

First version

**INFORMATIVE INVENTORY REPORT
OF THE UKRAINE
1990-2017**

Submission under the UNECE Convention on Long Range
Transboundary Air Pollution

Kyiv 2019

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Chapter 1. introduction

In this report, the following abbreviations are used:

LIST OF ACRONYMS, ABBREVIATIONS AND UNITS

Organisations	
MoE	Ministry of Environment of the Ukraine
GEF	Global Environment Facility
IEA	International Energy Agency
UA	Ukraine
EU	European Union
UNFCCC	The United Nations Framework Convention on Climate Change
UNEP	United Nation Environment Programme
IPCC	The Intergovernmental Panel on Climate Change
CLRTAP	Convention on Long-Range Transboundary Air Pollution
AD	Activity Data
IIR	Informative Inventory Report
EB	Energy Balances
EF	Emission Factor
EMEP/EEA	EMEP/EEA Air Pollutant Emission Inventory Guidebook
FOD	First Order Decay
Gg	Gigagram
GHG	Greenhouse gases
J.S.C.	Joint Stock Company
IPPC	Integrated Pollution Prevention and Control
Kt	Kilo tonne
MCF	Methane Correction Factors
MSW	Municipal Solid Waste
NFR	Nomenclature for Reporting
QA/QC	Quality assurance and quality control
WBT	Water Biological Treatment
CRF	common reporting format
GHG	greenhouse gas
LULUCF	land use, land-use change and forestry
NIR	national inventory report
SBDT	sectoral background data tables
g I-Teq	Grams of toxic equivalent
kg	Kilograms
Mg	Megagrams = metric tons
Gg	Gigagrams = kilotons = 1000 metric tons

Pollutants	
As	Arsenic
BC	Black carbon
Cd	Cadmium
CH ₄	methane
CO	carbon monoxide
CO ₂	carbon dioxide
Cr	Chromium
Cu	Copper
DOC	Degradable Organic Carbon
DOC _f	Fraction of Degradable Organic Carbon Dissimilated
HCB	Hexachlorobenzene
HCH	Lindane (gamma-HCH)
HFCs	hydrofluorocarbons
Hg	Mercury
MIX	Unspecified mix of HFCs and PFCs
N ₂ O	nitrous oxide
NF ₃	nitrogen trifluoride
NH ₃	Ammonia
Ni	Nickel
NM VOC	Non-Methane Volatile Organic Compounds
NO _x	Nitrogen Oxides
PAHs	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCB	Polychlorinated Biphenyls
PCDD/PCDF	Polychlorinated dibenzo-dioxins (PCDDs) and Polychlorinated dibenzo-furans (PCDFs)
PFCs	Perfluorocarbons
PM ₁₀	Particulates < 10 pm
PM _{2.5}	Particulate matter (PM) or Particulates < 2.5 pm (micrometer)
POPs	Persistent Organic Pollutants
Se	Selenium
SF ₆	sulphur hexafluoride
SO ₂	sulphur dioxide
TSP	Total Suspended Particulates
Zn	Zinc
Notation keys	
C	confidential
IE	included elsewhere
NA	not applicable
NE	not estimated
NO	not occurring

List of used rows in reporting table

No			Original english name	Ukrainian translation
1	NFR Aggregation for Gridding and LPS (GNFR)	NFR Code	Longname	
2	A_PublicPower	1A1a	Public electricity and heat production	Громадський електричної і теплової енергії
3	B_Industry	1A1b	Petroleum refining	Нафтопереробка
4	B_Industry	1A1c	Manufacture of solid fuels and other energy industries	Виробництво твердих палив та інших енергетичних галузей
5	B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	Стаціонарне спалювання в оброблювальній промисловості і будівництві: Залізо і сталь
6	B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals	Стаціонарне спалювання в обробній промисловості та будівництва: Кольорові метали
7	B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals	Стаціонарне спалювання в оброблювальній промисловості і будівництві: Хімічні
8	B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print	Стаціонарне спалювання в обробній промисловості та будівництва: Целюлоза, папір і друк
9	B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	Стаціонарне спалювання в обробній промисловості та будівництва: Харчова промисловість, напої і тютюн
10	B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Стаціонарне спалювання в обробній промисловості та будівництва: неметалеві корисні копалини
11	I_Offroad	1A2gvii	Mobile Combustion in manufacturing industries and construction:	Мобільний спалювання палива в оброблювальній промисловості і будівництві:
12	B_Industry	1A2gviii	Stationary combustion in manufacturing industries and construction: Other	Стаціонарне спалювання в оброблювальній промисловості і будівництві: Інше
13	H_Aviation	1A3ai(i)	International aviation LTO (civil)	Міжнародний авіаційний LTO (цивільна)
14	H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)	Вітчизняної авіації LTO (цивільна)

No			Original english name	Ukrainian translation
15	F_RoadTransport	1A3bi	Road transport: Passenger cars	Автомобільний транспорт: легкові
16	F_RoadTransport	1A3bii	Road transport: Light duty vehicles	Автомобільний транспорт: Легкові автомобілі борг
17	F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses	Автомобільний транспорт: Транспортні засоби великої вантажопідйомності і автобуси
18	F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles	Автомобільний транспорт: Мопеди і мотоцикли
19	F_RoadTransport	1A3bv	Road transport: Gasoline evaporation	Автомобільний транспорт: Бензин випаровування
20	F_RoadTransport	1A3bvi	Road transport: Automobile tyre and brake wear	Автомобільний транспорт: Автомобільна шина і знос гальмівних
21	F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion	Автомобільний транспорт: автодорога до стирання
22	I_Offroad	1A3c	Railways	Залізниця
23	G_Shipping	1A3di(ii)	International inland waterways	Міжнародні внутрішні водні шляхи
24	G_Shipping	1A3dii	National navigation (shipping)	Національний навігації (доставка)
25	I_Offroad	1A3ei	Pipeline transport	Трубопровідний транспорт
26	I_Offroad	1A3eii	Other (please specify in the IIR)	Інше
27	C_OtherStationaryC omb	1A4ai	Commercial/institutional: Stationary	Комерційна / інституційна: Стационарний
28	I_Offroad	1A4aii	Commercial/institutional: Mobile	Комерційна / інституційна: Мобільний
29	C_OtherStationaryC omb	1A4bi	Residential: Stationary	Житловий: Стационарний
30	I_Offroad	1A4bii	Residential: Household and gardening (mobile)	Житловий: Дім и садівництво (мобільний)

No			Original english name	Ukrainian translation
31	C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary	Сільське господарство / Лісове господарство / Рибальство: Стационарний
32	I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	Сільське господарство / Лісове господарство / Рибальство: Всюдиходи і іншої техніки
33	I_Offroad	1A4ciii	Agriculture/Forestry/Fishing: National fishing	Сільське господарство / Лісове господарство / Рибальство: національної риболовлі
34	C_OtherStationaryComb	1A5a	Other stationary (including military)	Інша стаціонарні (у тому числі військових)
35	I_Offroad	1A5b	Other, Mobile (including military, land based and recreational boats)	Інше Мобільна (у тому числі військові, наземних і рекреаційні човни)
36	D_Fugitive	1B1a	Fugitive emission from solid fuels: Coal mining and handling	Неорганізований викид з твердих видів палива: Видобуток вугілля і звернення
37	D_Fugitive	1B1b	Fugitive emission from solid fuels: Solid fuel transformation	Неорганізований викид від спалювання твердого палива: перетворення твердого палива
38	D_Fugitive	1B1c	Other fugitive emissions from solid fuels	Інші неорганізовані викиди від твердого палива
39	D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport	Летючі викиди нафти: Розвідка, видобуток, транспорт
40	D_Fugitive	1B2aiv	Fugitive emissions oil: Refining / storage	Летючі викиди нафти: Переробка / зберігання
41	D_Fugitive	1B2av	Distribution of oil products	Розподіл нафтопродуктів
42	D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	Летючі викиди з природного газу (розвідка, видобуток, переробка, транспортування, зберігання, розповсюдження та інше)
43	D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)	Вентиляція і спалювання (нафта, газ, в поєднанні нафти і газу)
44	D_Fugitive	1B2d	Other fugitive emissions from energy production	Інші неорганізовані викиди від виробництва енергії
45	B_Industry	2A1	Cement production	Виробництво цементу

No			Original english name	Ukrainian translation
46	B_Industry	2A2	Lime production	Виробництво вапна
47	B_Industry	2A3	Glass production	Виробництво скла
48	B_Industry	2A5a	Quarrying and mining of minerals other than coal	Кар'єр та добування інших корисних копалин, ніж вугілля
49	B_Industry	2A5b	Construction and demolition	Будівництво та знесення
50	B_Industry	2A5c	Storage, handling and transport of mineral products	Зберігання, обробка та транспортування корисних копалин
51	B_Industry	2A6	Other mineral products	Інші мінеральні продукти
52	B_Industry	2B1	Ammonia production	Виробництво аміаку
53	B_Industry	2B2	Nitric acid production	Виробництво азотної кислоти
54	B_Industry	2B3	Adipic acid production	Виробництво кислоти адипінової
55	B_Industry	2B5	Carbide production	Виробництво карбіду
56	B_Industry	2B6	Titanium dioxide production	Виробництва діоксиду титану
57	B_Industry	2B7	Soda ash production	Виробництві кальцинованої соди
58	B_Industry	2B10a	Chemical industry: Other	Хімічна промисловість: Інше
59	B_Industry	2B10b	Storage, handling and transport of chemical products	Зберігання, обробка та транспортування хімічної продукції
60	B_Industry	2C1	Iron and steel production	Виробництво чавуну і сталі
61	B_Industry	2C2	Ferroalloys production	Виробництво феросплавів

No			Original english name	Ukrainian translation
62	B_Industry	2C3	Aluminium production	Виробництво алюмінію
63	B_Industry	2C4	Magnesium production	Виробництво магнію
64	B_Industry	2C5	Lead production	Виробництво свинцю
65	B_Industry	2C6	Zinc production	Виробництво цинку
66	B_Industry	2C7a	Copper production	Виробництво міді
67	B_Industry	2C7b	Nickel production	Виробництво нікелю
68	B_Industry	2C7c	Other metal production (please specify in the IIR)	Інше виробництво металу
69	B_Industry	2C7d	Storage, handling and transport of metal products	Зберігання, обробка та транспортування металопродукції
70	E_Solvents	2D3a	Domestic solvent use including fungicides	Побутове використання розчинників, включаючи фунгіцидів
71	B_Industry	2D3b	Road paving with asphalt	Дорожнього покриття асфальтом
72	B_Industry	2D3c	Asphalt roofing	Асфальт для покрівель
73	E_Solvents	2D3d	Coating applications	Нанесення покриттів
74	E_Solvents	2D3e	Degreasing	Знежирення
75	E_Solvents	2D3f	Dry cleaning	Хімчистка
76	E_Solvents	2D3g	Chemical products	Хімічні товари
77	E_Solvents	2D3h	Printing	Друк

No			Original english name	Ukrainian translation
78	E_Solvents	2D3i	Other solvent use	Інша розчинник використання
79	E_Solvents	2G	Other product use	Інше використання продукту
80	B_Industry	2H1	Pulp and paper industry	Целюлозно-паперова промисловість
81	B_Industry	2H2	Food and beverages industry	Їжа та напої промисловості
82	B_Industry	2H3	Other industrial processes	Інші промислові процеси
83	B_Industry	2I	Wood processing	Деревообробка
84	B_Industry	2J	Production of POPs	Виробництво СОЗ
85	B_Industry	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	Споживання СОЗ і важких металів (наприклад, електричне і наукове обладнання)
86	B_Industry	2L	Other production, consumption, storage, transportation or handling of bulk products	Інше виробництво, споживання, зберігання, перевезення чи звернення сипучих продуктів
87	K_AgriLivestock	3B1a	Manure management - Dairy cattle	Управління гною - молочна худоба
88	K_AgriLivestock	3B1b	Manure management - Non-dairy cattle	Управління гною - Номери для молочної худоби
89	K_AgriLivestock	3B2	Manure management - Sheep	Управління гною - Вівці
90	K_AgriLivestock	3B3	Manure management - Swine	Управління гною - Свинячий
91	K_AgriLivestock	3B4a	Manure management - Buffalo	Управління гною - Буффало
92	K_AgriLivestock	3B4d	Manure management - Goats	Управління гною - Кози
93	K_AgriLivestock	3B4e	Manure management - Horses	Управління гною - Коні

No			Original english name	Ukrainian translation
94	K_AgriLivestock	3B4f	Manure management - Mules and asses	Управління гною - Мули і віслюки
95	K_AgriLivestock	3B4gi	Manure management - Laying hens	Гній Management – кури несучки
96	K_AgriLivestock	3B4gii	Manure management - Broilers	Гній Management - бройлери
97	K_AgriLivestock	3B4giii	Manure management - Turkeys	Гній Management - Індички
98	K_AgriLivestock	3B4giv	Manure management - Other poultry	Управління гною - Інші птахи
99	K_AgriLivestock	3B4h	Manure management - Other animals	Управління гною - Інші тварини
100	L_AgriOther	3Da1	Inorganic N-fertilizers (includes also urea application)	Неорганічні N-добрива (включає також застосування сечовини)
101	L_AgriOther	3Da2a	Animal manure applied to soils	Внесення гною в ґрунт
102	L_AgriOther	3Da2b	Sewage sludge applied to soils	Осад стічних вод у ґрунт
103	L_AgriOther	3Da2c	Other organic fertilisers applied to soils (including compost)	Інші органічні добрива в ґрунт(у тому числі компосту)
104	L_AgriOther	3Da3	Urine and dung deposited by grazing animals	Сеча і екскременти пасовищних тварин
105	L_AgriOther	3Da4	Crop residues applied to soils	Рослинні залишки в ґрунт
106	L_AgriOther	3Db	Indirect emissions from managed soils	Непрямі викиди з оброблюваних ґрунтів
107	L_AgriOther	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	На рівні ферми і сільськогосподарські підприємства, включаючи зберігання, обробки і транспортування сільськогосподарської продукції
108	L_AgriOther	3Dd	Off-farm storage, handling and transport of bulk agricultural products	Викл-ферми для зберігання, обробки та транспортування сипучих сільськогосподарських продуктів
109	L_AgriOther	3De	Cultivated crops	Просапних культур

No			Original english name	Ukrainian translation
110	L_AgriOther	3Df	Use of pesticides	Використання пестицидів
111	L_AgriOther	3F	Field burning of agricultural residues	Спалювання сільськогосподарських залишків
112	L_AgriOther	3I	Agriculture other	Сільське господарство Інші
113	J_Waste	5A	Biological treatment of waste - Solid waste disposal on land	Біологічне очищення відходів - захоронення твердих відходів на землі
114	J_Waste	5B1	Biological treatment of waste - Composting	Біологічне очищення відходів - Компостування
115	J_Waste	5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	Біологічне очищення відходів - анаеробного травлення в біогазових установках
116	J_Waste	5C1a	Municipal waste incineration	Муніципальних відходів
117	J_Waste	5C1bi	Industrial waste incineration	Промислові відходи спалювання
118	J_Waste	5C1bii	Hazardous waste incineration	Спалювання небезпечних відходів
119	J_Waste	5C1biii	Clinical waste incineration	Клінічна спалювання відходів
120	J_Waste	5C1biv	Sewage sludge incineration	Спалювання каналізаційного мулу
121	J_Waste	5C1bv	Cremation	Кремація
122	J_Waste	5C1bvi	Other waste incineration	Інші відходи
123	J_Waste	5C2	Open burning of waste	Відкрите спалювання відходів
124	J_Waste	5D1	Domestic wastewater handling	Побутові стічні води
125	J_Waste	5D2	Industrial wastewater handling	Промислові стічні води

No			Original english name	Ukrainian translation
126	J_Waste	5D3	Other wastewater handling	Інше звернення стічних вод
127	J_Waste	5E	Other waste	Інші відходи
128	M_Other	6A	Other (included in national total for entire territory)	Інше (включені в національне Всього за всієї території)
129		NATION AL TOTAL	National total for the entire territory (based on fuel sold)	Національні підсумки загальні для всієї території (на основі проданого палива)
130		ADJUST MENTS (Net total)	Sum of adjustments (negative value) from Annex VII	Сума коригування (від'ємне значення) з Додатка VII
131		NATION AL TOTAL FOR COMPLI ANCE	National total for compliance assessment	Національні підсумки загальні для оцінки відповідності
132	'MEMO' ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS			"МЕМО" ПУНКТИ - не включаються в національні підсумки
133	O_AviCruise	1A3ai(ii)	International aviation cruise (civil)	Міжнародний авіаційний круїз (цивільна)
134	O_AviCruise	1A3aii(ii)	Domestic aviation cruise (civil)	Вітчизняний авіаційний круїз (цивільна)
135	P_IntShipping	1A3di(i)	International maritime navigation	Міжнародна морська навігація
136	z_Memo	1A5c	Multilateral operations	Багатосторонні операції
137	z_Memo	1A3	Transport (fuel used)	Транспорт (використовується паливо)
138	z_Memo	6B	Other not included in national total of the entire territory (please specify in the IIR)	Інше, не включене в національні підсумки в цілому на всій території
139	N_Natural	11A	Volcanoes	Вулкани

No			Original english name	Ukrainian translation
140	N_Natural	11B	Forest fires	Лісові пожежі
141	N_Natural	11C	Other natural emissions (please specify in the IIR)	Інші природні викиди
142	(a) For example, fugitive emissions from the production of geothermal power could be reported here.			(a), наприклад, може бути повідомлено тут неорганізовані викиди від виробництва геотермальної енергії.
143	(b) Only NH3 and NMVOC emissions from crops should be reported here.			(б) тільки викиди NH3 і НМЛОС з культур повинні бути представлені тут.
144	(c) Excludes waste incineration for energy (this is included in 1A1) and in industry (if used as fuel).			(c) Виключаючи спалювання відходів для отримання енергії (це входить в 1A1) і в промисловості (при використанні як палива).
145	(d) Includes accidental fires.			(d) Включає випадкові пожежі.
146	(e) The 'National Total for Compliance' includes any aggregated combination of i) adjustments to national totals; ii) national totals based on transport fuel used; iii) territory declared upon ratification of the relevant Protocol of the Convention. Member States of the European Union may also use this line for reporting national totals for compliance purposes under the National Emission Ceilings Directive (NECD) if these differ from the main National Total. MS should consult the definitions of geographical coverage in the NECD to determine what should be included within the NECD National Total.			(e) “Національні підсумки за дотриманням” включає в себе будь-яку комбінацію агрегованих I) коригування національних підсумків; II) Національні підсумкові на основі транспортного палива, використовуваного; III) територія оголошена після ратифікації відповідного протоколу до Конвенції.

List of used columns in reporting (main table)

Excel table column			units	Ukrainian translation	Stat form 2TTP air code	2TP air name	Units from 2 TP air
A	link		NFR Aggregation for Gridding and LPS (GNFR)	Агрегація NFR	-	-	-
B	NFR sectors to be reported		NFR Code	Код NFR	-	-	-
C			Longname	Найменування	-	-	-
D			Notes	Примітка	-	-	-
E	Main Pollutants (from 1990)	NO _x (as NO ₂)	kt	Оксиди азоту NO та NO ₂	4001	Оксиди азоту (у перерахунку на діоксид азоту [NO + NO ₂])	Гг
F		NM VOC Non-methane volatile organic compound	kt	Неметанові летючі органічні сполуки	11000	Неметанові леткі органічні сполуки (НМЛЮС) Включають	Гг
G		SO _x (as SO ₂)	kt	Окисли сірки	5000	Діоксид та інші сполуки сірки Включають Remark 1	Гг
H		NH ₃	kt	Аміак	4003	Аміак	Гг
I	Particulate Matter (from 2000)	PM _{2.5} particular particulate matter	kt	Тверді частинки 2,5 мкм та менше	3002	Речовини у вигляді суспендованих твердих частинок 2,5 мкм та менше	Гг
J		PM ₁₀ particulate matter	kt	Тверді частинки більше 2,5 мкм та менше 10 мкм	3001	Речовини у вигляді суспендованих твердих частинок більше 2,5 мкм та менше 10 мкм	Гг
K		TSP Total Suspended Particulates	kt	Тверді частинки	3000	Речовини у вигляді суспендованих твердих частинок (мікро-частинки та волокна)	Гг
L		BC black carbon PM ≤ 2.5 μm in aerodynamic diameter	kt	Чорний вуглець ≤ 2,5 мкм аеродинамічний діаметр		Немає аналогів в Україні	
M	Other (from 1990)	CO carbon monoxide	kt	Монооксид вуглецю	6000	Оксид вуглецю	Гг

Excel table column			units	Ukrainian translation	Stat form 2TP air code	2TP air name	Units from 2 TP air	
N	Priority Heavy Metals (from 1990)	Pb Lead		t	Рв Свинець	1009	Свинець та його сполуки (у перерахунку на свинець)	Мг
O		Cd Cadmium		t	Сd Кадмій	1004	Кадмій та його сполуки (у перерахунку на кадмій)	Мг
P		Hg Mercury		t	Нг Ртуть	1007	Ртуть та її сполуки (у перерахунку на ртуть)	Мг
Q	Additional Heavy Metals (from 1990, voluntary reporting)	As Arsenic		t	As Миш'як	1001	Миш'як та його сполуки (у перерахунку на миш'як)	Мг
R		Cr Chromium		t	Сr Хром	1010	Хром та його сполуки (у перерахунку на триоксид хрому)	Мг
S		Cu Copper		t	Сu Мідь	1005	Мідь та її сполуки (у перерахунку на мідь)	Мг
T		Ni Nickel		t	Ni Нікель	1006	Нікель та його сполуки (у перерахунку на нікель)	Мг
U		Se Selenium		t	Сi Селен	1008	Селен та його сполуки (у перерахунку на селен)	Мг
V		Zn Zinc		t	Зn Цинк	1011	Цинк та його сполуки (у перерахунку на цинк)	Мг
W	POPs ⁽¹⁾ Persistent Organic Pollutants (from 1990)	PCDD/ PCDF Polychlorinated dibenzodioxins (PCDDs) and Polychlorinated dibenzofurans (PCDFs) (dioxins/ furans)		g I-TEQ	ПХДД / ПХДФ (діоксини / фурани)	13009	Поліхлоровані дибензо-п-діоксини	кг
		13010	Поліхлоровані дибензофурани			кг		
		13012	2,3,7,8 – Тетрахлордибензо-парадіоксин (ТХДД)			кг		
X		PAHs Polycyclic Aromatic Hydrocarbons	benzo(a) pyrene	t	Бенз (а) пірен	13101	Бенз(а)пірен	Мг
Y			benzo(b) fluoranthene	t	Бензо (б) флуорантен	13102	Бенз(б)флуорантен	Мг
Z			benzo(k) fluoranthene	t	Бензо (к) флуорантен	13103	Бенз(к)флуорантен	Мг
AA	Indeno (1,2,3-cd) pyrene		t	Індено (1,2,3-кд) пірен	13104	Індено (1,2,3-кд) пірен	Мг	
AB	Total 1-4		t	ПАУ Разом 1-4	13100	Поліароматичні вуглеводні (ПАВ)	Мг	

Excel table column			units	Ukrainian translation	Stat form 2TP air code	2TP air name	Units from 2 TP air
AC		HCB Hexachlorobenzene	kg	ГХБ	13002	Гексахлорбензол	кг
AD		PCBs Polychlorinated Biphenyls	kg	ПХБ	13011	Поліхлоровані дифеніли	кг
AF	Activity Data (from 1990)	Liquid Fuels	TJ NCV	Рідке паливо	-	-	-
AG		Solid Fuels	TJ NCV	Тверде паливо	-	-	-
AH		Gaseous Fuels	TJ NCV	Газоподібне паливо	-	-	-
AI		Biomass	TJ NCV	Біомаса	-	-	-
AJ		Other Fuels	TJ NCV	Інше паливо	-	-	-
AK		Other activity (specified)	-	Інша діяльність	-	-	-
AL		Other Activity Units	-	Інші одиниці виміру	-	-	-

Remarks		11013	Диметилформамід	11035	Піридин
05000 Діоксид та інші сполуки сірки including		11014	Дихлоретан	11036	Спирт метиловий
05001 Сірки діоксид		11015	Дихлорфенол	11037	Стирол
05002 Сірководень (H S)		11016	Дибенз(а,п)антрацен	11039	Тетрагідрофуран
05003 Сірковуглець		11017	Діетиловий ефір	11040	Трикрезол
05004 Сульфатна кислота (H SO) [сірчана кислота]		11018	Діетилбензол	11041	Толуол
Remark		11019	Етилбензол	11042	Толуїлендіізоціанат
Including		11020	Етилцелозольв	11043	Толуїдини
11001	Акрилонітрил	11021	Етилацетат	11044	Трихлоретилен
11002	Ангідрид малеїновий	11022	Етилену оксид	11045	Трихлорбензол
11003	Ангідрид фталевий	11023	Кислота акрилова	11046	Трихлорметан (хлороформ)
11004	Акролеїн	11025	Кислота масляна	11047	Тетрахлоретилен (перхлоретилен)
11005	Альдегід масляний	11026	Кислота мурашина	11048	Фенол
11006	Ацетальдегід	11027	Кислота пропіонова	11049	Формальдегід
11007	Ацетон	11028	Кислота оцтова	11050	Фурфурол
11008	Бензол	11029	Кислота терефталева	11051	1-Хлор-2,3-епіксипропан
11009	Бутиловий ефір оцтової кислоти	11030	Ксилол	(епіхлоргідрин)	
(бутилацетат)		11031	Метилізобутилкетон	11052	Хлоропрен
11010	1,3-Бутадієн (дивініл)	11032	Метилетилкетон	11053	Циклогексанон
11011	Вінілацетат	11033	Метилацетат		
11012	Гідразин гідрат	11034	Нафталін		

EXECUTIVE SUMMARY

This is an informational report about cadasters (IRC) of Ukraine to the Convention on Long-Range Transboundary Air Pollution (CLRTAP).

The main responsibility according to the Convention is to provide annual reports about the atmosphere emissions of pollutants to the Convention executive body. The IIR report is necessary both for the Convention Secretariat in order to understand the country's context along with the data and internally for a more coherent record and a progress assessment in the area of air pollution countering.

The main aim of this Informational report about the inventory was to describe input data and methods of calculating which were the basement of the emission assessment. IIR contains detailed information about annual measurements of emissions polluting the air in Ukraine since 1990.

Data about the activity used in this report was based on officially published information such as national publications on statistics, reports of central government, public sectors, scientific literature and a private sector. The input data was processed with the Excel format using the reporting format which was requested by ECE \ CRLTAP Secretariat.

Statistical data which is necessary for the National Greenhouse Gas Inventories and EMEP are available in statistical reports, energy budgets and other sectoral statistical publications of Dergcomstat service on Ukraine.

Data about the activity provided by State Statistics Service of Ukraine in statistical yearbooks, energetic budgets (EB), sectoral statistical publications and on its website as a part of the statistics database are available for the period till 2017 on the whole territory of Ukraine but since 2014 State Service has had a lot of problems with temporary occupied Ukrainian territories.

GENERAL

Introduction

1.1 National Inventory Background

Reporting and inventory of emissions is one of the main tasks among the responsibilities of a country in CLRTAP. Corresponding public authorities make efforts in order to conform to the requirements for guiding principles of the Convention. There are disadvantages which have appeared because of a lack of resources in order to fully follow the rules.

Ukraine is at the early stage of building the information collecting system. The team of inventory air experts still needs additional knowledge and experience to identify and process corresponding data in a proper way.

Further efforts for increasing transparency, completeness and general quality of data are necessary as well as for getting the full accordance of introduced data and formats used for collecting, processing and making reports.

Nevertheless, the authors of the report and the reporting agency are sure about the improvement of future reports along with the growing potential and resources of the country in this aspect.

Beginning with the calculations of pollutants emissions into the ambient air of 2017, Ukraine has been changing the attitude to calculations themselves as well as to collecting the statistical data about emissions in accordance to international norms and standards. Changing the approach lies in using coefficients and the principles of calculations according to EMEP\EEA methodology Air Pollutant Emission Inventory Guidebook 2016.

Guidebook methodology

It is impractical to measure emissions from all the sources that, together, comprise an emissions inventory. Consequently, the most common estimation approach is to combine information on the extent to which a human activity takes place (called activity data or AD) with coefficients that quantify the emissions or removals per unit activity, called emission factors (EF). The basic equation is therefore: $Emissions = AD \times EF$. In the energy sector, for example, fuel consumption would constitute activity data and mass of sulphur dioxide emitted per unit of fuel consumed would be an emission factor. The basic equation can, in some circumstances, be modified to include other estimation parameters than emission factors, for example, to accommodate the effects of additional, secondary, abatement. The Guidebook describes a tiered methodology for estimating emissions. Simple (Tier 1) methods are given for all the sources and substances which the countries that have ratified Convention protocols need to report. More advanced (Tier 2) methods are given for key categories. Further information is given for advanced (Tier 3) approaches for key categories where suitable methods are available.

- Tier 1 methods apply a simple linear relation between activity data and emission factors. The activity data is derived from readily available statistical information (energy statistics, production statistics, traffic counts, population sizes, etc.). The default Tier 1 emission factors are chosen in way that they represent 'typical' or 'averaged' process conditions — they tend to be

technology independent.

- Tier 2 methods use the same or similar activity data to Tier 1 methods, but apply country-specific emission factors; country-specific emission factors need to be developed, using country-specific information on process conditions, fuel qualities, abatement technologies, etc. In many cases these methods could also be applied at a higher level of detail, where the activity statistics are further split into sub-activities with more or less homogenous process characteristics.

- Tier 3 methods go beyond the above; these may include using facility level data and/or sophisticated models. Examples might include the use of PRTR data or data from emission trading schemes for industrial emissions or models like COPERT for road transport emissions. Wherever possible, an estimate has been made of the uncertainty that can be associated with both the emissions factors and the activity statistics quoted.

Method tiers

Emissions can be estimated at different levels of complexity. Within the IPCC Guidelines and adopted by this Guidebook, these are expressed in three tiers of increasing complexity. The 'Tier 1' method is a 'simple' method using default emission factors only. To upgrade a Tier 1 to a Tier 2 method, the default emission factors should be replaced by country-specific or technology-specific emission factors. This might also require a further split of the activity data over a range of different technologies, implicitly aggregated in the Tier 1 method. A Tier 3 method could be regarded as a method that uses the latest scientific knowledge in more sophisticated approaches and models; more detailed definitions follow.

Tier 1: A method using readily available statistical data on the intensity of processes (activity rates) and default emission factors. These emission factors assume a linear relation between the intensity of the process and the resulting emissions. The Tier 1 default emission factors also assume an average or typical process description. This method is the simplest method, has the highest level of uncertainty and should not be used to estimate emissions from key categories.

Tier 2: More complex method Tier 2 is similar to Tier 1 but uses more specific emission factors developed on the basis of knowledge of the types of processes and specific process conditions that apply in the country for which the inventory is being developed. Tier 2 methods are more complex, will reduce the level of uncertainty, and are considered adequate for estimating emissions for key categories.

Tier 3: Tier 3 is defined as any methodology more detailed than Tier 2; hence there is a wide range of Tier 3 methodologies. At one end of the range there are methodologies similar to Tier 2 (i.e. activity data x emission factor) but with a greater disaggregation of activity data and emission factors. At the other end of the range are complex, dynamic models in which the processes leading to emissions are described in great detail. The key criterion to be met before a Tier 3 methodology can replace a Tier 2 methodology is a more accurate estimation of the relevant emissions, reducing the following common sources of error. The key criterion to be met before a Tier 3 methodology can replace a Tier 2 methodology is a

more accurate estimation of the relevant emissions, reducing the following common sources of error.

Model error:the extent to which the mathematical representation of the processes underlying the emissions deviate from reality. **Parameter error:**the error in the model parameters (e.g. emission factors, coefficients,etc.)

Input error:the error in activity data.

Process error:error introduced through mistakes in the process of compiling the inventory. For complex models, this includes errors in the software implementation of the model.

For small extensions to Tier 2 methodologies, such as the inclusion of abatement measures or refinements to emission factors, it is sufficient to document the quality assurance/quality control (QA/QC)process by which the revised/additional emission factors and associated activity data were obtained. However, where parties wish to use complex simulation models in inventory construction, the model is quite likely to have been developed by a third party. If the use of such models within a methodology is to be accepted as Tier 3, it is necessary to ensure that QA/QC criteria are met by the complex model, the process of parameterisation, and the input data necessary to run the model. These criteria must acknowledge that reviewers should be able to review the methodology within a reasonable time period and are listed below.

For the inventory construction process to be sufficiently transparent, the model documentation has to be clear, correct, concise, comprehensible, and consistent.

The scientific quality of the model has to have been documented in peer-reviewed publications.

The model has to have been tested successfully in the situations for which it will be used in inventory construction, implying that model parameters are available for those situations.

The input data required by the model must be available, and of adequate quality, at the spatial and temporal scales for which the model is to be used. These criteria are valid for all Tier 3 methodologies. However, they may require further interpretation for sector-specific applications and additional criteria may also be appropriate. For example, where it is appropriate, models intended to be used as Tier 3 methods should demonstrate that they obey the law of conservation of matter.

Country's commitments under CLRTAP

Title	Entry into force	Status of ratification
1. Convention on Long-range Transboundary Air Pollution Geneva, 13 November 1979	16 March 1983, in accordance with article 16(1). Registration: 16 March 1983, No. 21623	Signature 14 Nov 1979, Ratification 5 Jun 1980
The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone and its 2012 amended version	17 May 2005	Original protocol Amended version
The 1998 Protocol on Persistent Organic Pollutants (POPs) and its 2009 amended version	23 October 2003	Original protocol signature 24 Jun 1998 Amended version, annex I and II Amended version, annex I, II, III, IV, VI, VIII
The 1998 Protocol on Heavy Metals and its 2012 amended version	29 December 2003	Original protocol signature 24 Jun 1998 Amended version
The 1994 Protocol on Further Reduction of Sulphur Emissions	5 August 1998	Status signature 14 Jun 1994
The 1991 Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes	29 September 1997	Status signature 19 Nov 1991
The 1988 Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes	14 February 1991	Status signature 1 Nov 1988 Ratification 24 Jul 1989 A
The 1985 Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent	2 September 1987	Status signature 9 Jul 1985 ratification 2 Oct 1986 A
The 1984 Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)	28 January 1988	Status signature 28 Sep 1984 ratification 29 Oct 1984 A

Thus, the Ukraine undertook all the emission reduction commitments according to the Convention and protocols.

The main purpose of this Informative Inventory Report was to describe the input data and calculation methodologies on which the emissions estimates are based.

IIR of the Ukraine 1990-2017 it is first attempt to include detailed information on annual emission estimates of air quality pollutants by source in the Ukraine from 1990 onwards.

According to the Guidelines for Estimating and Reporting Emission Data, each party must report the annual national emission data of pollutants in the NFR source category and shall submit an informative inventory report on the latest version of the templates to the Convention Secretariat.

The inventory detail the anthropogenic emissions of the main pollutants (SO_x, NO_x, NMVOC, NH₃ and CO), particulate matter (TSP, PM₁₀, PM_{2.5}), heavy metals (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn) and persistent organic pollutants (dioxins, HCB, PAHs, PCB). Projected emissions for sulphur dioxide, nitrogen oxides, ammonia, PM_{2.5} and NMVOCs are reported for the years 2020, 2025 and 2030.

1.2 Institutional arrangements (to be updated when there have been major changes since the last report)

Institutional arrangements

Institutional arrangements

The Ministry of Environmental Protection and Ecology of the Ukraine has overall responsibility for the CLRTAP reporting. Ministry is responsible for the necessary institutional, legal and procedural arrangements, and for the strategic development of the inventory.

There is a well-functioning national inventory system in relation with the UNFCCC reporting with all the necessary institutional, legal and procedural arrangements; however there is no institutional arrangement for the preparation of the reports to CLRTAP.

Until 2019 the yearly reports to CLRTAP were prepared by different experts from the organizations subordinated to the Ministry of Environment, mainly research institutions.

All relevant entities subordinated to Ministry were involved.

For a number of reasons, not all the potential of these offices was used in the past. Further work is needed to streamline the operation of these offices so that their contribution to the reporting process is in line with existing potential.

In addition to the MEP and SEIA, involved in preparing the inventory are:

- ministries, state committees, the Regional State Administration (RSA), National Academy of Sciences (NAS) of Ukraine;
- research institutes (SRI): the Ukrainian Hydrometeorological Institute (UHMI), the Ukrainian Research Institute of Forestry and Agroforestry; the State Enterprise “Cherkassky Research Institute of Technological and Economic Information in the Chemical Industry” (NIITEKKhIM);
- independent experts and organizations;
- public and non-governmental organizations.

The groundwork for the source data in making a report for 2017 was statistical compilations, State Statistics Service of Ukraine forms, analytical data, Ministry of Ecology and Natural Resources of Ukraine’s expert estimates.

Creating a specialized division as part of an air pollution abatement ministry will be a significant improvement in institutional reporting mechanisms. Its creating can enhance the reporting process and make it more sustainable in the long term as well as tendering such kinds of activity over a long period for the research of emission dynamics, predicting emission tendencies, creating a register for source data, offers on improving the mechanisms of statistical reporting and creating a unified form of filling for enterprises which are the main polluters in the country.

