	0,02926	0,00005	0,00016	0,00544	0,01132	0,01256
5 C Waste incineration	5 C Termička obrada otpada	PAH	0,000005	0	50,0	100,0	111,80	0,00000	0,00000	0,00000	-0,00001	0,00000	0,00001
5 C 1 b v Cremation	5 C 1 b v Kremiranje	PAH	4,9542E-08	2,2497E-07	50	100,0	111,80	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
TOTAL			21,91	13,40	% Uncertainty in total inventory			373,97			Trend uncertainty:		26,64

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kg	kg	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	HCB	0,00500698	0,05393985	3,0	100,0	100,04	8,94585	0,00755	0,00761	0,75462	0,03227	0,75531
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	HCB	0,03371407	0,01861622	3,0	100,0	100,04	3,08747	0,00222	0,00263	0,22206	0,01114	0,22234
1 A 3 b Road Transport	1 A 3 b Cestovni promet	HCB	0,00042881	0,00088016	3,0	400,0	400,01	0,58364	0,00012	0,00012	0,04759	0,00053	0,04759
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	HCB	0,0035192	0,0039215	3,0	400,0	400,01	2,60041	0,00051	0,00055	0,20431	0,00235	0,20432
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	HCB	0,00201686	0,00284209	5,0	400,0	400,03	1,88472	0,00038	0,00040	0,15063	0,00283	0,15066
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	HCB	0,21397433	0,21113932	3,0	400,0	400,01	140,00962	0,02720	0,02977	10,87954	0,12632	10,88027
3 D f Use of pesticides	3 D f Uporaba pesticida	HCB	6,8180805	0,31089438	3,0	30,0	30,15	15,53858	-0,03758	0,04384	-1,12749	0,18600	1,14273
5 C Waste incineration	5 C Termička obrada otpada	HCB	0,0145	0	50,0	100,0	111,80	0,00000	-0,00017	0,00000	-0,01739	0,00000	0,01739
5 C 1 b v Cremation	5 C 1 b v Kremiranje	HCB	0,0002196	0,0009972	50,0	100,0	111,80	0,18482	0,00014	0,00014	0,01380	0,00994	0,01701
TOTAL			7,09	0,60	% Uncertainty in total inventory			141,22			Trend uncertainty:		10,97

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			g I-TEQ	g I-TEQ	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	PCDD/PCDF	0,2129213	0,62092627	3,0	100,0	100,04	2,29991	0,01024	0,01261	1,02397	0,05351	1,02537
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	PCDD/PCDF	2,71062964	0,51505737	3,0	100,0	100,04	1,90777	-0,01974	0,01046	-1,97381	0,04439	1,97430
1 A 3 b Road Transport	1 A 3 b Cestovni promet	PCDD/PCDF	0,4938148	0,9055327	3,0	400,0	400,01	13,41069	0,01289	0,01839	5,15583	0,07804	5,15642
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	PCDD/PCDF	0,35938016	0,39711149	3,0	400,0	400,01	5,88111	0,00406	0,00807	1,62440	0,03422	1,62476
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	PCDD/PCDF	0,21185927	0,05833589	5,0	400,0	400,03	0,86398	-0,00118	0,00119	-0,47049	0,00838	0,47057
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	PCDD/PCDF	33,7567672	21,9453328	3,0	400,0	400,01	325,00425	0,06908	0,44579	27,63100	1,89133	27,69565
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	PCDD/PCDF	1,668	0	10,0	400,0	400,12	0,00000	-0,01858	0,00000	-7,43384	0,00000	7,43384
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	PCDD/PCDF	0,02434635	0,00744927	3,0	400,0	400,01	0,11032	-0,00012	0,00015	-0,04801	0,00064	0,04802
2 C Metal production	2 C Industrija metala	PCDD/PCDF	0,5307944	0,20737781	7,5	400,0	400,07	3,07166	-0,00170	0,00421	-0,68129	0,04468	0,68276
2 G Other product use	2 G Ostala uporaba proizvoda	PCDD/PCDF	0,0012091	0,00118234	10,0	400,0	400,12	0,01752	0,00001	0,00002	0,00422	0,00034	0,00423
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	PCDD/PCDF	0,825495	0,764697	50,0	100,0	111,80	3,16533	0,00633	0,01553	0,63321	1,09841	1,26786
5 C Waste incineration	5 C Termička obrada otpada	PCDD/PCDF	5,69	0,00	50,0	100,0	111,80	0,00000	-0,06332	0,00000	-6,33176	0,00000	6,33176
5 C 1 b v Cremation	5 C 1 b v Kremiranje	PCDD/PCDF	3,9528E-05	0,0001795	50,0	100,0	111,80	0,00074	0,00000	0,00000	0,00032	0,00026	0,00041
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	PCDD/PCDF	2,745048	1,586864	30,0	100,0	104,40	6,13377	0,00164	0,03224	0,16389	1,36762	1,37741
TOTAL			49,23	27,01	% Uncertainty in total inventory			**325,44**			Trend uncertainty:		**30,01**

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	Pb	0,62418557	0,32432652	3,0	100,0	100,04	6,27945	0,00062	0,00063	0,06169	0,00267	0,06174
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	Pb	0,67593872	0,37485171	3,0	100,0	100,04	7,25770	0,00071	0,00073	0,07138	0,00308	0,07145
1 A 3 b Road Transport	1 A 3 b Cestovni promet	Pb	432,214548	0,96624509	3,0	200,0	200,02	37,40331	-0,00647	0,00187	-1,29444	0,00795	1,29446
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	Pb	0,36298604	0,14344352	3,0	400,0	400,01	11,10445	0,00027	0,00028	0,10846	0,00118	0,10846
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	Pb	0,17477713	0,0233032	5,0	400,0	400,03	1,80407	0,00004	0,00005	0,01672	0,00032	0,01672
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	Pb	3,5135867	1,18389407	3,0	400,0	400,01	91,64925	0,00223	0,00230	0,89105	0,00974	0,89110
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	Pb	0,21397622	0,000978	10,0	400,0	400,12	0,07569	0,00000	0,00000	-0,00091	0,00003	0,00091
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	Pb	0,4100438	0,13150421	3,0	400,0	400,01	10,18019	0,00025	0,00026	0,09883	0,00108	0,09883
2 A 3 Glass production	2 A 3 Proizvodnja stakla	Pb	0,468333	0,48335997	3,0								
2 C Metal production	2 C Industrija metala	Pb	76,3933844	0,17972744	7,5	400,0	400,07	13,91536	-0,00113	0,00035	-0,45380	0,00370	0,45382
2 G Other product use	2 G Ostala uporaba proizvoda	Pb	0,555856	1,354752	10,0	400,0	400,12	104,90576	0,00262	0,00263	1,04664	0,03716	1,04730
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	Pb	0,00018161	0,00016823	50,0	100,0	111,80	0,00364	0,00000	0,00000	0,00003	0,00002	0,00004
5 C Waste incineration	5 C Termička obrada otpada	Pb	0,009005	0	50,0	100,0	111,80	0,00000	0,00000	0,00000	-0,00002	0,00000	0,00002
5 C 1 b v Cremation	5 C 1 b v Kremiranje	Pb	4,3964E-05	0,00019964	50,0	700,0	701,78	0,02711	0,00000	0,00000	0,00027	0,00003	0,00027
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	Pb	0,00079725	0,00045701	30,0	700,0	700,64	0,06197	0,00000	0,00000	0,00061	0,00004	0,00061
TOTAL			515,62	5,17	% Uncertainty in total inventory			146,01			Trend uncertainty:		1,95

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	Cd	0,0398587	0,026646	3,0	100,0	100,04	3,43852	-0,00078	0,02373	-0,07785	0,10068	0,12727
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	Cd	0,08382496	0,04018445	3,0	100,0	100,04	5,18559	-0,01575	0,03579	-1,57451	0,15184	1,58182
1 A 3 b Road Transport	1 A 3 b Cestovni promet	Cd	0,00252474	0,00451356	3,0	200,0	200,02	1,16451	0,00247	0,00402	0,49344	0,01705	0,49373
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	Cd	0,00120389	0,00064546	3,0	400,0	400,01	0,33303	-0,00017	0,00057	-0,06618	0,00244	0,06622
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	Cd	0,00264174	0,00691151	5,0	400,0	400,03	3,56624	0,00453	0,00616	1,81231	0,04352	1,81283
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	Cd	0,56116569	0,55068472	3,0	400,0	400,01	284,13169	0,14465	0,49043	57,85813	2,08074	57,89553
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	Cd	0,00777703	0,0014948	10,0	400,0	400,12	0,77148	-0,00345	0,00133	-1,38027	0,01883	1,38040
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	Cd	0,08072737	0,02470022	3,0	400,0	400,01	12,74434	-0,02762	0,02200	-11,04896	0,09333	11,04935
2 A 3 Glass production	2 A 3 Proizvodnja stakla	Cd	0,0358137	0,03696282	3,0	400,0	400,01	19,07136	0,01089	0,03292	4,35722	0,13966	4,35946
2 C Metal production	2 C Industrija metala	Cd	0,2367564	0,01382519	7,5	400,0	400,07	7,13431	-0,13299	0,01231	-53,19630	0,13059	53,19646
2 G Other product use	2 G Ostala uporaba proizvoda	Cd	0,06634072	0,06640357	10,0	400,0	400,12	34,27138	0,01833	0,05914	7,33360	0,83634	7,38113
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	Cd	0,00145287	0,00134587	50,0	100,0	111,80	0,19409	0,00031	0,00120	0,03052	0,08475	0,09008
5 C Waste incineration	5 C Termička obrada otpada	Cd	0,001145	0,000000	50,0	100,0	111,80	0,00000	-0,00070	0,00000	-0,07041	0,00000	0,07041
5 C 1 b v Cremation	5 C 1 b v Kremiranje	Cd	7,3639E-06	3,3439E-05	50,0	100,0	111,80	0,00482	0,00003	0,00003	0,00253	0,00211	0,00329
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	Cd	0,00161105	0,00092299	30,0	700,0	700,64	0,83414	-0,00017	0,00082	-0,11805	0,03487	0,12309
TOTAL			1,12	0,78	% Uncertainty in total inventory			287,29			Trend uncertainty:		79,91

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	Hg	0,06344416	0,10960339	3,0	100,0	100,04	28,02966	0,07734	0,09670	7,73352	0,41025	7,74440
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	Hg	0,12	0,12920593	3,0	100,0	100,04	33,04276	0,07790	0,11399	7,79048	0,48362	7,80548
1 A 3 b Road Transport	1 A 3 b Cestovni promet	Hg	0,01704429	0,02245923	3,0	200,0	200,02	11,48345	0,01462	0,01981	2,92449	0,08407	2,92569
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	Hg	0,00322001	0,00170361	3,0	400,0	400,01	1,74197	0,00052	0,00150	0,20900	0,00638	0,20910
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	Hg	0,00806037	0,00135041	5,0	400,0	400,03	1,38088	-0,00126	0,00119	-0,50514	0,00842	0,50521
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	Hg	0,05808745	0,03899267	3,0	400,0	400,01	39,87068	0,01671	0,03440	6,68208	0,14595	6,68367
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	Hg	0,70839317	0,00031104	10,0	400,0	400,12	0,31814	-0,21409	0,00027	-85,63551	0,00388	85,63551
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	Hg	0,08969708	0,03147321	3,0	400,0	400,01	32,18190	0,00045	0,02777	0,18179	0,11781	0,21662
2 A 3 Glass production	2 A 3 Proizvodnja stakla	Hg	0,00082647	0,00085299	3,0	400,0	400,01	0,87220	0,00050	0,00075	0,20035	0,00319	0,20038
2 C Metal production	2 C Industrija metala	Hg	0,00857783	0,0034563	7,5	400,0	400,07	3,53465	0,00044	0,00305	0,17495	0,03234	0,17791
2 G Other product use	2 G Ostala uporaba proizvoda	Hg	4,0413E-05	9,8496E-05	10,0	400,0	400,12	0,10074	0,00007	0,00009	0,02984	0,00123	0,02986
2 K Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	2 K Uporaba POO i teških metala (npr. električna i znanstvaena oprema)	Hg	0,04778	0,04065253	50,0	400,0	403,11	41,89023	0,02131	0,03587	8,52309	2,53607	8,89240
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	Hg	0,00023114	0,00021412	50,0	100,0	111,80	0,06119	0,00012	0,00019	0,01185	0,01336	0,01786
5 C Waste incineration	5 C Termička obrada otpada	Hg	0,006034	0,000000	50,0	100,0	111,80	0,00000	-0,00184	0,00000	-0,18372	0,00000	0,18372
5 C 1 b v Cremation	5 C 1 b v Kremiranje	Hg	0,00218136	0,00990552	50,0	100,0	111,80	2,83094	0,00807	0,00874	0,80747	0,61795	1,01679
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	Hg	0,00161105	0,00092299	30,0	700,0	700,64	1,65307	0,00032	0,00081	0,22662	0,03455	0,22924
TOTAL			1,13	0,39	% Uncertainty in total inventory			80,12			Trend uncertainty:		87,11