1.3 Inventory preparation process (to be updated when there have been major changes since the last report)

Inventory compilation methodology and process

The methodology for estimating and reporting emissions is consistent with the "EMEP/EEA air pollutant emission inventory guidebook - 2016". The pollutants covered by this methodology guidebook are: SO₂, NO_x, NH₃, NMVOC, CO, TSP, PM₁₀, PM₂₅, Heavy Metals, (Cd, Pb, Hg, As, Cr, Cu, Ni, Se, Zn), POPs (HCB, PCB, dioxins / furans) and PAHs.

The annual inventory cycle is aimed to be carried out in accordance with the principles and procedures set out in the UNECE Emission Reporting Guidelines. As a general method of preparing the inventory, the procedures described in the EMEP/EEA Emissions Inventory Guidebook 2016 are applied. The sectoral experts are responsible for the choice of methods and emission factors. According to the recommendations of the EMEP/EEA Emissions Inventory Guidebook 2016, the calculation methods are chosen by taking into account the technologies available in the Ukraine whenever possible. The calculation of emissions occurs basically by using the formula: AD x EF, where the activity data (AD) can be raw material or product or energy use etc. Part of the available data (e.g. production data) can directly be entered into the formula above; others required previous processing and conversion. For example, energy data are not always available in the required depth and resolution. After preliminary quality control of the basic data, the necessary calculations are carried out by the core team. After other necessary QC/QA steps, NFR table is filled in and the assigned chapters of IIR report are prepared.

The Ukraine's IIR is prepared using a "top-down" approach, providing estimates at a sectoral level of segregation without attribution to individual emitters. Activity data used in this report are based on officially published data, such as national statistic publications, reports of central public authorities, public sectors, scientific literature and private sector.

The input data were processed using Excel format applying the reporting formats requested by the UNECE/CRLTAP Secretariat.

According to EMEP/EEA Emissions Inventory Guidebook 2016 the key categories were identified. The inventory was first disaggregated by source categories which further were used to identify key categories.

Current national inventory system

Ukraine is developing the inventory system for EMEP aims. The authors and developers of the present report are in a constant contact with competent representatives of Ministry of Ecology and Natural Resources of Ukraine, State Statistics Service of Ukraine on purpose to design a unified reporting format for calculations, making reports and predictions according to the methodological requirements of EMEP\EEA Emissions Inventory Guidebook.

1.4 Methods and data sources (to be updated when there have been major changes since the last report)

Data collection and data sources

The activity data needed for developing the national inventories are available in the Statistical annual reports (SY), Energy Balances (EBs) and other sectoral statistic publications of the State statistic Service of the Ukraine. The activity data provided by the state statistic Service of the Ukraine in the Statistical Yearbooks, Energy Balances (EB), sectoral statistical publications and on its website, as part of the statistical database are available for the period until 1992 for the whole territory of the Ukraine.

The main data providers are as follows:

Table Summary of the main sources of activity data for estimating emissions

Description of a data source	Description of activity data
State Statistics Committee of Ukraine (State Statistic service of Ukraine)	Amount of fuel consumed; The calorific value of basic fuels; Production volumes, imports, exports and changes in fuel stocks; Amounts of oil and natural gas transported through main oil and gas pipelines; Production, exports and imports of industrial products; The use of limestone for agriculture and for the production of sugar, soda and cement; Consumption of pig iron to produce steel; Number of animals by type and gender group in the public and private sectors; Consumption of feed to feed cows and breeding bulls of dairy herds and other cattle of agricultural enterprises and households across Ukraine and across regions; Milk production; Quantity of wool produced per sheep; Gross yield, yield capacity and total harvested area of crops; Amounts of nitrogen mineral and organic fertilizers introduced into soil; Grouping of enterprises by main indicators of livestock production; Area of felling in forestry (including fellings according to their purpose by regions); Total and urban population; Information on total forest area and areas covered with forest vegetation in Ukraine; Amounts and area of application of nitrogen and organic fertilizers introduced into soil, by crop species; Total and urban population; Amount of waste of I-III hazard class of the food industry and agribusiness, placed in landfills; Average annual consumption of protein by the population of Ukraine.
Ministry of Fuel and Energy of Ukraine	The amount of fuel consumed by thermal power-stations and thermoelectric plants, as well as its calorific value; Production of oil and natural gas; Import / export of petroleum and petroleum products.
Ministry of Coal Industry of Ukraine	Production, import / export of coal.
Ministry of Industrial Policy of Ukraine	Production, export and import of industrial products; Data on the proportion of carbon in coke, conversion pig iron and steel.
Ministry of Agricultural Policy and Food	Information about the volume of activities for the period since 1990 that fall under paragraphs 3 and 4 of Article 3 of the Kyoto Protocol (to create a geobase of data for additional reporting under the Kyoto Protocol)
Ministry of Defence of Ukraine	Information about the volume of activities for the period since 1990 that fall under paragraphs 3 and 4 of Article 3 of the Kyoto Protocol (to create a geobase of data for additional reporting under the Kyoto Protocol)
The Ministry of Emergencies of Ukraine	Information about the volume of activities for the period since 1990 that fall under paragraphs 3 and 4 of Article 3 of the Kyoto Protocol (to create a geobase of data for additional reporting under the Kyoto Protocol) Data on annual average air temperature by regions and meteorological network stations of the State Committee for Hydrometeorology
Industrial enterprises	Ammonia and ferro-alloys production, as well as consumption of hydrofluorocarbons
Ministry of Construction, Architecture and Housing and Communal Services of Ukraine	Data on the amount of municipal solid waste disposed of in landfills; Data on volumes of waste household water; Information on the state of sanitation of settlements; Data on sewage management; Fuel combustion and communal services.

Description of a data source	Description of activity data
The State Committee of Ukraine for Water Management	Information on the volumes of wastewater subjected to local treatment, by branches of industries; Data on the area of cultivated peat soils
Ministry of Environmental Protection / State Departments of Ecology and Natural Resources in oblasts	Amounts and composition of waste incinerated at waste incineration plants in Ukraine; Data on the recovery of methane from landfills; Data on the morphological composition and density of the waste; Data on household wastewater. Information about the volume of activities for the period since 1990 that fall under paragraphs 3 and 4 of Article 3 of the Kyoto Protocol (to create a geobase of data for additional reporting under the Kyoto Protocol)
Ministry of Infrastructure	Information about the volume of activities for the period since 1990 that fall under paragraphs 3 and 4 of Article 3 of the Kyoto Protocol (to create a geobase of data for additional reporting under the Kyoto Protocol)
State Agency for Land Resources of Ukraine	Reported data on quantifiable land of Ukraine, including the report on land availability and distribution of land between land owners by types of land-use and economic activities; The Land Inventory of Ukraine.
The State Agency for Roest Resources of Ukraine	Information about the volume of activities for the period since 1990 that fall under paragraphs 3 and 4 of Article 3 of the Kyoto Protocol (to create a geobase of data for additional reporting under the Kyoto Protocol)
National University of Life and Environmental Sciences of Ukraine	The amount of excreted manure, the fraction of ash and nitrogen in dry matter of manure, by types, sex and age groups of cattle, pigs and poultry; Distribution of manure of cattle, swine and poultry per animal waste management systems; Data on the average live weight and daily gains and breeds composition of cattle; Data on the average live weight of sheep by breed and sex and age groups, herd structure, daily milk yields, energy nutrition value of milk, method of feeding, digestibility of feed and number of lambs per year from a single ewe; Data on the proportions of total nitrogen losses from manure storage in the liquid and solid forms
NSC "Institute of Agriculture UAAS"	Share values of nitrogen in aboveground crop residues; Data on losses of nitrogen due to volatilization as NH ₃ and NO _x from the applied nitrogen fertilizers; Data on losses of nitrogen through leaching/runoff from fertilizers
The Council of Ministers of the Autonomous Republic of Crimea	Information about the volume of activities for the period since 1990 that fall under paragraphs 3 and 4 of Article 3 of the Kyoto Protocol (to create a geodatabase of data for additional reporting under the Kyoto Protocol)
Regional, Kiev and Sebastopol City Administrations	Information about the volume of activities for the period since 1990 that fall under paragraphs 3 and 4 of Article 3 of the Kyoto Protocol (to create a geobase of data for additional reporting under the Kyoto Protocol)

Recalculations (to be updated each year)

The national inventory contains assessments regarding a calendar year during which emissions get into the atmosphere. In the case when such a principle cannot be realized referring to the absence of appropriate data, measurement of emissions can be carried out using data over other years provided the usage of corresponding methods such as averaging, interpolation and extrapolation. The consequence of annual inventory assessments carries the name "a temporary set". Considering the importance of monitoring emission tendencies in the dynamics of time both for predicting the quantity of pollutant emissions and for creating national plans for the control and reduction of emissions, Ukraine will use the recalculation of all the temporary set starting with a new basic years which will be chosen as the most accurate and comprehensive in terms of getting source data and emission calculations of all pollutants according to the requirements of EMEP\EEA Emissions Inventory Guidebook requirements.

1.5 Key Categories (to be updated each year)

Key category

A key category means a source category of emissions that has a significant influence on a Party's total emissions in terms of the absolute level of emissions of a given substance the trend in emissions over a given time period or the uncertainty in the estimates for that Party. The concept of key categories is an important aspect in inventory development in that it helps to identify priorities for resource allocation in data collection and compilation, quality assurance/quality control and reporting.

When analyzing the key category, ten manufacturing sectors were defined which make the most significant contribution according to all the pollutants (Table of main sectors in terms of emissions). The rest of sectors were identified as others, their total contribution according to all the pollutants is less than 1.5%.

Percentage contribution of every manufacturing sector is represented by the diagram (Interest contribution of main sectors in terms of emissions).

Summing the percentage contributions of pollutants for each of certain key categories allows making a single rank of all the main sectors.

After the conducted analysis we can make a conclusion that two main sectors are key in amount of all pollutants:

1A1a Public electricity and heat production – gross emissions of all pollutants accounted for 37.48% of total emissions in Ukraine.

1A3bi Road transport: Passenger cars - gross emissions of all pollutants accounted for 15.14% of total emissions in Ukraine.

These two categories form more than a half of all the pollutant emissions of the country.

However, if we make a comparison of sectors for all substances, we can see that 2C1 iron and steel production is a sector which dramatically influences the quantity of emissions of total. Also 1A3biii category (Road transport: Heavy duty vehicles and buses) has a significant contribution in such substances as benzo(k) fluoranthe, benzo(b) fluoranthe.

To summarize, we can say, that analysing the key categories we identified 4 sectors which give a total contribution of pollutant emissions of more than 60% and have a bigger part of links as metallurgical sector has a big input in fuel combustion and electricity consumption produced through it, and transport along with heavy cars are parts of metallurgical sector production.

Table of main sectors in terms of emissions

		NO _x (as NO ₂) kt	NM VOC kt	SO _x (as SO ₂) kt	NH ₃ kt	PM _{2.5} kt	PM ₁₀ kt
1A1a	Public electricity and heat production	368,122	28,100	103,353	0,941	36,016	43,095
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	10,783	4,372	35,282	0,003	0,038	0,284
1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals	1,084	0,413	1,999	0,001	2,053	8,520
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	5,823	2,313	7,447	0,000	2,464	7,747
1A3bi	Road transport: Passenger cars	56,866	41,383	0,285	0,895	1,316	1,316
1A3biii	Road transport: Heavy duty vehicles and buses	38,897	1,832	0,157	0,020	0,960	0,960
1A4bi	Residential: Stationary	20,322	14,909	20,255	0,022	0,119	1,521
2C1	Iron and steel production	1,985	2,302	42,893	0,198	0,100	10,935
2C2	Ferroalloys production	1,282	0,003	1,832	NA	0,112	0,993
2H2	Food and beverages industry	1,382	52,009	0,887	0,319	0,784	3,762

Table of main sectors in terms of emissions

		TSP	BC	CO	Pb	Cd	Hg
		kt	kt	kt	t	t	t
1A1a	Public electricity and heat production	49,227	4,024	303,494	44,273	1,698	3,675
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	9,594	NE	53,474	4,550	0,083	0,001
1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals	11,680	NE	3,344	1,427	0,002	0,003
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	32,591	NE	9,790	1,812	0,177	0,624
1A3bi	Road transport: Passenger cars	1,316	0,726	403,545	2,372	0,000	0,021
1A3biii	Road transport: Heavy duty vehicles and buses	0,960	0,509	9,198	0,002	0,000	0,008
1A4bi	Residential: Stationary	7,213	NE	161,834	1,839	NA	0,004
2C1	Iron and steel production	68,615	NE	27,887	36,881	1,042	0,277
2C2	Ferroalloys production	2,596	NE	24,925	0,345	NA	NA
2H2	Food and beverages industry	10,816	NE	7,033	0,030	NA	0,006

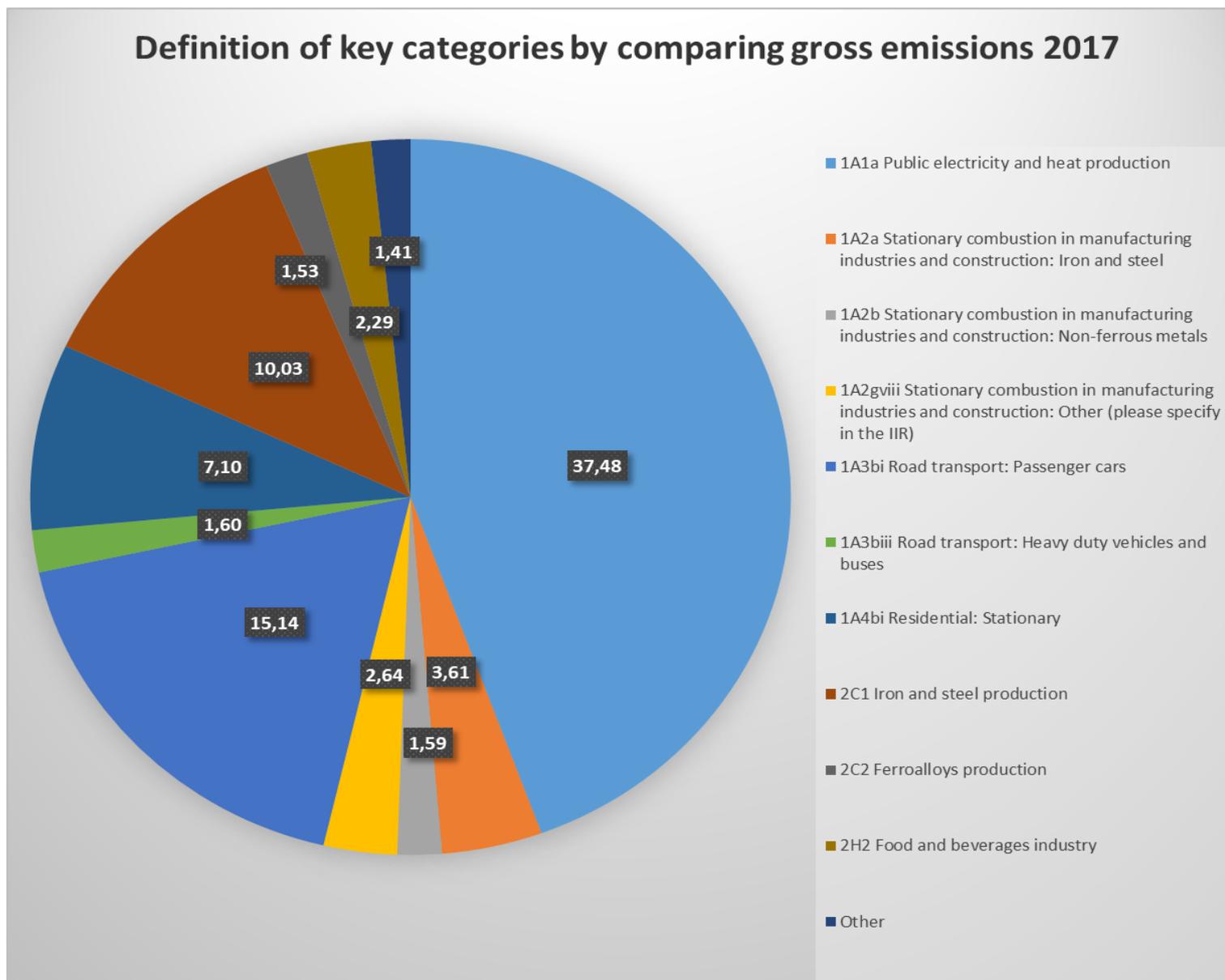
Table of main sectors in terms of emissions

		As	Cr	Cu	Ni	Se	Zn
		t	t	t	t	t	t
1A1a	Public electricity and heat production	10,649	8,338	20,742	24,427	26,143	123,166
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0,002	0,078	1,877	0,742	NA	0,742
1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals	0,066	0,053	14,847	0,034	NA	8,207
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	1,612	3,894	2,618	1,816	2,482	5,887
1A3bi	Road transport: Passenger cars	0,001	0,020	0,014	0,004	0,000	0,078
1A3biii	Road transport: Heavy duty vehicles and buses	0,000	0,013	0,009	0,000	0,000	0,028
1A4bi	Residential: Stationary	0,519	1,235	1,474	3,154	0,001	5,482
2C1	Iron and steel production	0,392	24,465	9,185	6,832	0,004	105,101
2C2	Ferroalloys production	NA	4,103	0,150	13,446	NA	1,913
2H2	Food and beverages industry	0,084	0,075	0,116	0,074	NA	0,012

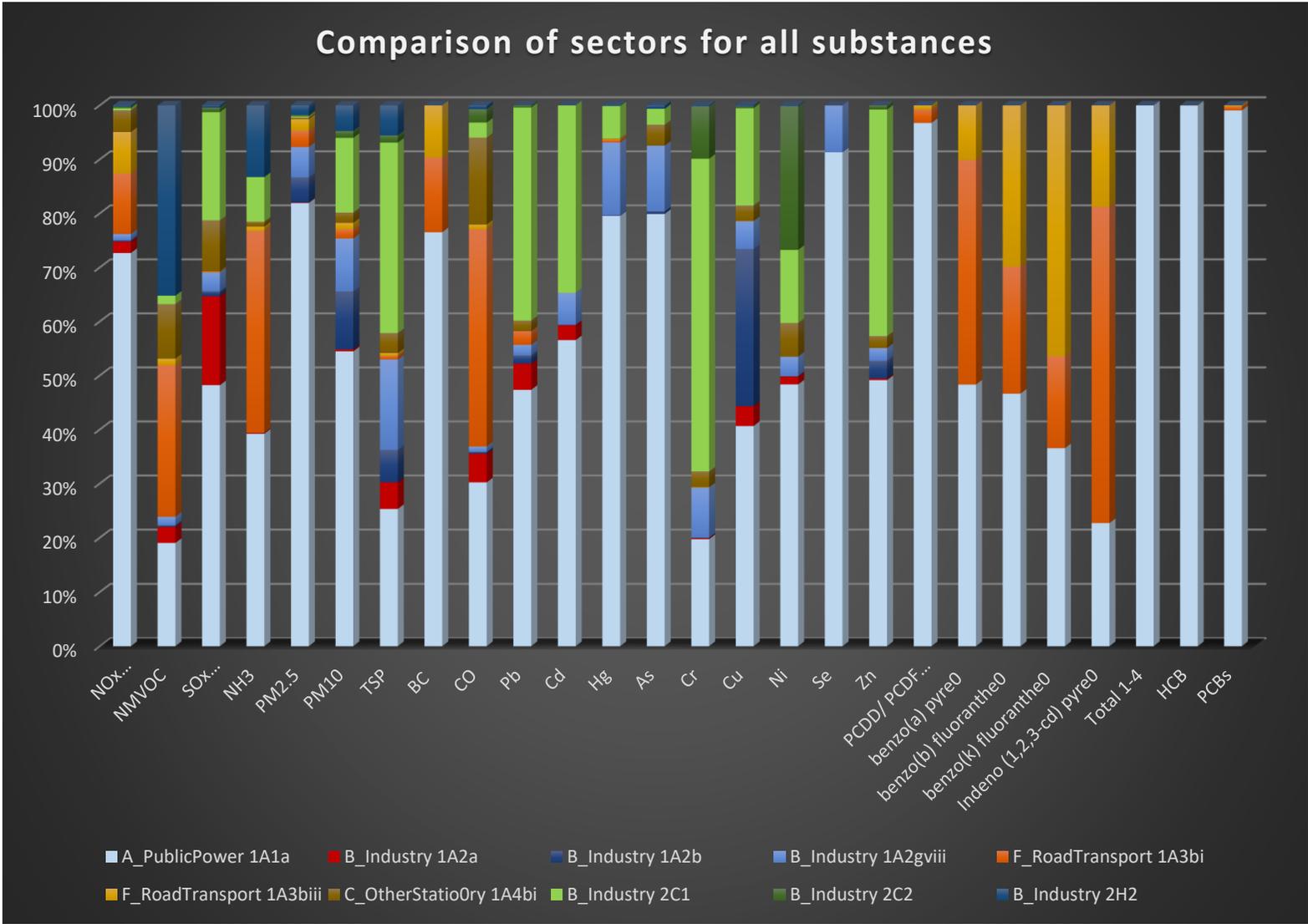
Table of main sectors in terms of emissions

		PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene	benzo(k) fluoranthene	Indeno (1,2,3- cd) pyrene	Total 1-4	HCB	PCBs
		g I-TEQ	t	t	t	t	t	kg	kg
1A1a	Public electricity and heat production	10,649	8,338	20,742	24,427	26,143	123,166	7,501	0,039
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0,002	0,078	1,877	0,742	NA	0,742	0,000	0,000
1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals	0,066	0,053	14,847	0,034	NA	8,207	0,000	0,000
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	1,612	3,894	2,618	1,816	2,482	5,887	0,000	0,000
1A3bi	Road transport: Passenger cars	0,001	0,020	0,014	0,004	0,000	0,078	0,001	0,000
1A3biii	Road transport: Heavy duty vehicles and buses	0,000	0,013	0,009	0,000	0,000	0,028	0,000	0,000
1A4bi	Residential: Stationary	0,519	1,235	1,474	3,154	0,001	5,482	0,000	0,000
2C1	Iron and steel production	0,392	24,465	9,185	6,832	0,004	105,101	0,000	0,000
2C2	Ferroalloys production	NA	4,103	0,150	13,446	NA	1,913	0,000	0,000
2H2	Food and beverages industry	0,084	0,075	0,116	0,074	NA	0,012	0,000	0,000

Interest contribution of main sectors in terms of emissions



Comparison of sectors for all substances



1.6 QA/QC and Verification methods (to be updated every 5 years or when there have been major changes since the last report)

The most effective way to ensure the quality of a time series is to apply both general and category-specific checks to the entire time series. For example, the outlier and implied emission factor checks will help to identify possible inconsistencies in the time series. Category-specific checks are particularly important because they are targeted to unique features of each category. As described above, plotting and comparing the results of splicing techniques on a graph is a useful QA/QC strategy. If alternative splicing methods produce different results, countries should consider which result is most realistic. In some cases, additional surrogate data can be used to check the spliced time series.

1.7 General uncertainty evaluation (to be updated every 5 years or when there have been major changes since the last report)

Activity data are usually derived from (economic) statistics, including energy statistics and balances, economic production rates, population data, etc. It is possible that these agencies have already assessed the uncertainties associated with their data as part of their data collection procedures. These uncertainties can be used to construct probability density functions. Only official statistics were used in the calculations.

1.8 General Assessment of Completeness (to be updated each year):

i) Sources Not Estimated (NE),

ii) Sources Included Elsewhere (IE),

ii) Other notation keys

Chapter 2 Explanation of key trends (to be updated each year)

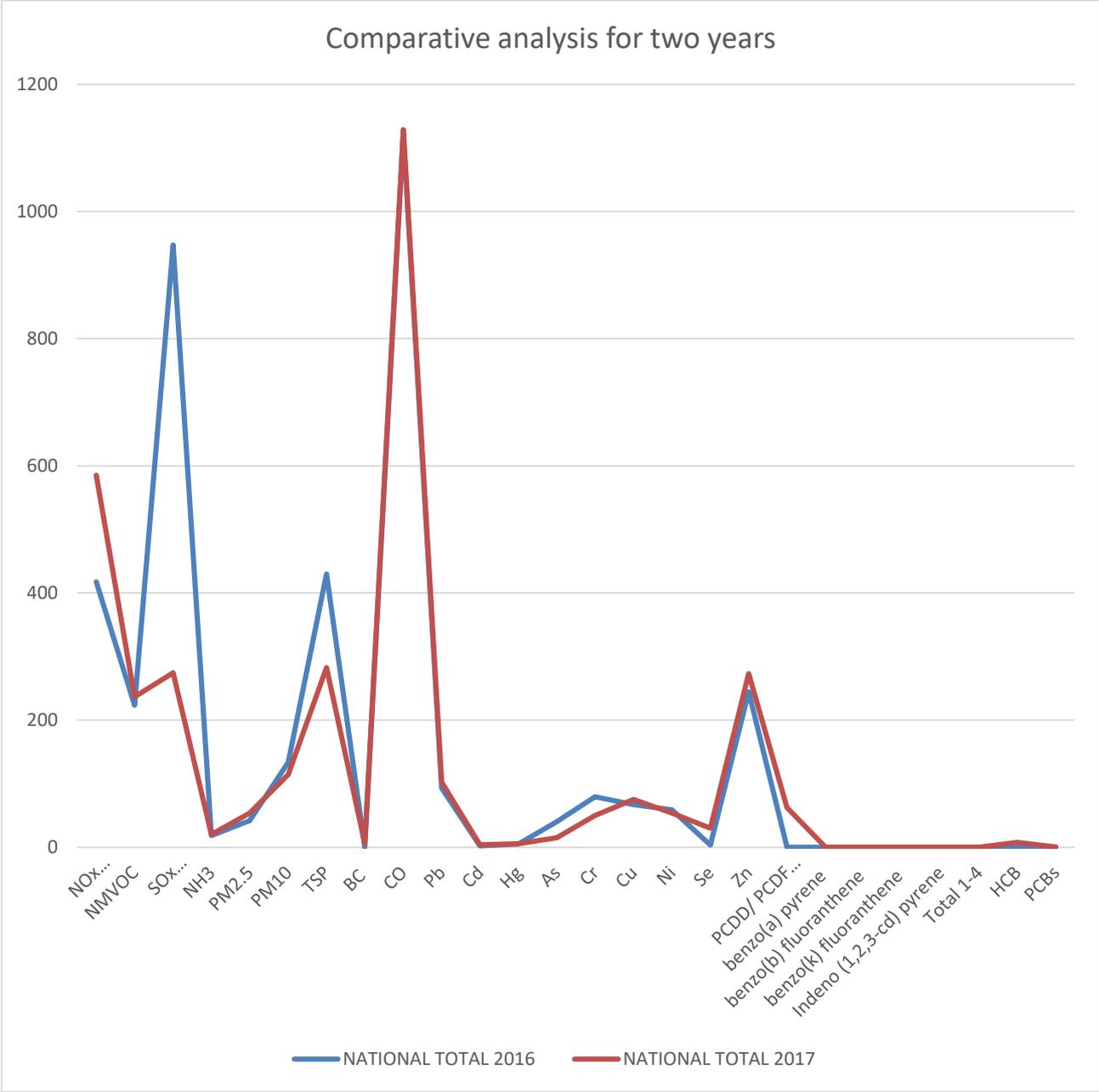
Under changing the approach to calculations in using coefficients and calculation principles according to the EMEP/EEA Air Pollutant Emission Inventory Guidebook 2016 methodology, the quantity of emissions has dramatically reduced compared with the last years. Comparative analysis of the number of emissions according to pollutants is shown in the tables below.

Pollutants	NO _x (as NO ₂)	NMVOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
NATIONAL TOTAL 2016	417,4789	223,2171	947,5267	18,47689	41,8032	133,5899	429,7305
NATIONAL TOTAL 2017	584,9567	236,4644	274,2569	20,14049	53,77405	114,3671	282,6243

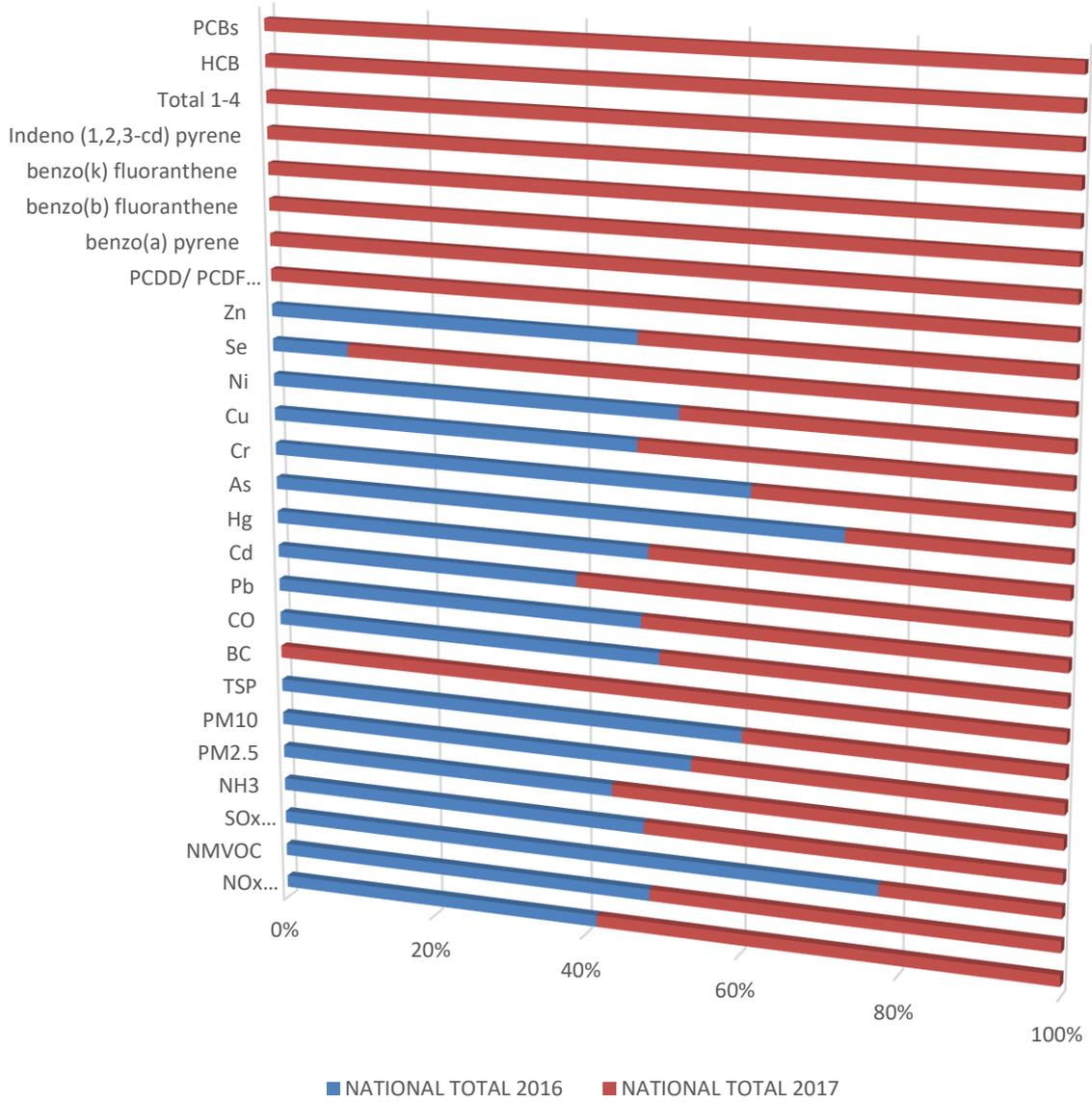
Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
NATIONAL TOTAL 2016	NE	1122,611	92,89687	2,392905	5,073667	40,1489	79,24518
NATIONAL TOTAL 2017	5,929575	1128,556	102,4342	3,696324	5,394242	14,93188	49,97191

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
NATIONAL TOTAL 2016	67,14818	59,14394	3,308228	244,4229	0	0	0
NATIONAL TOTAL 2017	75,37387	53,785	30,07238	273,3102	62,33069	0,089137	0,174069

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
NATIONAL TOTAL 2016	0	0	0	0	0
NATIONAL TOTAL 2017	0,122179	0,076648	0,17394	7,531001	0,676608



Comparative analysis for two years



Chapter 3 (Energy (NFR sector 1))

(to be updated when there have been major changes since the last report)

A_PublicPower	1A1a	Public electricity and heat production	Громадський електричної і теплової енергії
B_Industry	1A1b	Petroleum refining	Нафтопереробка
B_Industry	1A1c	Manufacture of solid fuels and other energy industries	Виробництво твердих палив та інших енергетичних галузей
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	Стационарне спалювання в оброблювальній промисловості і будівництві: Залізо і сталь
B_Industry	1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals	Стационарне спалювання в обробній промисловості та будівництва: Кольорові метали
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals	Стационарне спалювання в оброблювальній промисловості і будівництві: Хімічні
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print	Стационарне спалювання в обробній промисловості та будівництва: Целюлоза, папір і друк
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	Стационарне спалювання в обробній промисловості та будівництва: Харчова промисловість, напої і тютюн
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Стационарне спалювання в обробній промисловості та будівництва: неметалеві корисні копалини
I_Offroad	1A2gvii	Mobile Combustion in manufacturing industries and construction: (please specify in the IIR)	Мобільний спалювання палива в оброблювальній промисловості і будівництві: (будь ласка, вкажіть у IIR)
B_Industry	1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	Стационарне спалювання в оброблювальній промисловості і будівництві: Інше (вкажіть будь ласка в IIR)
H_Aviation	1A3ai(i)	International aviation LTO (civil)	Міжнародний авіаційний LTO (цивільна)
H_Aviation	1A3aai(i)	Domestic aviation LTO (civil)	Вітчизняної авіації LTO (цивільна)
F_RoadTransport	1A3bi	Road transport: Passenger cars	Автомобільний транспорт: легкові
F_RoadTransport	1A3bii	Road transport: Light duty vehicles	Автомобільний транспорт: Легкові автомобілі борг
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses	Автомобільний транспорт: Транспортні засоби великої вантажопідйомності і автобуси
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles	Автомобільний транспорт: Мопеди і мотоцикли
F_RoadTransport	1A3bv	Road transport: Gasoline evaporation	Автомобільний транспорт: Бензин випаровування
F_RoadTransport	1A3bvi	Road transport: Automobile tyre and brake wear	Автомобільний транспорт: Автомобільна шина і знос гальмівних
F_RoadTransport	1A3bvii	Road transport: Automobile road abrasion	Автомобільний транспорт: автодорога до стирання
I_Offroad	1A3c	Railways	Залізниці
G_Shipping	1A3di(ii)	International inland waterways	Міжнародні внутрішні водні шляхи

G_Shipping	1A3dii	National navigation (shipping)	Національний навігації (доставка)
I_Offroad	1A3ei	Pipeline transport	Трубопровідний транспорт
I_Offroad	1A3eii	Other (please specify in the IIR)	Інше (будь ласка, вкажіть в IIR)
C_OtherStationaryComb	1A4ai	Commercial/institutional: Stationary	Комерційна / інституційна: Стаціонарний
I_Offroad	1A4aii	Commercial/institutional: Mobile	Комерційна / інституційна: Мобільний
C_OtherStationaryComb	1A4bi	Residential: Stationary	Житловий: Стаціонарний
I_Offroad	1A4bii	Residential: Household and gardening (mobile)	Житловий: Дом и садівництво (мобільний)
C_OtherStationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary	Сільське господарство / Лісове господарство / Рибальство: Стаціонарний
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	Сільське господарство / Лісове господарство / Рибальство: Всюдиходи і іншої техніки
I_Offroad	1A4ciii	Agriculture/Forestry/Fishing: National fishing	Сільське господарство / Лісове господарство / Рибальство: національної риболовлі
C_OtherStationaryComb	1A5a	Other stationary (including military)	Інша стаціонарні (у тому числі військових)
I_Offroad	1A5b	Other, Mobile (including military, land based and recreational boats)	Інше Мобільна (у тому числі військові, наземних і рекреаційні човни)
D_Fugitive	1B1a	Fugitive emission from solid fuels: Coal mining and handling	Неорганізований викид з твердих видів палива: Видобуток вугілля і звернення
D_Fugitive	1B1b	Fugitive emission from solid fuels: Solid fuel transformation	Неорганізований викид від спалювання твердого палива: перетворення твердого палива
D_Fugitive	1B1c	Other fugitive emissions from solid fuels	Інші неорганізовані викиди від твердого палива
D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport	Летючі викиди нафти: Розвідка, видобуток, транспорт
D_Fugitive	1B2aiv	Fugitive emissions oil: Refining / storage	Летючі викиди нафти: Переробка / зберігання
D_Fugitive	1B2av	Distribution of oil products	Розподіл нафтопродуктів
D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	Летючі викиди з природного газу (розвідка, видобуток, переробка, транспортування, зберігання, розповсюдження та інше)
D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)	Вентиляція і спалювання (нафта, газ, в поєднанні нафти і газу)
D_Fugitive	1B2d	Other fugitive emissions from energy production	Інші неорганізовані викиди від виробництва енергії

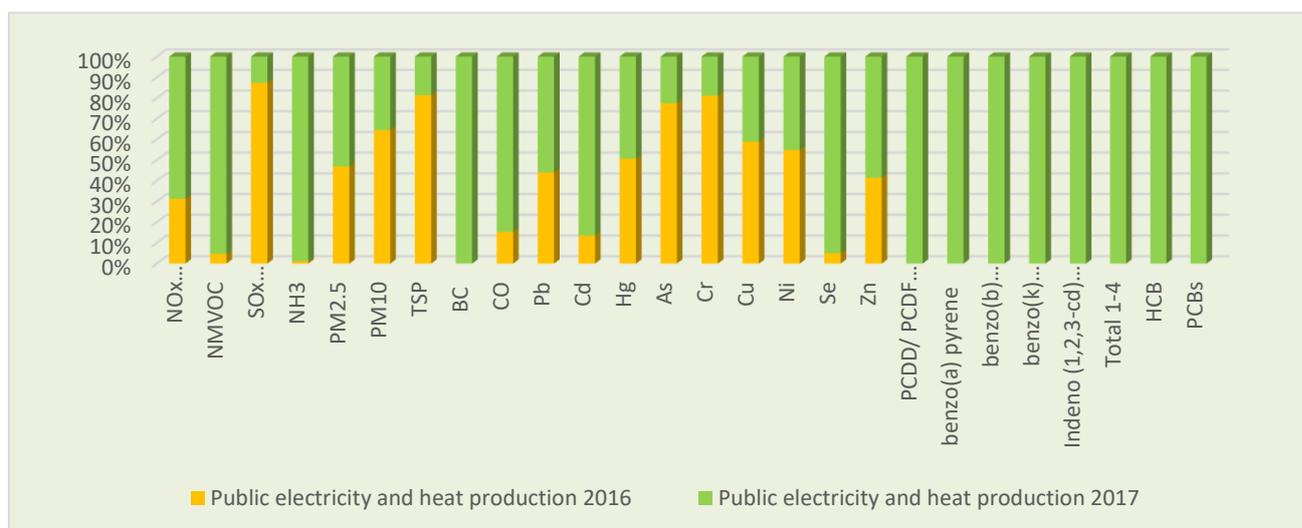
1A1a Public electricity and heat production

United Power Grid of Ukraine (UPGU) includes, apart from thermal power plants that burn fossil fuels, nuclear power plants (NPP), hydroelectric plants (HPP) and wind power plants (WPP). Thermal power stations operating in Ukraine are divided into condensing thermal power plants (TPP) and combined heat-and-power plants (CHP).