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	As	0,77941468	0,13298266	3,0	100,0	100,04	22,53080	0,00923	0,01546	0,92320	0,06561	0,92553
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	As	0,09943151	0,07128459	3,0	100,0	100,04	12,07751	0,00749	0,00829	0,74944	0,03517	0,75026
1 A 3 b Road Transport	1 A 3 b Cestovni promet	As	0,00626124	0,01135207	3,0	200,0	200,02	3,84539	0,00127	0,00132	0,25401	0,00560	0,25407
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	As	0,00392465	0,00203015	3,0	400,0	400,01	1,37527	0,00020	0,00024	0,08189	0,00100	0,08190
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	As	0,00731397	0,00161992	5,0	400,0	400,03	1,09742	0,00013	0,00019	0,05199	0,00133	0,05201
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	As	0,024281	0,01113959	3,0	400,0	400,01	7,54619	0,00110	0,00130	0,44058	0,00550	0,44061
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	As	0,00786199	0,00024751	10,0	400,0	400,12	0,16772	-0,00003	0,00003	-0,01360	0,00041	0,01360
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	As	0,01793942	0,30091339	3,0	400,0	400,01	203,84498	0,03485	0,03499	13,93882	0,14845	13,93961
2 A 3 Glass production	2 A 3 Proizvodnja stakla	As	0,0523431	0,05402258	3,0	100,0	100,04	9,15286	0,00586	0,00628	0,58636	0,02665	0,58697
2 C Metal production	2 C Industrija metala	As	7,59739707	0,00103689	7,5	400,0	400,07	0,70251	-0,06001	0,00012	-24,00406	0,00128	24,00406
2 G Other product use	2 G Ostala uporaba proizvoda	As	0,00094297	0,00229824	10,0	400,0	400,12	1,55732	0,00026	0,00027	0,10389	0,00378	0,10396
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	As	1,0566E-05	9,7881E-06	50,0	100,0	111,80	0,00185	0,00000	0,00000	0,00011	0,00008	0,00013
5 C Waste incineration	5 C Termička obrada otpada	As	0,000032	0	50,0	100,0	111,80	0,00000	0,00000	0,00000	-0,00003	0,00000	0,00003
5 C 1 b v Cremation	5 C 1 b v Kremiranje	As	1,9925E-05	9,0479E-05	50,0	100,0	111,80	0,01713	0,00001	0,00001	0,00104	0,00074	0,00128
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	As	0,00255698	0,0014637	30,0	700,0	700,64	1,73674	0,00015	0,00017	0,10485	0,00722	0,10510
TOTAL			8,60	0,59	% Uncertainty in total inventory			205,84			Trend uncertainty:		27,80

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	Cr	1,91682979	0,13679116	3,0	100,0	100,04	7,16139	-0,10544	0,02594	-10,54368	0,11007	10,54426
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	Cr	0,32434905	0,15530156	3,0	100,0	100,04	8,13046	0,00715	0,02945	0,71543	0,12497	0,72626
1 A 3 b Road Transport	1 A 3 b Cestovni promet	Cr	0,20193484	0,37240874	3,0	200,0	200,02	38,98006	0,05673	0,07063	11,34573	0,29966	11,34969
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	Cr	0,00867266	0,00350793	3,0	400,0	400,01	0,73429	0,00007	0,00067	0,02766	0,00282	0,02781
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	Cr	0,08068901	0,02355664	5,0	400,0	400,03	4,93118	-0,00108	0,00447	-0,43147	0,03159	0,43262
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	Cr	1,05364526	0,98532961	3,0	400,0	400,01	206,25171	0,11422	0,18688	45,68895	0,79286	45,69583
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	Cr	0,10541263	0,0038258	10,0	400,0	400,12	0,80105	-0,00652	0,00073	-2,60769	0,01026	2,60771
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	Cr	0,42285767	0,12938211	3,0	400,0	400,01	27,08259	-0,00453	0,02454	-1,81004	0,10411	1,81303
2 A 3 Glass production	2 A 3 Proizvodnja stakla	Cr	0,0633627	0,06539576	3,0	400,0	400,01	13,68881	0,00805	0,01240	3,21859	0,05262	3,21902
2 C Metal production	2 C Industrija metala	Cr	1,0807925	0,00691259	7,5	400,0	400,07	1,44718	-0,07283	0,00131	-29,13361	0,01391	29,13362
2 G Other product use	2 G Ostala uporaba proizvoda	Cr	0,0110604	0,0269568	10,0	400,0	400,12	5,64427	0,00435	0,00511	1,74091	0,07230	1,74241
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	Cr	0,00013208	0,00012235	50,0	100,0	111,80	0,00716	0,00001	0,00002	0,00141	0,00164	0,00217
5 C Waste incineration	5 C Termička obrada otpada	Cr	0,000355	0,000000	50,0	100,0	111,80	0,00000	-0,00002	0,00000	-0,00244	0,00000	0,00244
5 C 1 b v Cremation	5 C 1 b v Kremiranje	Cr	1,9852E-05	9,0147E-05	50,0	100,0	111,80	0,00527	0,00002	0,00002	0,00157	0,00121	0,00198
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	Cr	0,00244325	0,00139898	30,0	700,0	700,64	0,51292	0,00010	0,00027	0,06817	0,01126	0,06909
TOTAL			5,27	1,91	% Uncertainty in total inventory			212,50			Trend uncertainty:		56,58

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	Cu	0,874229739	0,282439467	3,0	100,0	100,04	2,80711	-0,12705	0,03879	-12,70492	0,16457	12,70599
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	Cu	0,579885731	0,366981853	3,0	100,0	100,04	3,64736	-0,05966	0,05040	-5,96552	0,21384	5,96935
1 A 3 b Road Transport	1 A 3 b Cestovni promet	Cu	4,260624382	7,87277945	3,0	200,0	200,02	156,43915	0,27070	1,08126	54,13921	4,58738	54,33322
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	Cu	0,109282553	0,071615504	3,0	400,0	400,01	2,84589	-0,01091	0,00984	-4,36495	0,04173	4,36515
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	Cu	0,036236108	0,006588774	5,0	400,0	400,03	0,26184	-0,00598	0,00090	-2,39002	0,00640	2,39002
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	Cu	0,724620507	0,56900516	3,0	400,0	400,01	22,61137	-0,05938	0,07815	-23,75149	0,33155	23,75380
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	Cu	0,032060436	0,001893343	10,0	400,0	400,12	0,07526	-0,00583	0,00026	-2,33084	0,00368	2,33085
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	Cu	0,179394163	0,056903638	3,0	400,0	400,01	2,26126	-0,02624	0,00782	-10,49615	0,03316	10,49620
2 A 3 Glass production	2 A 3 Proizvodnja stakla	Cu	0,00192843	0,001990306	3,0	400,0	400,01	0,07909	-0,00009	0,00027	-0,03712	0,00116	0,03714
2 C Metal production	2 C Industrija metala	Cu	0,08251068	0,001382519	7,5	400,0	400,07	0,05495	-0,01547	0,00019	-6,18996	0,00201	6,18996
2 G Other product use	2 G Ostala uporaba proizvoda	Cu	0,3800874	0,831078134	10,0	400,0	400,12	33,03513	0,04195	0,11414	16,78043	1,61420	16,85789
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	Cu	0,000120522	0,000111646	50,0	100,0	111,80	0,00124	-0,00001	0,00002	-0,00076	0,00108	0,00132
5 C Waste incineration	5 C Termička obrada otpada	Cu	0,014470	0,000000	50,0	100,0	111,80	0,00000	-0,00275	0,00000	-0,27474	0,00000	0,27474
5 C 1 b v Cremation	5 C 1 b v Kremiranje	Cu	1,81975E-05	8,26346E-05	50,0	100,0	111,80	0,00092	0,00001	0,00001	0,00079	0,00080	0,00113
5 E Other waste (Building and car fires)	5 E Ostali otpad (Požari na građevinama i vozilima)	Cu	0,00567462	0,00325332	30,0	700,0	700,64	0,22644	-0,00063	0,00045	-0,44144	0,01896	0,44185
TOTAL			7,28	10,07	% Uncertainty in total inventory			161,59			Trend uncertainty:		64,63

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	Ni	11,6433713	1,65267619	3,0	100,0	100,04	59,25842	-0,01522	0,09731	-1,52194	0,41287	1,57695
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	Ni	0,2572225	0,14686135	3,0	100,0	100,04	5,26587	0,00616	0,00865	0,61583	0,03669	0,61692
1 A 3 b Road Transport	1 A 3 b Cestovni promet	Ni	0,03208735	0,05727546	3,0	200,0	200,02	4,10596	0,00306	0,00337	0,61241	0,01431	0,61258
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	Ni	0,11016182	0,04734931	3,0	400,0	400,01	6,78817	0,00172	0,00279	0,68889	0,01183	0,68899
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	Ni	0,86880829	0,14524153	5,0	400,0	400,03	20,82340	0,00015	0,00855	0,05892	0,06047	0,08443
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	Ni	0,36966944	0,14874374	3,0	400,0	400,01	21,32445	0,00518	0,00876	2,07244	0,03716	2,07277
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	Ni	0,07931627	0,00466752	10,0	400,0	400,12	0,66934	-0,00049	0,00027	-0,19698	0,00389	0,19702
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	Ni	0,78164599	0,31570266	3,0	400,0	400,01	45,26030	0,01102	0,01859	4,40906	0,07887	4,40976
2 A 3 Glass production	2 A 3 Proizvodnja stakla	Ni	0,1349901	0,1393214	3,0	400,0	400,01	19,97363	0,00690	0,00820	2,75885	0,03480	2,75907
2 C Metal production	2 C Industrija metala	Ni	2,6514066	0,04838816	7,5	400,0	400,07	6,93813	-0,02276	0,00285	-9,10591	0,03022	9,10596
2 G Other product use	2 G Ostala uporaba proizvoda	Ni	0,0539157	0,08376307	10,0	400,0	400,12	12,01200	0,00441	0,00493	1,76418	0,06975	1,76556
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	Ni	8,5851E-05	7,9528E-05	50,0	100,0	111,80	0,00319	0,00000	0,00000	0,00039	0,00033	0,00051
5 C Waste incineration	5 C Termička obrada otpada	Ni	0,000315	0,000000	50,0	100,0	111,80	0,00000	0,00000	0,00000	-0,00030	0,00000	0,00030
5 C 1 b v Cremation	5 C 1 b v Kremiranje	Ni	2,5371E-05	0,00011521	50,0	100,0	111,80	0,00462	0,00001	0,00001	0,00065	0,00048	0,00081
TOTAL			16,98	2,79	% Uncertainty in total inventory			84,44			Trend uncertainty:		11,01

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	Se	0,07919249	0,02471999	3,0	100,0	100,04	6,80223	0,08815	0,05518	8,81454	0,23413	8,81765
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	Se	0,07508923	0,06426589	3,0	100,0	100,04	17,68413	0,00740	0,14347	0,74018	0,60867	0,95831
1 A 3 b Road Transport	1 A 3 b Cestovni promet	Se	0,00396793	0,00723752	3,0	200,0	200,02	3,98177	0,00897	0,01616	1,79334	0,06855	1,79465
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	Se	0,00498067	0,00493106	3,0	400,0	400,01	5,42525	0,00198	0,01101	0,79338	0,04670	0,79475
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	Se	0,00247402	0,00092235	5,0	400,0	400,03	1,01484	0,00242	0,00206	0,96937	0,01456	0,96948
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	Se	0,03241907	0,0234599	3,0	400,0	400,01	25,81108	0,00636	0,05237	2,54518	0,22219	2,55486
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	Se	0,01143806	0,00089369	10,0	400,0	400,12	0,98353	0,01872	0,00200	7,48972	0,02821	7,48977
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	Se	0,01793942	0,00951745	3,0	400,0	400,01	10,47130	0,01125	0,02125	4,50107	0,09014	4,50197
2 A 3 Glass production	2 A 3 Proizvodnja stakla	Se	0,220392	0,22746351	3,0	400,0	400,01	250,26021	0,10793	0,50778	43,17306	2,15434	43,22678
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	Se	3,302E-05	3,0588E-05	50,0	100,0	111,80	0,00941	0,00001	0,00007	0,00085	0,00483	0,00490
5 C 1 b v Cremation	5 C 1 b v Kremiranje	Se	2,8958E-05	0,0001315	50,0	100,0	111,80	0,04044	0,00024	0,00029	0,02411	0,02076	0,03181
TOTAL			0,45	0,36	% Uncertainty in total inventory			252,61			Trend uncertainty:		45,11

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kt	kt	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	Zn	2,73092892	2,19791094	3,0	100,0	100,04	7,25394	0,00173	0,06003	0,17263	0,25470	0,30769
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	Zn	5,62896532	2,14490667	3,0	100,0	100,04	7,07900	0,06861	0,05859	6,86108	0,24856	6,86558
1 A 3 b Road Transport	1 A 3 b Cestovni promet	Zn	1,53964844	2,83753287	3,0	200,0	200,02	18,72354	0,04267	0,07750	8,53338	0,32883	8,53971
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	Zn	0,16562434	0,11345641	3,0	400,0	400,01	1,49716	0,00065	0,00310	0,25868	0,01315	0,25901
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	Zn	0,30460203	0,29271054	5,0	400,0	400,03	3,86278	0,00111	0,00800	0,44252	0,05653	0,44611
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	Zn	22,9264254	21,8202897	3,0	400,0	400,01	287,93931	0,07703	0,59600	30,81021	2,52863	30,91380
1 B Extraction and distribution of fossil fuels	1 B Ekstrakcija i distribucija fosilnih goriva	Zn	0,15842718	0,01612049	10,0	400,0	400,12	0,21279	0,00314	0,00044	1,25699	0,00623	1,25701
1 B 2 a iv Refining / storage	1 B 2 a iv Rafiniranje / skladištenje	Zn	0,15376643	0,05309081	3,0	400,0	400,01	0,70058	0,00203	0,00145	0,81092	0,00615	0,81095
2 A 3 Glass production	2 A 3 Proizvodnja stakla	Zn	0,1019313	0,10520188	3,0	400,0	400,01	1,38824	0,00057	0,00287	0,22730	0,01219	0,22763
2 C Metal production	2 C Industrija metala	Zn	2,68198038	0,24885337	7,5	400,0	400,07	3,28434	0,05382	0,00680	21,52724	0,07210	21,52736
2 G Other product use	2 G Ostala uporaba proizvoda	Zn	0,2169857	0,48120307	10,0	400,0	400,12	6,35173	0,00824	0,01314	3,29437	0,18588	3,29961
3 F Field burning of agricultural residues	3 F Spaljivanje poljoprivrednih ostataka na polju	Zn	0,00092455	0,00085646	50,0	100,0	111,80	0,00316	0,00000	0,00002	0,00025	0,00165	0,00167
5 C Waste incineration	5 C Termička obrada otpada	Zn	0,000525	0,000000	50,0	100,0	111,80	0,00000	0,00001	0,00000	0,00119	0,00000	0,00119
5 C 1 b v Cremation	5 C 1 b v Kremiranje	Zn	0,00023442	0,00106448	50,0	100,0	111,80	0,00393	0,00002	0,00003	0,00238	0,00206	0,00314
TOTAL			36,61	30,31	% Uncertainty in total inventory			**288,85**			Trend uncertainty:		**39,40**

NFR Source		Pollutant	Emissions 1990	Emissions 2019	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
	NFR Izvor	Onečišćujuća tvar	Emisija 1990	Emisija 2019	Nesigurnost podatka o aktivnosti	Nesigurnost faktora emisije	Ukupna nesigurnost	Ukupna nesigurnost kao % ukupne emisije u promatranoj godini t	Tip A osjetljivost	Tip B osjetljivost	Nesigurnost trenda emisije izražena preko nesigurnosti faktora emisije	Nesigurnost trenda emisije izražena preko nesigurnosti podatka o aktivnosti	Nesigurnost trenda emisije izražena preko ukupne emisije
			kg	kg	%	%	%	%	%	%	%	%	%
1 A 1 Energy Industries	1 A 1 Termoelektrane, javne toplane i kotlovnice	PCB	1,083	2,494	3,0	100,0	100,04	0,60889	0,00326	0,00517	0,32611	0,02191	0,32685
1 A 2 Manufacturing Industries and Construction	1 A 2 Izgaranje u industriji	PCB	2,12	0,53390266	3,0	100,0	100,04	0,13036	-0,00262	0,00111	-0,26241	0,00469	0,26245
1 A 3 b Road Transport	1 A 3 b Cestovni promet	PCB	0,00010374	0,00017916	3,0	400,0	400,01	0,00017	0,00000	0,00000	0,00008	0,00000	0,00008
1 A 3 Other mobile source and machinery	1 A 3 Ostali pokretni izvori i strojevi	PCB	4,0E-02	2,9E-03	3,0	400,0	400,01	0,00282	-0,00006	0,00001	-0,02566	0,00003	0,02566
1 A 4 a Commercial, institutional combustion	1 A 4 a Izgaranje u sektoru opće potrošnje	PCB	0,15	3,1E-05	5,0	400,0	400,03	0,00003	-0,00027	0,00000	-0,10692	0,00000	0,10692
1 A 4 b Residential combustion , 1 A 4 c Combustion in Agriculture/Forestry/ Fishing	1 A 4 b Izgaranje u sektoru kućanstva, 1 A 4 c Izgaranje u Poljoprivredi/šumarstvu/ribarstvu	PCB	0,75	0,02	3,0	400,0	400,01	0,01723	-0,00129	0,00004	-0,51577	0,00016	0,51577
2 C Metal production	2 C Industrija metala	PCB	0,85	0,17	7,5	400	400,07	0,16873	-0,00113	0,00036	-0,45199	0,00380	0,45201
2 K Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	2 K Uporaba POO i teških metala (npr. električna i znanstvaena oprema)	PCB	477,80	406,53	50	400	403,11	399,94109	0,00209	0,84201	0,83733	59,53934	59,54523
5 C Waste incineration	5 C Termička obrada otpada	PCB	0,002800	0,000000	50,0	100	111,80	0,00000	0,00000	0,00000	-0,00049	0,00000	0,00049
5 C 1 b v Cremation	5 C 1 b v Kremiranje	PCB	6,0E-04	2,7E-03	50,0	100	111,80	0,00074	0,00000	0,00001	0,00046	0,00040	0,00061
TOTAL			482,80	409,75	% Uncertainty in total inventory			399,94			Trend uncertainty:		59,55

Appendix 8. Influence of recalculations 1990 – 2018 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%	-1%	0%	0%	52%	0%	0,0%
1991	0%	0%	0%	0%	-	0%	-1%	0%	0%	64%	0%	0,0%
1992	0%	0%	0%	0%	-	0%	-1%	0%	0%	73%	0%	-0,1%
1993	0%	0%	0%	0%	-	0%	-1%	0%	0%	70%	0%	0,0%
1994	0%	0%	0%	0%	-	0%	-1%	0%	0%	78%	0%	0,0%
1995	0%	0%	0%	0%	-	0%	-1%	0%	0%	72%	0%	0,0%
1996	0%	0%	0%	0%	-	0%	-1%	0%	0%	88%	0%	-0,1%
1997	0%	0%	0%	0%	-	0%	-1%	0%	0%	93%	0%	-0,1%
1998	0%	0%	0%	0%	-	0%	-2%	0%	0%	70%	0%	-0,1%
1999	0%	0%	0%	0%	-	0%	-2%	0%	0%	99%	0%	-0,1%
2000	0%	0%	0%	0%	-	0%	-2%	0%	0%	61%	0%	-0,2%
2001	0%	0%	0%	0%	-	0%	-2%	0%	0%	86%	0%	-0,1%
2002	0%	0%	0%	0%	-	0%	-3%	0%	0%	91%	0%	-0,2%
2003	0%	0%	0%	0%	-	0%	-3%	0%	0%	91%	0%	-0,3%
2004	0%	0%	0%	0%	-	0%	-3%	0%	0%	93%	0%	-0,3%
2005	0%	0%	0%	0%	-	0%	-4%	0%	0%	129%	0%	-0,3%
2006	0%	0%	0%	0%	-	0%	-4%	0%	0%	87%	0%	-0,3%
2007	0%	0%	0%	0%	-	0%	-4%	0%	0%	71%	0%	-0,2%
2008	0%	0%	0%	0%	-	0%	-4%	0%	0%	113%	0%	-0,2%
2009	0%	0%	0%	0%	-	0%	-5%	0%	0%	96%	0%	-0,2%
2010	0%	0%	0%	0%	-	0%	-4%	0%	0%	114%	0%	-0,2%
2011	0%	0%	0%	0%	-	0%	-5%	0%	0%	86%	0%	-0,1%
2012	0%	0%	0%	0%	-	0%	-8%	0%	0%	57%	0%	0,0%
2013	0%	0%	0%	0%	-	0%	-5%	0%	0%	84%	0%	0,0%
2014	0%	0%	0%	0%	-	0%	-4%	0%	0%	117%	0%	0,0%
2015	0%	0%	0%	0%	-	0%	-4%	0%	0%	82%	0%	0,0%
2016	0%	0%	0%	0%	-	0%	-3%	0%	0%	81%	0%	0,0%
2017	0%	0%	0%	0%	-	0%	-3%	0%	0%	74%	18%	0,0%
2018	-4%	-4%	0%	0%	-	0%	-9%	0%	0%	97%	46%	-1,4%

Pollutant	NOx											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	2%	9%	0%	7%	0%	2,9%
1991	0%	0%	0%	0%	-	0%	4%	10%	0%	8%	0%	3,4%
1992	0%	0%	0%	0%	-	0%	4%	20%	0%	6%	0%	3,9%
1993	0%	0%	0%	0%	-	0%	4%	16%	0%	7%	0%	3,6%
1994	0%	0%	0%	0%	-	0%	3%	8%	0%	6%	0%	2,7%
1995	0%	0%	0%	0%	-	0%	3%	10%	0%	7%	0%	2,9%
1996	0%	0%	0%	0%	-	0%	3%	11%	0%	7%	0%	3,0%
1997	0%	0%	0%	0%	-	0%	4%	10%	0%	6%	0%	3,1%
1998	0%	0%	0%	0%	-	0%	4%	9%	0%	7%	0%	3,1%
1999	0%	0%	0%	0%	-	0%	4%	9%	0%	7%	0%	3,1%
2000	0%	0%	0%	0%	-	0%	7%	8%	0%	7%	0%	4,5%
2001	0%	0%	0%	0%	-	0%	5%	7%	0%	7%	0%	3,7%
2002	0%	0%	0%	0%	-	0%	5%	8%	0%	8%	0%	3,8%
2003	0%	0%	0%	0%	-	0%	5%	8%	0%	7%	0%	3,9%
2004	0%	0%	0%	0%	-	0%	6%	9%	0%	9%	0%	4,5%
2005	0%	0%	0%	0%	-	0%	5%	9%	0%	9%	0%	4,1%
2006	0%	0%	0%	0%	-	0%	4%	10%	0%	8%	0%	3,8%
2007	0%	0%	0%	0%	-	0%	4%	10%	0%	7%	0%	3,6%
2008	0%	0%	0%	0%	-	0%	4%	11%	0%	7%	0%	4,0%
2009	0%	0%	0%	0%	-	0%	4%	15%	0%	8%	0%	4,6%
2010	0%	0%	0%	0%	-	0%	4%	12%	0%	8%	0%	4,3%
2011	0%	0%	0%	0%	-	0%	4%	14%	0%	7%	0%	4,4%
2012	0%	0%	0%	0%	-	0%	4%	14%	0%	8%	0%	4,7%
2013	0%	0%	0%	0%	-	0%	4%	18%	0%	8%	0%	5,0%
2014	0%	0%	0%	0%	-	0%	3%	20%	0%	9%	0%	5,3%
2015	0%	0%	0%	0%	-	0%	4%	22%	0%	9%	0%	5,4%
2016	0%	0%	0%	0%	-	0%	4%	24%	0%	10%	0%	5,7%
2017	0%	0%	0%	0%	-	0%	4%	26%	0%	7%	18%	6,1%
2018	1%	-3%	8%	0%	-	0%	4%	28%	0%	7%	46%	6,7%