In the vast majority of cases a technology of fuel combustion in a boiler is used in Ukraine to generate steam for its subsequent supply to the steam turbine. The use of the internal combustion technology (gas turbines and internal combustion engines) for production of electricity is not yet widely spread. For combustion in steam boilers of thermal power plants, coal is mostly used, while thermoelectric plants use natural gas.

This category also includes emissions from the boiler systems for district heating and waste incineration plants, which produce heat and/or electricity.

This category does not include emissions from power plants and boiler companies, which produce heat and electricity for the needs of these enterprises. Emissions from these power stations and boilers are included in categories, which cover the companies whose needs these plants and boilers meet.



Pollutants	NO _x (as NO ₂)	NMVOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
1A1a Public electricity and heat production 2016	167,76	1,40	712,40	0,01	31,76	78,26	215,04
1A1a Public electricity and heat production 2017	368,1222	28,1005	103,353	0,94111	36,01629	43,09482	49,22676

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
1A1a Public electricity and heat production 2016	NE	54,68	34,68	0,27	3,77	36,68	35,75
1A1a Public electricity and heat production 2017	4,023639	303,494	44,273	1,69787	3,67486	10,6485	8,33779

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
1A1a Public electricity and heat production 2016	29,68	29,61	1,39	86,94	0,00	0,00	0,00
1A1a Public electricity and heat production 2017	20,7419	24,427	26,1432	123,166	59,8153	0,03818	0,07545

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
1A1a Public electricity and heat production 2016	0,00	0,00	0,00	0,00	0,00
1A1a Public electricity and heat production 2017	0,04245	0,01498	0,17107	7,50063	0,03939

1A1b Petroleum refining

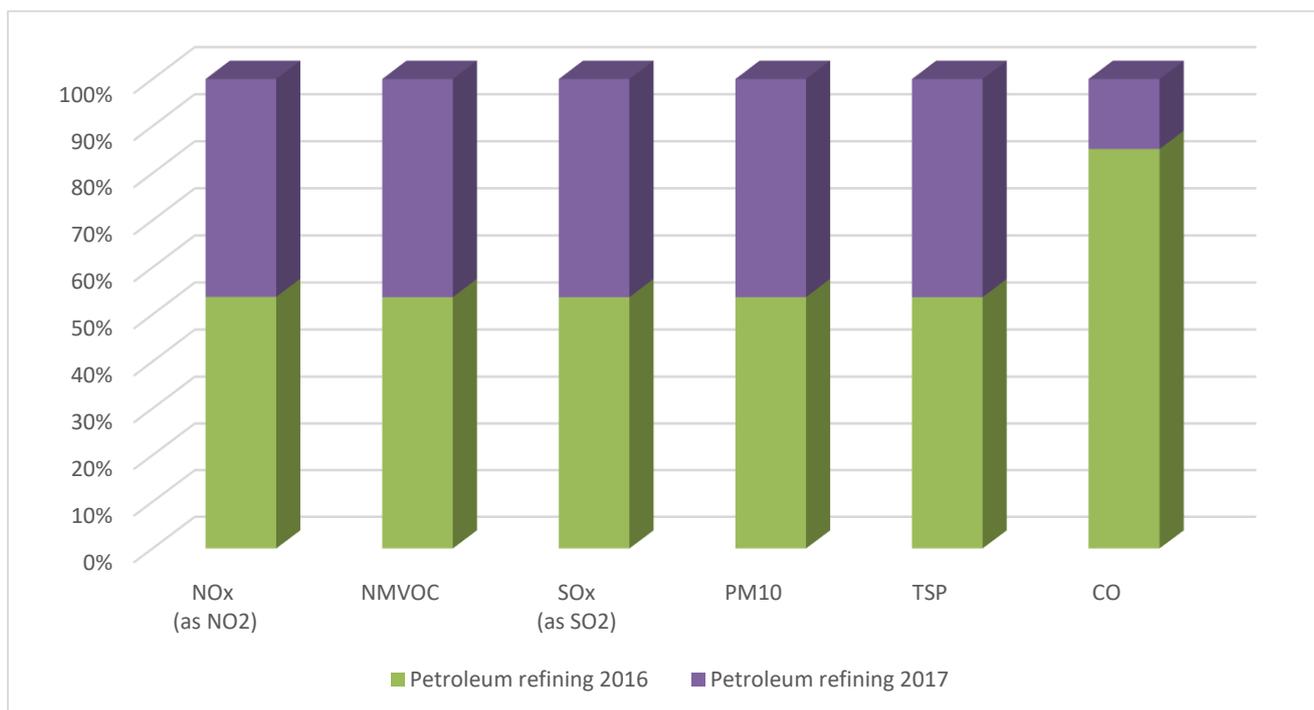
This category accounts for the combustion of both derivative fuels (refinery gas), as well as fossil fuels supplied from aside. Refineries and gas processing plants use both types of fuels to produce heat and electricity that are needed primarily for the implementation of technological processes, as well as for other business needs.

Pollutants	NO _x (as NO ₂)	NM VOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
Petroleum refining 2016	0,63151	0,01099	1,99748	NA	NA	0,01367	0,01815
Petroleum refining 2017	0,54369	0,00949	1,72382	NA	NA	0,01180	0,01566

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
Petroleum refining 2016	NE	0,08973	0,00000	0,00000	0,00000	0,00000	0,00000
Petroleum refining 2017	NE	0,01566	0,00000	0,00000	0,00000	0,00000	0,00000

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
Petroleum refining 2016	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
Petroleum refining 2017	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
Petroleum refining 2016	0,00000	0,00000	0,00000	0,00000	0,00000
Petroleum refining 2017	0,00000	0,00000	0,00000	0,00000	0,00000



1A1c Manufacture of solid fuels and other energy industries

This category includes emissions from fuel combustion at the enterprises engaged in production of energy materials (coal, peat, gas, oil and uranium ore), manufacture of coke from coal, as well as processing of uranium ore.

The heaviest portion in the consumption of fuel for energy needs belongs to the coke producing companies and the companies producing fossil fuel energy resources.

This category covers GHG emissions by economic sectors that have been assigned code designations at the level of subsection CA “Extraction of fuel and energy mineral resources”, at the level of group 23.1 “Coke Production” and 23.3 “Production of Nuclear Materials” in accordance with CEA.

It should be noted that, in the production of coke, the consumption of coking coal was not considered in the fuel combustion, while the combustion of the coke oven gas was considered which was produced through the coking process and used for heating the coke oven batteries, as well as for other needs. This category does not include the combustion of coke oven gas by flaring (category 1.B.1.a “Solid Fuel”).

The use of coke is reflected in sector “Industrial Processes”, category “Iron and Steel Production” (category 2.C.1).

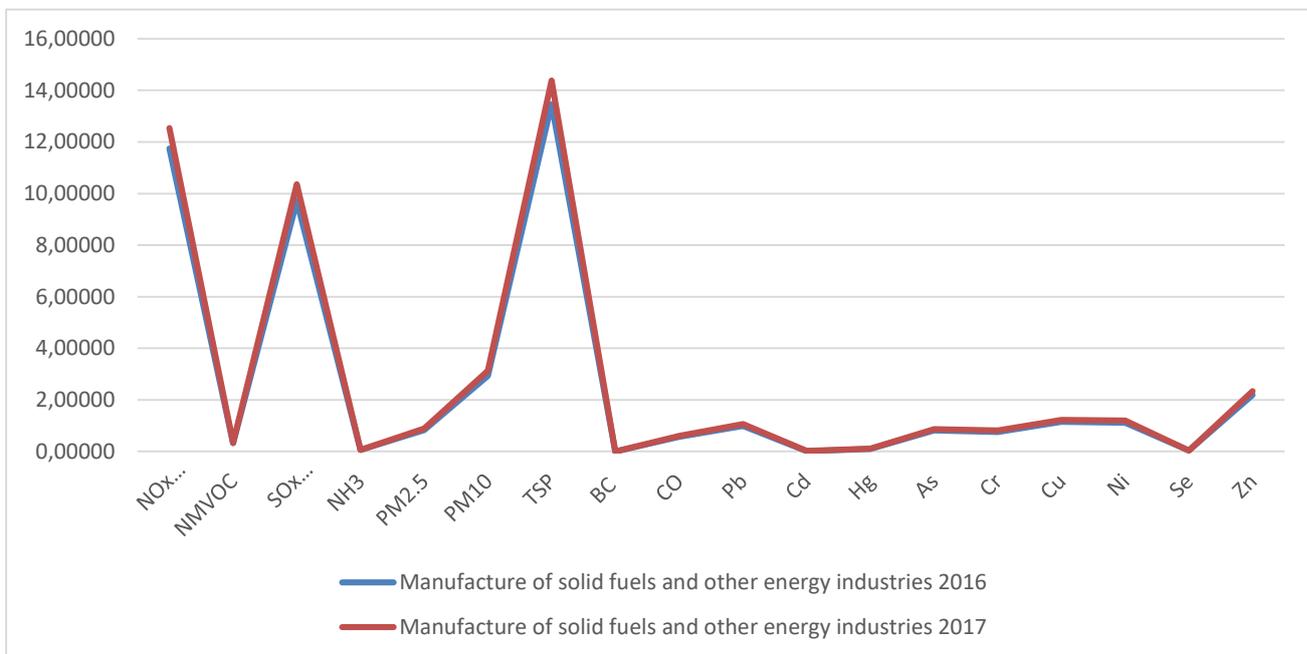
To avoid double counting of emissions, as well as underestimation of emissions, the balance for coking coal, coke and coke oven gas was composed, which is presented in Annex . The balance showed a good convergence and allowed to confirm that there was no double counting of emissions, as well as underestimation of emissions in this, as well as in other related categories.

Pollutants	NO _x (as NO ₂)	NMVOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
Manufacture of solid fuels and other energy industries 2016	11,74532	0,31454	9,70468	0,05633	0,83216	2,93202	13,46932
Manufacture of solid fuels and other energy industries 2017	12,54401	0,33593	10,36460	0,06017	0,88875	3,13139	14,38523

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
Manufacture of solid fuels and other energy industries 2016	NE	0,56743	0,99017	0,01643	0,09762	0,81441	0,75828
Manufacture of solid fuels and other energy industries 2017	NE	0,60602	1,05750	0,01755	0,10426	0,86979	0,80984

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
Manufacture of solid fuels and other energy industries 2016	1,14375	1,11743	0,03599	2,19149	0,00000	0,00000	0,00000
Manufacture of solid fuels and other energy industries 2017	1,22152	1,19342	0,03843	2,34051	0,00000	0,00000	0,00000

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
Manufacture of solid fuels and other energy industries 2016	0,00000	0,00000	0,00000	0,00000	0,00000
Manufacture of solid fuels and other energy industries 2017	0,00000	0,00000	0,00000	0,00000	0,00000



1A2a Stationary combustion in manufacturing industries and construction: Iron and steel

The ferrous metal industry is the second largest, after the thermoelectric power industry, consumer of natural gas. This category is distinguished by a large share of non-energy use of fuels, mostly coke. Emissions from use of coke in blast furnaces are accounted for in sector “Industrial Processes”.

This category covers emissions of the economic entities that have been assigned code designations at group levels 27.1 “Production of pig iron, steel and ferroalloys”, 27.2 “Manufacture of tubes” and 27.3 “Other types of primary steel processing” in accordance with CEA .

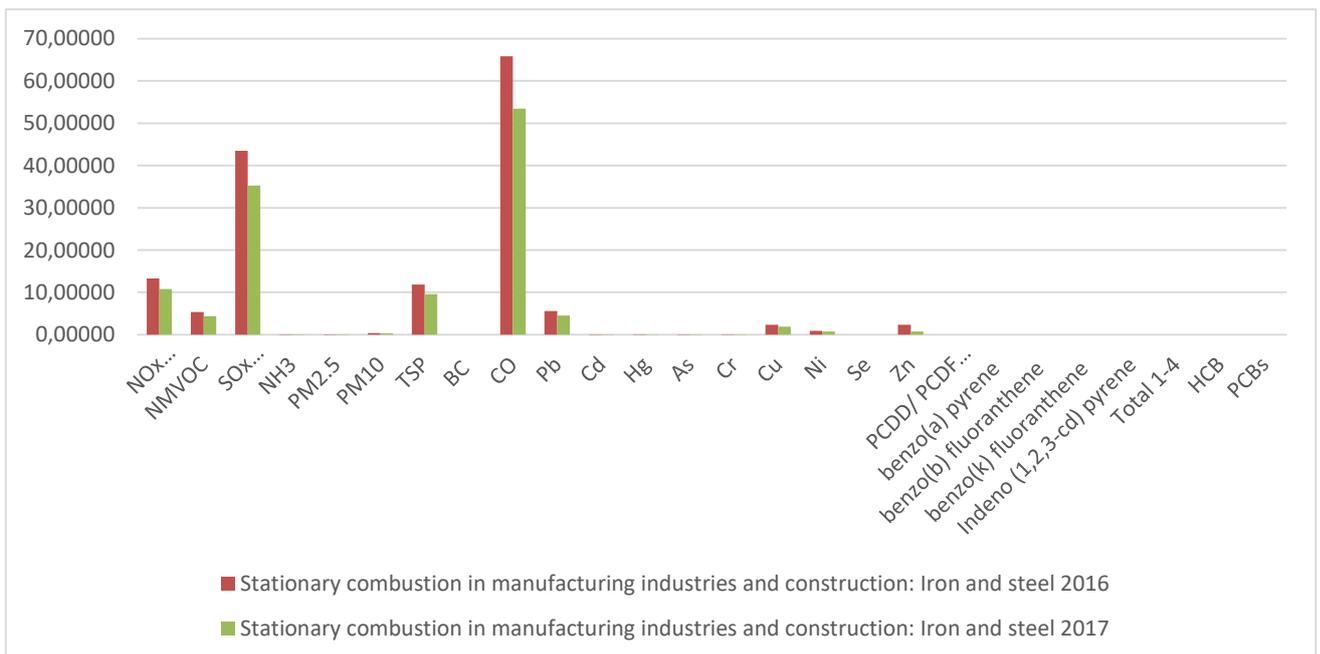
It should be noted that emissions associated with the use of metallurgical coke in the blast furnace process are reflected in sector “Industrial Processes”

Pollutants	NO _x (as NO ₂)	NMVOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
Manufacture of solid fuels and other energy industries 2016	11,74532	0,31454	9,70468	0,05633	0,83216	2,93202	13,46932
Manufacture of solid fuels and other energy industries 2017	12,54401	0,33593	10,36460	0,06017	0,88875	3,13139	14,38523

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
Manufacture of solid fuels and other energy industries 2016	NE	0,56743	0,99017	0,01643	0,09762	0,81441	0,75828
Manufacture of solid fuels and other energy industries 2017	NE	0,60602	1,05750	0,01755	0,10426	0,86979	0,80984

Pollutants	Cu	Ni	Se	Zn	PCDD/PCDF (dioxins/furans) g I-TEQ	benzo(a) pyrene t	benzo(b) fluoranthene t
Manufacture of solid fuels and other energy industries 2016	1,14375	1,11743	0,03599	2,19149	0,00000	0,00000	0,00000
Manufacture of solid fuels and other energy industries 2017	1,22152	1,19342	0,03843	2,34051	0,00000	0,00000	0,00000

Pollutants	benzo(k) fluoranthene t	Indeno (1,2,3-cd) pyrene t	Total 1-4 t	HCB kg	PCBs kg
Manufacture of solid fuels and other energy industries 2016	0,00000	0,00000	0,00000	0,00000	0,00000
Manufacture of solid fuels and other energy industries 2017	0,00000	0,00000	0,00000	0,00000	0,00000



1A2b Stationary combustion in manufacturing industries and construction: Non-ferrous metals

Unlike “Iron and Steel”, “Non-Ferrous Metals” in Ukraine has a smaller share, both in production volumes, and in amounts of consumed fuel resources. However, the industry consumes large amounts of electricity, mainly in the production of aluminum. The main share in the production of nonferrous metals is occupied by aluminum and copper. Ukraine produces both primary aluminum and the raw material for its production – alumina. The raw material for production of alumina – bauxites – is imported.

Zinc, magnesium, chromium, nickel, titanium dioxide and other non-ferrous metals are also produced in Ukraine, though in small quantities.

This category covers emissions of the economic entities that have been assigned code designations at group level 27.4 “Non-ferrous metals” in accordance with CEA .

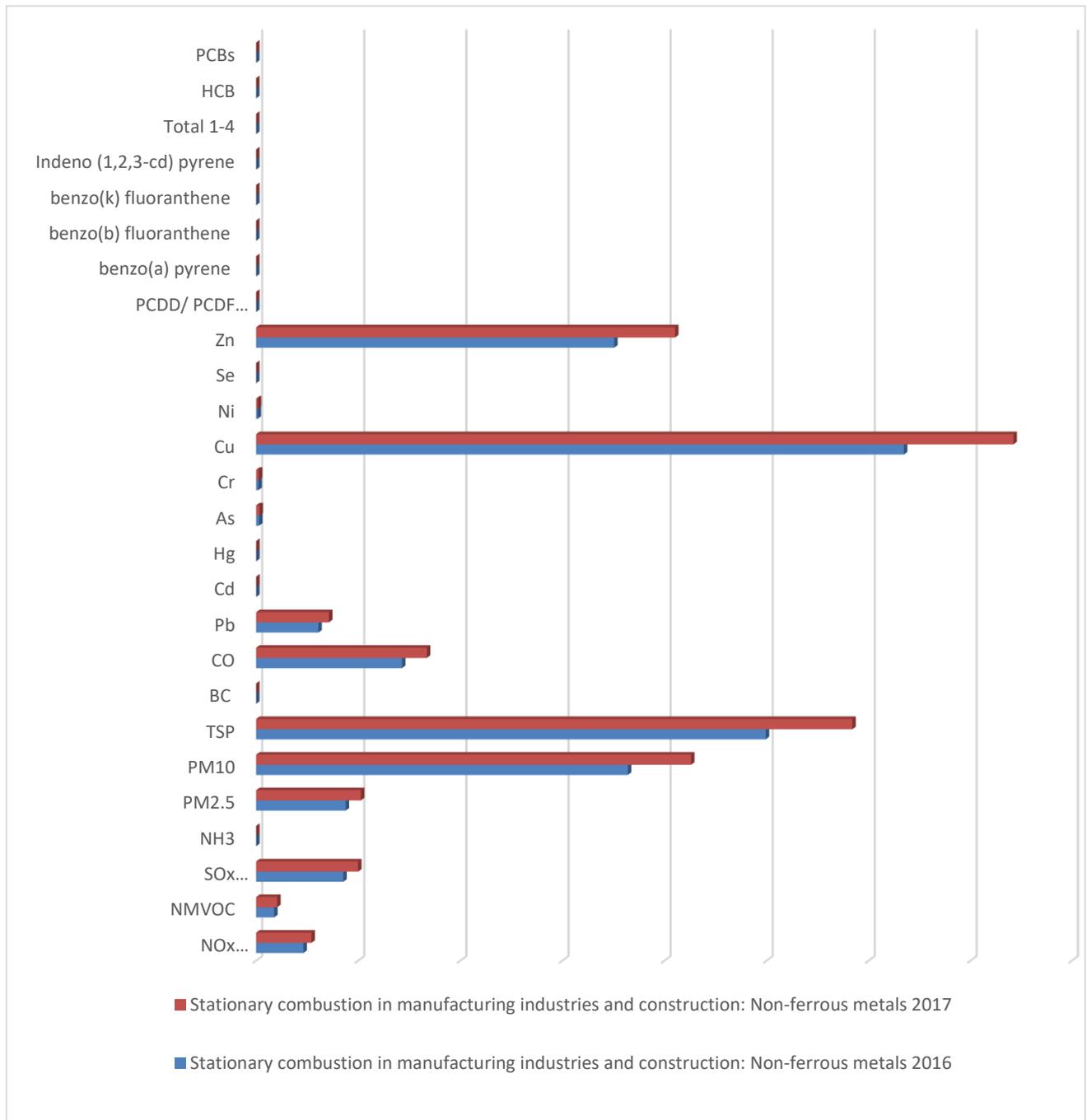
The main direction of fuel use in this category is to provide enterprises with heat and electricity, and to cover technological needs.

Pollutants	NO _x (as NO ₂)	NM VOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
Stationary combustion in manufacturing industries and construction: Non-ferrous metals 2016	0,92643	0,35261	1,70814	0,00092	1,75492	7,28237	9,98332
Stationary combustion in manufacturing industries and construction: Non-ferrous metals 2017	1,08392	0,41256	1,99852	0,00108	2,05326	8,52037	11,68049

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
Stationary combustion in manufacturing industries and construction: Non-ferrous metals 2016	NE	2,85839	1,21933	0,00185	0,00277	0,05679	0,04532
Stationary combustion in manufacturing industries and construction: Non-ferrous metals 2017	NE	3,34431	1,42661	0,00216	0,00324	0,06644	0,05303

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
Stationary combustion in manufacturing industries and construction: Non-ferrous metals 2016	12,69015	0,02892	NA	7,01453	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-ferrous metals 2017	14,84748	0,03384	NA	8,20700	0,00000	0,00000	0,00000

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
Stationary combustion in manufacturing industries and construction: Non-ferrous metals 2016	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-ferrous metals 2017	0,00000	0,00000	0,00000	0,00000	0,00000



1A2c Stationary combustion in manufacturing industries and construction: Chemicals

The main products of the chemical industry are ammonia, mineral fertilizers (urea, ammonium nitrate, etc.), acids (sulfuric, nitric, etc.), baking soda, as well as plastic and rubber products.

The chemical industry is one of the largest industrial consumers of natural gas in Ukraine, after the thermal power industry and ferrous metal industry. Annually, the enterprises included in this category consumed smaller volumes of natural gas, which is lower than the value for former years and is caused, first of all, by a substantial increase of natural gas costs and a reduction in the consumption of main products – ammonia and fertilizers. This led to a corresponding reduction of emissions in the category.

This category is distinguished by a large share of fuel used as a raw material, mainly of natural gas. About 74% of the gas consumed by this industry is used as a raw material. Emissions from use of natural gas as a raw material are accounted for in sector “Industrial Processes”.

This category covers the economic entities, that have been assigned code designations at the level of sub-section DG “Chemical Industry” and DH “Manufacture of rubber and plastic products” in accordance with CEA .

The main direction of fuel use in this category is to provide enterprises with heat and electricity, and to cover technological needs.

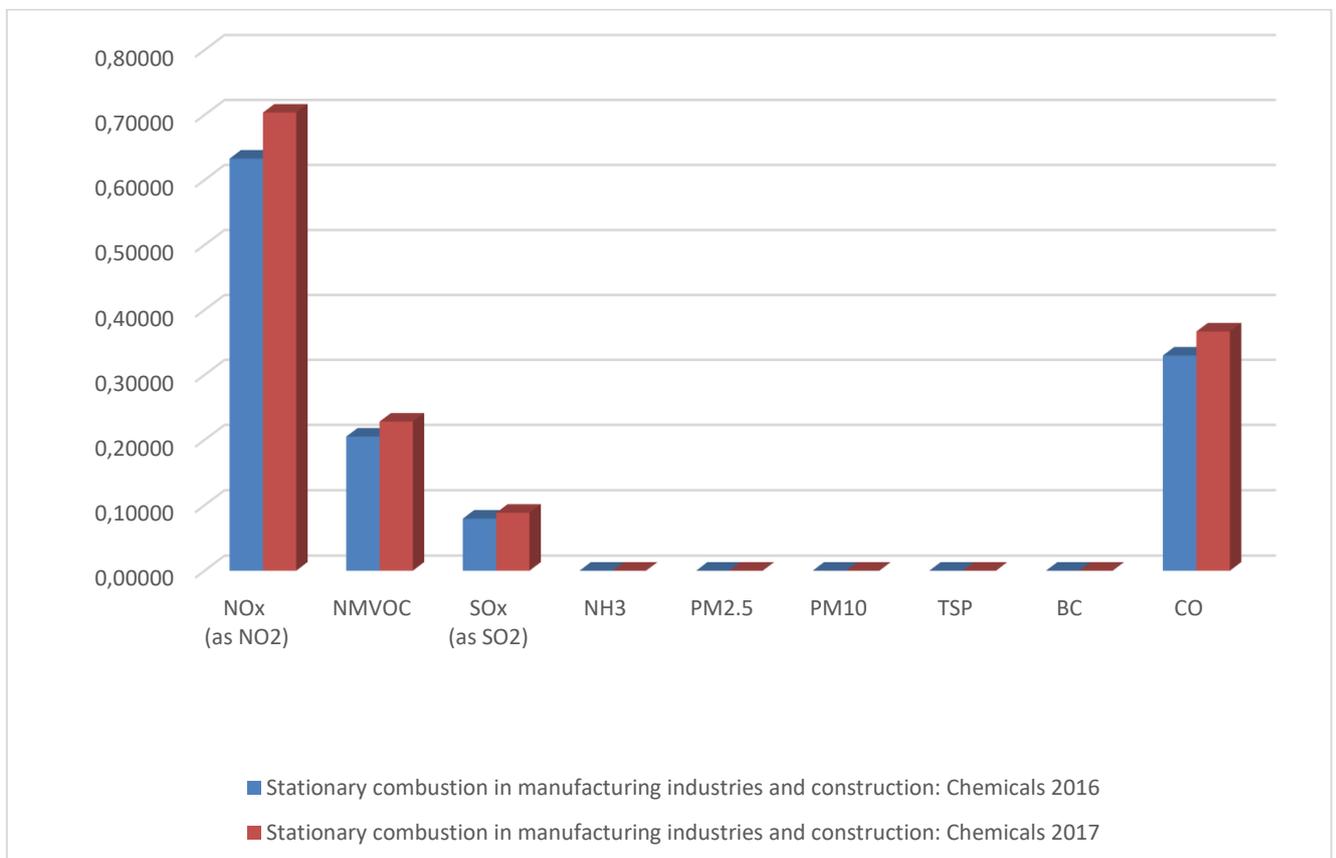
Emissions from the non-energy use of fossil fuels (e.g., natural gas for ammonia production) are reflected in sector “Industrial Processes”.

Pollutants	NO _x (as NO ₂)	NM VOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
Stationary combustion in manufacturing industries and construction: Chemicals 2016	0,63279	0,20510	0,07957	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Chemicals 2017	0,70366	0,22808	0,08848	0,00000	0,00000	0,00000	0,00000

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
Stationary combustion in manufacturing industries and construction: Chemicals 2016	NE	0,32983	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Chemicals 2017	NE	0,36677	0,00000	0,00000	0,00000	0,00000	0,00000

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
Stationary combustion in manufacturing industries and construction: Chemicals 2016	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Chemicals 2017	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
Stationary combustion in manufacturing industries and construction: Chemicals 2016	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Chemicals 2017	0,00000	0,00000	0,00000	0,00000	0,00000



1A2d Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print

This category includes emissions from companies that manufacture paper and cardboard and their products, as well as carry out publishing and printing activities. The main direction of fuel use in this category is to provide enterprises with heat and electricity, and to cover technological needs.

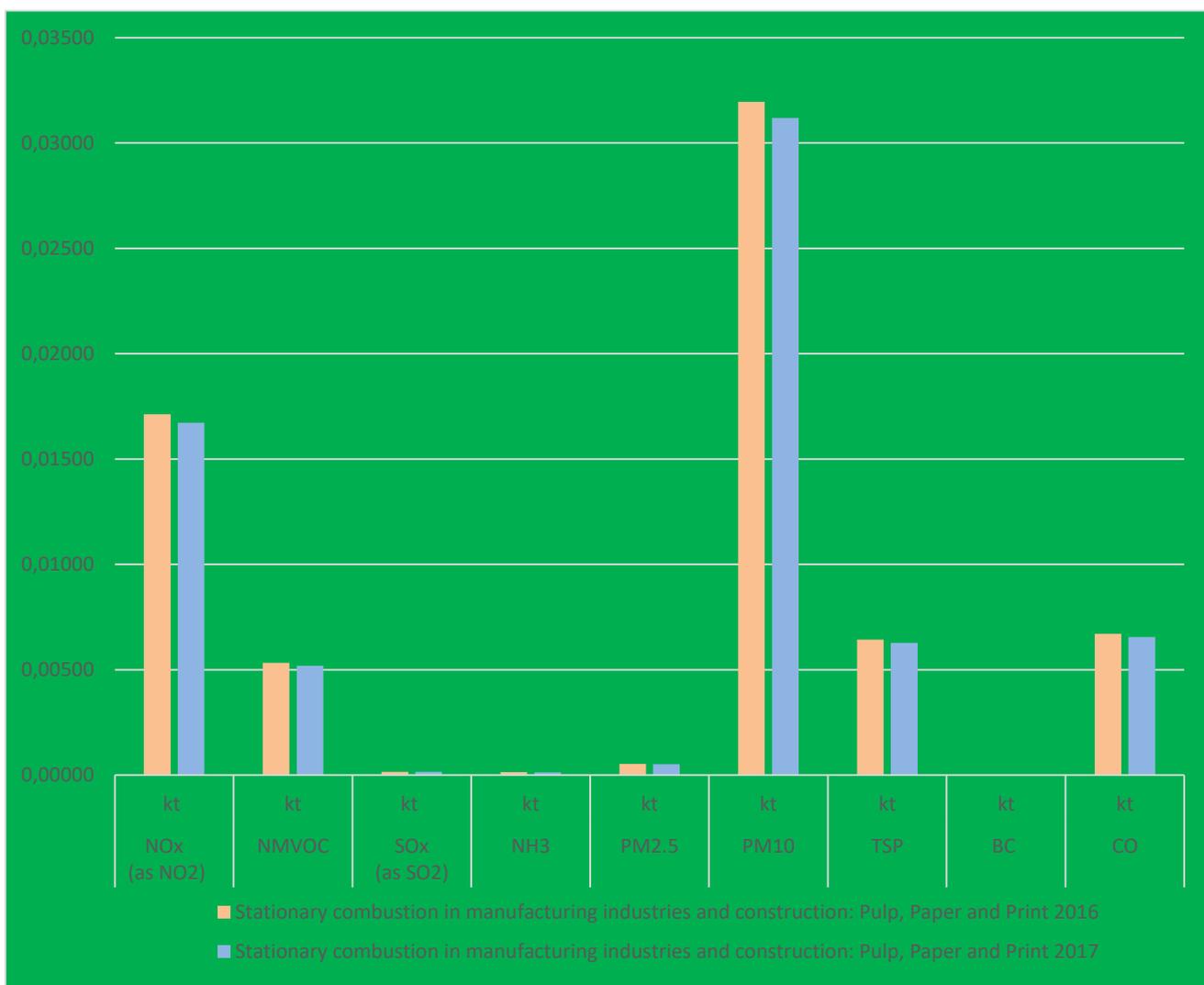
This category covers emissions of economic entities that have been assigned code designations at the level of subsection DE “Pulp and paper industry and publishing” in accordance with CEA.

Pollutants	NO _x (as NO ₂)	NM VOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print 2016	0,01713	0,00532	0,00016	0,00014	0,00053	0,03196	0,00643
Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print 2017	0,01672	0,00520	0,00015	0,00014	0,00052	0,03119	0,00628

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print 2016	NE	0,00671	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print 2017	NE	0,00655	0,00000	0,00000	0,00000	0,00000	0,00000

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print 2016	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print 2017	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print 2016	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print 2017	0,00000	0,00000	0,00000	0,00000	0,00000



1A2e Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco

The main sources of emissions in this category are businesses of sugar, baking and dairy industries, as well as enterprises for the production of beverages.

The main direction of fuel use in this category is to provide enterprises with heat and electricity, and to cover technological needs.

This category covers emissions of economic entities that have been assigned code designations at the level of subsection DA “Production of foods, beverages and tobacco products” in accordance with CEA .

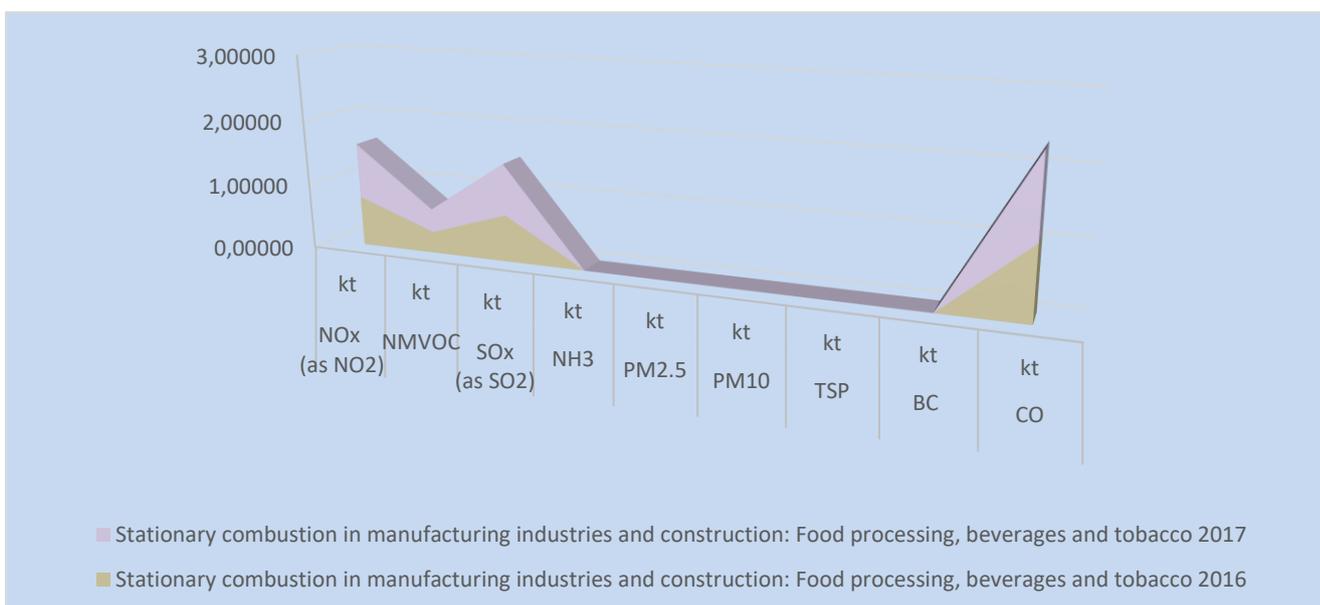
The main direction of fuel use in this category is to provide enterprises with heat and electricity, and to cover technological needs.

Pollutants	NO _x (as NO ₂)	NMVOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco 2016	0,76643	0,32822	0,71502	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco 2017	0,84460	0,36170	0,78796	0,00000	0,00000	0,00000	0,00000

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco 2016	NE	1,10399	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco 2017	NE	1,21660	0,00000	0,00000	0,00000	0,00000	0,00000

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco 2016	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco 2017	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco 2016	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco 2017	0,00000	0,00000	0,00000	0,00000	0,00000



1A2f Stationary combustion in manufacturing industries and construction: Non-metallic minerals

This category includes emissions from fuel combustion by enterprises that are not included in other categories.

This category covers emissions of the economic entities that have been assigned code designations in accordance with CEA :

- 1) at the section level:
 - F “Construction”;
- 2) at the subsection level:
 - CB “Mining and quarrying, except fuel and energy resources”;
 - DB “The textile industry, production of garments, furs and fur products”;
 - DC “Manufacture of leather, leather goods and other materials”;
 - DD “Wood processing and production of wood products, except furniture”;
 - DI “Manufacture of other non-metallic mineral products”;

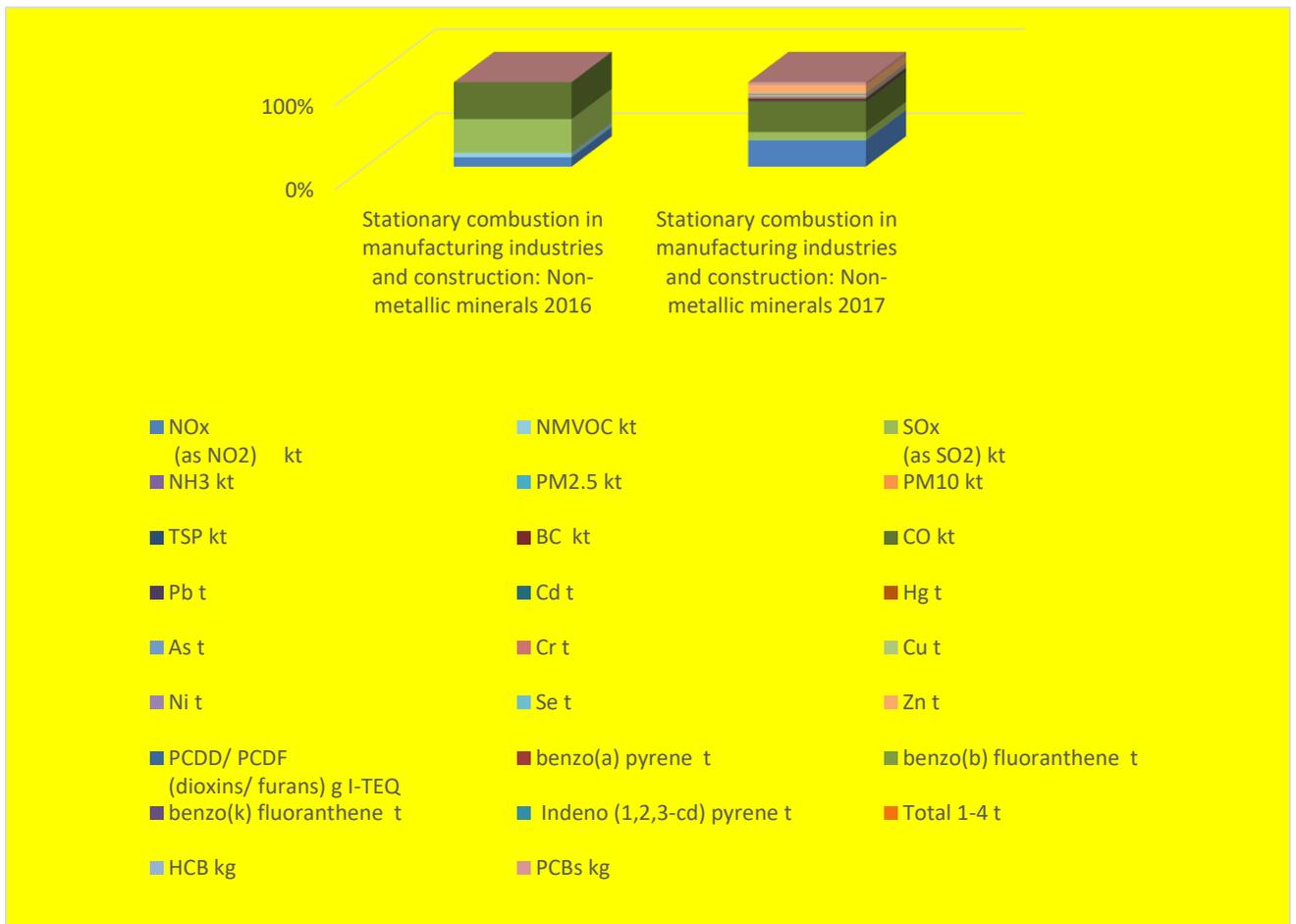
- DK “Manufacture of machinery and equipment”;
- DL “Manufacture of electrical, electronic and optical equipment”;
- DM “Production of vehicles and equipment”;
- DN “Other industries”;
- 3) at the section level:
 - 28 “Manufacture of finished metal products”;
- 4) at the group level:
 - 27.5 “Casting of metals”.

Pollutants	NO _x (as NO ₂)	NM VOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2016	5,87086	2,92444	21,48776	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2017	7,67172	0,11127	2,31203	0,00000	0,00000	0,00000	0,00000

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2016	NE	23,46952	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2017	0,00000	8,99464	0,60582	0,04946	0,30291	0,16382	0,25346

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2016	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2017	0,39997	0,30291	0,15640	2,62112	0,02535	0,00040	0,00173

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3-cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2016	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2017	0,00027	0,00287	0,02844	0,63673	0,00027



1A3ai(i) International aviation LTO (civil)

1A3a(i) Domestic aviation LTO (civil)

This category includes emissions from combustion of fuel used by aircraft of civil aviation. This category does not include emissions from fuel use by ground transportation at airports and use of fuel for stationary combustion (boiler plants, etc.) at airports.

The estimation of emissions was carried out separately for aircraft equipped with jet and turboprop engines, which use jet fuel, and for those equipped with piston engines, which use aviation gasoline.

It should be noted that the database of departures from airports in Ukraine, provided by the state-owned “UKRAERORUKH” Company covers the period from 1996 to 2009. The data for the period of 1990-1995 have not survived.

Emissions from bunker fuels used by air transport were not included in this category, but identified separately in the international aviation bunker

Pollutants	NO _x (as NO ₂)	NM VOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt	kt	kt	kt	kt	kt	kt
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2016	5,87086	2,92444	21,48776	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2017	7,67172	0,11127	2,31203	0,00000	0,00000	0,00000	0,00000

Pollutants	BC	CO	Pb	Cd	Hg	As	Cr
	kt	kt	t	t	t	t	t
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2016	NE	23,46952	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2017	0,00000	8,99464	0,60582	0,04946	0,30291	0,16382	0,25346

Pollutants	Cu	Ni	Se	Zn	PCDD/ PCDF (dioxins/ furans)	benzo(a) pyrene	benzo(b) fluoranthene
	t	t	t	t	g I-TEQ	t	t
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2016	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2017	0,39997	0,30291	0,15640	2,62112	0,02535	0,00040	0,00173

Pollutants	benzo(k) fluoranthene	Indeno (1,2,3- cd) pyrene	Total 1-4	HCB	PCBs
	t	t	t	kg	kg
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2016	0,00000	0,00000	0,00000	0,00000	0,00000
Stationary combustion in manufacturing industries and construction: Non-metallic minerals 2017	0,00027	0,00287	0,02844	0,63673	0,00027

1A3bi Road transport: Passenger cars

This category includes emissions from fuel combustion by motor vehicles, including vehicles owned by the public.

- 1A3bii Road transport: Light duty vehicles**
- 1A3biii Road transport: Heavy duty vehicles and buses**
- 1A3biv Road transport: Mopeds & motorcycles**
- 1A3bv Road transport: Gasoline evaporation**
- 1A3bvi Road transport: Automobile tyre and brake wear**
- 1A3bvii Road transport: Automobile road abrasion**

1A3c Railways

This category includes emissions from fuel combustion, consumed for heat traction of the rolling stock. In Ukraine, diesel fuel is used as a fuel for diesel engines. This category does not include emissions associated with the production of electricity needed to drive electric locomotives.

This category includes emissions from industries which have been assigned a code designation at group level 60.1 “Work of Railway Transport” CEA .

1A3di(ii) International inland waterways

This category includes emissions from fuel combustion, consumed by propulsion systems of sea and river vessels.

This category includes emissions from industries, which have been assigned a code designation at the level of section 61 “Marine” under CEA .

Emissions from bunker fuels used for shipping are not included in total emissions, as they are shown separately in the CRF (as a reference data).

The methods for separation of marine bunker fuel from the total fuel combustion for shipping.

The national statistics do not contain any data on international marine transportation. In this regard, an indirect method of evaluation was used, that is based on data on total consumption of fuel by maritime transport (form #4-MTP) and the turnover of maritime transport in coastal waters and on foreign trips [20-22, 40]. The data on the turnover of maritime transport in inland and outland navigation are rendered in next table .

Table. Maritime transportation of cargoes

Value	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Outland navigation, thousand tons	36377	5241	6780	6288	5981	5972	6334	6106	5785	5365	2676
Inland navigation, thousand tons	16876	1075	1452	2498	2870	2822	2241	2559	3339	2863	1976
Freight traffic, thousand tons	53253	6316	8232	8786	8851	8794	8575	8665	9124	8228	4652
Share of outland navigation in freight traffic	0.683	0.830	0.824	0.716	0.676	0.679	0.739	0.705	0.634	0.652	0.575

It was assumed that the amount of fuel used for outland navigation directly depends on the outland navigation turnover. The results of estimating emissions from the international maritime bunker are presented in next Table.

Table . International bunker of maritime transport

Fuel and energy resource	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Diesel fuel, thousand tons	358.4	83.0	85.2	37.9	35.6	43.6	49.6	45.0	36.7	30.2	20.4
Petrol, thousand tons	405.0	16.6	18.8	14.8	6.2	4.8	0.0	0.0	0.0	0.0	0.0
Fuel oil, thousand tons	193.9	7.3	7.4	6.1	0.8	1.4	18.0	21.9	8.9	5.0	3.4
Navigation fuel oil, thousand tons	179.5	2.2	5.5	10.7	6.4	9.3	0.0	0.0	0.0	0.0	0.0
Oils and lubricants, tons	-	0.0	0.5	3.8	0.8	1.1	0.6	0.1	0.0	0.0	0.0

1A3dii National navigation (shipping)

1A3ei Pipeline transport

This category includes emissions from natural gas combustion in drives of gas transfer pumps of gas trunk pipelines. The fuel gas amounts were estimated based on the data of State Concern “Ukrtransgas”, National Joint Stock Company “Naftogaz of Ukraine”, which is the national operator of Ukraine's gas transportation system.

The emission factors of non-CO₂ gases are regarded to be the same as in category of “Public Electricity and Heat Production”, since the gas turbines used in gas trunk pipelines are similar to power plants by their technical specifications.

1A3eii Other (please specify in the IIR)

1A4ai Commercial/institutional: Stationary

This category includes GHG emissions from fuel combustion by economic entities referred under the CEA to the following activities:

- € trade, repair of motor vehicles, household goods and personal items (code CEA G);
- € hotel and restaurant activities (H);
- € financial activities (J);
- € real estate operations, leasing, engineering and support services to entrepreneurs (K);
- € public administration (L);
- € education (M);
- € health and social care (N);
- € provision of communal and personal services, cultural activities and sports (O);
- € transport and communication activities (I);
- € collection, treatment and distribution of water (41).

1A4aii Commercial/institutional: Mobile
1A4bi Residential: Stationary

emissions were estimated based on the data on the amount of fuel dispensed to the population (Column 9, Section 4 of Form #4-MTP). emissions from private vehicles are accounted for in category "Road Transportation" (CRF category 1.A.3.b).

1A4bii Residential: Household and gardening (mobile)

1A4ci Agriculture/Forestry/Fishing: Stationary

1A4cii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery

This category includes emissions from fuel combustion to drive the so-called internal transport of enterprises of all sectors of the economy, as well as construction machinery and vehicles. The internal transport includes, inter alia, heavy-duty vehicles in mining industry.

1A4ciii Agriculture/Forestry/Fishing: National fishing

1A5a Other stationary (including military)

1A5b Other, Mobile (including military, land based and recreational boats)

1B1a Fugitive emission from solid fuels: Coal mining and handling

1B1b Fugitive emission from solid fuels: Solid fuel transformation

1B1c Other fugitive emissions from solid fuels

1B2ai Fugitive emissions oil: Exploration, production, transport

1B2aiv Fugitive emissions oil: Refining / storage

1B2av Distribution of oil products

1B2b Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)

1B2c Venting and flaring (oil, gas, combined oil and gas)

1B2d Other fugitive emissions from energy production

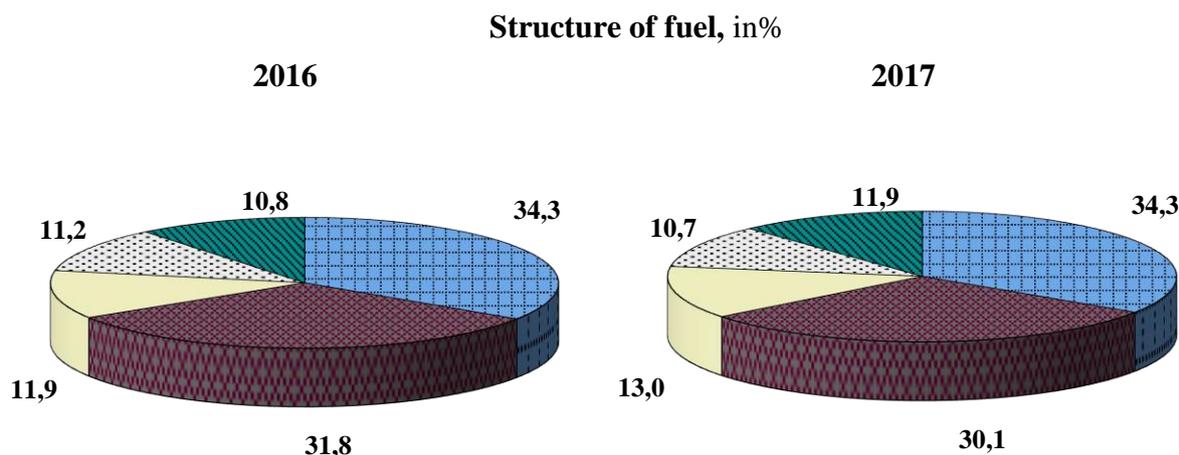
3. Energy (NFR 1)

3.1. Sector Overview

The energy sector includes stationary fuel combustion (1A1, 1A2, 1A4), mobile sources (1A3, 1A5) and fugitive emissions from the distribution of solid, liquid and gaseous fuels (1B). Each of these activities include subcategories, description and analysis of which is given in the relevant sections.

Use and fuel stocks in 2017 rotsil

Companies and organizations in 2017. used 106.5 million tons umov.palyv primary and secondary types (including sales to the population), which is 5.2% less than in the previous year.



The structure used fuel accounted for 34.3% of natural gas, 30.1% - coal, 13.0% - for oil products, 10.7% - of coke and semi-coke and 11.9% - to other fuels. In comparison with 2016. the structure of fuel held minor changes: increased share of oil and other fuels by 1.1 pp, respectively, for coke and semi-coke - 0.5 pct while reducing the use of coal by 1.7 percentage points

The distribution of fuel consumption trends for conversion to other fuels and energy accounted for 48.3% of the cost for the purpose of final consumption - 47.9%, in the non-energy needs - 3.1% loss in the distribution, transportation and storage amounted to 0.7%.

The main share in the structure of fuel accounted for converting coal - 57%, natural gas - 23% (in 2016. - respectively 57% and 22%).

In 2017. decreased compared to the previous year, the volume of coal coke and semi-coke respectively 12.3%, natural gas by 1.4%; including oil, kerosene - by 21.4%, heavy oil fuel - by 12.6%, motor gasoline - by 10.2%, while increased use of liquefied butane and propane by 15.9% and gas oil by 5.7%.

The main consumers of natural gas companies and organizations were 11 regions, the volume of which use (based on volume implementation of population) accounted for almost 68% of the total volume in Ukraine.

Consumers Dnipropetrovsk region accounted for 10.4% of natural gas, Kiev - 9.1%, Kharkiv region - 8.2%, Poltava - 7.5%, Cherkasy - 6.2%, Lviv - 6.1% and Odessa - 5.8%, Donetsk - 5.5%, Kiev - 5.2%, Zaporizhia and Ivano-Frankivsk - by 3.7%.

Reduced consumption of natural gas production, 14 regions, including much of Rivne (25.0%), Sumy (10.4%), Kirovohrad (8.5%), Kherson (6.2%) and Chernihiv (5.7%) regions.

¹ Excluding the temporarily occupied territory of the Autonomous Republic of Crimea, Sevastopol and temporarily occupied territories of Donetsk and Lugansk regions.

Use of natural gas for certain regions

	Natural gas, m3	In% 2016.
Ukraine	31501.5	98.6
Dnipropetrovsk	3281.7	96.1
Donetsk	1739.3	107.8
Zaporizhia	1175.5	95.5
Ivano-Frankivsk	1178.0	106.5
Kiev	1627.7	97.6
Lviv	1908.3	103.1
Odessa	1814.1	111.2
Poltava	2360.6	100.3
Kharkov	2591.8	98.1
Cherkassy	1949.1	91.6
m. Kyiv	2881.6	96.4

A large proportion of the petrol engine in 2017. used by enterprises and organizations of 10 regions (63% of the total volume in Ukraine).

The share of motor gasoline use by enterprises and organizations Kiev was 10.6%, Dnipropetrovsk region - 8.6%, of Odessa - 8.1%, Kiev - 6.7%, Lviv - 6.4%, Zaporozhye - 5, 3%, Kharkov - 5.2%, Poltava - 4.5%, Cherkasy - 4.1%, the Transcarpathian - 3.6%.

The decline in motor gasoline use was observed in most regions, the most in Lviv (20.2%), Kiev (17.1%), Ternopil (15.6%), Luhansk (14.8%), Dnipropetrovsk (13.6%), Chernivtsi (12.8%) and Donetsk (12.3%) regions.

Using a gasoline engine for different regions

	Gasoline engine, tons	In% 2016.
Ukraine	1985.9	89.8
Dnipropetrovsk	170.0	86.4
Zakarpattya	71.0	90.4
Zaporizhia	106.1	92.4
Kiev	133.6	82.9
Lviv	126.7	79.8
Odessa	160.0	94.1
Poltava	89.4	101.3
Kharkov	103.3	89.0
Cherkassy	81.1	91.7
m. Kyiv	210.0	92.2

More than half of the consumption of gas oil (63% of the total) accounted for 11 enterprises and organizations of the country. Of them share the Dnipropetrovsk region was 9.6%, Poltava - 6.9%, of Odessa - 6.6%, Kiev - 6.4%, Lviv - 6.2%, Kiev - 5.6%, Kharkiv - 5.4%, Vinnytsia - 4.3%, Zaporozhye - 4.0%, Donetsk and Mykolaiv - by 3.8%.

The most significant increase in the use of gas oil held in Kiev (17.9%), Chernihiv (14.5%), Poltava (14.1%), Zhytomyr (11.3%) and Ivano-Frankivsk (on 11.1%) regions.

The use of gas oil (diesel fuel) for different regions

	Gas oil (diesel fuel), tons	In% 2016.
Ukraine	5148.6	105.7
Vinnytsia	221.7	105.2
Dnipropetrovsk	494.3	104.7
Donetsk	197.6	105.7
Zaporizhia	208.2	101.6
Kiev	289.7	104.3
Lviv	316.9	102.0
Mykolaiv	194.4	104.6
Odessa	338.3	106.5
Poltava	356.5	114.1
Kharkov	275.5	103.6
m. Kyiv	329.4	117.9

The largest consumers of coal were companies and organizations 8 regions, amounts which were used 93% of the total in Ukraine. The share of coal enterprises and organizations of Donetsk region was 33.3%, Dnipropetrovsk - 20.6%, Ivano-Frankivsk - 12.0%, Zaporozhye - 11.4%, Vinnytsia - 6.3%, Luhansk - 3.5 %, Lviv - 3.4%, Kharkov - 2.3%.

In comparison with 2016. there was a reduction in coal use in general in Ukraine by enterprises and organizations of 15 regions, including most of Kyiv (by 66.3%), Luhansk (at 60.9%), Kharkiv (42.4%), Volyn (on 29.0%) regions. However increasing coal use was observed in 10 regions, including in the Ternopil- 34.3% Vinnitsa - 22.9% and Rivne - 15.2% areas.

The use of coal in some regions

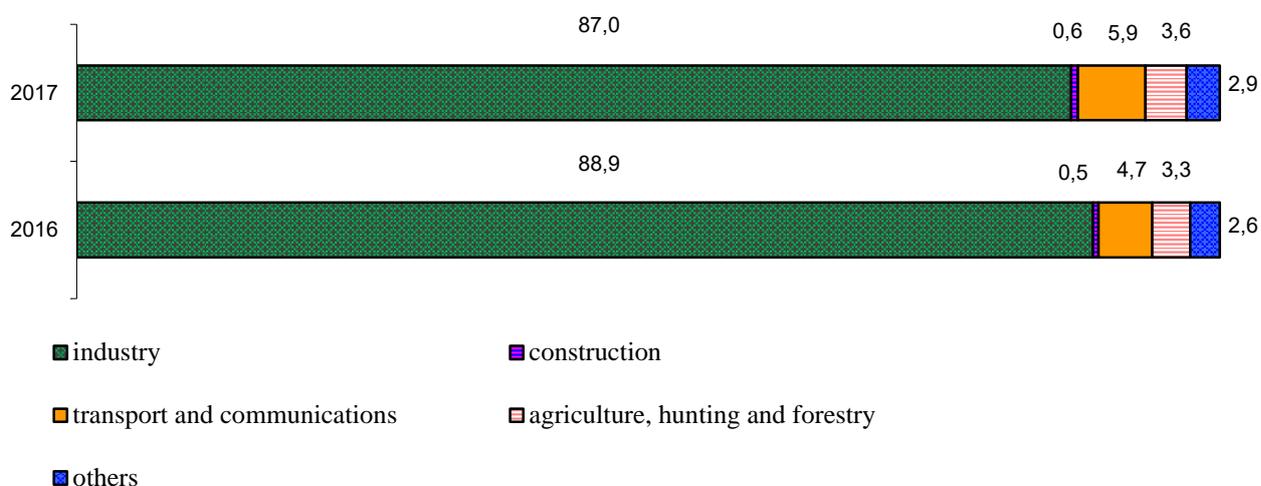
	Coal, tons	In% 2016.
Ukraine	42669.7	87.7
Vinnytsia	2705.6	122.9
Dnipropetrovsk	8782.6	85.7
Donetsk	14192.0	87.8
Zaporizhia	4877.0	114.4
Ivano-Frankivsk	5126.6	107.1
Lugansk	1489.5	39.1
Lviv	1444.2	114.3
Kharkov	979.8	57.6

The distribution of fuel by economic activity increased gas consumption against 2016. companies and organizations:

- transport and communication - 19.1%, including fuel for jet engines type kerosene - by 42.5%, natural gas - by 27.7%, gas oil - 8.5%;
- construction- 10.0% of these oils and lubricants oil - to 79.9%, heavy oil fuel - by 37.6%, gas oil and coal - by 15.9% while reducing the use of gasoline engine - 26.7%, liquefied butane and propane - 21.5%, natural gas - by 7.5%;
- agriculture - 3.7%, including gas oil - 8.2%, oils and lubricants oil - 1.9%, heavy oil fuel - by 1.0%, while reducing the use of coal - by 32.1%, liquefied propane and butane - by 20.3%, gasoline engine - 5.1%.

At the same time reduced the volume of fuel companies and organizations in the industry - by 6.1%, including heavy fuel oil fuel- 13.3%, coal and motor gasoline - by 12.3%, natural gas - by 6.6% while increasing the use of oils and lubricants oil - 21.3% of oil, including gas condensate, - at 19.0%, gas oil - by 8.8%.

Distribution of fuel use by types of economic activity, %



In 2017. total sales of enterprises and organizations of public consumption was 18.9 million tons umov.palyv, which is 0.8% less than in the previous year. In comparison with 2016. reduced sales volumes of coal to population - by 27.4%, motor gasoline - by 11%, gas oil - 5% while increasing realization briquettes, pellets fuels like peat - 50.8%, fuel briquettes and wood pellets and other natural raw materials - 38.8%, natural gas - by 0.9%. The structure of the realized fuel populations have been no significant changes, the most traditionally accounted for using natural gas (70%), motor gasoline (11%) and gas oils (9%).

December 31, 2017. Fuel stocks in enterprises and organizations, taking into account the volume of natural gas in underground gas storage facilities, according to the JSC "Ukrtransgaz" and of fuel at gas stations in general increased by 14.5% and amounted to 18.5 million tonnes conditions. fuels, including among consumers - 4.1 million tons umov.palyv, suppliers - 14.4 million tons umov.palyv. Compared with the corresponding date in 2016 fuel stocks in consumer rose by 8.1% to suppliers - by 16.5%.

Increased compared to 31 December of the previous year accumulated stocks of firewood for heating (51.1%), coke and semi-coke (26.9%), liquefied butane and propane (24.1%), natural gas (22, 7%) while reducing motor gasoline inventories (21.3%), heavy fuel oil fuel (by 17.2%), gas oil (4.8%).

The main consumers increase fuel stocks held at the premises:

- construction (22.7%), including fuel heavy fuel oil - by 37.6%, oil bitumen - by 17.4%, gas oil - 15.9%;
- transport and communication (20.7%), including fuel heavy fuel oil - by 24.2%, liquefied propane and butane - by 5.8%;

However, reduced accumulated stocks at the enterprises:

- industry (4.2%), including fuel heavy fuel oil - by 18.6%, coal - by 13.9%, bitumen - by 9.4%;
- agriculture (1%), including coal - 32.0%, motor gasoline - by 5.1%, natural gas - by 0.5%.

Figure 3.3 The distribution of emissions within the energy sector, 2017

1A1 - Energy Sector

1A2 - Combustion in manufacturing industries and construction

1A3 - Transport

1A4 - Small burning

1B - Fugitive emissions in the distribution of solid, liquid and gaseous fuels

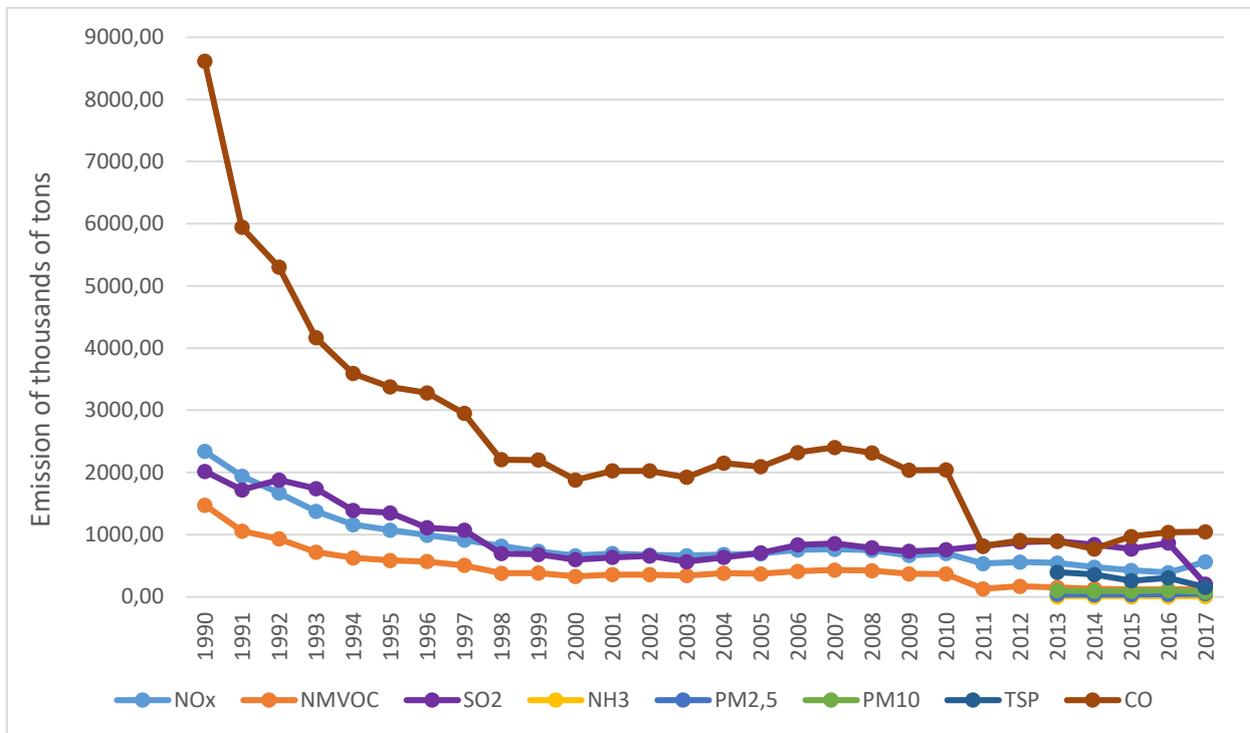


Figure 3.4. Emissions from the energy sector (1A, 1B) in 1990-2017

Table 3.1. Emissions from the energy sector (1A, 1B) for the period 1990-2017

	NO _x	NMVOG	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	2337,63	1471,87	2016,78					8612,88
1991	1939,31	1057,83	1718,23					5943,95
1992	1669,69	932,31	1878,29					5304,68
1993	1375,68	718,99	1739,27					4165,12
1994	1159,43	624,68	1387,25					3592,39
1995	1072,95	583,65	1349,62					3374,40
1996	990,54	567,62	1111,44					3281,42
1997	913,97	505,99	1072,05					2950,27
1998	816,05	379,08	693,84					2204,75
1999	730,23	380,78	681,37					2199,51
2000	661,65	327,35	598,47					1877,78
2001	694,35	356,30	634,23					2024,25
2002	671,12	357,25	657,02					2024,37
2003	660,86	339,82	564,05					1921,26
2004	678,54	378,63	634,54					2150,52
2005	693,03	369,20	705,10					2092,06
2006	755,22	410,84	833,57					2319,60
2007	763,85	429,45	857,11					2401,75
2008	750,14	421,03	788,26					2314,48
2009	664,23	367,77	730,13					2034,80
2010	698,63	367,04	757,23					2039,16
2011	533,53	126,39	816,55					815,30
2012	559,13	167,59	879,97					904,63
2013	544,19	151,16	896,14	0,45	38,20	98,46	393,68	891,71
2014	475,59	130,29	838,59	0,39	35,41	90,51	358,47	770,49
2015	424,59	117,29	770,59	0,39	35,41	90,51	258,47	970,49
2016	390,27	117,19	864,01	0,40	39,34	102,71	304,23	1035,89
2017	561,66	124,50	204,26	2,34	48,63	75,72	152,07	1045,86
changes, 1990- 2017	-76,0%	-91,5%	-89,9%					-87,9%

Reduction of emissions from 1990 to 2017 due to a decrease in fuel consumption for the same.

3.2 Stationary Combustion (NFR 1A1, 1A2, 1A4)

3.2.1 Description of the sector

Stationary Combustion includes categories listed in Table 3.2. The table gives a brief description of the categories and methodologies for the calculation of the list of substances for which emissions are calculated.

Table 3.2 Brief description of the stationary fuel combustion sector

NFR	Source	Description	Method	Emissions
Energy industry				
1A1a	Public electricity and heat production	It includes emissions from thermal condensing power plants, combined power plants, boilers. Fuel - statistics	Tier 1,2,3	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, B(a)p
1A1b	Petroleum refining	It includes emissions from oil and gas processing plants. Fuel - statistics.	Tier 1	NO _x , NMVOC, SO _x , PM ₁₀ , TSP, CO
1A1c	Manufacture of solid fuels and other energy industries	It includes emissions from enterprises engaged in extraction and processing of energetic materials. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, B(a)p
Stationary combustion in manufacturing industries and construction				
1A2a	Iron and steel	It includes emissions from the steel industry enterprises. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn, B(a)p
1A2b	Non-ferrous metals	It includes emissions from non-ferrous metallurgy. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn
1A2c	Chemicals	It includes emissions from combustion processes in the chemical industry. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , CO
1A2d	Pulp, Paper and Print	It includes emissions from combustion processes in the pulp and paper industry. Fuel - statistics	Tier 1	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO

NFR	Source	Description	Method	Emissions
1A2e	Food processing, beverages and tobacco	It includes emissions from combustion processes in the food industry. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , CO
1A2fi	Non-metallic minerals	It includes emissions from combustion processes in enterprises producing construction and other non-metallic materials. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, B(a)p, HCB
1A2giii	Other	It includes emissions from combustion processes in enterprises drugihotrasley industry. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , CO
Non-industrial combustion plants				
1A4ai	Commercial/Institutional: Stationary	It includes emissions from the boilers and other stationary combustion plants of commercial and institutional sector. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn, B(a)p
1A4bi	Residential: Stationary	It includes emissions from the boilers and other stationary combustion plants household sector. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Pb, Cr, Cu, Ni, Se, Zn, B(a)p
1A4ci	Agriculture/Forestry/Fishing: Stationary	It includes emissions from the boilers and other stationary combustion plants sector, forestry and agriculture. Fuel - statistics	Tier 1	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Pb, Cr, Cu, Ni, Zn

Table 3.3 Emissions from stationary combustion fuel energy sector for the period 1990-2017

	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	1039,31	269,09	1883,28					2266,92
1991	885,09	147,06	1603,65					1140,05
1992	752,36	139,81	1782,39					1124,60
1993	686,42	123,59	1666,02					1024,63
1994	552,41	100,32	1323,63					826,63
1995	502,85	91,16	1290,04					776,71
1996	433,65	86,50	1054,09					743,72
1997	431,09	88,73	1023,40					749,41
1998	367,81	72,95	648,30					591,85
1999	322,41	67,27	640,52					543,26
2000	300,76	59,73	561,94					463,93
2001	328,42	58,53	598,02					447,17
2002	309,35	58,62	620,28					442,34
2003	300,80	58,50	526,54					430,74
2004	316,27	64,26	596,75					483,65
2005	337,50	60,08	668,57					450,67
2006	361,81	61,58	791,89					462,32
2007	358,51	58,85	813,97					429,61
2008	337,90	47,41	744,04					325,63
2009	296,85	39,81	690,17					288,26
2010	313,65	41,64	714,68					305,49
2011	331,69	42,33	786,44					312,35
2012	337,84	42,80	833,14					323,51
2013	329,42	43,14	849,86					337,89
2014	303,15	35,34	797,71	0,10	33,34	86,79	343,65	282,21
2015	273,15	29,34	729,71	0,10	33,34	86,79	243,65	282,21
2016	229,32	29,24	821,71	0,11	37,01	98,51	286,94	324,56
2017	431,48	52,84	187,97	1,05	42,23	66,68	129,78	549,61
Change, 1990-2017	-58,5%	-80,4%	-90,0%					-75,8%

Between 1990 and 2017, emissions from stationary combustion sectors declined: NO_x by 58,5%, NMVOC -80,4%, SO₂ - 90%, CO – 75,8% (Table 3.3).

In 2017, the main share of emissions of nitrogen oxides and sulfur dioxide accounted for the energy sector (1A1). Small combustion is the main source of volatile organic compounds and carbon monoxide, which can be attributed significantly higher consumption of biomass incineration which released a significantly larger amount of these substances, as compared with other types of fuels, particularly combustion conditions in boiler and the low power household ovens

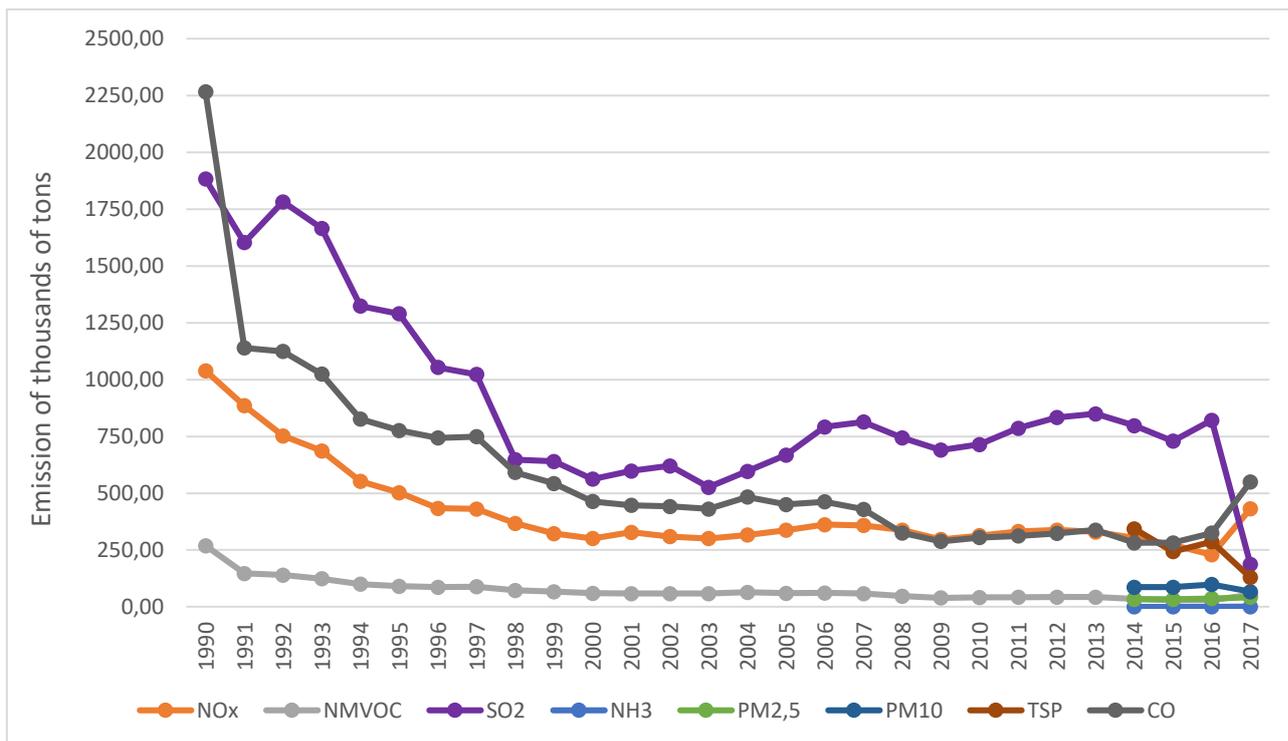


Figure 3.3. Emissions from the 1A1 energy industry and electricity production in 1990-2017

3.2.2 Energy Sector (NFR 1A1)

3.2.2.1 Description of the sector.

the energy sector include NFR categories 1A1a, 1A1b and 1A1c. Energy industry is a major source of SO₂ and NO_x emissions.