Pollutant	NMHOS											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	0%	0%	-1%	-6%	-34%	0%	0%	-0,3%
1991	0%	0%	0%	0%	3%	0%	-1%	-4%	-35%	0%	0%	-0,3%
1992	0%	0%	0%	0%	0%	0%	-1%	-5%	-36%	0%	0%	-0,5%
1993	0%	0%	0%	0%	0%	0%	-1%	-6%	-35%	0%	0%	-0,4%
1994	0%	0%	0%	0%	0%	0%	-1%	-4%	-35%	0%	0%	-0,4%
1995	0%	0%	0%	0%	0%	0%	-1%	-4%	-35%	0%	0%	-0,3%
1996	0%	0%	0%	0%	0%	0%	-1%	-5%	-34%	0%	0%	-0,4%
1997	0%	0%	0%	0%	0%	0%	-1%	-5%	-33%	0%	0%	-0,4%
1998	0%	0%	0%	0%	0%	0%	-1%	-4%	-32%	0%	0%	-0,4%
1999	0%	0%	0%	0%	0%	0%	0%	-4%	-31%	0%	0%	-0,4%
2000	0%	0%	0%	0%	0%	0%	7%	-4%	-30%	0%	0%	1,6%
2001	0%	0%	0%	0%	0%	0%	5%	-4%	-29%	0%	0%	1,0%
2002	0%	0%	0%	0%	0%	0%	3%	-5%	-30%	0%	0%	0,4%
2003	0%	0%	0%	0%	0%	0%	3%	-5%	-30%	0%	0%	0,2%
2004	0%	0%	0%	0%	0%	0%	4%	-5%	-29%	0%	0%	0,5%
2005	0%	0%	0%	0%	0%	0%	0%	-6%	-30%	-1%	0%	-0,4%
2006	0%	0%	0%	0%	0%	0%	0%	-6%	-29%	-2%	0%	-0,5%
2007	0%	0%	0%	0%	0%	0%	-1%	-6%	-28%	-3%	0%	-0,8%
2008	0%	0%	0%	1%	0%	0%	-2%	-7%	-27%	0%	0%	-0,6%
2009	0%	0%	0%	0%	0%	0%	-1%	-9%	-27%	0%	0%	-0,7%
2010	0%	0%	0%	0%	0%	0%	-2%	-9%	-28%	0%	0%	-0,7%
2011	0%	0%	0%	0%	0%	0%	-2%	-10%	-27%	0%	0%	-0,7%
2012	0%	0%	0%	0%	0%	0%	-1%	-11%	-27%	0%	0%	-0,7%
2013	0%	0%	0%	1%	0%	0%	-1%	-13%	-28%	0%	0%	-0,7%
2014	0%	0%	0%	0,33%	0%	0%	-1%	-14%	-28%	0%	0%	-0,8%
2015	0%	0%	0%	0,36%	0%	0%	-1%	-15%	-28%	0%	0%	-0,8%
2016	0%	0%	0%	0,32%	0%	0%	-1%	-15%	-29%	0%	0%	-0,8%
2017	0%	0%	0%	0,29%	0%	0%	-1%	-17%	-29%	0%	18%	-0,8%
2018	0%	-3%	6%	1%	0%	0%	-1%	-18%	-29%	0%	46%	-1,5%

Pollutant	CO											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-3%	-4%	0%	52%	0%	-1,2%
1991	0%	0%	0%	0%	-	0%	-3%	-2%	0%	64%	0%	-1,0%
1992	0%	0%	0%	0%	-	0%	-2%	-3%	0%	73%	0%	-1,0%
1993	0%	0%	0%	0%	-	0%	-1%	-2%	0%	70%	0%	-0,6%
1994	0%	0%	0%	0%	-	0%	-2%	-2%	0%	78%	0%	-0,9%
1995	0%	0%	0%	0%	-	0%	-2%	-2%	0%	72%	0%	-0,7%
1996	0%	0%	0%	0%	-	0%	-2%	-2%	0%	88%	0%	-0,7%
1997	0%	0%	0%	0%	-	0%	-1%	-2%	0%	93%	0%	-0,7%
1998	0%	0%	0%	0%	-	0%	-2%	-2%	0%	70%	0%	-0,8%
1999	0%	0%	0%	0%	-	0%	-1%	-2%	0%	99%	0%	-0,6%
2000	0%	0%	0%	0%	-	0%	6%	-2%	0%	61%	0%	2,1%
2001	0%	0%	0%	0%	-	0%	4%	-2%	0%	86%	0%	1,5%
2002	0%	0%	0%	0%	-	0%	2%	-2%	0%	91%	0%	0,7%
2003	0%	0%	0%	0%	-	0%	2%	-2%	0%	91%	0%	0,5%
2004	0%	0%	0%	0%	-	0%	4%	-2%	0%	93%	0%	1,0%
2005	0%	0%	0%	0%	-	0%	-2%	-2%	0%	129%	0%	-0,7%
2006	0%	0%	0%	0%	-	0%	-2%	-2%	0%	87%	0%	-0,5%
2007	0%	0%	0%	0%	-	0%	-3%	-2%	0%	71%	0%	-0,8%
2008	0%	0%	0%	0%	-	0%	-3%	-3%	0%	113%	0%	-0,9%
2009	0%	0%	0%	0%	-	0%	-3%	-3%	0%	96%	0%	-0,9%
2010	0%	0%	0%	0%	-	0%	-4%	-3%	0%	114%	0%	-0,8%
2011	0%	0%	0%	0%	-	0%	-4%	-3%	0%	86%	0%	-0,9%
2012	0%	0%	0%	0%	-	0%	-3%	-3%	0%	57%	0%	-0,5%
2013	0%	0%	0%	0%	-	0%	-2%	-4%	0%	84%	0%	-0,5%
2014	0%	0%	0%	0%	-	0%	-3%	-4%	0%	117%	0%	-0,6%
2015	0%	0%	0%	0%	-	0%	-2%	-4%	0%	82%	0%	-0,5%
2016	0%	0%	0%	0%	-	0%	-3%	-4%	0%	81%	0%	-0,5%
2017	0%	0%	0%	0%	-	0%	-2%	-4%	0%	74%	18%	-0,5%
2018	6%	-3%	34%	0%	-	0%	-2%	-5%	0%	97%	46%	-2%

Pollutant	NH_3											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	11%	0%	0%	5%	0%	4,6%
1991	0%	0%	0%	0%	-	0%	9%	0%	0%	6%	0%	5,0%
1992	0%	0%	0%	0%	-	0%	3%	0%	0%	6%	0%	4,6%
1993	0%	0%	0%	0%	-	0%	4%	0%	0%	6%	0%	5,1%
1994	0%	0%	0%	0%	-	0%	4%	0%	0%	7%	0%	6,1%
1995	0%	0%	0%	0%	-	0%	-4%	0%	0%	7%	0%	5,8%
1996	0%	0%	0%	0%	-	0%	-5%	0%	0%	8%	0%	6,2%
1997	0%	0%	0%	0%	-	0%	-4%	0%	0%	8%	0%	6,1%
1998	0%	0%	0%	0%	-	0%	-3%	0%	0%	9%	0%	7,1%
1999	0%	0%	0%	0%	-	0%	-3%	0%	0%	10%	0%	7,8%
2000	0%	0%	0%	0%	-	0%	-2%	0%	0%	9%	0%	7,3%
2001	0%	0%	0%	0%	-	0%	-3%	0%	0%	8%	0%	6,6%
2002	0%	0%	0%	0%	-	0%	-3%	0%	0%	10%	0%	7,9%
2003	0%	0%	0%	0%	-	0%	-3%	0%	0%	10%	0%	8,0%
2004	0%	0%	0%	0%	-	0%	-3%	0%	0%	12%	0%	9,2%
2005	0%	0%	0%	0%	-	0%	-4%	0%	0%	10%	0%	8,0%
2006	0%	0%	0%	0%	-	0%	-8%	0%	0%	11%	0%	9,5%
2007	0%	0%	0%	0%	-	0%	-8%	0%	0%	11%	0%	8,6%
2008	0%	0%	0%	0%	-	0%	-11%	0%	0%	8%	0%	6,9%
2009	0%	0%	0%	0%	-	0%	-10%	0%	0%	12%	0%	9,7%
2010	0%	0%	0%	0%	-	0%	-7%	0%	0%	12%	0%	9,3%
2011	0%	0%	0%	0%	-	0%	-6%	0%	0%	10%	0%	8,5%
2012	0%	0%	0%	0%	-	0%	-8%	0%	0%	10%	0%	8,2%
2013	0%	0%	0%	0%	-	0%	-8%	0%	0%	12%	0%	9,9%
2014	0%	0%	0%	0%	-	0%	-8%	0%	0%	14%	0%	11,0%
2015	0%	0%	0%	0%	-	0%	-9%	0%	0%	14%	0%	10,8%
2016	0%	0%	0%	0%	-	0%	-9%	0%	0%	15%	0%	11,7%
2017	0%	0%	0%	0%	-	0%	-8%	0%	0%	13%	18%	10,4%
2018	0%	-3%	0%	0%	-	0%	-8%	0%	0%	11%	46%	8,9%

Pollutant	TSP											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	56%	0%	0%	8%	-7%	0%	3%	-	8,7%
1991	0%	0%	0%	55%	0%	0%	10%	-8%	0%	3%	-	6,5%
1992	0%	0%	0%	19%	0%	0%	10%	-15%	0%	3%	-	2,3%
1993	0%	0%	0%	17%	0%	0%	10%	-14%	0%	3%	-	2,0%
1994	0%	0%	0%	80%	0%	0%	8%	-7%	0%	4%	-	12,8%
1995	0%	0%	0%	82%	0%	0%	7%	-10%	0%	4%	-	13,0%
1996	0%	0%	0%	90%	0%	0%	6%	-11%	0%	4%	-	14,6%
1997	0%	0%	0%	113%	0%	0%	7%	-10%	0%	4%	-	21,7%
1998	0%	0%	0%	111%	0%	0%	7%	-9%	0%	4%	-	21,0%
1999	0%	0%	0%	112%	0%	0%	7%	-10%	0%	4%	-	22,7%
2000	0%	0%	0%	105%	-	0%	36%	-8%	0%	5%	-	25,2%
2001	0%	0%	0%	93%	-	0%	25%	-8%	0%	5%	-	18,8%
2002	0%	0%	0%	116%	-	0%	27%	-10%	0%	5%	-	32,1%
2003	0%	0%	0%	128%	-	0%	30%	-10%	0%	5%	-	40,7%
2004	0%	0%	0%	131%	-	0%	24%	-11%	0%	6%	-	46,9%
2005	0%	0%	0%	128%	-	0%	18%	-12%	0%	6%	-	42,2%
2006	0%	0%	0%	122%	-	0%	14%	-12%	0%	6%	-	41%
2007	0%	0%	0%	119%	-	0%	9%	-13%	0%	5%	-	41%
2008	0%	0%	0%	141%	-	0%	9%	-14%	0%	5%	-	54,4%
2009	0%	0%	0%	121%	-	0%	7%	-19%	0%	5%	-	41,0%
2010	0%	0%	0%	85%	-	0%	5%	-17%	0%	2%	-	24,9%
2011	0%	0%	0%	105%	-	0%	1%	-18%	0%	3%	-	32,3%
2012	0%	0%	0%	121%	-	0%	0%	-19%	0%	3%	-	35,4%
2013	0%	0%	0%	191%	-	0%	0%	-23%	0%	3%	-	49,4%
2014	0%	0%	0%	124%	-	0%	-1%	-27%	0%	3%	-	37,5%
2015	0%	0%	0%	112%	-	0%	-1%	-28%	0%	0%	-	31,5%
2016	0%	0%	0%	123%	-	0%	-1%	-30%	0%	1%	-	34,4%
2017	0%	0%	0%	105%	-	0%	-1%	-33%	0%	1%	-	31,8%
2018	10%	-2%	0%	128%	-	0%	0%	-35%	0%	-1%	-	39%