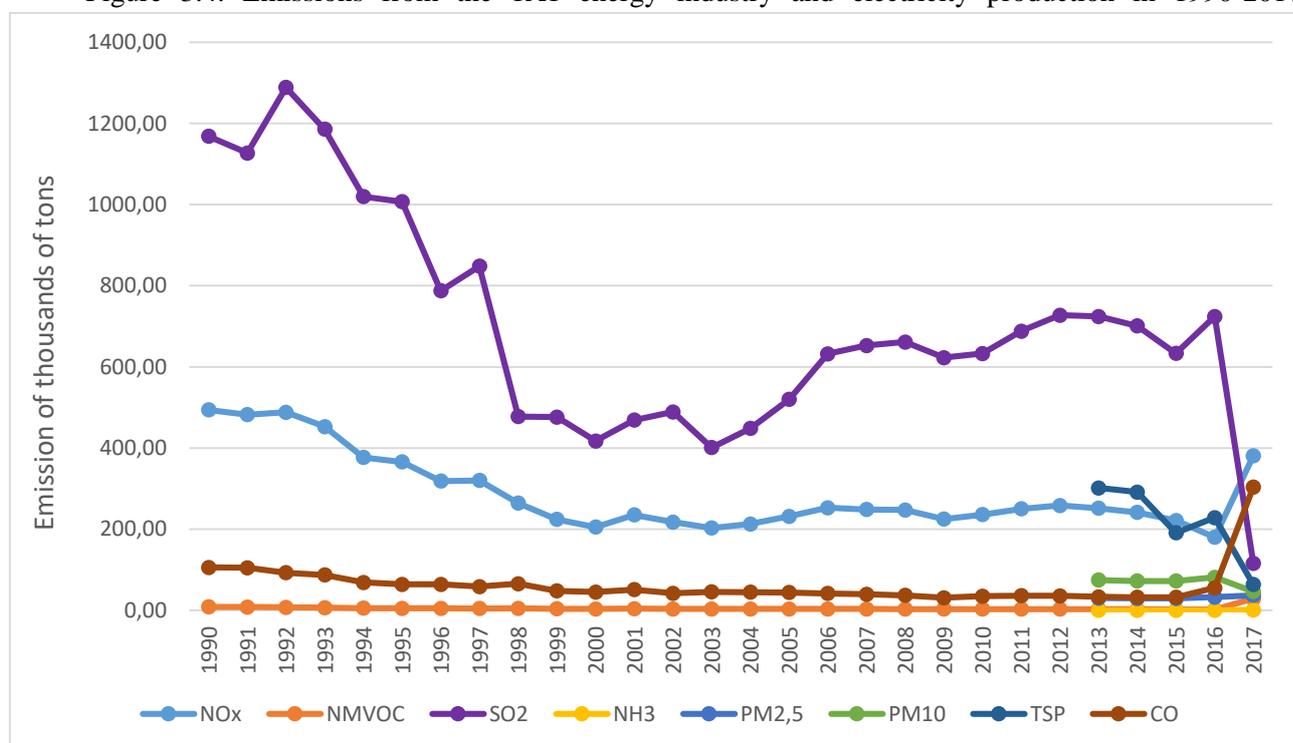
Between 1990 and 2017, emissions of pollutants from the energy sector decreased: SO₂ - by 90,1%, NO_x – 22,9%. The increase in NMVOC - 238%, CO - 188% occurred as a result of a change in the method of recapture (Fig. 3.4).

Table 3.4 Emissions from the energy sector 1A1

	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	494,18	8,41	1168,42					105,60
1991	482,14	8,23	1127,02					104,99
1992	488,16	7,32	1288,69					92,90
1993	452,87	6,70	1185,64					87,11
1994	376,81	5,35	1019,74					68,71
1995	365,84	5,08	1007,18					63,85
1996	318,42	4,97	787,42					64,19
1997	320,10	4,57	847,96					58,33
1998	264,19	4,99	477,57					65,64
1999	224,22	3,76	476,14					47,82
2000	205,23	3,53	417,18					44,99
2001	234,98	4,12	468,70					51,02

2002	217,61	3,48	488,74					41,83
2003	202,77	3,58	401,06					45,70
2004	212,72	3,55	448,23					44,93
2005	231,63	3,63	520,05					43,87
2006	252,74	3,56	632,06					41,55
2007	248,38	3,32	652,37					39,59
2008	247,51	3,24	661,27					37,01
2009	224,89	2,89	622,80					31,13
2010	235,88	3,09	632,99					34,95
2011	250,22	3,17	688,08					35,95
2012	258,31	3,15	727,47					35,84
2013	251,49	2,99	724,18	0,07	30,21	74,75	301,81	33,21
2014	241,36	2,83	701,10	0,06	29,25	72,12	291,24	32,17
2015	221,36	1,83	633,10	0,06	29,25	72,12	191,24	32,17
2016	180,13	1,73	724,10	0,07	32,60	81,20	228,53	55,34
2017	381,21	28,45	115,44	1,00	36,91	46,24	63,63	304,12
Changing, 1990-2017	-22,9%	238,0%	-90,1%					188,0%

Figure 3.4. Emissions from the 1A1 energy industry and electricity production in 1990-2017



Category NFR 1A1a includes emissions from stationary fuel combustion in the production of electricity and heat by thermal condensation of public electricity stations (IES), stations of combined production of heat and electricity, boilers, thermal power enterprises, incinerators.

Between 1990 and 2017 emissions of polluting substances in the production of electricity and heat decreased: SO₂ - by 90,3%, NO_x – 20,2%. The increase in NMVOC - 253%, CO - 198% occurred as a result of a change in the method of recapture (Table 3.5).

Table 3.5 Emissions of pollutants in the production of electricity and public heat (1A1a).

	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	461,25	7,96	1067,49					101,87
1991	447,74	7,84	1006,56					101,24
1992	460,41	7,04	1193,81					88,93
1993	429,67	6,47	1106,77					82,62
1994	354,76	5,12	947,32					65,54
1995	353,43	4,86	979,68					61,58
1996	299,46	4,76	727,22					62,19
1997	303,28	4,37	796,00					57,34
1998	250,72	4,69	456,71					64,72
1999	211,06	3,47	457,90					47,08
2000	191,65	3,21	401,25					44,20
2001	213,86	3,61	443,34					49,98
2002	196,80	3,00	459,97					40,69
2003	185,35	3,19	372,63					44,43
2004	196,80	3,18	427,49					43,94
2005	212,04	3,14	502,25					42,88
2006	232,00	3,05	611,25					40,60
2007	230,75	2,91	626,94					38,47
2008	226,94	2,75	634,76					35,97
2009	204,20	2,40	595,15					30,36
2010	216,37	2,62	610,10					34,14
2011	230,76	2,71	665,03					34,96
2012	242,06	2,74	714,10					35,09
2013	234,64	2,57	707,89					32,53
2014	228,51	2,50	689,40	0,01	28,56	69,40	280,31	31,68
2015	208,51	1,50	621,40	0,01	28,56	69,40	180,31	31,68
2016	167,76	1,40	712,40	0,01	31,76	78,26	215,04	54,68
2017	368,12	28,10	103,35	0,94	36,02	43,09	49,23	303,49
Changing, 1990-2017	-20,2%	253,0%	-90,3%					198,0%

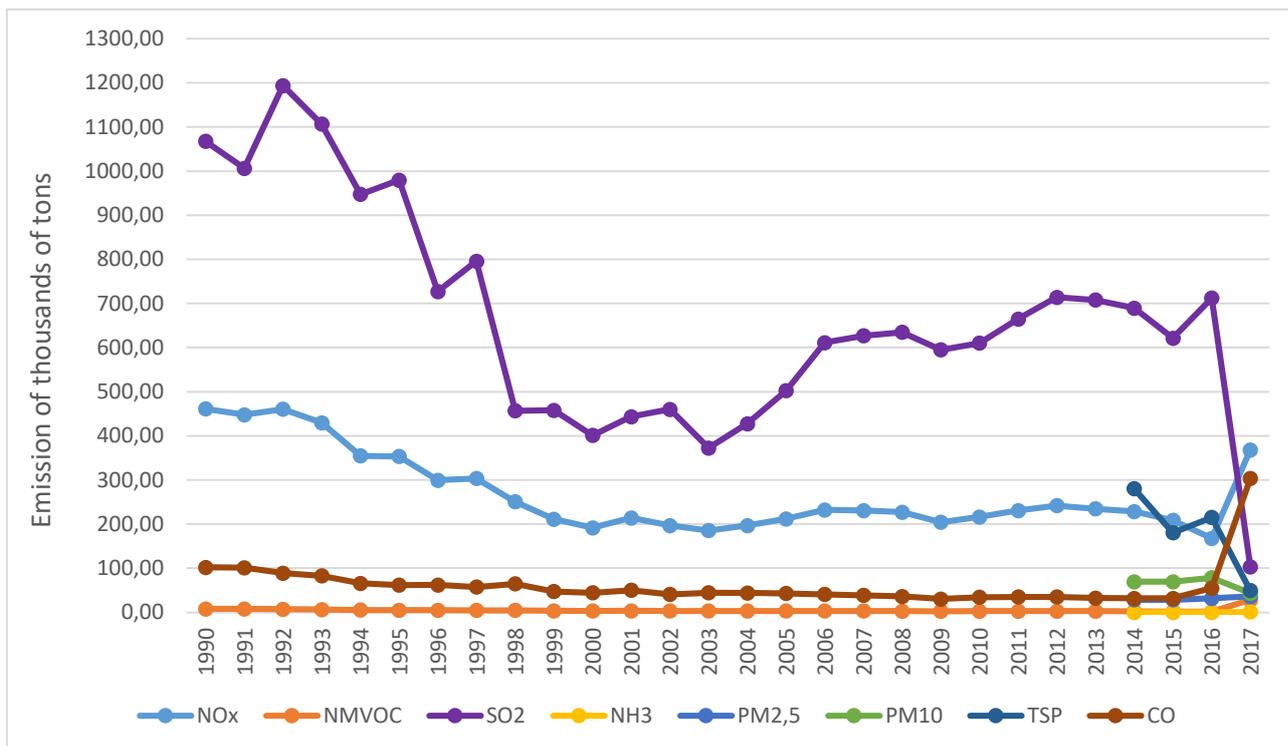


Figure 3.5. Emissions from the 1A1a in 1990-2017

NFR 1A1b category includes oil refineries and gas processing plants. In this category of derivatives is considered as the combustion of fuels (refinery gas) and supplied by fossil fuel (natural gas, crude oil). Fuels for these companies are used for the production of heat and electricity, which are required primarily for technological processes, as well as other needs of enterprises.

Emissions of substances decreased by almost 95% in the period From 1990 to 2017Year (Table 3.6).

In Figure 3.6, you can trace the trend of emission and petroleum products.

Figure 3.6. Emissions in the process of oil and oil products in 1990-2017 purification and production of oil products in 2003-2017

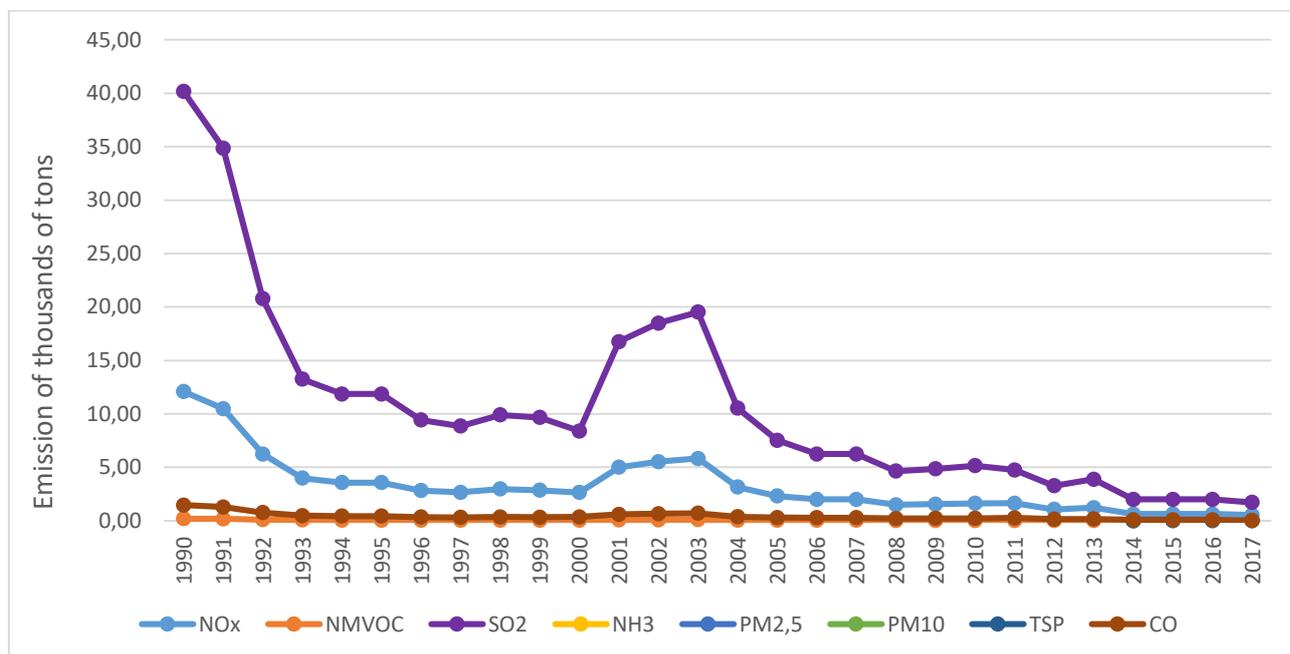


Table 3.6 Emissions of pollutants in the oil refining and petroleum products (1A1b)

	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	12,08	0,20	40,17					1,47
1991	10,49	0,18	34,87					1,28
1992	6,25	0,11	20,78					0,76
1993	3,99	0,07	13,25					0,48
1994	3,57	0,06	11,86					0,43
1995	3,57	0,06	11,86					0,43
1996	2,83	0,05	9,42					0,34
1997	2,66	0,04	8,86					0,32
1998	2,97	0,05	9,90					0,36
1999	2,86	0,05	9,67					0,33
2000	2,65	0,05	8,39					0,36
2001	5,00	0,08	16,76					0,60
2002	5,53	0,09	18,49					0,66
2003	5,83	0,10	19,52					0,70
2004	3,16	0,05	10,53					0,38
2005	2,32	0,04	7,53					0,30
2006	2,00	0,04	6,25					0,28
2007	2,00	0,04	6,24					0,28
2008	1,49	0,03	4,64					0,21
2009	1,56	0,03	4,86					0,22
2010	1,63	0,03	5,15					0,22

2011	1,64	0,03	4,75					0,27
2012	1,06	0,02	3,27					0,15
2013	1,23	0,02	3,88					0,17
2014	0,63	0,01	2,00			0,01	0,02	0,09
2015	0,63	0,01	2,00			0,01	0,02	0,09
2016	0,63	0,01	2,00			0,01	0,02	0,09
2017	0,54	0,01	1,72			0,01	0,02	0,02
Changing, 1990-2017	-95,5%	-95,0%	-95,7%					-98,6%

1A1c category includes emissions from fuel combustion at the enterprises which are engaged in production of energy materials (coal, peat, natural gas, oil, uranium ore), coke production from coal, as well as the processing of uranium ore.

Coking industry - an important link in the chain of coal-coke-metal. The raw material for coking industry is coking coal. Coke side-products, including phenol, are widely used in the chemical industry

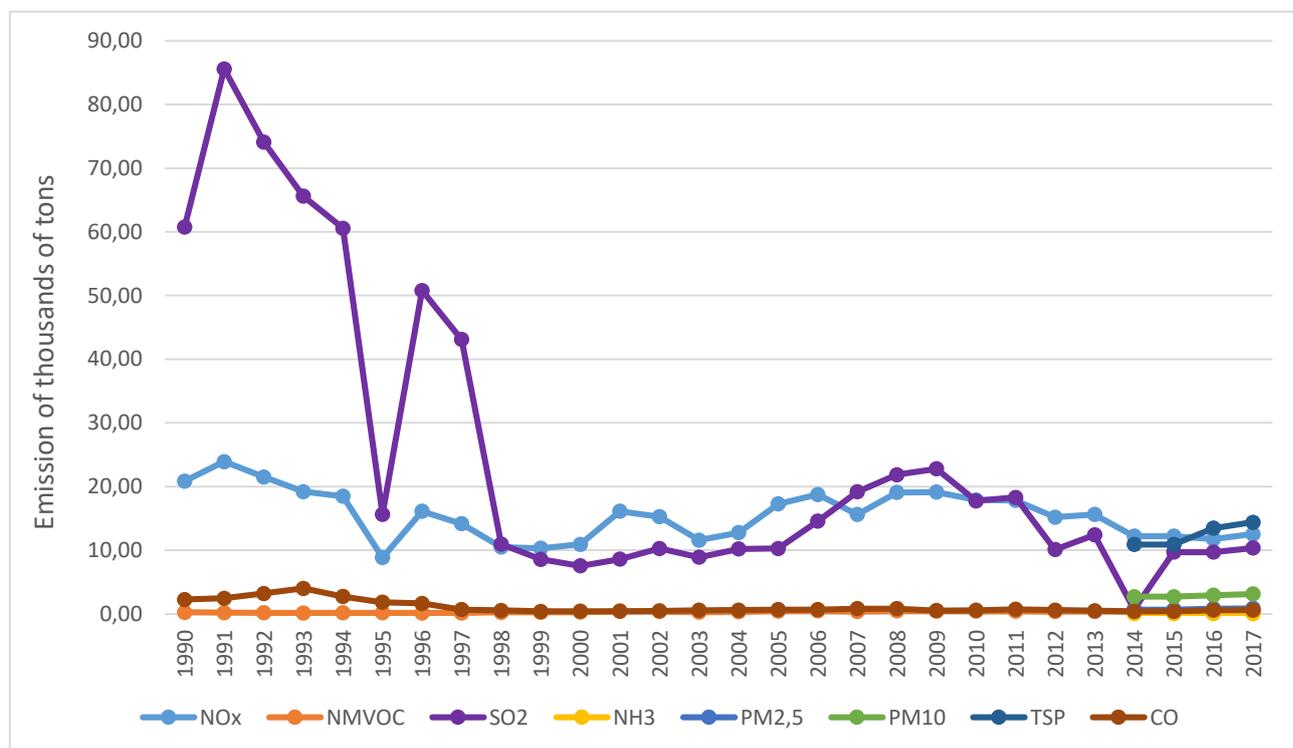


Figure 3.7. Emissions from 1A1s category and coke production

Table 3.7 Emissions of pollutants in the production of solid fuels and other energy industries (1A1c)

	NO _x	NM VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	CO
1990	20,85	0,25	60,76					2,27
1991	23,91	0,21	85,59					2,47
1992	21,50	0,17	74,09					3,22
1993	19,21	0,16	65,61					4,01
1994	18,48	0,17	60,56					2,74
1995	8,85	0,17	15,64					1,84
1996	16,13	0,16	50,79					1,66
1997	14,16	0,15	43,10					0,67
1998	10,50	0,25	10,96					0,56
1999	10,30	0,25	8,57					0,41
2000	10,94	0,28	7,54					0,42
2001	16,13	0,42	8,61					0,44
2002	15,27	0,38	10,29					0,48
2003	11,59	0,29	8,91					0,57
2004	12,76	0,32	10,21					0,61
2005	17,27	0,45	10,27					0,69
2006	18,75	0,48	14,57					0,67
2007	15,63	0,38	19,18					0,84
2008	19,09	0,47	21,87					0,82
2009	19,14	0,46	22,78					0,54
2010	17,89	0,44	17,74					0,59
2011	17,82	0,44	18,30					0,73
2012	15,19	0,39	10,10					0,60
2013	15,62	0,40	12,40					0,51
2014	12,22	0,31	0,70	0,05	0,69	2,71	10,91	0,40
2015	12,22	0,31	9,70	0,05	0,69	2,71	10,91	0,40
2016	11,75	0,31	9,70	0,06	0,83	2,93	13,47	0,57
2017	12,54	0,34	10,36	0,06	0,89	3,13	14,39	0,61
Changing, 1990-2017	-39,8%	36,0%	-82,9%					-73,1%

3.2.2.2 Methodology

To calculate the emissions used Tier 1 EMEP / EEA management. Data on the use of fuels for all categories of the energy industry are taken on the basis of the ICC (fuel) statistical reporting and a detailed description can be found in the report "National inventory of anthropogenic emissions by sources and removals by sinks in Ukraine for 1990-2017 years."

Table 3.8 Coefficients of specific emissions for the category 1A1a

Substance	Unit	Hard coal	Brown coal	Gaseous fuels	Fuel oil	Gasoil	Biomass
NOx	g/GJ	209	247	89	142	65	81
NMVOС	g/GJ	1	1.4	2.6	2.3	0.8	7.31
SO2	g/GJ	820	1680	0.281	495	46.5	10.8
NH3	g/GJ	NE	NE	NE	NE	NE	NE
PM2,5	g/GJ	3.4	3.2	0.89	19.3	0.8	133
PM10	g/GJ	7.7	7.9	0.89	25.2	3.2	155
TSP	g/GJ	11.4	11.7	0.89	35.4	6.5	172
BC	% PM2,5	2.2	NE	2.5	5.6	33.5	3.3
BC	g/GJ	0.0748	NE	0.02225	1.0808	0.268	4.389
CO	g/GJ	8.7	8.7	39	15.1	16.2	90
Pb	mg/GJ	7.3	15	0.0015	4.56	4.07	20.6
Cd	mg/GJ	0.9	1.8	0.00025	1.2	1.36	1.76
Hg	mg/GJ	1.4	2.9	0.1	0.341	1.36	1.51
As	mg/GJ	7.1	14.3	0.12	3.98	1.81	9.46
Cr	mg/GJ	4.5	9.1	0.00076	2.55	1.36	9.03
Cu	mg/GJ	7.8	1	0.000076	5.31	2.72	21.1
Ni	mg/GJ	4.9	9.7	0.00051	255	1.36	14.2
Se	mg/GJ	23	45	0.0112	2.06	6.79	1.2
Zn	mg/GJ	19	8.8	0.0015	87.8	1.81	181
PCDD/F	ng/GJ	10	10	0.5	2.5	0.5	50
Benzo(a)pyrene	µg/GJ	0.7	1.3	0.56	NE	NE	1120
Benzo(b)fluoranthene	µg/GJ	37	37	0.84	4.5	NE	43
Benzo(k)fluoranthene	µg/GJ	29	29	0.84	4.5	NE	15.5
Indeno(1,2,3-cd)pyrene	µg/GJ	1.1	2.1	0.84	6.92	6.92	37.4
HCB	µg/GJ	6.7	6.7	NE	NE	NE	5
PCB	µg/GJ	0.0033	0.0033	NE	NE	NE	3.5

Table Ошибка! Текст указанного стиля в документе отсутствует..1 Coefficients of specific emissions for the category 1A1b

Substance	Unit	Refinery gas	Natural gas	Fuel oil	Gasoil
NOx	g/GJ	63	89	142	65
NMVOС	g/GJ	2.58	2.6	2.3	0.8
SO2	g/GJ	0.281	0.281	495	46.5
NH3	g/GJ	NE	NE	NE	NE
PM2,5	g/GJ	0.89	0.89	19.3	0.8
PM10	g/GJ	0.89	0.89	25.2	3.2
TSP	g/GJ	0.89	0.89	35.4	6.5
BC	g/GJ	0.16376	0.02225	1.0808	0.268
CO	g/GJ	39.3	39	15.1	16.2
Pb	mg/GJ	1.79	0.0015	4.56	4.07

Substance	Unit	Refinery gas	Natural gas	Fuel oil	Gasoil
Cd	mg/GJ	0.712	0.00025	1.2	1.36
Hg	mg/GJ	0.086	0.1	0.341	1.36
As	mg/GJ	0.343	0.12	3.98	1.81
Cr	mg/GJ	2.74	0.00076	2.55	1.36
Cu	mg/GJ	2.22	0.000076	5.31	2.72
Ni	mg/GJ	3.6	0.00051	255	1.36
Se	mg/GJ	0.42	0.0112	2.06	6.79
Zn	mg/GJ	25.5	0.0015	87.8	1.81
PCDD/F	ng/GJ	NE	0.5	2.5	0.5
Benzo(a)pyrene	µg/GJ	0.669	0.56	NE	NE
Benzo(b)fluoranthene	µg/GJ	1.14	0.84	4.5	NE
Benzo(k)fluoranthene	µg/GJ	0.631	0.84	4.5	NE
Indeno(1,2,3-cd)pyrene	µg/GJ	0.631	0.84	6.92	6.92
Total 1-4	µg/GJ				
HCB	µg/GJ		NE	NE	NE
PCB	µg/GJ		NE	NE	NE

To calculate the emissions used Tier 2 EMEP / EEA management. Data on the use of fuels for all categories of the energy industry are taken on the basis of the ICC (fuel) statistical reporting and a detailed description can be found in the report "National inventory of anthropogenic emissions by sources and removals by sinks in Ukraine for 1990-2017 years."

Tier2 technology-specific approach Algorithm The Tier2 approach is similar to the Tier1 approach. To apply the Tier2 approach, both the activity data and the emission factors need to be applied according to a country's fuel usage and installed combustion technologies. These techniques may include: relative mix of fuels,

1.A.1 Energy industries EMEP/EEA air pollutant emission inventory guidebook 2016 22 types of combustion plant. There are two approaches possible: 1. disaggregate the fuel use in the country to model the different combustion and abatement types into the inventory by a) defining the activity data using each of the identified process types (together called 'technologies' in the formulae below) separately, and b) applying technology-specific emission factors for each process type: $estechnologi, pollutanttechnologytechnologyproduction$

3.2.2.3 Uncertainty Evaluation

Uncertainty assessment carried out in accordance Methodology Guide EMEP / EEA inventory of pollutant emissions.

3.2.3 Burning in industry and construction (NFR 1A2)

3.2.3.1 Description of the sector

Sector includes pollutant emissions from stationary combustion of fossil fuels in the extraction of non-energy materials, as well as in industry and construction. This includes following NFR categories:

- ✓ 1A2a - Iron and Steel
- ✓ 1A2b - Non-ferrous metals
- ✓ 1A2s - Chemicals
- ✓ 1A2d - Cellulose
- ✓ 1A2e - Food Industry
- ✓ 1A2f - Non-metallic minerals
- ✓ 1A2gviii - Other

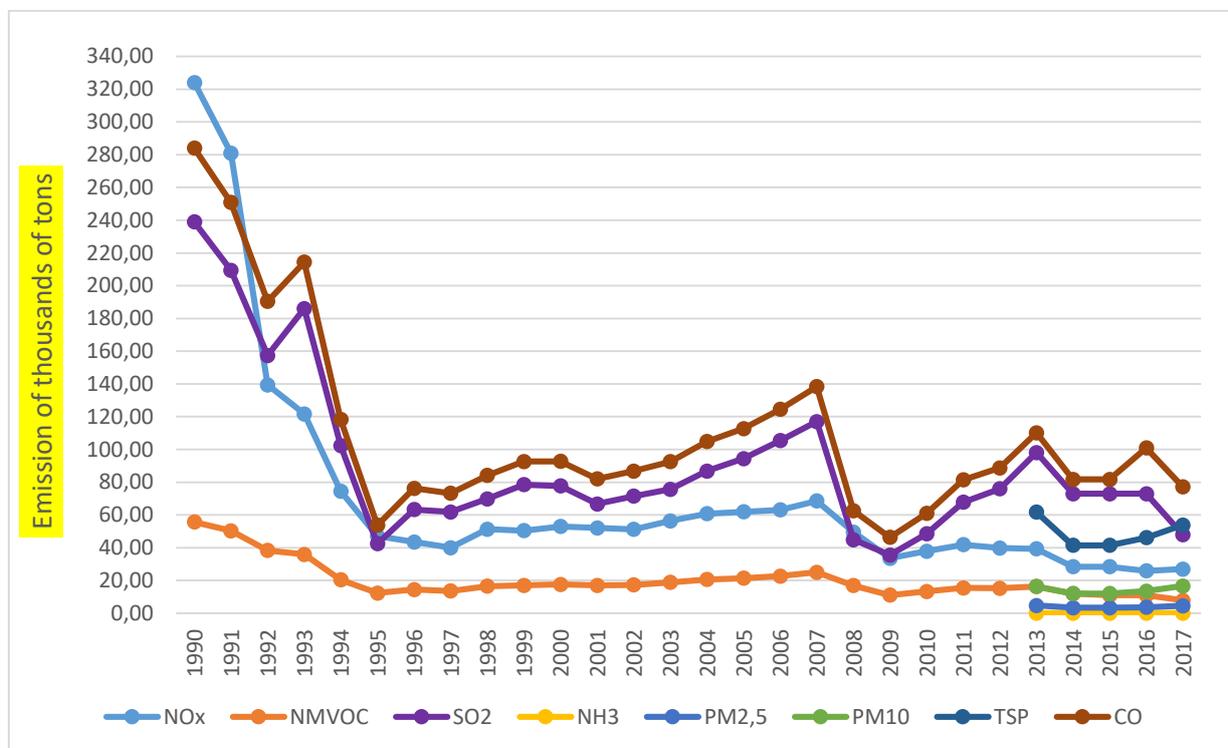


Figure 3.8 Emissions l consumption by 1A2 sector in 1990-2017 .

Table 3.8 Emissions from the combustion in the manufacturing and construction 1A2

	NO _x	NMVOG	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	324,09	55,75	238,95					283,96
1991	280,98	50,32	209,47					250,87
1992	139,48	38,38	157,39					190,40
1993	121,67	35,92	186,07					214,39
1994	74,49	20,40	102,37					118,32
1995	47,01	12,32	42,43					53,77
1996	43,55	14,50	63,33					76,30
1997	39,97	13,57	61,87					73,28
1998	51,36	16,49	69,79					84,21
1999	50,46	16,99	78,47					92,67
2000	52,93	17,61	77,75					92,73
2001	52,13	17,03	66,69					82,07
2002	51,19	17,29	71,51					86,80
2003	56,42	18,82	75,72					92,55
2004	60,74	20,60	86,76					104,82
2005	61,97	21,36	94,40					112,71
2006	63,14	22,67	105,41					124,56
2007	68,59	25,01	117,04					138,35
2008	49,56	16,94	44,85					62,66
2009	33,57	11,10	35,54					46,36
2010	37,87	13,28	48,46					61,01
2011	41,89	15,47	67,80					81,45
2012	39,78	15,28	75,95					88,78
2013	39,34	16,32	98,13	0,01	4,74	16,31	61,70	110,23
2014	28,44	11,93	73,00	0,01	3,40	12,07	41,47	81,74
2015	28,44	10,93	73,00	0,01	3,40	12,07	41,47	81,74
2016	25,84	10,93	73,00	0,01	3,64	13,45	46,13	100,93
2017	26,93	7,80	47,92	0,00	4,55	16,58	53,87	77,19
Changing,1990-2017	-91,7%	-86,0%	-79,9%					-72,8%

1A2a sector includes iron and steel production

Table 3.9 Emissions in the production of iron and steel 1A2a

Year	NO _x	NM VOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	90,21	32,1	173,89					198,16
1991	82,06	28,32	137,12					159,95
1992	65,59	22,24	104,37					122,57
1993	59,77	21,67	134,29					149,18
1994	36,93	12,28	69,99					78,93
1995	25,99	7,49	24,05					31,12
1996	22,54	8,87	48,08					54,83
1997	23,95	9,30	48,00					55,30
1998	35,38	12,31	61,19					71,14
1999	36,5	12,98	70,28					80,11
2000	38,75	13,85	71,29					82,15
2001	36,84	12,66	59,33					69,72
2002	32,55	11,37	55,76					64,88
2003	35,47	12,41	60,30					70,29
2004	37,39	13,43	68,28					78,84
2005	38,25	13,98	76,42					86,96
2006	39,55	14,50	84,37					94,84
2007	41,65	15,30	87,80					98,95
2008	24,56	7,46	17,39					25,03
2009	16,89	5,27	14,01					19,26
2010	20,08	6,32	16,38					22,78
2011	21,6	7,34	27,87					34,46
2012	20,81	7,86	42,89					48,83
2013	20,97	8,76	59,63	0,01	4,74	16,31	61,7	65,23
2014	15,28	6,38	43,45	0,00	0,04	0,29	10,86	47,53
2015	15,28	5,38	43,45	0,00	0,04	0,29	10,86	47,53
2016	13,28	5,38	43,45	0,00	0,05	0,35	11,82	65,85
2017	10,78	4,37	35,28	0,00	0,04	0,28	9,59	53,47
Changing, 1990-2017	-88,1%	-86,4%	-79,7%					-73,0%

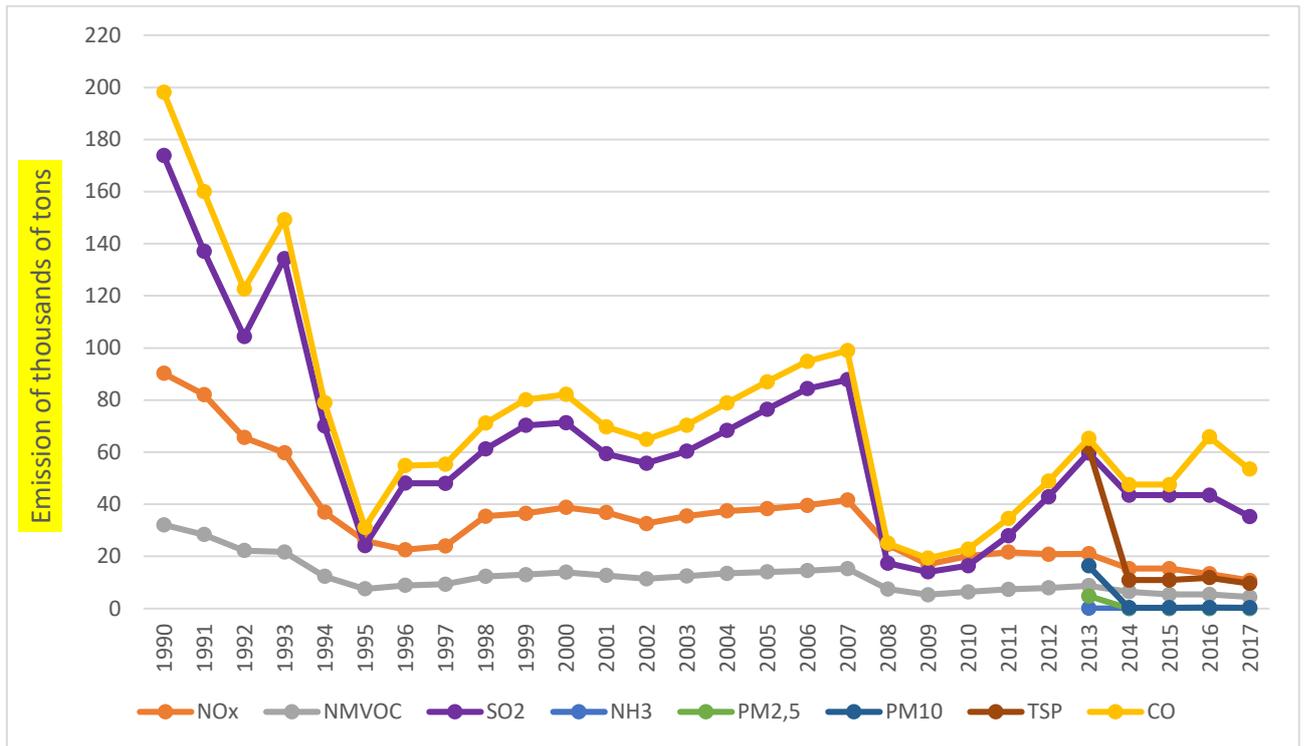


Figure 3.9 Emissions in the production of iron and steel production and steel production in 1990-2017 .

1A2b sector includes non-ferrous metallurgy, which specializes in the extraction and enrichment of ore production and processing of non-ferrous metals and their alloys.

The leading sectors of non-ferrous metallurgy in Ukraine since the beginning of 1990 were aluminum, zinc, magnesium, titanium, mercury, nickel. Aluminium production in Ukraine ended in May 2010. At present, the bulk of non-ferrous metals in the production of zinc and lead is occupied. Although the production of non-ferrous metals is a minor source of emissions in the atmosphere (Figure 3.10), the sector is characterized by high energy consumption.