Pollutant	$PM_{2.5}$											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	24%	0%	0%	11%	-7%	0%	-34%	-	0,1%
1991	0%	0%	0%	23%	0%	0%	14%	-8%	0%	-35%	-	-0,1%
1992	0%	0%	0%	7%	0%	0%	13%	-15%	0%	-37%	-	-0,5%
1993	0%	0%	0%	6%	0%	0%	13%	-15%	0%	-37%	-	-0,4%
1994	0%	0%	0%	45%	0%	0%	11%	-7%	0%	-38%	-	0,7%
1995	0%	0%	0%	48%	0%	0%	9%	-10%	0%	-39%	-	0,7%
1996	0%	0%	0%	57%	0%	0%	8%	-12%	0%	-38%	-	0,9%
1997	0%	0%	0%	82%	0%	0%	9%	-11%	0%	-38%	-	1,8%
1998	0%	0%	0%	82%	0%	0%	9%	-9%	0%	-37%	-	1,8%
1999	0%	0%	0%	76%	0%	0%	9%	-10%	0%	-38%	-	2,0%
2000	0%	0%	0%	65%	-	0%	48%	-9%	0%	-45%	-	4,1%
2001	0%	0%	0%	55%	-	0%	33%	-9%	0%	-43%	-	2,6%
2002	0%	0%	0%	93%	-	0%	36%	-10%	0%	-45%	-	4,4%
2003	0%	0%	0%	121%	-	0%	39%	-10%	0%	-44%	-	5,9%
2004	0%	0%	0%	127%	-	0%	32%	-11%	0%	-47%	-	6,5%
2005	0%	0%	0%	119%	-	0%	24%	-12%	0%	-43%	-	5,4%
2006	0%	0%	0%	112%	-	0%	19%	-13%	0%	-44%	-	5,1%
2007	0%	0%	0%	105%	-	0%	12%	-14%	0%	-44%	-	4,9%
2008	0%	0%	0%	138%	-	0%	12%	-15%	0%	-42%	-	6,6%
2009	0%	0%	0%	111%	-	0%	9%	-20%	0%	-44%	-	4,5%
2010	0%	0%	0%	78%	-	0%	7%	-17%	0%	-44%	-	2,6%
2011	0%	0%	0%	98%	-	0%	2%	-19%	0%	-45%	-	3,1%
2012	0%	0%	0%	103%	-	0%	-1%	-20%	0%	-43%	-	3,2%
2013	0%	0%	0%	131%	-	0%	-1%	-24%	0%	-43%	-	4,0%
2014	0%	0%	0%	99%	-	0%	-2%	-28%	0%	-43%	-	3,2%
2015	0%	0%	0%	92%	-	0%	-2%	-29%	0%	-42%	-	2,6%
2016	0%	0%	0%	99%	-	0%	-2%	-31%	0%	-43%	-	2,9%
2017	0%	0%	0%	87%	-	0%	-1%	-34%	0%	-46%	-	2,8%
2018	3%	-2%	0%	113%	-	0%	-1%	-37%	0%	-43%	-	1,9%

Pollutant	PM_{10}											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	28%	0%	0%	9%	-7%	0%	-19%	-	-0,7%
1991	0%	0%	0%	28%	0%	0%	12%	-8%	0%	-19%	-	-1,3%
1992	0%	0%	0%	9%	0%	0%	11%	-15%	0%	-21%	-	-2,3%
1993	0%	0%	0%	7%	0%	0%	11%	-14%	0%	-20%	-	-2,2%
1994	0%	0%	0%	46%	0%	0%	9%	-7%	0%	-20%	-	0,8%
1995	0%	0%	0%	48%	0%	0%	8%	-10%	0%	-21%	-	1,0%
1996	0%	0%	0%	55%	0%	0%	7%	-11%	0%	-18%	-	1,8%
1997	0%	0%	0%	78%	0%	0%	8%	-10%	0%	-18%	-	4,0%
1998	0%	0%	0%	75%	0%	0%	8%	-9%	0%	-17%	-	4,0%
1999	0%	0%	0%	74%	0%	0%	8%	-10%	0%	-17%	-	4,4%
2000	0%	0%	0%	66%	-	0%	41%	-8%	0%	-28%	-	6,1%
2001	0%	0%	0%	54%	-	0%	29%	-8%	0%	-27%	-	3,8%
2002	0%	0%	0%	80%	-	0%	31%	-10%	0%	-28%	-	8,3%
2003	0%	0%	0%	95%	-	0%	34%	-10%	0%	-28%	-	12,0%
2004	0%	0%	0%	100%	-	0%	28%	-11%	0%	-29%	-	14,2%
2005	0%	0%	0%	96%	-	0%	21%	-12%	0%	-26%	-	12,3%
2006	0%	0%	0%	89%	-	0%	17%	-13%	0%	-27%	-	11,7%
2007	0%	0%	0%	85%	-	0%	10%	-14%	0%	-27%	-	11,5%
2008	0%	0%	0%	105%	-	0%	10%	-15%	0%	-25%	-	16,6%
2009	0%	0%	0%	88%	-	0%	8%	-19%	0%	-27%	-	11,2%
2010	0%	0%	0%	63%	-	0%	6%	-17%	0%	-27%	-	5,7%
2011	0%	0%	0%	80%	-	0%	2%	-18%	0%	-27%	-	8,0%
2012	0%	0%	0%	90%	-	0%	0%	-19%	0%	-25%	-	8,8%
2013	0%	0%	0%	130%	-	0%	-1%	-23%	0%	-23%	-	12,4%
2014	0%	0%	0%	90%	-	0%	-1%	-27%	0%	-24%	-	9,1%
2015	0%	0%	0%	81%	-	0%	-1%	-28%	0%	-24%	-	7,3%
2016	0%	0%	0%	88%	-	0%	-1%	-30%	0%	-24%	-	8,0%
2017	0%	0%	0%	75%	-	0%	-1%	-33%	0%	-26%	-	7,3%
2018	6%	-2%	0%	95%	-	0%	-1%	-35%	0%	-25%	-	9%

Pollutant	Cd											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-36%	0%	0%	52%	-	-0,1%
1991	0%	0%	0%	0%	-	0%	-41%	0%	0%	64%	-	-0,1%
1992	0%	0%	0%	0%	-	0%	-34%	0%	0%	73%	-	-0,1%
1993	0%	0%	0%	0%	-	0%	-29%	0%	0%	70%	-	0,0%
1994	0%	0%	0%	0%	-	0%	-27%	0%	0%	78%	-	-0,1%
1995	0%	0%	0%	0%	-	0%	-31%	0%	0%	72%	-	-0,1%
1996	0%	0%	0%	0%	-	0%	-38%	0%	0%	88%	-	-0,1%
1997	0%	0%	0%	0%	-	0%	-42%	0%	0%	93%	-	-0,2%
1998	0%	0%	0%	0%	-	0%	-37%	0%	0%	70%	-	-0,1%
1999	0%	0%	0%	0%	-	0%	-37%	0%	0%	99%	-	-0,1%
2000	0%	0%	0%	0%	-	0%	-41%	0%	0%	61%	-	-0,2%
2001	0%	0%	0%	0%	-	0%	-43%	0%	0%	86%	-	-0,2%
2002	0%	0%	0%	0%	-	0%	-40%	0%	0%	91%	-	-0,2%
2003	0%	0%	0%	0%	-	0%	-38%	0%	0%	91%	-	-0,2%
2004	0%	0%	0%	0%	-	0%	-40%	0%	0%	93%	-	-0,2%
2005	0%	0%	0%	0%	-	0%	-40%	0%	0%	129%	-	-0,2%
2006	0%	0%	0%	0%	-	0%	-38%	0%	0%	87%	-	-0,2%
2007	0%	0%	0%	0%	-	0%	-36%	0%	0%	71%	-	-0,2%
2008	0%	0%	0%	0%	-	0%	-38%	0%	0%	113%	-	-0,2%
2009	0%	0%	0%	0%	-	0%	-37%	0%	0%	96%	-	-0,2%
2010	0%	0%	0%	0%	-	0%	-37%	0%	0%	114%	-	-0,2%
2011	0%	0%	0%	0%	-	0%	-36%	0%	0%	86%	-	-0,2%
2012	0%	0%	0%	0%	-	0%	-34%	0%	0%	57%	-	-0,2%
2013	0%	0%	0%	0%	-	0%	-31%	0%	0%	84%	-	-0,1%
2014	0%	0%	0%	0%	-	0%	-34%	0%	0%	117%	-	-0,2%
2015	0%	0%	0%	0%	-	0%	-31%	0%	0%	82%	-	-0,1%
2016	0%	0%	0%	0%	-	0%	-30%	0%	0%	81%	-	-0,1%
2017	0%	0%	0%	0%	-	0%	-27%	0%	0%	74%	-	-0,1%
2018	2%	-4%	0%	0%	-	0%	-26%	0%	0%	97%	-	-3%

Pollutant	Hg											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	0%	0%	98%	0%	0%	52%	-	0,8%
1991	0%	0%	0%	0%	0%	0%	97%	0%	0%	64%	-	0,6%
1992	0%	0%	0%	0%	0%	0%	98%	0%	0%	73%	-	0,5%
1993	0%	0%	0%	0%	0%	0%	98%	0%	0%	70%	-	1,9%
1994	0%	0%	0%	0%	0%	0%	98%	0%	0%	78%	-	2,3%
1995	0%	0%	0%	0%	0%	0%	98%	0%	0%	72%	-	2,5%
1996	0%	0%	0%	0%	0%	0%	98%	0%	0%	88%	-	2,8%
1997	0%	0%	0%	0%	0%	0%	98%	0%	0%	93%	-	2,6%
1998	0%	0%	0%	0%	0%	0%	98%	0%	0%	70%	-	2,6%
1999	0%	0%	0%	0%	0%	0%	98%	0%	0%	99%	-	2,6%
2000	0%	0%	0%	0%	0%	0%	97%	0%	0%	61%	-	2,0%
2001	0%	0%	0%	0%	0%	0%	98%	0%	0%	86%	-	2,0%
2002	0%	0%	0%	0%	0%	0%	97%	0%	0%	91%	-	1,9%
2003	0%	0%	0%	0%	0%	0%	97%	0%	0%	91%	-	1,9%
2004	0%	0%	0%	0%	0%	0%	97%	0%	0%	93%	-	1,9%
2005	0%	0%	0%	0%	0%	0%	97%	0%	0%	129%	-	1,9%
2006	0%	0%	0%	0%	0%	0%	97%	0%	0%	87%	-	2,1%
2007	0%	0%	0%	0%	0%	0%	97%	0%	0%	71%	-	2,0%
2008	0%	0%	0%	0%	0%	0%	97%	0%	0%	113%	-	2,1%
2009	0%	0%	0%	0%	0%	0%	96%	0%	0%	96%	-	2,3%
2010	0%	0%	0%	0%	0%	0%	96%	0%	0%	114%	-	2,1%
2011	0%	0%	0%	0%	0%	0%	96%	0%	0%	86%	-	2,2%
2012	0%	0%	0%	0%	0%	0%	85%	0%	0%	57%	-	2,0%
2013	0%	0%	0%	0%	0%	0%	94%	0%	0%	84%	-	2,1%
2014	0%	0%	0%	0%	0%	0%	94%	0%	0%	117%	-	2,1%
2015	0%	0%	0%	0%	0%	0%	95%	0%	0%	82%	-	2,2%
2016	0%	0%	0%	0%	0%	0%	97%	0%	0%	81%	-	2,3%
2017	0%	0%	0%	0%	0%	0%	97%	0%	0%	74%	-	2,8%
2018	16%	-3%	0%	0%	0%	0%	85%	0%	0%	97%	-	6,6%