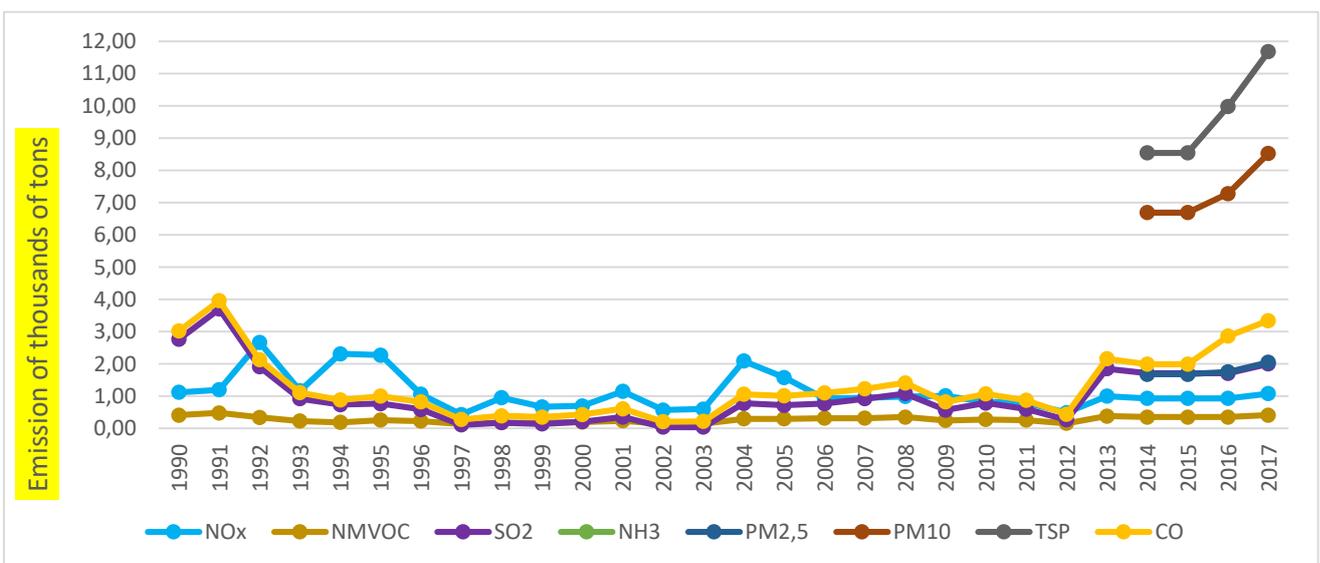


Table 3.16 Emissions in the production of non-ferrous metals 1A2b

Year	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	1,12	0,41	2,76					3,02
1991	1,20	0,48	3,70					3,96
1992	2,67	0,34	1,91					2,13
1993	1,17	0,23	0,92					1,11
1994	2,31	0,19	0,74					0,88
1995	2,27	0,26	0,77					1,00
1996	1,06	0,23	0,59					0,82
1997	0,43	0,14	0,11					0,28
1998	0,95	0,18	0,18					0,39
1999	0,67	0,18	0,14					0,35
2000	0,70	0,2	0,21					0,43
2001	1,15	0,24	0,35					0,61
2002	0,57	0,14	0,04					0,21
2003	0,60	0,15	0,04					0,22
2004	2,09	0,3	0,78					1,06
2005	1,58	0,3	0,72					1,01
2006	0,93	0,32	0,77					1,10
2007	0,95	0,32	0,92					1,23
2008	0,99	0,35	1,08					1,41
2009	1,01	0,25	0,57					0,82
2010	0,82	0,28	0,79					1,07
2011	0,79	0,26	0,60					0,87
2012	0,49	0,16	0,27					0,44
2013	1,00	0,38	1,85					2,16
2014	0,93	0,35	1,71		1,68	6,69	8,54	1,99
2015	0,93	0,35	1,71		1,68	6,69	8,54	1,99
2016	0,93	0,35	1,71		1,75	7,28	9,98	2,86
2017	1,08	0,41	2,00		2,05	8,52	11,68	3,34
Changing,1990-2017	-3,6%	0,0%	-27,5%					10,6%

1A2s sector includes combustion processes in the chemical industry, the main products of which is ammonia, mineral fertilizers; sulfuric acid, nitric acid and other acids; plastics and rubber products. The chemical industry is one of the largest consumers of natural gas in Ukraine. sector emissions are insignificant in comparison with other categories of industrial combustion (Figure 3.11).

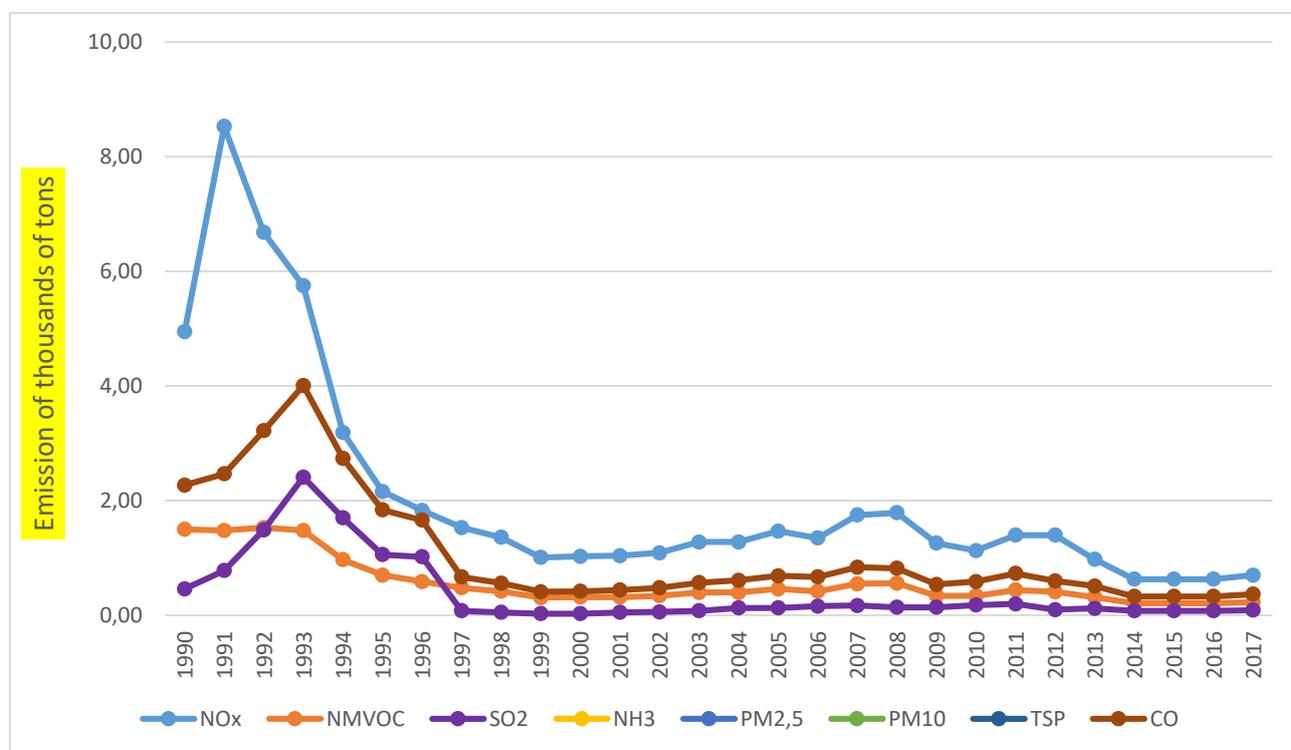


Figure 3.11 Emissions from 1A2s sector and the consumption of natural gas in 1990-2017 years.

Table 3.11 Emissions in the production of chemicals 1A2s

	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	4,95	1,50	0,46					2,27
1991	8,53	1,48	0,78					2,47
1992	6,68	1,53	1,49					3,22
1993	5,75	1,48	2,41					4,01
1994	3,19	0,97	1,70					2,74
1995	2,16	0,70	1,06					1,84
1996	1,83	0,59	1,02					1,66
1997	1,53	0,48	0,08					0,67
1998	1,36	0,42	0,05					0,56
1999	1,01	0,31	0,03					0,41
2000	1,03	0,32	0,03					0,42
2001	1,04	0,32	0,05					0,44
2002	1,09	0,34	0,06					0,48
2003	1,28	0,40	0,08					0,57
2004	1,28	0,40	0,13					0,61

2005	1,47	0,46	0,13					0,69
2006	1,35	0,42	0,16					0,67
2007	1,75	0,55	0,17					0,84
2008	1,79	0,56	0,14					0,82
2009	1,26	0,34	0,14					0,54
2010	1,13	0,34	0,18					0,59
2011	1,40	0,44	0,20					0,73
2012	1,40	0,41	0,10					0,60
2013	0,98	0,32	0,12					0,51
2014	0,63	0,21	0,08					0,33
2015	0,63	0,21	0,08					0,33
2016	0,63	0,21	0,08					0,33
2017	0,70	0,23	0,09					0,37
Changing,1990-2017	-85,6%	-84,7%	-80,4%					-83,7%

1A2d sector includes combustion processes in the pulp industry, the production of paper and in the printing industry. The sector is a minor source of emissions, pollutant emissions and their change for the period from 1990 to 2017. listed in Table 3.12.

Table 3.12 Emissions of pollutants in pulp and paper production 1A2d

	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	0,26	0,07	0,19					0,26
1991	0,31	0,15	0,22					0,43
1992	0,61	0,21	1,38					1,51
1993	1,41	0,09	0,19					0,27
1994	0,99	0,14	0,66					0,77
1995	0,81	0,09	0,41					0,48
1996	0,18	0,05	0,31					0,34
1997	0,09	0,03	0,04					0,08
1998	0,02	0,01	0,00					0,01
1999	0,01	0,00	0,00					0,00
2000	0,01	0,00	0,00					0,01
2001	0,01	0,00	0,00					0,01
2002	0,02	0,01	0,00					0,01
2003	0,04	0,01	0,00					0,02
2004	0,05	0,02	0,00					0,02
2005	0,06	0,02	0,00					0,03
2006	0,06	0,02	0,00					0,02
2007	0,07	0,02	0,00					0,03
2008	0,07	0,02	0,00					0,03
2009	0,06	0,02	0,00					0,02

2010	0,07	0,02	0,00					0,03
2011	0,06	0,02	0,00					0,03
2012	0,06	0,02	0,00					0,03
2013	0,02	0,01	0,00					0,01
2014	0,02	0,01	0,00			0,01	0,01	0,01
2015	0,02	0,01	0,00			0,01	0,01	0,01
2016	0,02	0,01	0,00			0,03	0,01	0,01
2017	0,02	0,01	0,00			0,03	0,01	0,01
Changing, 1990-2017	-92,3%	-85,7%	-100,0%					-96,2%

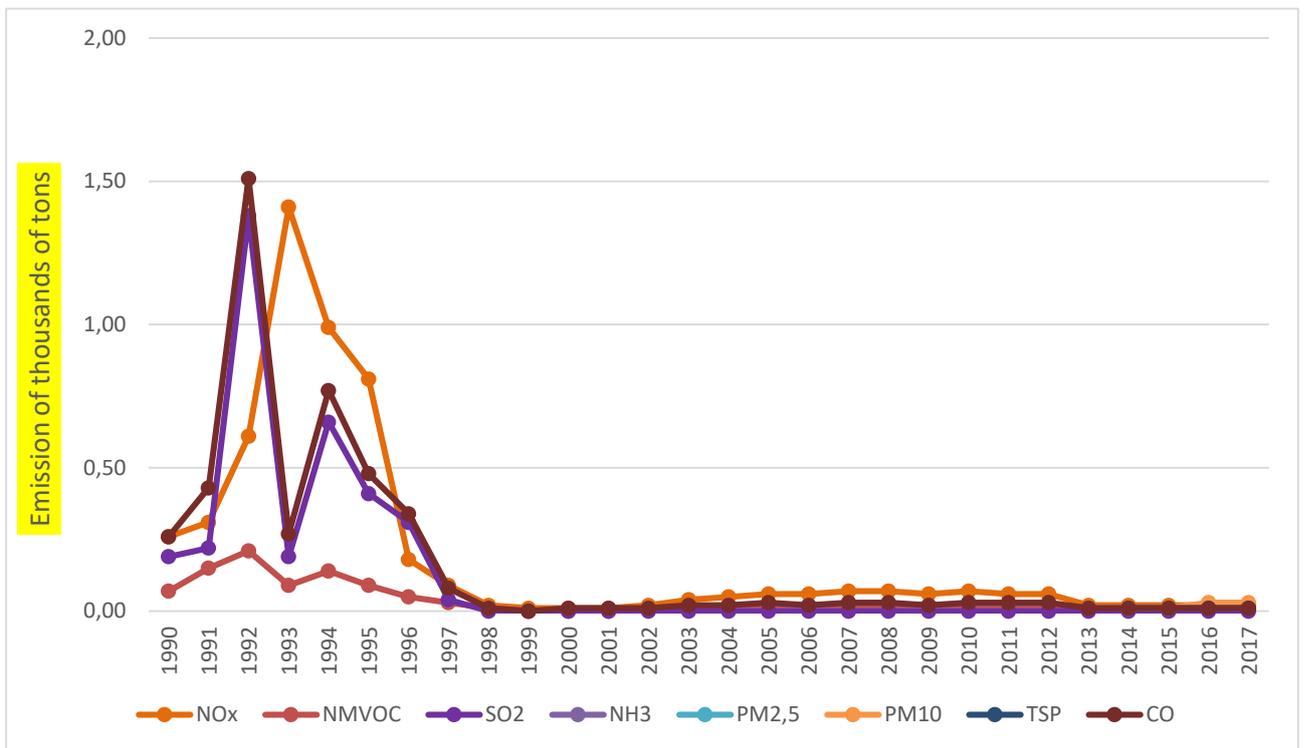


Figure 3.12 Emissions of pollutants in pulp and paper production 1A2d.

1A2e sector includes combustion processes in the food industry. The main sources of pollution in this sector are companies of sugar, baking and dairy industries. The sector is a minor source of emissions, pollutant emissions and their change for the period from 1990 to 2017. listed in Table 3.13.

Table 3.13 Emissions from the food industry 1A2e

Year	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	13,41	2,12	11,21					12,84
1991	11,07	2,23	13,62					15,09
1992	18,73	2,28	11,70					13,27
1993	16,95	1,69	5,03					6,46
1994	13,17	1,89	9,72					11,13
1995	6,84	1,34	8,33					9,19
1996	8,22	1,05	4,43					5,25
1997	3,52	0,42	0,27					0,73
1998	2,33	0,66	3,57					4,08
1999	1,89	0,57	3,14					5,58
2000	1,69	0,52	2,41					2,86
2001	1,61	0,70	2,68					3,43
2002	1,56	0,60	2,36					2,97
2003	1,56	0,65	2,20					2,92
2004	1,39	0,58	1,70					2,56
2005	1,23	0,48	1,82					2,28
2006	1,34	0,52	2,28					2,74
2007	1,12	0,44	1,71					2,12
2008	0,99	0,38	1,12					1,51
2009	0,87	0,34	0,77					1,16
2010	0,89	0,42	1,12					1,62
2011	0,99	0,38	1,42					1,79
2012	0,92	0,41	1,16					1,63
2013	0,76	0,32	0,71					1,09
2014	0,77	0,33	0,72					1,10
2015	0,77	0,33	0,72					1,10
2016	0,77	0,33	0,72					1,10
2017	0,84	0,36	0,79					1,22
Changing, 1990-2017	-93,7%	-83,0%	-92,9%					-90,5%

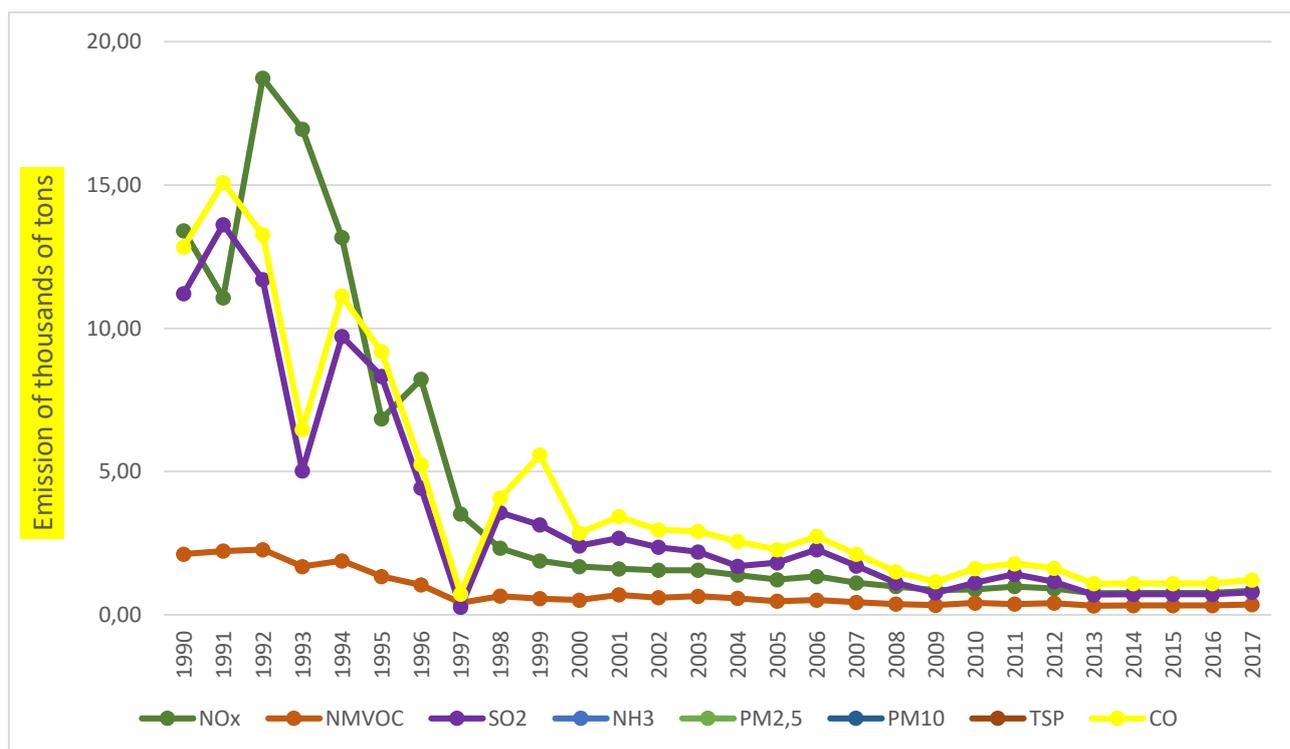


Figure 3.13 Emissions from the food industry 1A2e

1A2f sector includes mainly combustion processes at the enterprises of the industry of building materials and construction, as well as the extraction of non-metallic non-fuel raw materials.

Table 3.14 Emissions of polluting substances in the manufacture of non-metallic minerals 1A2f

Year	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	27,78	8,14	30,21					37,53
1991	28,06	8,22	30,51					37,91
1992	27,49	8,06	29,90					37,15
1993	22,82	6,69	24,82					30,84
1994	11,87	5,48	12,91					16,03
1995	4,51	1,32	4,90					6,09
1996	4,84	1,34	4,22					5,49
1997	5,17	1,35	3,54					4,90
1998	5,24	1,26	2,16					3,54
1999	4,24	1,26	2,04					3,49
2000	4,31	1,10	1,62					2,85
2001	5,35	1,37	2,11					3,70
2002	6,35	2,00	2,80					5,16
2003	7,32	2,31	3,62					6,30
2004	8,03	2,94	4,84					7,96
2005	8,69	2,94	4,29					7,74
2006	9,35	3,19	5,33					9,00

2007	10,88	3,99	12,69					16,75
2008	10,72	4,03	14,32					18,25
2009	6,01	2,50	14,38					16,34
2010	7,50	3,31	23,62					25,80
2011	8,94	4,31	30,83					33,80
2012	7,31	3,69	25,23					27,98
2013	7,20	3,59	26,37					28,80
2014	5,87	2,92	21,49					23,47
2015	5,87	2,92	21,49					23,47
2016	5,87	2,92	21,49					23,47
2017	7,67	0,11	2,31					8,99
Changing, 1990-2017	-72,4%	-98,6%	-92,4%					-76,0%

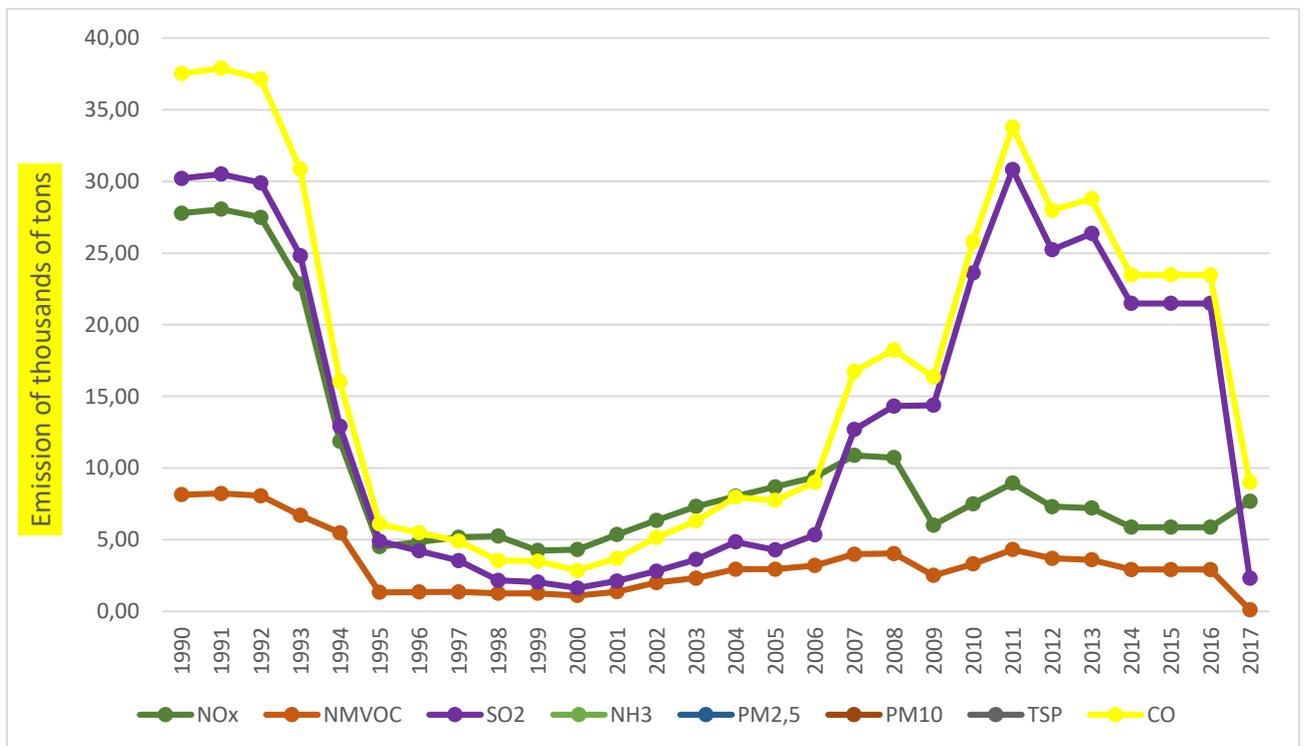


Figure 3.14 Emissions from 1A2f sector, the production of clinker and fuel consumption in the 1990-2017 biennium.

1A2gviii sector includes fuel combustion processes (boilers and process equipment) that are not included in the category 1A2a - 1A2f (engineering, woodworking, electrical engineering, furniture, textiles, etc.).

Table 3.15 Emissions of pollutants from other industries 1A2gviii

Year	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	186,35	11,42	20,23					29,88
1991	149,74	9,44	23,52					31,05
1992	17,70	3,72	6,64					10,53
1993	13,79	4,08	18,43					22,53
1994	6,05	1,44	6,66					7,84
1995	4,43	1,11	2,90					4,06
1996	4,88	2,36	4,68					7,90
1997	5,27	1,84	9,81					11,33
1998	6,10	1,65	2,64					4,49
1999	6,14	1,68	2,85					4,72
2000	6,43	1,62	2,18					4,01
2001	6,12	1,74	2,17					4,17
2002	9,04	2,83	10,50					13,10
2003	10,16	2,88	9,49					12,23
2004	10,50	3,15	11,02					13,96
2005	10,69	3,18	11,02					14,02
2006	10,57	3,70	12,49					16,18
2007	12,17	4,39	13,76					18,43
2008	10,43	4,15	10,80					15,60
2009	7,47	2,39	5,66					8,21
2010	7,38	2,57	6,37					9,13
2011	8,11	2,72	6,88					9,77
2012	8,78	2,72	6,29					9,26
2013	8,41	2,94	9,46					12,43
2014	4,94	1,73	5,56		1,68	5,09	22,06	7,31
2015	4,94	1,73	5,56		1,68	5,09	22,06	7,31
2016	4,35	1,73	5,56		1,84	5,78	24,32	7,31
2017	5,82	2,31	7,45		2,46	7,75	32,59	9,79
Changing,1990-2017	-96,9%	-79,8%	-63,2%					-67,2%

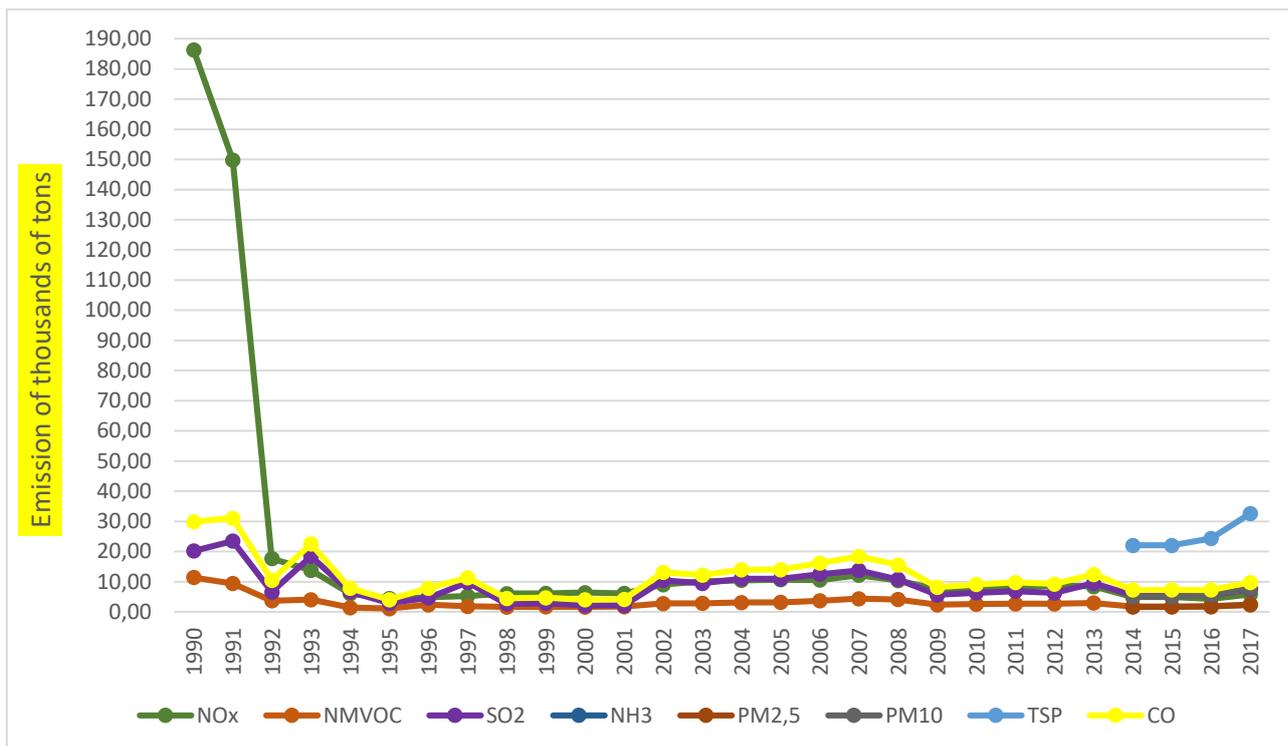


Figure 3.15 Emissions of pollutants from other industries 1A2gviii

3.2.4 A small (non-industrial) burning (NFR 1A4)

3.2.4.1 Description of the sector

The sector includes three categories of small combustion:

1A4ai - Commercial and Institutional sector;

1A4bi - the domestic sector;

1A4si - Agriculture, forestry and fisheries;

1A5a - Other, including military.

Small combustion plants are designed for heating and hot water in the residential sector and the commercial sector. Some settings are also used for cooking in the residential sector. In agriculture, the heat generated by the installation is used for drying grain and heat greenhouses. The main source of contamination in the sector is the residential sector (Figure 3.16)

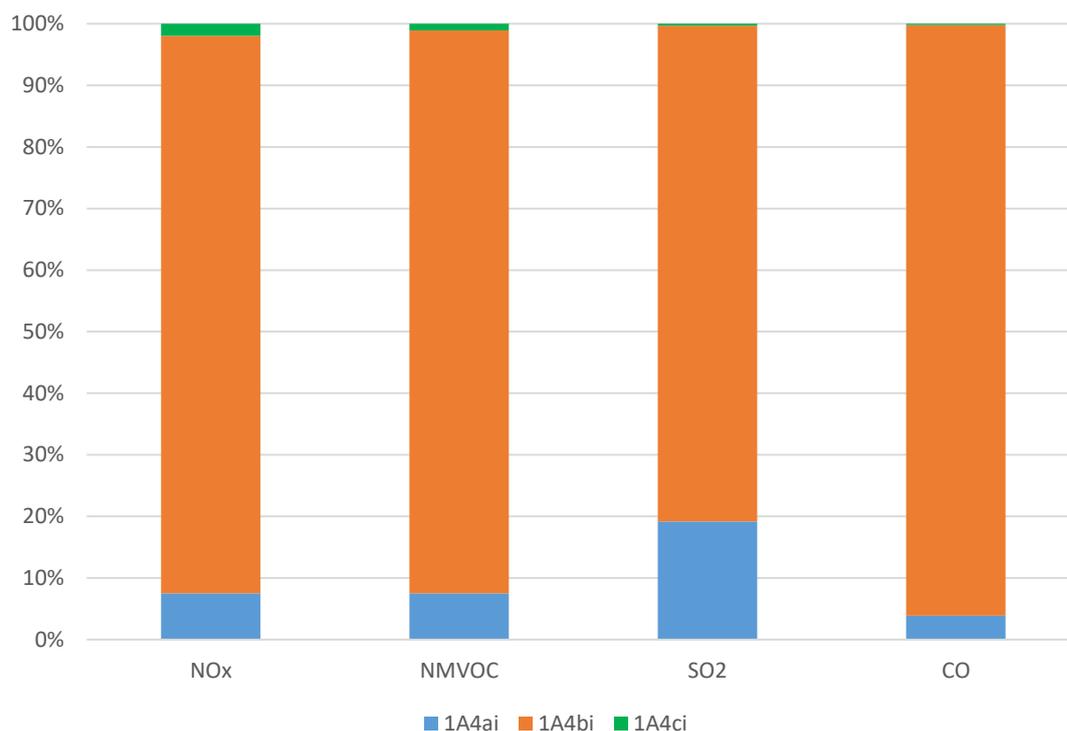


Figure 3.16 The distribution of emissions within the sector of small combustion

Table 3.17 Emissions from small combustion 1A4

Year	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	221,04	204,93	475,90					1877,36
1991	121,98	88,51	267,16					784,18
1992	124,72	94,11	336,31					841,30
1993	111,88	80,97	294,31					723,13
1994	101,11	74,57	201,52					639,59
1995	90,00	73,75	240,42					659,08
1996	71,68	67,03	203,34					603,22
1997	71,02	70,60	113,58					617,79
1998	52,25	51,47	100,94					441,99
1999	47,73	46,51	85,90					402,77
2000	42,60	38,58	67,01					326,21
2001	41,31	37,39	62,63					314,08
2002	40,55	37,86	60,02					313,71
2003	41,61	36,10	49,76					292,49
2004	42,81	40,10	61,76					333,90
2005	43,90	35,09	54,11					294,09
2006	45,92	35,35	54,41					296,21
2007	41,54	30,51	44,56					251,68
2008	40,82	27,23	37,92					225,97
2009	38,38	25,83	31,83					210,77

2010	39,90	25,28	33,22					209,53
2011	39,57	23,69	30,56					194,94
2012	39,75	24,37	29,73					198,89
2013	38,59	23,84	27,55	0,05	0,82	3,07	12,88	194,45
2014	33,35	20,59	23,61	0,04	0,68	2,60	10,94	168,30
2015	23,35	16,59	23,61	0,04	0,68	2,60	10,94	168,30
2016	23,35	85,02	53,62	0,04	0,07	3,86	12,28	831,69
2017	23,35	16,59	24,61	0,04	0,77	3,86	12,28	168,30
Changing,1990-2017	-89,4%	-91,9%	-94,8%					-91,0%

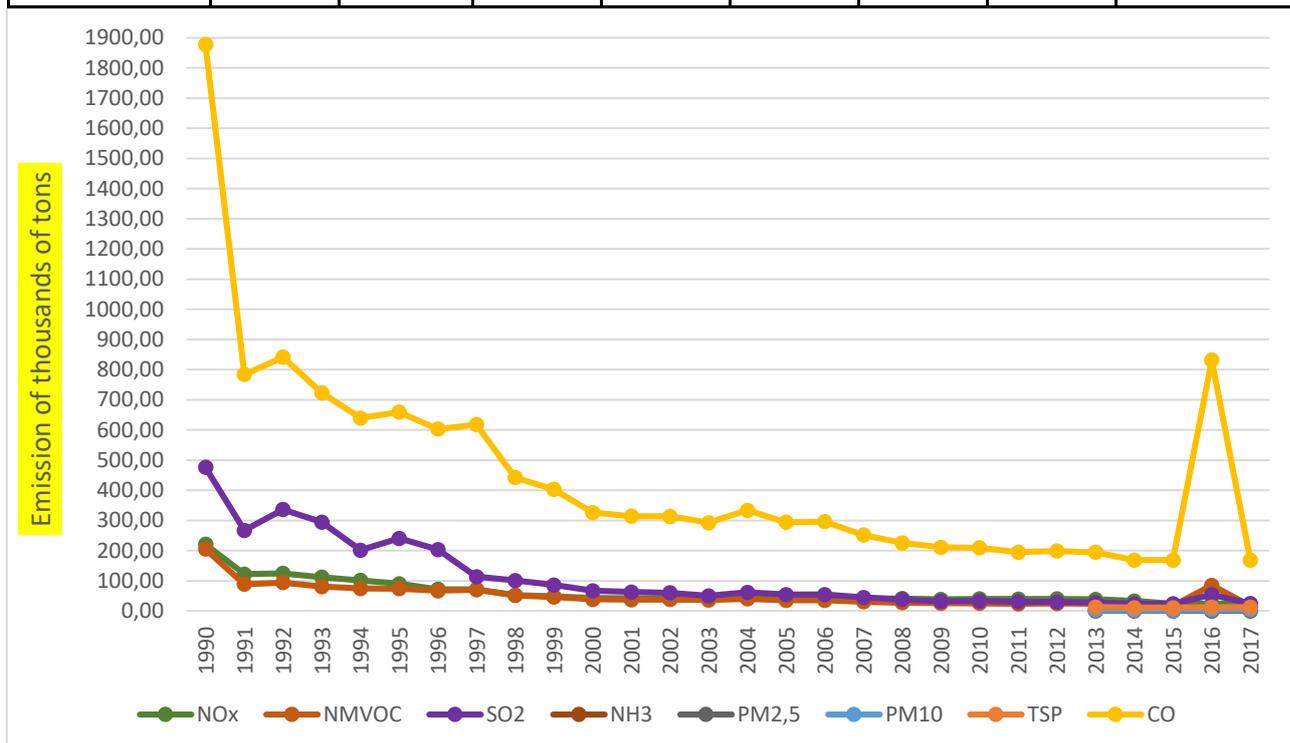


Figure 3.17 Emissions from small combustion 1A4

3.2.4.2 Methodology

To calculate the emissions used Tier 1 EMEP / EEA management. Data on the use of fuels for all categories of the energy industry are taken on the basis of the ICC (fuel) statistical reporting and a detailed description can be found in the report "National inventory of anthropogenic emissions by sources and removals by sinks in Ukraine for years."

When calculating the emissions used specific emission factors Tier 1 methodology Guide EMEP / EEA (Tables 3.25 - 3.26).

Table 3.17 Coefficients of specific emissions for the category and 1A4ai 1A4si

Substance	Unit	Black and brown coal	Gaseous fuels	Liquid fuels	Biomass
NOx	g/GJ	173	74	513	91
NMVOG	g/GJ	88.8	23	25	300
SO2	g/GJ	900	0.67	47	11
NH3	g/GJ				37
PM2,5	g/GJ	108	0.78	20	140
PM10	g/GJ	117	0.78	20	143
TSP	g/GJ	124	0.78	20	150
BC	g/GJ	6.912	0.0312	11.2	39.2
CO	g/GJ	931	29	66	570
Pb	mg/GJ	134	0.011	0.08	27
Cd	mg/GJ	1.8	0.0009	0.006	13
Hg	mg/GJ	7.9	0.54	0.12	0.56
As	mg/GJ	4	0.1	0.03	0.19
Cr	mg/GJ	13.5	0.013	0.2	23
Cu	mg/GJ	17.5	0.0026	0.22	6
Ni	mg/GJ	13	0.013	0.008	2
Se	mg/GJ	1.8	0.058	0.11	0.5
Zn	mg/GJ	200	0.73	29	512
PCDD/F	ng/GJ	203	0.52	1.4	100
Benzo(a)pyrene	mg/GJ	45.5	0.00072	0.0019	10
Benzo(b)fluoranthene	mg/GJ	58.9	0.0029	0.015	16
Benzo(k)fluoranthene	mg/GJ	23.7	0.0011	0.0017	5
Indeno(1,2,3-cd)pyrene	mg/GJ	18.5	0.00108	0.0015	4
HCB	µg/GJ	0.62			5
PCB	µg/GJ	170			0.06

Table 3.18 Coefficients of specific emissions for the category 1A4bi

Substance	Unit	Black and brown coal	Gaseous fuels	Liquid fuels	Biomass
NOx	g/GJ	110	51	51	80
NMVOOC	g/GJ	484	1.9	0.69	600
SO2	g/GJ	900	0.3	70	11
NH3	g/GJ	0.3			70
PM2,5	g/GJ	398	1.2	1.9	740
PM10	g/GJ	404	1.2	1.9	760
TSP	g/GJ	444	1.2	1.9	800
BC	g/GJ	25.472	0.0648	0.1615	74
CO	g/GJ	4600	26	57	4000
Pb	mg/GJ	130	0.0015	0.012	27
Cd	mg/GJ	1.5	0.00025	0.001	13
Hg	mg/GJ	5.1	0.68	0.12	0.56
As	mg/GJ	2.5	0.12	0.002	0.19
Cr	mg/GJ	11.2	0.00076	0.2	23
Cu	mg/GJ	22.3	0.000076	0.13	6
Ni	mg/GJ	12.7	0.00051	0.005	2
Se	mg/GJ	1	0.011	0.002	0.5
Zn	mg/GJ	220	0.0015	0.42	512
PCDD/F	ng/GJ	800	1.5	5.9	800
Benzo(a)pyrene	mg/GJ	230	0.56	0.08	121
Benzo(b)fluoranthene	mg/GJ	330	0.84	0.04	111
Benzo(k)fluoranthene	mg/GJ	130	0.84	0.7	42
Indeno(1,2,3-cd)pyrene	mg/GJ	110	0.84	0.16	71
HCB	µg/GJ	0.62			5
PCB	µg/GJ	170			0.06

3.3 Transport (NFR 1A3)

3.3.1 Description of the sector

"Transport" sector includes all kinds of mobile sources, which are summarized in Table 3.30.

Table 3.30 Short description sector

NFR	Source	Description	Method	Emissions
1A2gii	Mobile Combustion in manufacturing industries and construction	Emissions included in the category 1A3eii	Tier 1	NO _x , NMVOC, SO ₂ , CO
1A3aii(i)	Domestic aviation LTO (civil)		Tier 1	NO _x , NMVOC, CO
1A3bi-iii	Road transport		Tier 1	NO _x , NMVOC, SO ₂ , CO
1A3c	Railways	It includes diesel emissions	Tier 1	NO _x , NMVOC, SO ₂ , CO
1A3dii	National navigation (Shipping)	It includes emissions from which depart and arrive in the ports of Ukraine	Tier 1	NO _x , NMVOC, SO ₂ , CO
1A3ei	Pipeline transport	Emissions included in the category 1A3eii	Tier 1	NO _x , NMVOC, SO ₂ , CO
1A4bii	Residential: Household and gardening (mobile)	Emissions included in the category 1A3eii	Tier 1	NO _x , NMVOC, SO ₂ , CO
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	Emissions included in the category 1A3eii	Tier 1	NO _x , NMVOC, SO ₂ , CO
1A5b	Other, Mobile (including military, land based and recreational boats)	It includes emissions from mobile sources, military	Tier 1	NO _x , NMVOC, SO ₂ , CO

Table 3.31 Emissions from the sector "Transport" 1990 2017

Year	NO _x	NMVOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
	kt							
1990	1298,32	1202,78	133,50					6345,96
1991	1054,22	910,77	114,58					4803,91
1992	917,33	792,49	95,90					4180,08
1993	689,26	595,40	73,25					3140,49
1994	607,02	524,36	63,62					2765,77
1995	570,10	492,49	59,59					2597,69
1996	556,89	481,12	57,35					2537,71
1997	482,88	417,26	48,65					2200,86
1998	448,25	306,13	45,54					1612,90
1999	407,83	313,50	40,85					1656,26
2000	360,88	267,62	36,53					1413,84
2001	365,93	297,77	36,21					1577,09
2002	361,78	298,63	36,74					1582,03
2003	360,06	281,31	37,52					1490,52
2004	362,28	314,38	37,79					1666,86
2005	355,53	309,12	36,53					1641,39
2006	393,41	349,27	41,69					1857,28
2007	405,34	370,60	43,14					1972,13
2008	412,24	373,62	44,22					1988,84
2009	367,38	327,96	39,96					1746,54
2010	384,98	325,40	42,56					1733,67
2011	201,85	84,06	30,11					502,95
2012	207,29	89,46	33,32					522,39
2013	199,15	85,29	31,93					497,96
2014	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2015	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2016	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2017	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Changing, 1990-2017	-84.7%	-92.9%	-76.1%					-92.2%

Currently, the main source of pollution in the sector of transport is road transport (Figure 3.30). However, in 1990, all-terrain vehicles (in the inventory under the category 1A3e including industrial vehicles, agricultural machinery, etc) has been a significant source of emissions (Figure 3.29). A significant change in the structure of emissions for the length of time from 1990 to 2013 was due to a drop in industry and agriculture.

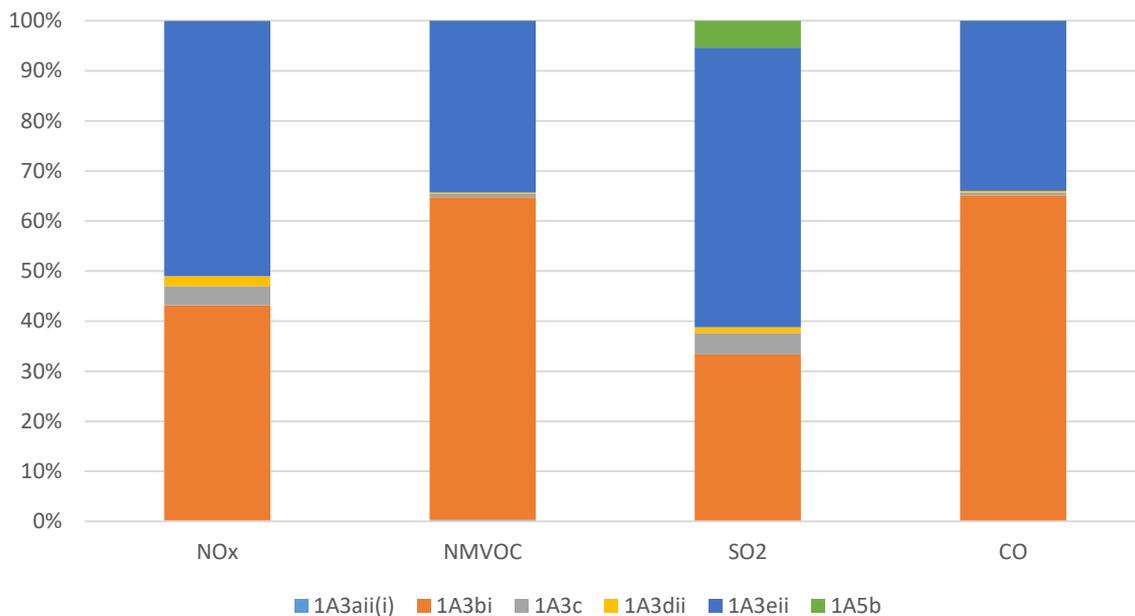


Figure 3.31 The distribution of emissions within the sector Transport, 1990

1A3a category includes emissions from civil aviation (domestic operations takeoff / landing)

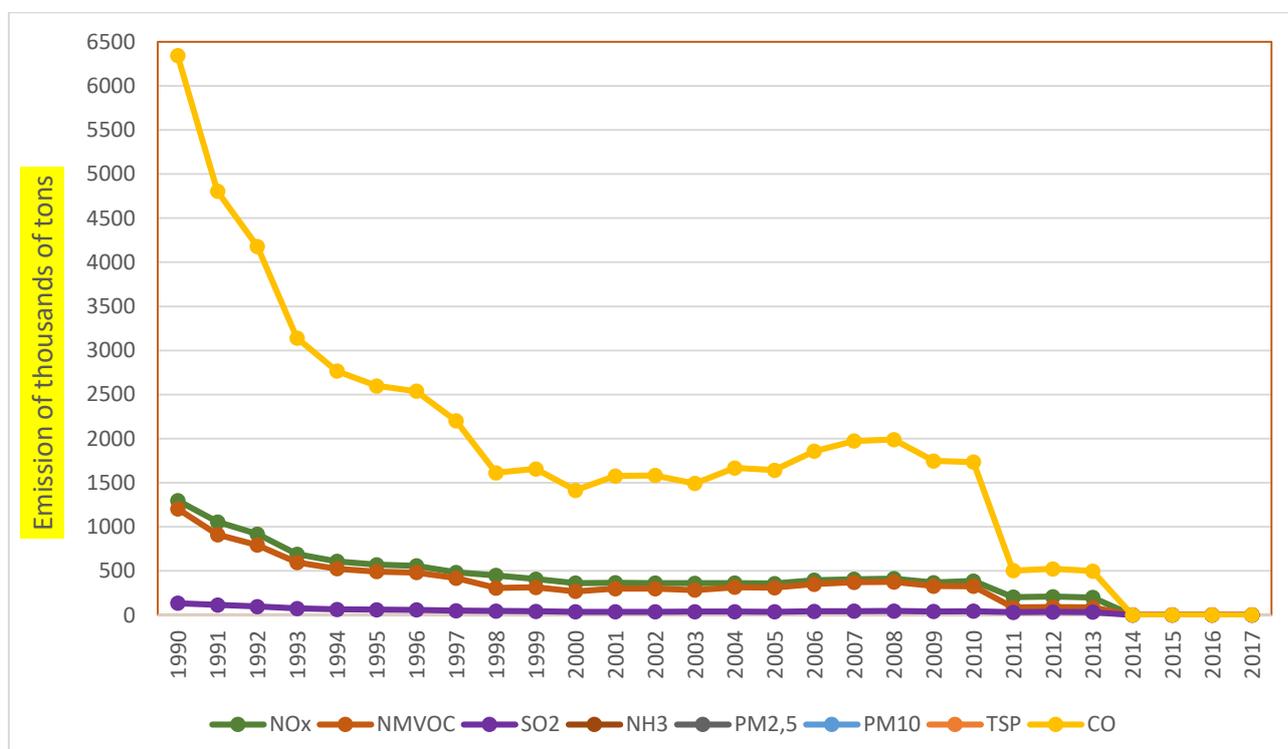


Figure 3.31 Emissions from 1A3a categories, fuel consumption and passenger traffic of civil aviation

Table 3.31 Emissions of Civil Aviation, 1990-2017.

Year	NO _x	NM VOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
	kt							
1990	1298,32	1202,78	133,5					6345,96
1991	1054,22	910,77	114,58					4803,91
1992	917,33	792,49	95,9					4180,08
1993	689,26	595,4	73,25					3140,49
1994	607,02	524,36	63,62					2765,77
1995	570,1	492,49	59,59					2597,69
1996	556,89	481,12	57,35					2537,71
1997	482,88	417,26	48,65					2200,86
1998	448,25	306,13	45,54					1612,9
1999	407,83	313,5	40,85					1656,26
2000	360,88	267,62	36,53					1413,84
2001	365,93	297,77	36,21					1577,09
2002	361,78	298,63	36,74					1582,03
2003	360,06	281,31	37,52					1490,52
2004	362,28	314,38	37,79					1666,86
2005	355,53	309,12	36,53					1641,39
2006	393,41	349,27	41,69					1857,28
2007	405,34	370,6	43,14					1972,13
2008	412,24	373,62	44,22					1988,84
2009	367,38	327,96	39,96					1746,54
2010	384,98	325,4	42,56					1733,67
2011	201,85	84,06	30,11					502,95
2012	207,29	89,46	33,32					522,39
2013	199,15	85,29	31,93					497,96
2014	0,25	0,12	0,04					0,00
2015	0,25	0,12	0,04					0,39
2016	0,25	0,12	0,04					0,39
2017	0,25	0,12	0,04					0,39
Changing, 1990-2017	-99,9%	99,9%	99,9%					-99,9%

1A3b category includes emissions from road transport. This includes passenger cars and trucks, buses and motorcycles and mopeds.

Road transport is a major source of pollution in the transport sector (**Figure 3.32**).

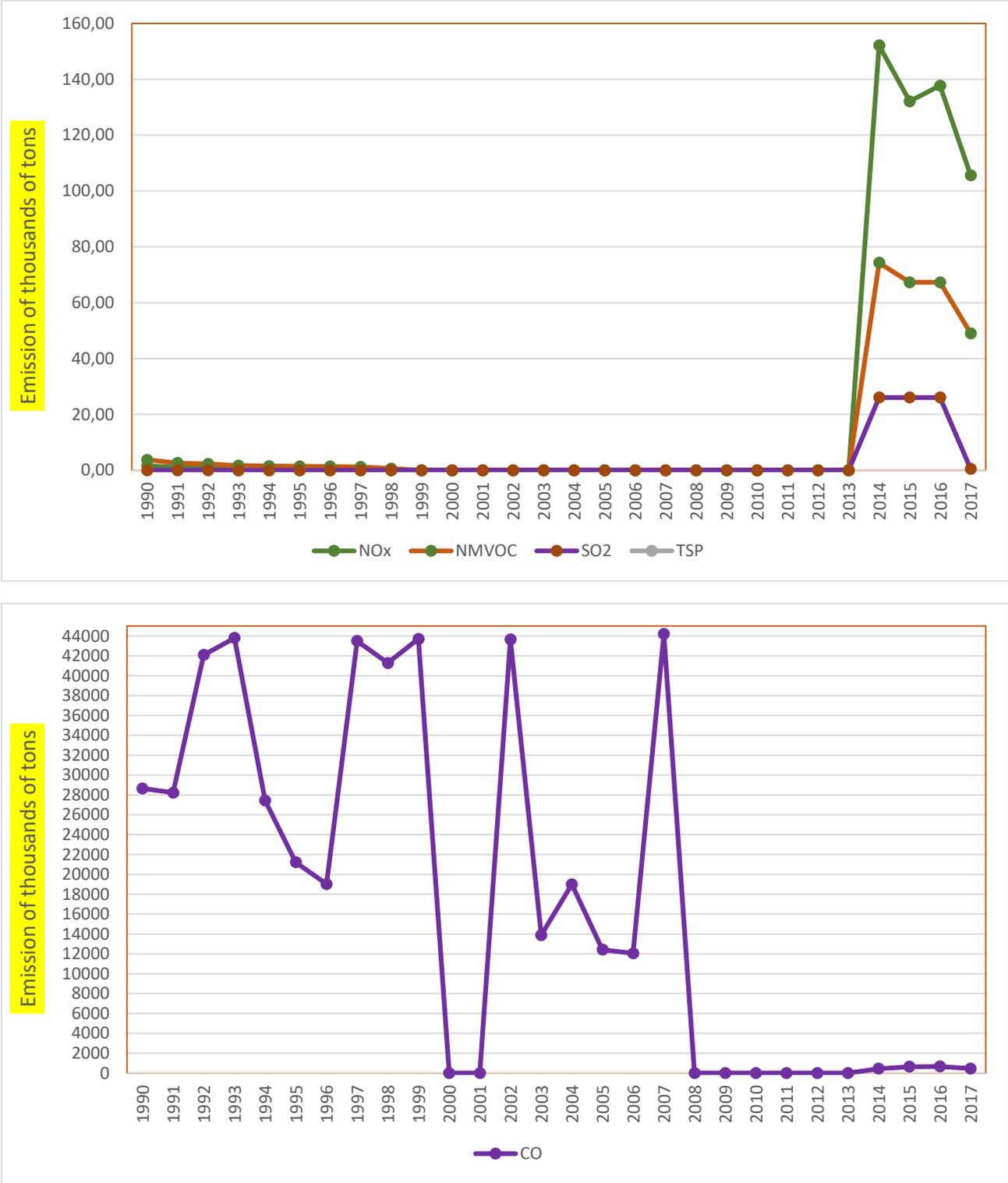


Figure 3.32 Emissions from road transport and fuel consumption, 1990-2017.

Table 3.33 Emissions from road transport, 1990-2017

	NO _x	NM VOC	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	1,59	3,72	0.05					28642
1991	1,12	2,62	0.04					28216
1992	0,97	2,28	0.04					42095
1993	0.73	1,71	0.03					43802
1994	0.64	1,51	0.02					27426
1995	0.61	1,42	0.02					21217
1996	0.59	1,38	0.02					19025
1997	0.51	1,20	0.02					43497
1998	0.26	0,62	0.02					41275
1999	0.24	0.60	0.02					43709
2000	0.23	0.53	0.02					0.97
2001	0.25	0.51	0.02					0.91
2002	0.29	0.59	0.02					43647
2003	0.38	0.75	0.02					13881
2004	0.44	0.84	0.03					18994
2005	0.43	0.75	0.03					12420
2006	0.51	0.70	0.03					12055
2007	0.59	0.61	0.03					44197
2008	0.64	0.33	0.03					0.76
2009	0.45	0.20	0.02					0.50
2010	0.44	0.14	0.02					0.41
2011	0.56	0.15	0.06					0.65
2012	0.61	0.14	0.05					0.51
2013	0.25	0.12	0.04					0.39
2014	152,09	74,30	26,05					435
2015	132,09	67,30	26,05					634,9
2016	137,7	67,3	26,05					657,9
2017	105,595	49,02	0,52					444,16
Changing, 1990-2017	6540%	121,7%	940%					-98%

1A3c category includes emissions from rail transport and affects freight and passenger transportation by diesel locomotives.

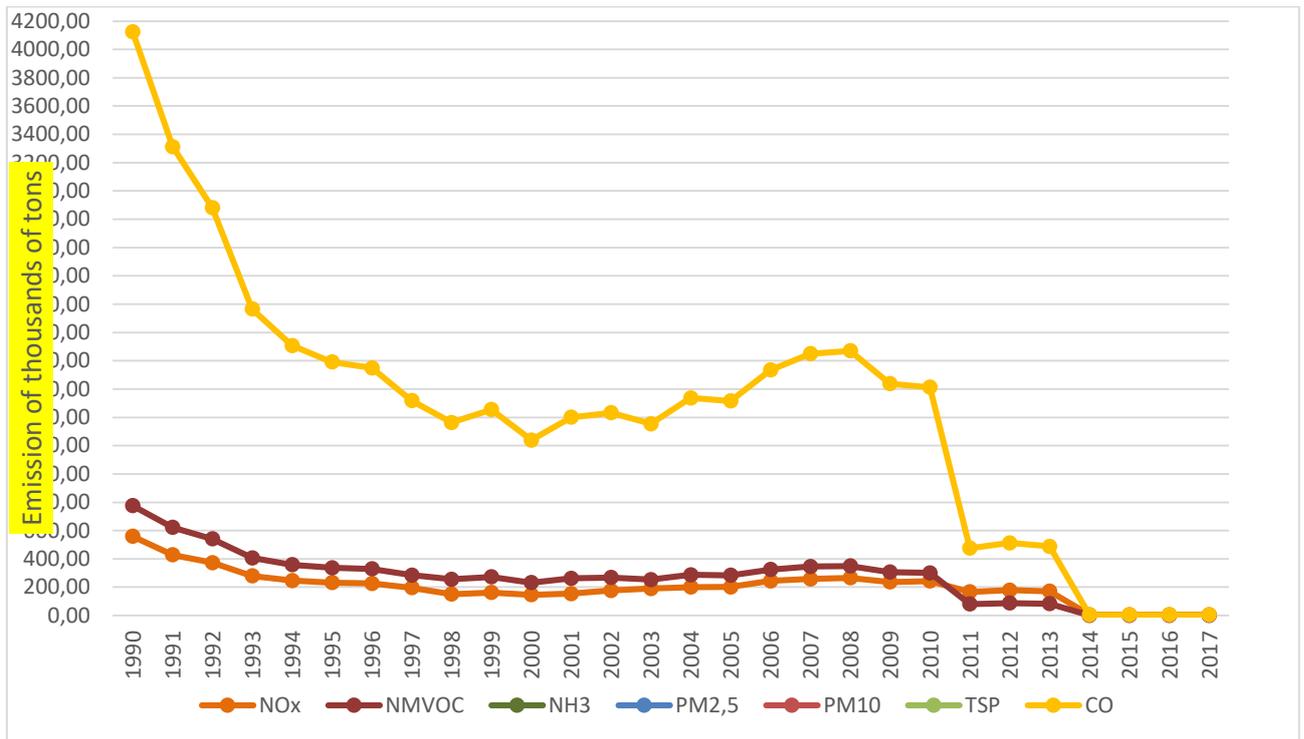


Figure 3.34 Emissions from railway transport and passenger and freight turnover, 1990-2017.

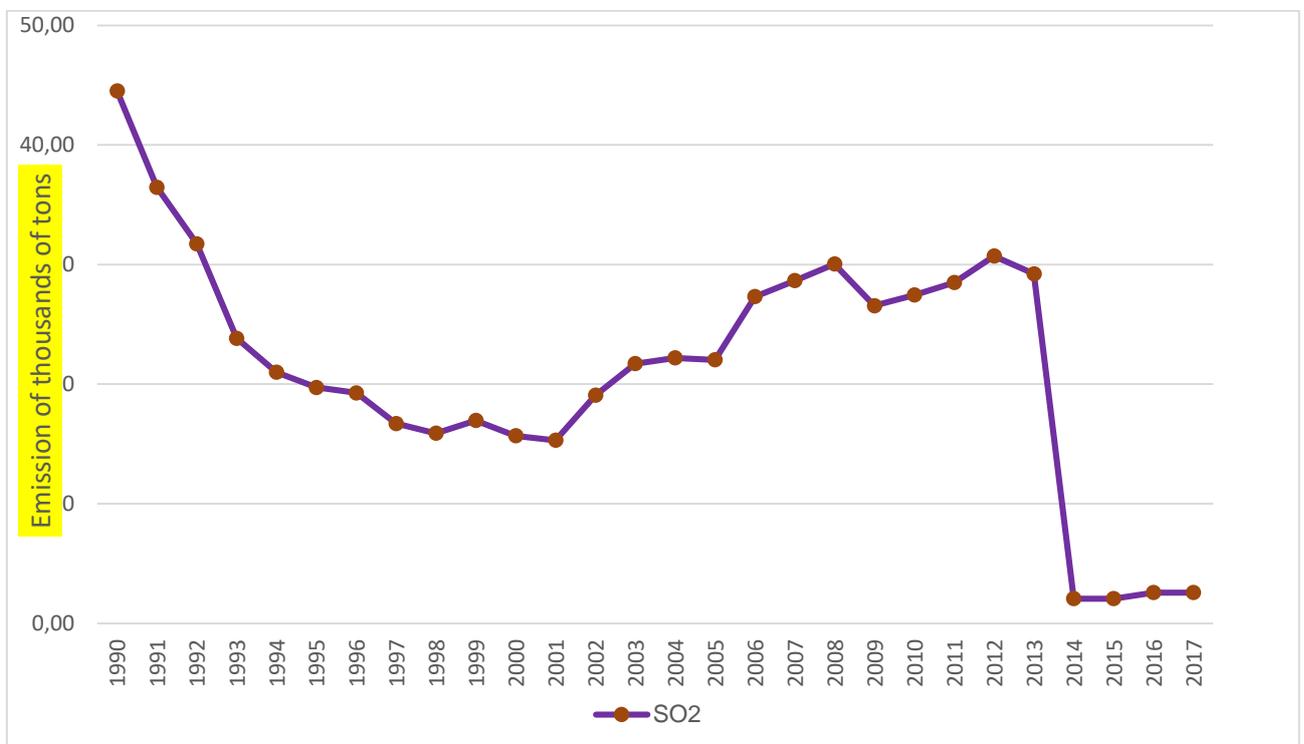


Figure 3.35 SO2 emissions from rail transport and consumption of diesel fuel, 1990-2017 years

Table 3.34 Emissions from railway transport for 1990-2017years

	NO_x	NMVOC	SO₂	NH₃	PM_{2,5}	PM₁₀	TSP	CO
1990	559,09	775,25	44,53					4123,94
1991	428,29	622,36	36,47					3312,25
1992	372,67	541,54	31,74					2882,12
1993	279,99	406,86	23,84					2165,33
1994	246,58	358,31	21,00					1906,96
1995	231,59	336,54	19,72					1791,08
1996	226,25	328,77	19,27					1749,72
1997	196,26	285,20	16,71					1517,84
1998	150,47	255,85	15,89					1363,61
1999	162,13	272,74	16,96					1454,62
2000	146,18	232,36	15,68					1239,62
2001	153,89	262,15	15,31					1400,79
2002	176,72	268,27	19,07					1432,50
2003	190,62	253,55	21,72					1354,48
2004	200,64	287,75	22,19					1536,77
2005	201,65	283,54	22,03					1516,25
2006	244,77	324,32	27,32					1734,94
2007	258,56	345,71	28,65					1849,75
2008	266,18	349,61	30,04					1870,02
2009	236,15	306,09	26,56					1637,90
2010	243,02	301,04	27,46					1612,29
2011	166,35	81,27	28,50					475,71
2012	179,25	87,58	30,71					512,59
2013	170,61	83,35	29,23					487,88
2014	5,27	0,87	2,07					4,39
2015	4,27	0,88	2,07					4,39
2016	5,27	0,88	2,57					4,39
2017	5,27	0,88	2,57					4,39
Changing, 1990-2017	-99%	-99,8%	-94,2%					-99,8%

Category 1A3dii - this national transport with the use of water transport. Emissions are calculated from the ships that depart and arrive in the ports of Ukraine. Emissions arising from maritime transport are the result of fuel combustion (ship) of the internal combustion engine. Category does not include the fishing and military vessels. Bunkers sea transport is not included in the category of water transport.

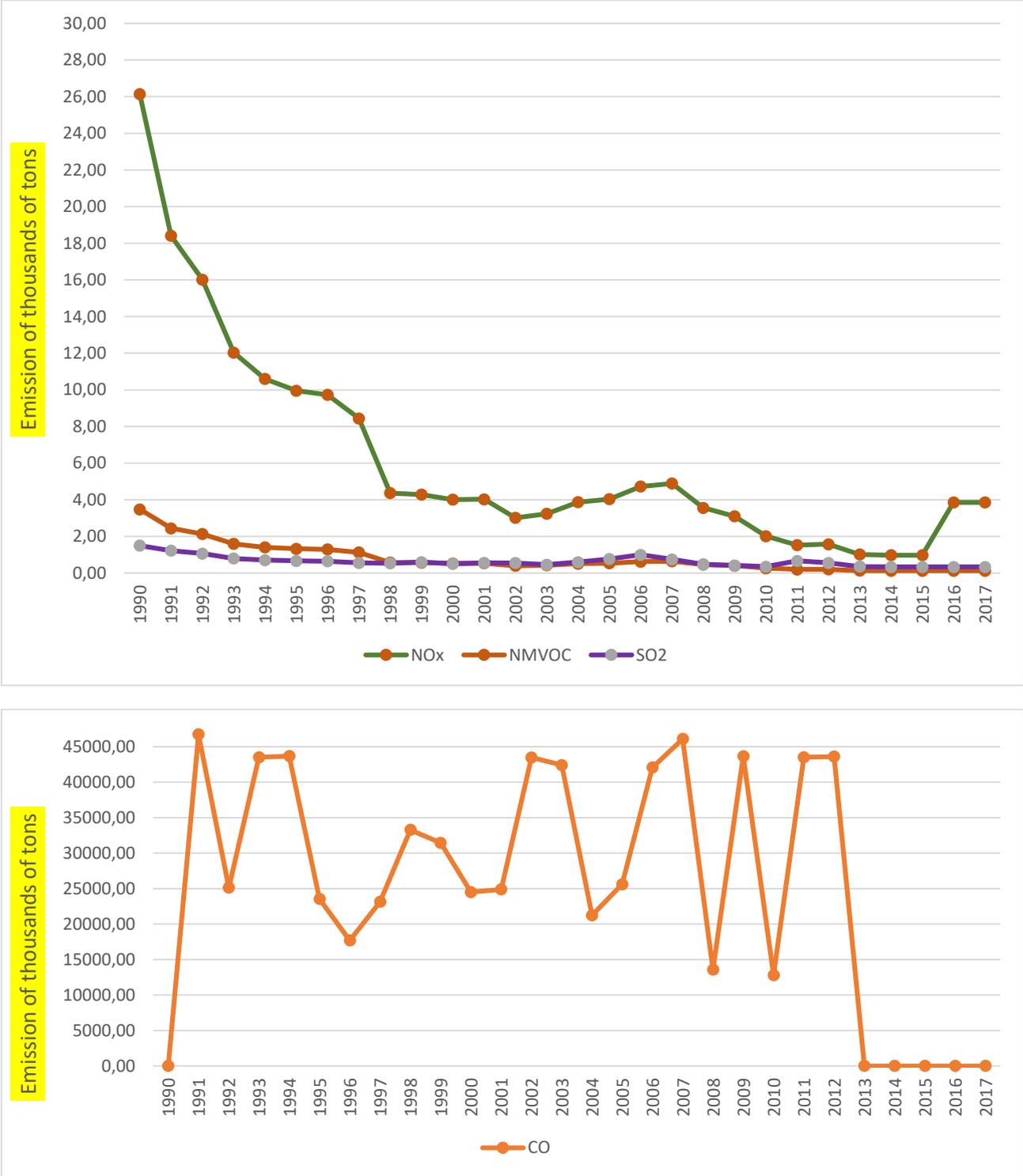


Figure 3.35 Emissions of pollutants from the water transport and fuel consumption, 1990-2017.

Table 3.35 Emissions of pollutants from water transport, 1990-2017.

	NO _x	NMVOG	SO ₂	NH ₃	PM _{2,5}	PM ₁₀	TSP	CO
1990	26,14	3,5	1,5					17,42
1991	18,41	2,45	1,23					46722,00
1992	16,02	2,14	1,07					25112,00
1993	12,04	1,60	0,80					43504,00
1994	10,60	1,41	0,71					43653,00
1995	9,96	1,33	0,67					23529,00
1996	9,73	1,30	0,65					17685,00
1997	8,44	1,13	0,56					23132,00
1998	4,37	0,58	0,54					33270,00
1999	4,29	0,57	0,60					31444,00
2000	4,01	0,53	0,51					24504,00
2001	4,03	0,54	0,56					24869,00
2002	3,02	0,40	0,55					43467,00
2003	3,24	0,43	0,46					42401,00
2004	3,87	0,52	0,60					21217,00
2005	4,04	0,54	0,77					25600,00
2006	4,73	0,63	1,00					42064,00
2007	4,89	0,65	0,75					46082,00
2008	3,56	0,47	0,48					13547,00
2009	3,10	0,41	0,42					43648,00
2010	2,02	0,27	0,35					12785,00
2011	1,53	0,20	0,67					43497,00
2012	1,58	0,21	0,56					43586,00
2013	1,02	0,14	0,36					0,68
2014	0,98	0,13	0,34					0,65
2015	0,98	0,13	0,34					0,65
2016	3,86	0,13	0,34					0,65
2017	3,86	0,13	0,34					0,65
Changing, 1990-2013	-85,2%	-96,20%	-77,30%					-96,20%

3.3.2 Methodology

Category 1A3a. used a database of departures from airports in Ukraine, provided by the state company "UkSATSE" Ukrainian State Air Traffic Service Enterprise In assessing the emissions from civil aviation.