Pollutant	Pb										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-2%	0%	0%	52%	-	-1,5%
1991	0%	0%	0%	0%	-	0%	-2%	0%	0%	64%	-	-1,7%
1992	0%	0%	0%	0%	-	0%	-2%	0%	0%	73%	-	-1,9%
1993	0%	0%	0%	0%	-	0%	-1%	0%	0%	70%	-	-1,3%
1994	0%	0%	0%	0%	-	0%	-2%	0%	0%	78%	-	-1,6%
1995	0%	0%	0%	0%	-	0%	-1%	0%	0%	72%	-	-1,3%
1996	0%	0%	0%	0%	-	0%	-1%	0%	0%	88%	-	-1,3%
1997	0%	0%	0%	0%	-	0%	-1%	0%	0%	93%	-	-1,3%
1998	0%	0%	0%	0%	-	0%	-1%	0%	0%	70%	-	-1,4%
1999	0%	0%	0%	0%	-	0%	-1%	0%	0%	99%	-	-1,1%
2000	0%	0%	0%	0%	-	0%	-1%	0%	0%	61%	-	-1,3%
2001	0%	0%	0%	0%	-	0%	-1%	0%	0%	86%	-	-0,8%
2002	0%	0%	0%	0%	-	0%	-1%	0%	0%	91%	-	-0,9%
2003	0%	0%	0%	0%	-	0%	-1%	0%	0%	91%	-	-0,7%
2004	0%	0%	0%	0%	-	0%	-1%	0%	0%	93%	-	-0,6%
2005	0%	0%	0%	0%	-	0%	-1%	0%	0%	129%	-	-0,6%
2006	0%	0%	0%	0%	-	0%	-1%	0%	0%	87%	-	-0,5%
2007	0%	0%	0%	0%	-	0%	-1%	0%	0%	71%	-	-0,6%
2008	0%	0%	0%	0%	-	0%	-1%	0%	0%	113%	-	-0,6%
2009	0%	0%	0%	0%	-	0%	-1%	0%	0%	96%	-	-0,7%
2010	0%	0%	0%	0%	-	0%	-1%	0%	0%	114%	-	-0,6%
2011	0%	0%	0%	0%	-	0%	-1%	0%	0%	86%	-	-0,6%
2012	0%	0%	0%	0%	-	0%	-6%	0%	0%	57%	-	-3,6%
2013	0%	0%	0%	0%	-	0%	-2%	0%	0%	84%	-	-0,8%
2014	0%	0%	0%	0%	-	0%	-2%	0%	0%	117%	-	-0,8%
2015	0%	0%	0%	0%	-	0%	-2%	0%	0%	82%	-	-0,8%
2016	0%	0%	0%	0%	-	0%	-1%	0%	0%	81%	-	-0,6%
2017	0%	0%	0%	0%	-	0%	-1%	0%	0%	74%	-	-0,7%
2018	7%	-4%	0%	0%	-	0%	-7%	0%	0%	97%	-	-4%

Pollutant	PCDD/PCDF											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-18%	0%	0%	52%	-	0,4%
1991	0%	0%	0%	0%	-	0%	-23%	0%	0%	64%	-	0,5%
1992	0%	0%	0%	0%	-	0%	-27%	0%	0%	73%	-	0,2%
1993	0%	0%	0%	0%	-	0%	-29%	0%	0%	70%	-	0,2%
1994	0%	0%	0%	0%	-	0%	-29%	0%	0%	78%	-	0,2%
1995	0%	0%	0%	0%	-	0%	-35%	0%	0%	72%	-	0,1%
1996	0%	0%	0%	0%	-	0%	-32%	0%	0%	88%	-	0,1%
1997	0%	0%	0%	0%	-	0%	-32%	0%	0%	93%	-	0,2%
1998	0%	0%	0%	0%	-	0%	-30%	0%	0%	70%	-	0,1%
1999	0%	0%	0%	0%	-	0%	-28%	0%	0%	99%	-	0,2%
2000	0%	0%	0%	0%	-	0%	-29%	0%	0%	61%	-	-0,1%
2001	0%	0%	0%	0%	-	0%	-29%	0%	0%	86%	-	0,1%
2002	0%	0%	0%	0%	-	0%	-26%	0%	0%	91%	-	0,2%
2003	0%	0%	0%	0%	-	0%	-25%	0%	0%	91%	-	-0,1%
2004	0%	0%	0%	0%	-	0%	-23%	0%	0%	93%	-	0,2%
2005	0%	0%	0%	0%	-	0%	-22%	0%	0%	129%	-	0,2%
2006	0%	0%	0%	0%	-	0%	-20%	0%	0%	87%	-	0,2%
2007	0%	0%	0%	0%	-	0%	-17%	0%	0%	71%	-	0,0%
2008	0%	0%	0%	0%	-	0%	-16%	0%	0%	113%	-	0,5%
2009	0%	0%	0%	0%	-	0%	-14%	0%	0%	96%	-	0,4%
2010	0%	0%	0%	0%	-	0%	-12%	0%	0%	114%	-	0,5%
2011	0%	0%	0%	0%	-	0%	-11%	0%	0%	86%	-	0,4%
2012	0%	0%	0%	0%	-	0%	-9%	0%	0%	57%	-	0,3%
2013	0%	0%	0%	0%	-	0%	-7%	0%	0%	84%	-	0,6%
2014	0%	0%	0%	0%	-	0%	-7%	0%	0%	117%	-	0,8%
2015	0%	0%	0%	0%	-	0%	-6%	0%	0%	82%	-	0,6%
2016	0%	0%	0%	0%	-	0%	-5%	0%	0%	81%	-	0,9%
2017	0%	0%	0%	0%	-	0%	-5%	0%	0%	74%	-	0,7%
2018	0%	-3%	0%	0%	-	0%	-4%	0%	0%	97%	-	-1%

Pollutant	PCB											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-7%	0%	0%	-	-	-1,50E-08
1991	0%	0%	0%	0%	-	0%	-9%	0%	0%	-	-	-1,70E-08
1992	0%	0%	0%	0%	-	0%	-11%	0%	0%	-	-	-2,00E-08
1993	0%	0%	0%	0%	-	0%	-13%	0%	0%	-	-	-6,89E-08
1994	0%	0%	0%	0%	-	0%	-13%	0%	0%	-	-	-2,52E-08
1995	0%	0%	0%	0%	-	0%	-16%	0%	0%	-	-	-3,31E-08
1996	0%	0%	0%	0%	-	0%	-13%	0%	0%	-	-	-3,19E-08
1997	0%	0%	0%	0%	-	0%	-12%	0%	0%	-	-	-3,24E-08
1998	0%	0%	0%	0%	-	0%	-10%	0%	0%	-	-	-2,94E-08
1999	0%	0%	0%	0%	-	0%	-9%	0%	0%	-	-	-2,55E-08
2000	0%	0%	0%	0%	-	0%	-9%	0%	0%	-	-	-2,98E-08
2001	0%	0%	0%	0%	-	0%	-9%	0%	0%	-	-	-2,82E-08
2002	0%	0%	0%	0%	-	0%	-7%	0%	0%	-	-	-2,36E-08
2003	0%	0%	0%	0%	-	0%	-4%	0%	0%	-	-	-1,45E-08
2004	0%	0%	0%	0%	-	0%	0%	0%	0%	-	-	-1,32E-09
2005	0%	0%	0%	0%	-	0%	3%	0%	0%	-	-	1,06E-08
2006	0%	0%	0%	0%	-	0%	6%	0%	0%	-	-	2,57E-08
2007	0%	0%	0%	0%	-	0%	10%	0%	0%	-	-	4,47E-08
2008	0%	0%	0%	0%	-	0%	11%	0%	0%	-	-	4,76E-08
2009	0%	0%	0%	0%	-	0%	12%	0%	0%	-	-	5,18E-08
2010	0%	0%	0%	0%	-	0%	13%	0%	0%	-	-	5,47E-08
2011	0%	0%	0%	0%	-	0,0%	13%	0%	0%	-	-	5,17E-08
2012	0%	0%	0%	0%	-	0,0%	12%	0%	0%	-	-	5,03E-08
2013	0%	0%	0%	0%	-	0,0%	8%	0%	0%	-	-	3,10E-08
2014	0%	0%	0%	0%	-	0,0%	9%	0%	0%	-	0%	3,50E-08
2015	0%	0%	0%	0%	-	0,0%	8%	0%	0%	-	0%	3,31E-08
2016	0%	0%	0%	-	-	0,0%	5%	0%	0%	-	0%	2,28E-08
2017	0%	0%	0%	0%	-	0,0%	2%	0%	0%	-	0%	8,50E-09
2018	0%	0%	0%	0%	-	0%	-4%	0%	0%	-	0%	-1,46E-07

Pollutant	PAUs											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	165%	0%	0%	52%	-	0,50%
1991	0%	0%	0%	0%	-	0%	165%	0%	0%	64%	-	0,39%
1992	0%	0%	0%	0%	-	0%	159%	0%	0%	73%	-	0,46%
1993	0%	0%	0%	0%	-	0%	153%	0%	0%	70%	-	0,48%
1994	0%	0%	0%	0%	-	0%	153%	0%	0%	78%	-	0,57%
1995	0%	0%	0%	0%	-	0%	147%	0%	0%	72%	-	0,58%
1996	0%	0%	0%	0%	-	0%	149%	0%	0%	88%	-	0,57%
1997	0%	0%	0%	0%	-	0%	149%	0%	0%	93%	-	0,69%
1998	0%	0%	0%	0%	-	0%	153%	0%	0%	70%	-	0,72%
1999	0%	0%	0%	0%	-	0%	153%	0%	0%	99%	-	0,79%
2000	0%	0%	0%	0%	-	0%	154%	0%	0%	61%	-	0,89%
2001	0%	0%	0%	0%	-	0%	139%	0%	0%	86%	-	0,76%
2002	0%	0%	0%	0%	-	0%	142%	0%	0%	91%	-	0,86%
2003	0%	0%	0%	0%	-	0%	135%	0%	0%	91%	-	0,82%
2004	0%	0%	0%	0%	-	0%	132%	0%	0%	93%	-	0,86%
2005	0%	0%	0%	0%	-	0%	130%	0%	0%	129%	-	0,85%
2006	0%	0%	0%	0%	-	0%	127%	0%	0%	87%	-	0,99%
2007	0%	0%	0,0%	0%	-	0%	125%	0%	0%	71%	-	1,11%
2008	0%	0%	0,0%	0%	-	0%	126%	0%	0%	113%	-	1,09%
2009	0%	0%	0,0%	0%	-	0%	126%	0%	0%	96%	-	1,07%
2010	0%	0%	0,0%	0%	-	0%	126%	0%	0%	114%	-	0,96%
2011	0%	0%	0,0%	0%	-	0%	125%	0%	0%	86%	-	0,98%
2012	0%	0%	0,0%	0%	-	0%	123%	0%	0%	57%	-	0,97%
2013	0%	0%	0,0%	0%	-	0%	125%	0%	0%	84%	-	1,02%
2014	0%	0%	0,0%	0%	-	0%	120%	0%	0%	117%	-	1,15%
2015	0%	0%	0,0%	0%	-	0%	117%	0%	0%	82%	-	1,08%
2016	0%	0%	0,0%	0%	-	0%	114%	0%	0%	81%	-	1,17%
2017	0%	0%	0,0%	0%	-	0%	115%	0%	0%	74%	-	1,32%
2018	0%	-2%	0%	0%	-	0%	116%	0%	0%	97%	-	-0,95%

Pollutant	As											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	2244%	0%	0%	52%	-	0,1%
1991	0%	0%	0%	0%	-	0%	2251%	0%	0%	64%	-	0,1%
1992	0%	0%	0%	0%	-	0%	2453%	0%	0%	73%	-	0,5%
1993	0%	0%	0%	0%	-	0%	2643%	0%	0%	70%	-	0,6%
1994	0%	0%	0%	0%	-	0%	2575%	0%	0%	78%	-	0,3%
1995	0%	0%	0%	0%	-	0%	2495%	0%	0%	72%	-	0,4%
1996	0%	0%	0%	0%	-	0%	2503%	0%	0%	88%	-	0,6%
1997	0%	0%	0%	0%	-	0%	2557%	0%	0%	93%	-	0,6%
1998	0%	0%	0%	0%	-	0%	2468%	0%	0%	70%	-	0,5%
1999	0%	0%	0%	0%	-	0%	2516%	0%	0%	99%	-	0,5%
2000	0%	0%	0%	0%	-	0%	2500%	0%	0%	61%	-	0,7%
2001	0%	0%	0%	0%	-	0%	2274%	0%	0%	86%	-	0,5%
2002	0%	0%	0%	0%	-	0%	2433%	0%	0%	91%	-	0,6%
2003	0%	0%	0%	0%	-	0%	2543%	0%	0%	91%	-	0,5%
2004	0%	0%	0%	0%	-	0%	2650%	0%	0%	93%	-	0,7%
2005	0%	0%	0%	0%	-	0%	2707%	0%	0%	129%	-	0,7%
2006	0%	0%	0%	0%	-	0%	2811%	0%	0%	87%	-	0,7%
2007	0%	0%	0%	0%	-	0%	2864%	0%	0%	71%	-	0,8%
2008	0%	0%	0%	0%	-	0%	2888%	0%	0%	113%	-	0,9%
2009	0%	0%	0%	0%	-	0%	2910%	0%	0%	96%	-	0,9%
2010	0%	0%	0%	0%	-	0%	2928%	0%	0%	114%	-	1,1%
2011	0%	0%	0%	0%	-	0%	2910%	0%	0%	86%	-	1,4%
2012	0%	0%	0%	0%	-	0%	2894%	0%	0%	57%	-	1,4%
2013	0%	0%	0%	0%	-	0%	3142%	0%	0%	84%	-	1,9%
2014	0%	0%	0%	0%	-	0%	3176%	0%	0%	117%	-	2,4%
2015	0%	0%	0%	0%	-	0%	3231%	0%	0%	82%	-	1,9%
2016	0%	0%	0%	0%	-	0%	3254%	0%	0%	81%	-	2,3%
2017	0%	0%	0%	0%	-	0%	3479%	0%	0%	74%	-	2,0%
2018	0%	-3%	0%	0%	-	0%	3421%	0%	0%	97%	-	1,7%

Pollutant	Cr											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-3%	0%	0%	52%	-	-0,1%
1991	0%	0%	0%	0%	-	0%	-4%	0%	0%	64%	-	-0,1%
1992	0%	0%	0%	0%	-	0%	-3%	0%	0%	73%	-	-0,1%
1993	0%	0%	0%	0%	-	0%	-2%	0%	0%	70%	-	-0,1%
1994	0%	0%	0%	0%	-	0%	-2%	0%	0%	78%	-	-0,1%
1995	0%	0%	0%	0%	-	0%	-2%	0%	0%	72%	-	-0,1%
1996	0%	0%	0%	0%	-	0%	-3%	0%	0%	88%	-	-0,2%
1997	0%	0%	0%	0%	-	0%	-4%	0%	0%	93%	-	-0,2%
1998	0%	0%	0%	0%	-	0%	-3%	0%	0%	70%	-	-0,2%
1999	0%	0%	0%	0%	-	0%	-3%	0%	0%	99%	-	-0,2%
2000	0%	0%	0%	0%	-	0%	-4%	0%	0%	61%	-	-0,3%
2001	0%	0%	0%	0%	-	0%	-4%	0%	0%	86%	-	-0,3%
2002	0%	0%	0%	0%	-	0%	-4%	0%	0%	91%	-	-0,2%
2003	0%	0%	0%	0%	-	0%	-3%	0%	0%	91%	-	-0,2%
2004	0%	0%	0%	0%	-	0%	-4%	0%	0%	93%	-	-0,3%
2005	0%	0%	0%	0%	-	0%	-3%	0%	0%	129%	-	-0,3%
2006	0%	0%	0%	0%	-	0%	-3%	0%	0%	87%	-	-0,3%
2007	0%	0%	0%	0%	-	0%	-3%	0%	0%	71%	-	-0,3%
2008	0%	0%	0%	0%	-	0%	-3%	0%	0%	113%	-	-0,3%
2009	0%	0%	0%	0%	-	0%	-3%	0%	0%	96%	-	-0,3%
2010	0%	0%	0%	0%	-	0%	-3%	0%	0%	114%	-	-0,4%
2011	0%	0%	0%	0%	-	0%	-3%	0%	0%	86%	-	-0,4%
2012	0%	0%	0%	0%	-	0%	-3%	0%	0%	57%	-	-0,4%
2013	0%	0%	0%	0%	-	0%	-3%	0%	0%	84%	-	-0,4%
2014	0%	0%	0%	0%	-	0%	-3%	0%	0%	117%	-	-0,4%
2015	0%	0%	0%	0%	-	0%	-3%	0%	0%	82%	-	-0,4%
2016	0%	0%	0%	0%	-	0%	-2%	0%	0%	81%	-	-0,4%
2017	0%	0%	0%	0%	-	0%	-2%	0%	0%	74%	-	-0,3%
2018	0%	-4%	0%	0%	-	0%	-2%	0%	0%	97%	-	-2,6%

Pollutant	Cu										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-5%	0%	0%	52%	-	-3,2%
1991	0%	0%	0%	0%	-	0%	-7%	0%	0%	64%	-	-3,9%
1992	0%	0%	0%	0%	-	0%	-5%	0%	0%	73%	-	-3,0%
1993	0%	0%	0%	0%	-	0%	-4%	0%	0%	70%	-	-2,5%
1994	0%	0%	0%	0%	-	0%	-4%	0%	0%	78%	-	-2,1%
1995	0%	0%	0%	0%	-	0%	-4%	0%	0%	72%	-	-2,7%
1996	0%	0%	0%	0%	-	0%	-6%	0%	0%	88%	-	-3,6%
1997	0%	0%	0%	0%	-	0%	-7%	0%	0%	93%	-	-4,5%
1998	0%	0%	0%	0%	-	0%	-6%	0%	0%	70%	-	-3,6%
1999	0%	0%	0%	0%	-	0%	-6%	0%	0%	99%	-	-3,7%
2000	0%	0%	0%	0%	-	0%	-7%	0%	0%	61%	-	-4,7%
2001	0%	0%	0%	0%	-	0%	-7%	0%	0%	86%	-	-4,6%
2002	0%	0%	0%	0%	-	0%	-6%	0%	0%	91%	-	-3,1%
2003	0%	0%	0%	0%	-	0%	-6%	0%	0%	91%	-	-2,5%
2004	0%	0%	0%	0%	-	0%	-6%	0%	0%	93%	-	-3,6%
2005	0%	0%	0%	0%	-	0%	-6%	0%	0%	129%	-	-4,1%
2006	0%	0%	0%	0%	-	0%	-6%	0%	0%	87%	-	-4,0%
2007	0%	0%	0%	0%	-	0%	-5%	0%	0%	71%	-	-3,8%
2008	0%	0%	0%	0%	-	0%	-6%	0%	0%	113%	-	-4,3%
2009	0%	0%	0%	0%	-	0%	-6%	0%	0%	96%	-	-4,3%
2010	0%	0%	0%	0%	-	0%	-6%	0%	0%	114%	-	-4,4%
2011	0%	0%	0%	0%	-	0%	-5%	0%	0%	86%	-	-4,3%
2012	0%	0%	0%	0%	-	0%	-5%	0%	0%	57%	-	-4,0%
2013	0%	0%	0%	0%	-	0%	-4%	0%	0%	84%	-	-3,3%
2014	0%	0%	0%	0%	-	0%	-5%	0%	0%	117%	-	-3,9%
2015	0%	0%	0%	0%	-	0%	-4%	0%	0%	82%	-	-3,4%
2016	0%	0%	0%	0%	-	0%	-4%	0%	0%	81%	-	-3,2%
2017	0%	0%	0%	0%	-	0%	-3%	0%	0%	74%	-	-2,8%
2018	0%	-4%	0%	0%	-	0%	-3%	0%	0%	97%	-	-2,7%

Pollutant	Ni										
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-24%	0%	0%	52%	-	-0,1%
1991	0%	0%	0%	0%	-	0%	-28%	0%	0%	64%	-	-0,1%
1992	0%	0%	0%	0%	-	0%	-22%	0%	0%	73%	-	-0,1%
1993	0%	0%	0%	0%	-	0%	-19%	0%	0%	70%	-	0,0%
1994	0%	0%	0%	0%	-	0%	-17%	0%	0%	78%	-	-0,1%
1995	0%	0%	0%	0%	-	0%	-20%	0%	0%	72%	-	-0,1%
1996	0%	0%	0%	0%	-	0%	-25%	0%	0%	88%	-	-0,1%
1997	0%	0%	0%	0%	-	0%	-29%	0%	0%	93%	-	-0,1%
1998	0%	0%	0%	0%	-	0%	-24%	0%	0%	70%	-	-0,1%
1999	0%	0%	0%	0%	-	0%	-25%	0%	0%	99%	-	-0,1%
2000	0%	0%	0%	0%	-	0%	-28%	0%	0%	61%	-	-0,1%
2001	0%	0%	0%	0%	-	0%	-30%	0%	0%	86%	-	-0,1%
2002	0%	0%	0%	0%	-	0%	-27%	0%	0%	91%	-	-0,1%
2003	0%	0%	0%	0%	-	0%	-25%	0%	0%	91%	-	-0,1%
2004	0%	0%	0%	0%	-	0%	-27%	0%	0%	93%	-	-0,1%
2005	0%	0%	0%	0%	-	0%	-27%	0%	0%	129%	-	-0,1%
2006	0%	0%	0%	0%	-	0%	-25%	0%	0%	87%	-	-0,1%
2007	0%	0%	0%	0%	-	0%	-24%	0%	0%	71%	-	-0,1%
2008	0%	0%	0%	0%	-	0%	-26%	0%	0%	113%	-	-0,2%
2009	0%	0%	0%	0%	-	0%	-25%	0%	0%	96%	-	-0,1%
2010	0%	0%	0%	0%	-	0%	-24%	0%	0%	114%	-	-0,2%
2011	0%	0%	0%	0%	-	0%	-24%	0%	0%	86%	-	-0,2%
2012	0%	0%	0%	0%	-	0%	-23%	0%	0%	57%	-	-0,2%
2013	0%	0%	0%	0%	-	0%	-20%	0%	0%	84%	-	-0,3%
2014	0%	0%	0%	0%	-	0%	-22%	0%	0%	117%	-	-0,3%
2015	0%	0%	0%	0%	-	0%	-20%	0%	0%	82%	-	-0,3%
2016	0%	0%	0%	0%	-	0%	-19%	0%	0%	81%	-	-0,3%
2017	0%	0%	0%	0%	-	0%	-17%	0%	0%	74%	-	-0,3%
2018	1%	-1%	0%	0%	-	0%	-16%	0%	0%	97%	-	0,3%

Pollutant	Se											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	-	-26%	0%	0%	52%	-	-0,3%
1991	0%	0%	0%	0%	-	-	-30%	0%	0%	64%	-	-0,4%
1992	0%	0%	0%	0%	-	-	-25%	0%	0%	73%	-	-0,3%
1993	0%	0%	0%	0%	-	-	-21%	0%	0%	70%	-	-0,3%
1994	0%	0%	0%	0%	-	-	-19%	0%	0%	78%	-	-0,2%
1995	0%	0%	0%	0%	-	-	-22%	0%	0%	72%	-	-0,3%
1996	0%	0%	0%	0%	-	-	-28%	0%	0%	88%	-	-0,5%
1997	0%	0%	0%	0%	-	-	-32%	0%	0%	93%	-	-0,7%
1998	0%	0%	0%	0%	-	-	-27%	0%	0%	70%	-	-0,5%
1999	0%	0%	0%	0%	-	-	-27%	0%	0%	99%	-	-0,6%
2000	0%	0%	0%	0%	-	-	-31%	0%	0%	61%	-	-0,7%
2001	0%	0%	0%	0%	-	-	-32%	0%	0%	86%	-	-0,6%
2002	0%	0%	0%	0%	-	-	-29%	0%	0%	91%	-	-0,6%
2003	0%	0%	0%	0%	-	0%	-27%	0%	0%	91%	-	-0,5%
2004	0%	0%	0%	0%	-	0%	-29%	0%	0%	93%	-	-0,6%
2005	0%	0%	0%	0%	-	0%	-29%	0%	0%	129%	-	-0,6%
2006	0%	0%	0%	0%	-	0%	-27%	0%	0%	87%	-	-0,6%
2007	0%	0%	0%	0%	-	0%	-25%	0%	0%	71%	-	-0,6%
2008	0%	0%	0%	0%	-	0%	-27%	0%	0%	113%	-	-0,6%
2009	0%	0%	0%	0%	-	0%	-27%	0%	0%	96%	-	-0,6%
2010	0%	0%	0%	0%	-	0%	-26%	0%	0%	114%	-	-0,6%
2011	0%	0%	0%	0%	-	0%	-26%	0%	0%	86%	-	-0,6%
2012	0%	0%	0%	0%	-	0%	-24%	0%	0%	57%	-	-0,6%
2013	0%	0%	0%	0%	-	0%	-22%	0%	0%	84%	-	-0,5%
2014	0%	0%	0%	0%	-	0%	-24%	0%	0%	117%	-	-0,5%
2015	0%	0%	0%	0%	-	-	-22%	0%	0%	82%	-	-0,5%
2016	0%	0%	0%	0%	-	-	-21%	0%	0%	81%	-	-0,5%
2017	0%	0%	0%	0%	-	-	-18%	0%	0%	74%	-	-0,4%
2018	0%	-4%	0%	0%	-	-	-18%	0%	0%	97%	-	-0,6%

Pollutant	Zn											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	0%	-	0%	-8%	0%	0%	52%	-	-0,4%
1991	0%	0%	0%	0%	-	0%	-10%	0%	0%	64%	-	-0,4%
1992	0%	0%	0%	0%	-	0%	-8%	0%	0%	73%	-	-0,3%
1993	0%	0%	0%	0%	-	0%	-6%	0%	0%	70%	-	-0,3%
1994	0%	0%	0%	0%	-	0%	-6%	0%	0%	78%	-	-0,3%
1995	0%	0%	0%	0%	-	0%	-7%	0%	0%	72%	-	-0,3%
1996	0%	0%	0%	0%	-	0%	-9%	0%	0%	88%	-	-0,4%
1997	0%	0%	0%	0%	-	0%	-11%	0%	0%	93%	-	-0,6%
1998	0%	0%	0%	0%	-	0%	-9%	0%	0%	70%	-	-0,5%
1999	0%	0%	0%	0%	-	0%	-9%	0%	0%	99%	-	-0,6%
2000	0%	0%	0%	0%	-	0%	-10%	0%	0%	61%	-	-0,7%
2001	0%	0%	0%	0%	-	0%	-11%	0%	0%	86%	-	-0,7%
2002	0%	0%	0%	0%	-	0%	-10%	0%	0%	91%	-	-0,6%
2003	0%	0%	0%	0%	-	0%	-9%	0%	0%	91%	-	-0,5%
2004	0%	0%	0%	0%	-	0%	-10%	0%	0%	93%	-	-0,7%
2005	0%	0%	0%	0%	-	0%	-9%	0%	0%	129%	-	-0,7%
2006	0%	0%	0%	0%	-	0%	-9%	0%	0%	87%	-	-0,7%
2007	0%	0%	0%	0%	-	0%	-8%	0%	0%	71%	-	-0,7%
2008	0%	0%	0%	0%	-	0%	-9%	0%	0%	113%	-	-0,7%
2009	0%	0%	0%	0%	-	0%	-8%	0%	0%	96%	-	-0,7%
2010	0%	0%	0%	0%	-	0%	-8%	0%	0%	114%	-	-0,6%
2011	0%	0%	0%	0%	-	0%	-8%	0%	0%	86%	-	-0,6%
2012	0%	0%	0%	0%	-	0%	-8%	0%	0%	57%	-	-0,6%
2013	0%	0%	0%	0%	-	0%	-7%	0%	0%	84%	-	-0,5%
2014	0%	0%	0%	0%	-	0%	-8%	0%	0%	117%	-	-0,6%
2015	0%	0%	0%	0%	-	0%	-7%	0%	0%	82%	-	-0,5%
2016	0%	0%	0%	0%	-	0%	-6%	0%	0%	81%	-	-0,5%
2017	0%	0%	0%	0%	-	0%	-5%	0%	0%	74%	-	-0,5%
2018	0%	-4%	0%	0%	-	0%	-5%	0%	0%	97%	-	-3,5%

Pollutant	HCB											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
1991	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
1992	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
1993	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
1994	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
1995	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
1996	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
1997	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
1998	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
1999	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2000	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2001	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2002	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2003	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2004	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2005	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2006	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2007	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2008	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2009	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2010	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2011	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2012	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2013	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2014	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2015	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2016	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2017	0%	0%	0%	-	-	-	0%	0%	0%	0%	-	0,0%
2018	0%	-4%	0%	-	-	-	0%	0%	0%	0%	-	-1,7%

Pollutant	BC											
SNAP sector	01	02	03	04	05	06	07	08	09	10	11	TOTAL
1990	0%	0%	0%	35%	-	0%	-1%	0%	0%	52%	-	0,3%
1991	0%	0%	0%	32%	-	0%	3%	0%	0%	64%	-	0,5%
1992	0%	0%	0%	11%	-	0%	0%	0%	0%	73%	-	0,1%
1993	0%	0%	0%	10%	-	0%	0%	0%	0%	70%	-	0,0%
1994	0%	0%	0%	83%	-	0%	-3%	0%	0%	78%	-	0,2%
1995	0%	0%	0%	135%	-	0%	-5%	0%	0%	72%	-	-0,2%
1996	0%	0%	0%	153%	-	0%	-6%	0%	0%	88%	-	-0,3%
1997	0%	0%	0%	185%	-	0%	-5%	0%	0%	93%	-	0,1%
1998	0%	0%	0%	195%	-	0%	-4%	0%	0%	70%	-	0,3%
1999	0%	0%	0%	181%	-	0%	-4%	0%	0%	99%	-	0,3%
2000	0%	0%	0%	165%	-	0%	38%	0%	0%	61%	-	8,6%
2001	0%	0%	0%	146%	-	0%	21%	0%	0%	86%	-	4,9%
2002	0%	0%	0%	215%	-	0%	25%	0%	0%	91%	-	6,6%
2003	0%	0%	0%	252%	-	0%	28%	0%	0%	91%	-	7,9%
2004	0%	0%	0%	259%	-	0%	21%	0%	0%	93%	-	6,9%
2005	0%	0%	0%	248%	-	0%	13%	0%	0%	129%	-	4,8%
2006	0%	0%	0%	235%	-	0%	8%	0%	0%	87%	-	4,0%
2007	0%	0%	0%	230%	-	0%	1%	0%	0%	71%	-	2,3%
2008	0%	0%	0%	279%	-	0%	1%	0%	0%	113%	-	3,0%
2009	0%	0%	0%	245%	-	0%	-1%	0%	0%	96%	-	1,8%
2010	0%	0%	0%	174%	-	0%	-3%	0%	0%	114%	-	0,7%
2011	0%	0%	0%	207%	-	0%	-8%	0%	0%	86%	-	-0,1%
2012	0%	0%	0%	227%	-	0%	-10%	0%	0%	57%	-	-0,3%
2013	0%	0%	0%	298%	-	0%	-10%	0%	0%	84%	-	0,2%
2014	0%	0%	0%	210%	-	0%	-11%	-1%	0%	117%	-	-0,4%
2015	0%	0%	0%	201%	-	0%	-11%	-1%	0%	82%	-	-0,5%
2016	0%	0%	0%	215%	-	0%	-11%	-1%	0%	81%	-	-0,4%
2017	0%	0%	0%	188%	-	0%	-9%	-1%	0%	74%	-	-0,2%
2018	4%	-3%	0%	233%	-	0%	-8%	-1%	0%	97%	-	-1,5%

Appendix 9. Inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ emission factors

Table A9-1 Inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ 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 the EPR database, 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 GB2019 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 GB2019 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 GB2019 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 GB2019 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 GB2019 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 GB2019 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, Paper and Print	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2019 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	
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 GB2019 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 GB2019 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 GB2019 and these emission factors represent total PM emissions (filterable and condensable fractions).
1A2gvii i	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 GB2019 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 GB2019. According to GB2019, 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 GB2019 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	
1A3bvii	Road transport: Automobile road abrasion	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2019 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 GB2019 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 GB2019 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 GB2019 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 GB2019 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 GB2019 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 GB2019 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 GB2019 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 GB2019 and these emission factors represent total PM emissions (filterable and condensable fractions).
1A4ciii	Agriculture/Forestry/ Fishing: National fishing	IE	IE	IE: 1A3dii
1A5a	Other stationary (including military)	IE	IE	IE: 1A4a

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
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 GB2019 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 GB2019 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 GB2019 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 GB2019 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 GB2019 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 GB2019 and there is no information on inclusion or exclusion of 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 GB2019 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	
2A3	Glass production	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2019 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 GB2019 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 GB2019 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 GB2019, 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 GB2019, 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 GB2019.
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 GB2019 and these PM factors represent filterable PM emissions only (excluding any condensable fraction (European Commission, 2001)).
2C2	Ferroalloys production	no	yes	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2019 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 GB2019 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	
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 GB2019 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 GB2019 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 GB2019.
2D3f	Dry cleaning	NE	NE	There is no emission factor for PM2.5 in the GB2019.
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 GB2019.
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 GB2019 and there is no information on inclusion or exclusion of the condensable component in PM emission 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 GB2019 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 GB2019 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 GB2019.

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
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 GB2019.
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 GB2019 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 GB2019 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 GB2019 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 GB2019 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
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 GB2019 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 GB2019 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 GB2019 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	
3B4gi	Manure mangement - Laying hens	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2019 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 GB2019 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 GB2019 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 GB2019 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 animals	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
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 GB2019 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 GB2019.
3De	Cultivated crops	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	
3Df	Use of pesticides	NA	NA	This activity does not result with TSP, PM10 and PM2.5 emissions.
3F	Field burning of agricultural residues	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2019 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
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 GB2019 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 GB2019.
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 GB2019 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 GB2019 and there is no information on inclusion or exclusion of the condensable component in PM emission factors.
5C1biv	Sewage sludge incineration	NO	NO	This activity does not exist in Croatia.
5C1bv	Cremation	unclear	unclear	The emission factors used for TSP, PM10 and PM2.5 are default ones from GB2019 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 GB2019.
5D2	Industrial wastewater handling	NE	NE	There is no emission factor for PM10 and PM2.5 in the GB2019.
5D3	Other wastewater handling	NE	NE	There is no emission factor for PM10 and PM2.5 in the GB2019.

NFR	Source / sector name	PM emissions: the condensable component is		EF reference and comments
		included	excluded	
5E	Other waste (please specify in IIR)	NE	NE	There is no emission factor for PM10 and PM2.5 in the GB2019.
6A	Other (included in national total for entire territory) (please specify in IIR)	NO	NO	This activity does not exist in Croatia.

12. List of abbreviations

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
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
MESD	- 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

13. List of tables

14. List of figures