It should be noted that the database of departures from airports in Ukraine provided by the state company "Aeroruh" covers the period from 1996 to 2017 Years. Data for the 1990-1995 biennium. have not survived. Therefore, to estimate emissions from international aviation in 1990 was based on the information on the total consumption of jet fuel for the needs of civil aviation and the average proportion of domestic aviation in the total consumption of jet fuel for the needs of civil aviation in 1990-2006. (Which is 22%). A detailed description of the method in NIR 2015 (http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php)

Category 1A3b. Emissions category for the entire time series 1990-2013 gg. It was calculated on the basis of data on the energy use of fuels according to the form "4-MTP", as well as data on the sale of gasoline and gas oil to the population through a network of filling stantsiy- A detailed description of the method in NIR 2015 (http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php)

Table 3.36 Specific emissions Tier 1 category of road transport (EMEP / EEA 2016)

NFR		1A3bi			1A3bii		1A3biii		1A3biv
Category		light passenger transport			freight transport		heavy freight		motorcycles and mopeds
Substance	Unit	Petrol	Diesel	Liquefied gas	Petrol	Diesel	Dieselъ	Compressed natural gas CNG (Buses)	Petrol
NOx	g/kg fuel	8.73	12.96	15.2	13.22	14.91	33.37	13	6.64
NMVOG	g/kg fuel	10.05	0.7	13.64	14.59	1.54	1.92	0.26	131.4
SOx	g/kg fuel								
NH3	g/kg fuel	1.106	0.065	0.08	0.667	0.038	0.013		0.059
PM2.5	g/kg fuel	0.03	1.2	0	0.02	1.52	0.94	0.02	2.2
PM10	g/kg fuel	0.03	1.2	0	0.02	1.52	0.94	0.02	2.2
TSP	g/kg fuel	0.03	1.2	0	0.02	1.52	0.94	0.02	2.2
CO	g/kg fuel	84.7	3.33	84.7	152.3	7.4	7.58	5.7	497.7
Pb	mkg/kg fuel	33.2	52.1		33.2	52.1	52.1	NA	33.2
Cd	mkg/kg fuel	10.8	8.7	10.6	10.8	8.7	8.7	NA	10.8
Hg	mkg/kg fuel	8.7	5.3		8.7	5.3	5.3	NA	8.7

NFR		1A3bi			1A3bii		1A3biii		1A3biv
Category		light passenger transport			freight transport		heavy freight		motorcycles and mopeds
Substance	Unit	Petrol	Diesel	Liquefied gas	Petrol	Diesel	Dieselъ	Compressed natural gas CNG (Buses)	Petrol
As	mkg/kg fuel	0.3	0.1		0.3	0.1	0.1	NA	0.3
Cr	mkg/kg fuel	16	30	9.3	16	30	30	NA	16
Cu	mkg/kg fuel	42	21.2	37.3	42	21.2	21.2	NA	42
Ni	mkg/kg fuel	13	8.8	10.7	13	8.8	8.8	NA	13
Se	mkg/kg fuel	0.2	0.1		0.2	0.1	0.1	NA	0.2
Zn	mkg/kg fuel	2163	1738	2130	2163	1738	1738	NA	2163
PCDD/ PCDF	mkg/kg fuel								
b(a)p	mkg/kg fuel	5.5	21.4	0.2	4.2	15.8	5.1	NA	8.4
b(b)f	mkg/kg fuel	7.9	22.4	0	6.1	16.6	30.8	NA	9.4
b(k)f	mkg/kg fuel	3.9	11.8	0.2	3	8.7	34.4	NA	6.8
I(1,2,3-cd)p	mkg/kg fuel	8.9	21.2	0.2	6.9	15.8	7.9	NA	10.2

SO₂ emissions for the m-th type of fuel estimated assuming that all of the sulfur in the fuel completely converted into SO₂, using the formula:

$$ESO_2, m = 2 \times kS, m \times FC_m$$

Where:

ESO_{2, m} - SO₂ emissions for the m-th fuel, g

kS, m - relative weight content of the m-th fuels such as sulfur, g / g of fuel,

FC_m - the fuel consumption of the m-th type of, g

Table 3.37 Standard fuel sulfur content, ppm (1 ppm = 10⁻⁶ g / g of oil)

	Basic fuel 1996 (market average)	Fuel 2000	Fuel 2005	Fuel 2009
Petrol	165	130	40	5
Diesel fuel	400	300	40	3

Table 3.38 Specific emission Level 1 when worn tires and brakes for road vehicles

1A3bvi	PM2,5	PM10	TSP
	g km ⁻¹ vehicle ⁻¹	g km ⁻¹ vehicle ⁻¹	g km ⁻¹ vehicle ⁻¹
Motorcycles, mopeds	0.0034	0.0064	0.0083
Passenger transport	0.0074	0.0138	0.0182
Light freight	0.0117	0.0216	0.0286
Heavy freight	0.0316	0.059	0.0777

Table 3.39 Specific emission Level 1 when worn pavement

1A3bvii	PM2,5	PM10	TSP
	g km ⁻¹ vehicle ⁻¹	g km ⁻¹ vehicle ⁻¹	g km ⁻¹ vehicle ⁻¹
Motorcycles, mopeds	0.0016	0.003	0.006
Passenger transport	0.0041	0.0075	0.015
Light freight	0.0041	0.0075	0.015
Heavy freight	0.0205	0.038	0.076

Category 1A3c. To calculate the emissions used Tier 1 EMEP / EEA management. Data on the use of fuels for all categories of the energy industry are taken on the basis of the ICC (fuel) statistical reporting and a detailed description can be found in the report "National inventory of anthropogenic emissions by sources and removals by sinks in Ukraine for 1990-2016 years." http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php , Annex 2.6

Table 3.40 Specific emissions Tier 1 category of railway transport (EMEP / EEA 2016)

Substance	Unit	Diesel	Gazoil
NO _x	kg/t	52.4	52.4
NMVO _C	kg/t	4.65	4.65
SO _x	kg/t	equation	equation
NH ₃	kg/t	0.007	0.007
PM _{2.5}	kg/t	1.37	1.37
PM ₁₀	kg/t	1.44	1.44
TSP	kg/t	1.52	1.52
CO	kg/t	10.7	10.7
Pb	g/t	NE	NE
Cd	g/t	0.01	0.01
Hg	g/t	NE	NE
As	g/t	NE	NE
Cr	g/t	0.05	0.05
Cu	g/t	1.7	1.7
Ni	g/t	0.07	0.07
Se	g/t	0.01	0.01
Zn	g/t	1	1
PCDD/ PCDF	TEQ μ g /tonne	NE	NE
b(a)p	g/t	0.03	0.03
b(b)f	g/t	0.05	0.05
b(k)f	g/t	0.0344	0.0344
I(1,2,3-cd)p	g/t	0.0079	0.0079
HCB	mg/t	NA	NA
PCBs	mg/t	NA	NA

Category 1A3dii. To calculate the emissions used Tier 1 EMEP / EEA management. Data on the use of fuels for all categories of the energy industry are taken on the basis of the ICC (fuel) statistical reporting and a detailed description can be found in the report "National inventory of anthropogenic emissions by sources and removals by sinks in Ukraine for 1990-2017 years." http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php Annex 2.6

Table 3.41 Specific emissions Tier 1 category of water transport (EMEP / EEA 2016)

Substance	Unit	Marine diesel	Bunker oil
NOx	kg/t	78.5	79.3
NMVOG	kg/t	2.8	2.7
SOx	kg/t	equation	equation
NH3	kg/t	NE	NE
PM2.5	kg/t	1.4	5.6
PM10	kg/t	1.5	6.2
TSP	kg/t	1.5	6.2
CO	kg/t	7.4	7.4
Pb	g/t	0.13	0.18
Cd	g/t	0.01	0.02
Hg	g/t	0.03	0.02
As	g/t	0.04	0.68
Cr	g/t	0.05	0.72
Cu	g/t	0.88	1.25
Ni	g/t	1	32
Se	g/t	0.1	0.21
Zn	g/t	1.2	1.2
PCDD/ PCDF	TEQmg /tonne	0.13	0.47
b(a)p	g/t	NE	NE
b(b)f	g/t	NE	NE
b(k)f	g/t	NE	NE
I(1,2,3-cd)p	g/t	NE	NE
HCB	mg/t	0.08	0.14
PCBs	mg/t	0.38	0.57

Category 1A3e. To calculate the emissions used Tier 1 EMEP / EEA management. Data on the use of fuels for all categories of the energy industry are taken on the basis of the ICC (fuel) statistical reporting and a detailed description can be found in the report "National inventory of anthropogenic emissions by sources and removals by sinks in Ukraine for 1990-2016 years." http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php, Annex 2.6

Table 3.42 Specific emissions Tier 1 category of off-road transport, industry (EMEP / EEA, 2016)

Substance	Unit	Diesel	Gazoil	Petrol
NOx	kg/t	32,792	32,792	7,117
NMVOc	kg/t	3,385	3,385	17,602
SOx	kg/t	equation	equation	equation
NH3	kg/t	0,008	0,008	0,004
PM2.5	kg/t	2,086	2,086	0,157
PM10	kg/t	2,086	2,086	0,157
TSP	kg/t	2,086	2,086	0,157
CO	kg/t	10,722	10,722	770,368
Pb	g/t			equation
Cd	g/t	0,01	0,01	0,01
Cr	g/t	0,05	0,05	0,05
Cu	g/t	1,7	1,7	1,7
Ni	g/t	0,07	0,07	0,07
Se	g/t	0,01	0,01	0,01
Zn	g/t	1	1	1
b(a)p	g/t	0,03	0,03	0,04
b(b)flu	g/t	0,05	0,05	0,04

Table 3.43 Specific emissions Tier 1 category of off-road transport, agriculture (EMEP / EEA 2016)

Substance	Unit	Diesel	Gazoil	Petrol
NOx	kg/t	35.043	35.043	7.117
NMVOc	kg/t	3.366	3.366	17.602
SOx	kg/t	equation	equation	equation
NH3	kg/t	0.008	0.008	0.004
PM2.5	kg/t	1.738	1.738	0.157
PM10	kg/t	1.738	1.738	0.157
TSP	kg/t	1.738	1.738	0.157
CO	kg/t	10.939	10.939	770.368
Pb	g/t	NA	NA	equation
Cd	g/t	0.01	0.01	0.01
Hg	g/t	NA	NA	NA
As	g/t	NA	NA	NA
Cr	g/t	0.05	0.05	0.05
Cu	g/t	1.7	1.7	1.7
Ni	g/t	0.07	0.07	0.07
Se	g/t	0.01	0.01	0.01
Zn	g/t	1	1	1
PCDD/ PCDF	TEQ μ g /tonne	NA	NA	NA
b(a)p	g/t	0.03	0.03	0.04
b(b)flu	g/t	0.05	0.05	0.04

Table 3.44 Specific emissions Tier 1 category of off-road vehicles, fishing (EMEP / EEA 2016)

Substance	Unit	Diesel	Gazoil	Petrol
NOx	kg/t	78,5	78,5	9,4
NMVOc	kg/t	2,8	2,8	181,5
SOx	kg/t	20*s	20*s	20
NH3	kg/t	NE	NE	NE
PM2.5	kg/t	1,4	1,4	9,5
PM10	kg/t	1,5	1,5	9,5

Substance	Unit	Diesel	Gazoil	Petrol
TSP	kg/t	1,5	1,5	9,5
CO	kg/t	7,4	7,4	573,9
Pb	g/t	0,13	0,13	NE
Cd	g/t	0,01	0,01	NE
Hg	g/t	0,03	0,03	NE
As	g/t	0,04	0,04	NE
Cr	g/t	0,05	0,05	NE
Cu	g/t	0,88	0,88	NE
Ni	g/t	1	1	NE
Se	g/t	0,1	0,1	NE
Zn	g/t	1,2	1,2	NE
PCDD/ PCDF	TEQmg /tonne	0,13	0,13	NE
b(a)p	g/t	NE	NE	NE
b(b)f	g/t	NE	NE	NE
b(k)f	g/t	NE	NE	NE
I(1,2,3-cd)p	g/t	NE	NE	NE
Total 1-4	g/t	NE	NE	NE
HCB	mg/t	0,08	0,08	NE
PCBs	mg/t	0,038	0,038	NE

3.3.3 Estimation of uncertainty

Uncertainty Evaluation is carried out in accordance methodology Guide EMEP / EEA inventory of pollutant emissions.

The calculated total uncertainty of the emissions and the overall uncertainty in the trend for the sector 1A1, see the table below:

1A3	NO _x	NM VOC	SO ₂	CO
General uncertainty%	5,79	4,07	1,31	4,07
The overall uncertainty in the trend,%	2,82	1,66	1,36	2,42

3.3.4 QA / QC procedures (quality assurance and quality control)

Applied general QC procedures laid Guide EMEP / EEA.

3.3.5 Recalculation

Explanation recalculations conducted, carried out in comparison with proshloYearney statements, if any. comparative analysis tables for each sector, and the substance can result in a separate chapter idk "Allocations"

3.3.6 Planned improvements

- Review of the possibility of using COPERT software for the calculation of emissions from motor vehicles

- Analysis of fuel statistics with the aim of a separate calculation of all categories of off-road vehicles designed under the category 1A3e.

- A more detailed calculation of the category of civil aviation

- Calculation of emissions from international maritime transport

3.4 Fugitive emissions from fuel use in the process (NFR 1B)

3.4.1 Brief description of the sector

It includes sector emissions during production, transport, transformation fuels. Brief description of the categories is shown in table 3.46.

Table 3.45 Description of fugitive emissions sector

NFR	Source	Description	Method	Emissions
Fugitive emission from solid fuels				
1B1a	Coal mining and handling	It includes fugitive emissions from coal mining and storage	Tier (1,2,3)	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO, Cr
1B1b	Solid fuel transformation	It includes fugitive emissions from coal conversion into coke	Tier	NO _x , NMVOC, SO _x , NH ₃ , PM ₁₀ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn, B(a)p
1B1c	Other fugitive emissions from solid fuels		Tier	NO _x , NMVOC, SO _x , PM _{2.5} , PM ₁₀ , TSP, CO
Fugitive emissions oil				
1B2ai	Exploration, production, transport	It includes fugitive emissions from production, transportation and oil	Tier	NO _x , NMVOC, SO _x , PM _{2.5} , PM ₁₀ , TSP, CO
1B2aiv	Refining / storage	It includes fugitive emissions during storage of oil	Tier	NO _x , NMVOC, SO _x , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO, Pb, Hg, Cr, Ni, B(a)p
1B2av	Distribution of oil	Emissions in the	Tier	NO _x , NMVOC, SO _x ,

NFR	Source	Description	Method	Emissions
Fugitive emission from solid fuels				
	products	distribution of petroleum products		NH3, PM2.5, PM10, TSP, CO, Pb, Cd, Cr, Cu, Ni, Se, Zn, B(a)p, B(k)f
Fugitive emissions from natural gas				
1B2b	Exploration, production, processing, transmission, storage, distribution and other	It includes fugitive emissions during extraction, transportation, storage and distribution of natural gas	Tier	NO _x , NMVOC, SO _x , NH3, PM2.5, PM10, TSP, CO
1B2c	Venting and flaring (oil, gas, combined oil and gas)	Flaring	Tier	NO _x , NMVOC, SO _x , PM2.5, PM10, TSP, CO

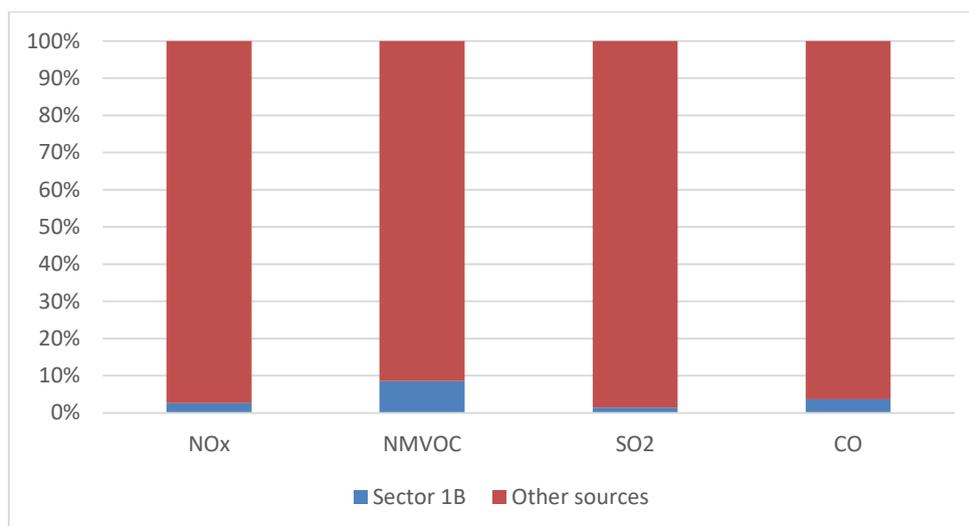


Figure 3.46 Share of sector emissions of fugitive emissions in total emissions in 2017

3.4.6 Estimation of uncertainty

Uncertainty Evaluation is carried out in accordance methodology Guide EMEP / EEA inventory of pollutant emissions.

The calculated total uncertainty of the emissions and the overall uncertainty in the trend for the sector 1A1, see the table below:

1B	NO _x	NMVOC	SO ₂	CO
General uncertainty%	1,62	2,93	0,85	1,3
The overall uncertainty in the trend,%	0,14	0,17	0,14	0,13

3.4.2 Planned improvements

- Analysis of pollutant emissions of all categories included in the sector of fugitive emissions
- Analysis of the initial data, calculation methods.

Identification of key categories

Calculations of pollutant emissions in a time series are based on an expert assessment Road transport

		NO _x (as NO ₂)	NMVOC	SO _x (as SO ₂)	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC	CO
		kt	kt	kt	kt	kt	kt	kt	kt	kt
1990										
1A3bi	Road transport: Passenger cars	359,8443	315,0389	27,27344	0,332266	NR	NR	NR	NR	3634,293
1A3bii	Road transport: Light duty vehicles	50,93487	27,93431	8,560365	0,050861	NR	NR	NR	NR	322,8901
1A3biii	Road transport: Heavy duty vehicles and buses	259,7779	19,0963	65,55299	0,085275	NR	NR	NR	NR	60,92566
1A3biv	Road transport: Mopeds & motorcycles	0,943388	14,56616	0,221707	0,005543	NR	NR	NR	NR	55,17183
1A3bv	Road transport: Gasoline evaporation	NA	53,11044	NA	NA	NR	NR	NR	NR	NA
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA
1991										
1A3bi	Road transport: Passenger cars	187,168	160,0405	18,43087	0,199599	NR	NR	NR	NR	1832,697
1A3bii	Road transport: Light duty vehicles	31,37492	14,62302	8,190669	0,040327	NR	NR	NR	NR	168,5808
1A3biii	Road transport: Heavy duty vehicles and buses	288,3246	21,14902	72,77354	0,094634	NR	NR	NR	NR	67,57583
1A3biv	Road transport: Mopeds & motorcycles	0,473596	7,312444	0,111301	0,002783	NR	NR	NR	NR	27,69713
1A3bv	Road transport: Gasoline evaporation	NA	30,54765	NA	NA	NR	NR	NR	NR	NA
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA
1992										
1A3bi	Road transport: Passenger cars	152,2064	152,3268	16,97643	0,183729	NR	NR	NR	NR	1748,563
1A3bii	Road transport: Light duty vehicles	21,06342	13,72668	6,167217	0,032235	NR	NR	NR	NR	157,1845
1A3biii	Road transport: Heavy duty vehicles and buses	187,5828	15,27864	52,53986	0,068329	NR	NR	NR	NR	42,89385
1A3biv	Road transport: Mopeds & motorcycles	0,452871	6,992438	0,10643	0,002661	NR	NR	NR	NR	26,48506
1A3bv	Road transport: Gasoline evaporation	NA	47,1305	NA	NA	NR	NR	NR	NR	NA

1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA
1993										
1A3bi	Road transport: Passenger cars	91,28046	82,2273	10,21818	0,671621	NR	NR	NR	NR	935,5782
1A3bii	Road transport: Light duty vehicles	13,24966	6,403315	4,12021	0,112234	NR	NR	NR	NR	76,63015
1A3biii	Road transport: Heavy duty vehicles and buses	127,9412	8,693111	35,8362	0,046603	NR	NR	NR	NR	29,25285
1A3biv	Road transport: Mopeds & motorcycles	0,271171	4,186956	0,063728	0,001593	NR	NR	NR	NR	15,85881
1A3bv	Road transport: Gasoline evaporation	NA	22,76417	NA	NA	NR	NR	NR	NR	NA
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA
1994										
1A3bi	Road transport: Passenger cars	80,94774	73,20157	8,8042	0,59653	NR	NR	NR	NR	833,4228
1A3bii	Road transport: Light duty vehicles	11,7821	5,703869	3,654572	0,099956	NR	NR	NR	NR	68,26696
1A3biii	Road transport: Heavy duty vehicles and buses	113,3872	7,704326	31,75958	0,041302	NR	NR	NR	NR	25,92527
1A3biv	Road transport: Mopeds & motorcycles	0,241664	3,731348	0,056794	0,00142	NR	NR	NR	NR	14,13312
1A3bv	Road transport: Gasoline evaporation	NA	19,02686	NA	NA	NR	NR	NR	NR	NA
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA
1995										
1A3bi	Road transport: Passenger cars	82,72082	75,28507	8,56123	0,611222	NR	NR	NR	NR	858,1359
1A3bii	Road transport: Light duty vehicles	11,60911	5,822744	3,409104	0,101646	NR	NR	NR	NR	69,83968
1A3biii	Road transport: Heavy duty vehicles and buses	103,801	7,055216	29,07356	0,03781	NR	NR	NR	NR	23,73565
1A3biv	Road transport: Mopeds & motorcycles	0,249028	3,845063	0,058525	0,001463	NR	NR	NR	NR	14,56384
1A3bv	Road transport: Gasoline evaporation	NA	22,58749	NA	NA	NR	NR	NR	NR	NA
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA
1996										
1A3bi	Road transport: Passenger cars	86,33575	78,73688	8,792027	0,638545	NR	NR	NR	NR	897,9571

1A3bii	Road transport: Light duty vehicles	12,01259	6,08114	3,474551	0,106052	NR	NR	NR	NR	71,97902
1A3biii	Road transport: Heavy duty vehicles and buses	105,2183	7,152215	29,47024	0,038327	NR	NR	NR	NR	22,31903
1A3biv	Road transport: Mopeds & motorcycles	0,260701	4,02529	0,061268	0,001532	NR	NR	NR	NR	15,24648
1A3bv	Road transport: Gasoline evaporation	NA	20,4917	NA	NA	NR	NR	NR	NR	NA
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA
1997										
1A3bi	Road transport: Passenger cars	81,54093	77,53192	7,994594	1,087157	NR	NR	NR	NR	878,1609
1A3bii	Road transport: Light duty vehicles	8,670588	4,75614	2,746506	0,167589	NR	NR	NR	NR	60,40267
1A3biii	Road transport: Heavy duty vehicles and buses	77,22181	4,454355	21,62587	0,02813	NR	NR	NR	NR	16,38743
1A3biv	Road transport: Mopeds & motorcycles	0,277328	4,282016	0,065175	0,001629	NR	NR	NR	NR	16,21887
1A3bv	Road transport: Gasoline evaporation	NA	21,93618	NA	NA	NR	NR	NR	NR	NA
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA
1998										
1A3bi	Road transport: Passenger cars	72,48462	68,85476	6,970023	0,955625	NR	NR	NR	NR	773,7153
1A3bii	Road transport: Light duty vehicles	7,233877	4,115672	2,174068	0,145383	NR	NR	NR	NR	52,46453
1A3biii	Road transport: Heavy duty vehicles and buses	59,25215	3,420222	16,59249	0,021585	NR	NR	NR	NR	12,57643
1A3biv	Road transport: Mopeds & motorcycles	0,241979	3,736225	0,056868	0,001422	NR	NR	NR	NR	14,15159
1A3bv	Road transport: Gasoline evaporation	NA	14,18204	NA	NA	NR	NR	NR	NR	NA
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA

1999										
1A3bi	Road transport: Passenger cars	81,60445	77,83079	7,621733	1,081152	NR	NR	NR	NR	876,2578
1A3bii	Road transport: Light duty vehicles	8,040468	4,653312	2,353895	0,164561	NR	NR	NR	NR	59,41875
1A3biii	Road transport: Heavy duty vehicles and buses	63,09928	3,643684	17,66923	0,022986	NR	NR	NR	NR	13,39438
1A3biv	Road transport: Mopeds & motorcycles	0,274617	4,24015	0,064538	0,001613	NR	NR	NR	NR	16,06029
1A3bv	Road transport: Gasoline evaporation	NA	17,51434	NA	NA	NR	NR	NR	NR	NA
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	NR	NR	NR	NR	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NR	NR	NR	NR	NA
2000										
1A3bi	Road transport: Passenger cars	70,14516	66,56012	6,693512	0,91812	0,911477	0,911477	0,911477	0,487788	744,2716
1A3bii	Road transport: Light duty vehicles	7,097791	3,953867	2,200242	0,139468	0,792116	0,792116	0,792116	0,433016	50,29403
1A3biii	Road transport: Heavy duty vehicles and buses	61,09497	3,525101	17,10916	0,022256	2,773742	2,773742	2,773742	1,470083	12,96609
1A3biv	Road transport: Mopeds & motorcycles	0,231366	3,572346	0,054374	0,001359	0,059811	0,059811	0,059811	0,006579	13,53087
1A3bv	Road transport: Gasoline evaporation	NA	13,09276	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,573607	1,06921	1,409749	0,141104	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,32763	0,602945	1,205889	0,012782	NA
2001										
1A3bi	Road transport: Passenger cars	70,72087	66,19259	2,90064	1,055073	0,507127	0,507127	0,507127	0,252736	740,3664
1A3bii	Road transport: Light duty vehicles	6,407317	3,357489	0,478255	0,15895	0,427075	0,427075	0,427075	0,231862	45,36572
1A3biii	Road transport: Heavy duty vehicles and buses	60,50882	3,43278	1,796713	0,023357	1,825518	1,825518	1,825518	0,967524	13,4218
1A3biv	Road transport: Mopeds & motorcycles	0,264681	4,086739	0,031102	0,001555	0,068423	0,068423	0,068423	0,007527	15,47922
1A3bv	Road transport: Gasoline evaporation	NA	6,100731	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,639927	1,192812	1,572759	0,157423	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,364243	0,670103	1,340206	0,014206	NA

2002										
1A3bi	Road transport: Passenger cars	77,03996	71,89252	3,16517	1,145865	0,590285	0,590285	0,590285	0,297072	803,4743
1A3bii	Road transport: Light duty vehicles	7,275134	3,674498	0,540552	0,173191	0,515824	0,515824	0,515824	0,280418	49,38349
1A3biii	Road transport: Heavy duty vehicles and buses	73,18516	4,149199	2,173089	0,02825	2,208118	2,208118	2,208118	1,170303	16,23095
1A3biv	Road transport: Mopeds & motorcycles	0,287006	4,431445	0,033725	0,001686	0,074195	0,074195	0,074195	0,008161	16,78486
1A3bv	Road transport: Gasoline evaporation	NA	6,062637	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,730546	1,361763	1,795475	0,179707	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,417417	0,768162	1,536325	0,016285	NA
2003										
1A3bi	Road transport: Passenger cars	79,67003	74,04495	1,145957	1,175882	0,657183	0,657183	0,657183	0,334339	824,5942
1A3bii	Road transport: Light duty vehicles	7,676054	3,780098	0,310318	0,177609	0,565992	0,565992	0,565992	0,307939	50,60887
1A3biii	Road transport: Heavy duty vehicles and buses	80,37052	4,554765	2,146788	0,031024	2,42502	2,42502	2,42502	1,285261	17,82276
1A3biv	Road transport: Mopeds & motorcycles	0,293309	4,52876	0,01034	0,001723	0,075824	0,075824	0,075824	0,008341	17,15345
1A3bv	Road transport: Gasoline evaporation	NA	5,076241	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,778012	1,450272	1,912139	0,191377	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,445577	0,82012	1,64024	0,017387	NA
2004										
1A3bi	Road transport: Passenger cars	82,65677	76,66985	1,207254	1,222613	0,716342	0,716342	0,716342	0,366406	855,8197
1A3bii	Road transport: Light duty vehicles	8,158046	3,952529	0,333129	0,185327	0,6161	0,6161	0,6161	0,33536	52,78419
1A3biii	Road transport: Heavy duty vehicles and buses	87,52942	4,959313	2,338048	0,033787	2,641094	2,641094	2,641094	1,39978	19,40916
1A3biv	Road transport: Mopeds & motorcycles	0,305351	4,714697	0,010764	0,001794	0,078937	0,078937	0,078937	0,008683	17,85772
1A3bv	Road transport: Gasoline evaporation	NA	4,461429	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,824069	1,53614	2,025325	0,202703	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,472786	0,870338	1,740676	0,018451	NA

2005										
1A3bi	Road transport: Passenger cars	88,95296	76,95856	1,659987	1,240569	1,77321	1,77321	1,77321	0,969539	849,3863
1A3bii	Road transport: Light duty vehicles	10,91908	4,184426	0,502521	0,189545	1,072745	1,072745	1,072745	0,586575	53,57481
1A3biii	Road transport: Heavy duty vehicles and buses	60,05269	3,409992	1,603862	0,023182	1,811573	1,811573	1,811573	0,960134	13,32363
1A3biv	Road transport: Mopeds & motorcycles	0,300119	4,633922	0,01058	0,001763	0,077585	0,077585	0,077585	0,008534	17,55177
1A3bv	Road transport: Gasoline evaporation	NA	4,160612	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,80986	1,508894	1,990036	0,199171	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,449227	0,825542	1,651083	0,017501	NA
2006										
1A3bi	Road transport: Passenger cars	90,64028	79,1977	1,772088	1,879363	1,292186	1,292186	1,292186	0,686478	870,7048
1A3bii	Road transport: Light duty vehicles	9,634223	3,683597	0,477702	0,244929	0,70587	0,70587	0,70587	0,384053	48,61471
1A3biii	Road transport: Heavy duty vehicles and buses	47,58444	2,458446	1,415216	0,02046	1,260998	1,260998	1,260998	0,668329	10,48165
1A3biv	Road transport: Mopeds & motorcycles	0,364804	5,632673	0,01286	0,002143	0,094307	0,094307	0,094307	0,010374	21,33471
1A3bv	Road transport: Gasoline evaporation	NA	4,87219	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,854693	1,592433	2,100288	0,210232	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,471183	0,865284	1,730568	0,018344	NA
2007										
1A3bi	Road transport: Passenger cars	105,6096	89,41776	2,21477	2,102205	1,890424	1,890424	1,890424	1,022297	972,5823
1A3bii	Road transport: Light duty vehicles	13,01129	4,31036	0,670814	0,27632	1,063289	1,063289	1,063289	0,580202	54,84924
1A3biii	Road transport: Heavy duty vehicles and buses	71,88435	3,701509	2,138389	0,030908	1,905591	1,905591	1,905591	1,009963	15,82233
1A3biv	Road transport: Mopeds & motorcycles	0,402521	6,21502	0,01419	0,002365	0,104057	0,104057	0,104057	0,011446	23,54045
1A3bv	Road transport: Gasoline evaporation	NA	5,033885	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	1,102415	2,054003	2,708966	0,271121	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,611425	1,123508	2,247015	0,023818	NA

2008										
1A3bi	Road transport: Passenger cars	109,6333	93,24656	2,287353	2,204358	1,911917	1,911917	1,911917	1,031661	1018,296
1A3bii	Road transport: Light duty vehicles	13,29558	4,494769	0,681986	0,289753	1,071585	1,071585	1,071585	0,584524	57,51513
1A3biii	Road transport: Heavy duty vehicles and buses	72,42018	3,730604	2,154272	0,031138	1,919718	1,919718	1,919718	1,01745	15,94172
1A3biv	Road transport: Mopeds & motorcycles	0,423559	6,539853	0,014931	0,002489	0,109495	0,109495	0,109495	0,012044	24,77082
1A3bv	Road transport: Gasoline evaporation	NA	4,544751	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	1,128764	2,103085	2,773711	0,277607	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,625519	1,149331	2,298661	0,024366	NA
2009										
1A3bi	Road transport: Passenger cars	103,068	88,50537	2,062595	2,059626	1,657641	1,657641	1,657641	0,890668	959,2519
1A3bii	Road transport: Light duty vehicles	11,83328	4,131917	0,601899	0,268664	0,888044	0,888044	0,888044	0,483906	53,0703
1A3biii	Road transport: Heavy duty vehicles and buses	60,0686	3,244832	1,872391	0,027065	1,487656	1,487656	1,487656	0,788457	13,85856
1A3biv	Road transport: Mopeds & motorcycles	0,394817	6,09608	0,013918	0,00232	0,102065	0,102065	0,102065	0,011227	23,08995
1A3bv	Road transport: Gasoline evaporation	NA	4,068459	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	1,03427	1,927055	2,541568	0,254377	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,572395	1,051494	2,102988	0,022292	NA
2010										
1A3bi	Road transport: Passenger cars	93,72591	80,55338	1,913785	1,883177	1,592584	1,592584	1,592584	0,854299	875,5781
1A3bii	Road transport: Light duty vehicles	11,89719	3,877679	0,527317	0,240936	0,962646	0,962646	0,962646	0,524996	49,38789
1A3biii	Road transport: Heavy duty vehicles and buses	65,16847	3,055721	1,580194	0,029363	1,614115	1,614115	1,614115	0,855481	15,0321
1A3biv	Road transport: Mopeds & motorcycles	0,389621	6,015848	0,013735	0,002289	0,100722	0,100722	0,100722	0,011079	22,78605
1A3bv	Road transport: Gasoline evaporation	NA	3,736259	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	1,062042	1,978788	2,609772	0,261194	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,588821	1,081908	2,163815	0,022936	NA

2011										
1A3bi	Road transport: Passenger cars	94,45925	78,00546	2,040308	1,814057	1,968413	1,968413	1,968413	1,071289	839,5781
1A3bii	Road transport: Light duty vehicles	13,2793	3,883318	0,593822	0,233556	1,140139	1,140139	1,140139	0,622848	47,77871
1A3biii	Road transport: Heavy duty vehicles and buses	54,87487	2,576539	1,330504	0,024725	1,358993	1,358993	1,358993	0,720266	12,66099
1A3biv	Road transport: Mopeds & motorcycles	0,369453	5,704446	0,013024	0,002171	0,095508	0,095508	0,095508	0,010506	21,60657
1A3bv	Road transport: Gasoline evaporation	NA	2,96297	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	1,046773	1,949968	2,57206	0,257412	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,57336	1,052878	2,105755	0,022321	NA
2012										
1A3bi	Road transport: Passenger cars	93,90359	76,00659	2,082626	1,762976	2,133082	2,133082	2,133082	1,166984	813,9361
1A3bii	Road transport: Light duty vehicles	14,12315	3,879642	0,63451	0,228484	1,249558	1,249558	1,249558	0,683181	46,67867
1A3biii	Road transport: Heavy duty vehicles and buses	60,18742	2,821846	1,459423	0,027119	1,490757	1,490757	1,490757	0,790101	13,88285
1A3biv	Road transport: Mopeds & motorcycles	0,356092	5,498154	0,012553	0,002092	0,092054	0,092054	0,092054	0,010126	20,8252
1A3bv	Road transport: Gasoline evaporation	NA	3,769935	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	1,082446	2,016403	2,659672	0,266166	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,593872	1,090781	2,181561	0,023125	NA
2013										
1A3bi	Road transport: Passenger cars	91,69988	73,33963	2,044757	1,681717	2,170749	2,170749	2,170749	1,191124	778,4421
1A3bii	Road transport: Light duty vehicles	14,19286	3,754588	0,639342	0,218146	1,277011	1,277011	1,277011	0,698503	44,52748
1A3biii	Road transport: Heavy duty vehicles and buses	61,53558	2,882746	1,492174	0,027726	1,52426	1,52426	1,52426	0,807858	14,19166
1A3biv	Road transport: Mopeds & motorcycles	0,336639	5,197789	0,011867	0,001978	0,087025	0,087025	0,087025	0,009573	19,68752
1A3bv	Road transport: Gasoline evaporation	NA	3,515908	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	1,079083	2,010144	2,651403	0,265328	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,592652	1,088641	2,177282	0,023079	NA

2014										
1A3bi	Road transport: Passenger cars	83,09803	65,33345	1,864065	1,470667	2,07708	2,07708	2,07708	1,144103	683,8563
1A3bii	Road transport: Light duty vehicles	13,35577	3,352599	0,603763	0,190925	1,035567	1,035567	1,035567	0,56624	38,22167
1A3biii	Road transport: Heavy duty vehicles and buses	59,22221	2,771532	1,436153	0,026684	1,254566	1,254566	1,254566	0,66492	13,65547
1A3biv	Road transport: Mopeds & motorcycles	0,290228	4,481189	0,010231	0,001705	0,075028	0,075028	0,075028	0,008253	16,97327
1A3bv	Road transport: Gasoline evaporation	NA	1,942756	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	1,005745	1,873539	2,471201	0,247282	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,553168	1,016236	2,032472	0,021544	NA
2015										
1A3bi	Road transport: Passenger cars	66,32429	48,62958	1,552634	1,119288	1,527112	1,527112	1,527112	0,839459	491,3923
1A3bii	Road transport: Light duty vehicles	11,35023	2,501969	0,523055	0,143704	0,914494	0,914494	0,914494	0,500387	26,90606
1A3biii	Road transport: Heavy duty vehicles and buses	44,9268	2,117865	1,269166	0,02358	1,108739	1,108739	1,108739	0,587631	10,62525
1A3biv	Road transport: Mopeds & motorcycles	0,225829	3,486859	0,007961	0,001327	0,05838	0,05838	0,05838	0,006422	13,20708
1A3bv	Road transport: Gasoline evaporation	NA	1,219497	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,864855	1,611106	2,125035	0,212629	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,476445	0,875378	1,750756	0,018558	NA
2016										
1A3bi	Road transport: Passenger cars	67,55666	49,16388	0,3382	1,063858	1,563337	1,563337	1,563337	0,862582	479,4139
1A3bii	Road transport: Light duty vehicles	11,47349	2,408555	0,089251	0,134855	0,940127	0,940127	0,940127	0,514692	25,1793
1A3biii	Road transport: Heavy duty vehicles and buses	46,20966	2,176282	0,186564	0,024253	1,140496	1,140496	1,140496	0,604463	10,92674
1A3biv	Road transport: Mopeds & motorcycles	0,207801	3,208501	0,002442	0,001221	0,053719	0,053719	0,053719	0,005909	12,15275
1A3bv	Road transport: Gasoline evaporation	NA	1,082641	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,888876	1,655908	2,184108	0,218527	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,490367	0,900948	1,801897	0,0191	NA

2017										
1A3bi	Road transport: Passenger cars	56,86552	41,38348	0,284679	0,895498	1,315932	1,315932	1,315932	0,726075	403,5446
1A3bii	Road transport: Light duty vehicles	9,657762	2,02739	0,075127	0,113514	0,791348	0,791348	0,791348	0,433239	21,19457
1A3biii	Road transport: Heavy duty vehicles and buses	38,89678	1,831876	0,157039	0,020415	0,960008	0,960008	0,960008	0,508804	9,197534
1A3biv	Road transport: Mopeds & motorcycles	0,174916	2,700742	0,002055	0,001028	0,045218	0,045218	0,045218	0,004974	10,22952
1A3bv	Road transport: Gasoline evaporation	NA	1,082641	NA						
1A3bvi	Road transport: Automobile tyre and brake wear	NA	NA	NA	NA	0,748207	1,393853	1,838463	0,183944	NA
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	0,412764	0,758369	1,516739	0,016077	NA

Calculations of pollutant emissions in a time series are based on an expert assessment Road transport

		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
		t	t	t	t	t	t	t	t	t
1990										
1A3bi	Road transport: Passenger cars	1438,63	0,001959	0,087729	0,002958	0,0673	0,047771	0,022221	0,001999	0,331064
1A3bii	Road transport: Light duty vehicles	161,9599	0,000248	0,012786	0,000388	0,012243	0,008507	0,002611	0,00028	0,047153
1A3biii	Road transport: Heavy duty vehicles and buses	0,803738	0,000329	0,034784	0,000657	0,055745	0,037383	0,001323	0,000656	0,118152
1A3biv	Road transport: Mopeds & motorcycles	16,62804	0,000022	0,000964	0,000033	0,000698	0,000499	0,000255	0,000022	0,003658
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	5,214442	0,024321	0,000021	0	1,930521	42,25544	0,306393	0,041509	16,4482
1A3bvii	Road transport: Automobile road abrasion	NA								
1991										
1A3bi	Road transport: Passenger cars	722,2152	0,001007	0,046553	0,001532	0,037814	0,026683	0,01125	0,001051	0,17473
1A3bii	Road transport: Light duty vehicles	81,30665	0,000144	0,008482	0,000234	0,009455	0,00649	0,001389	0,000179	0,030679
1A3biii	Road transport: Heavy duty vehicles and buses	0,405482	0,000329	0,03859	0,000728	0,06187	0,04149	0,001462	0,000728	0,131071
1A3biv	Road transport: Mopeds & motorcycles	8,347538	0,000011	0,000484	0,000017	0,000351	0,00025	0,000128	0,000011	0,001836
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	3,379745	0,015764	0,000014	0	1,251269	27,3879	0,198589	0,026904	10,66092
1A3bvii	Road transport: Automobile road abrasion	NA								

1992										
1A3bi	Road transport: Passenger cars	690,6098	0,00096	0,044173	0,001459	0,035609	0,025146	0,010745	0,000998	0,165917
1A3bii	Road transport: Light duty vehicles	77,74845	0,000129	0,007229	0,000207	0,007626	0,005257	0,001295	0,000155	0,02634
1A3biii	Road transport: Heavy duty vehicles and buses	0,386885	0,000263	0,027866	0,000526	0,044671	0,029956	0,001057	0,000526	0,094647
1A3biv	Road transport: Mopeds & motorcycles	7,982236	0,000011	0,000463	0,000016	0,000335	0,000239	0,000122	0,000011	0,001756
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,894165	0,013499	0,000012	0	1,071494	23,45298	0,170057	0,023038	9,129224
1A3bvii	Road transport: Automobile road abrasion	NA								
1993										
1A3bi	Road transport: Passenger cars	413,5257	0,000575	0,026478	0,000874	0,021367	0,015087	0,006435	0,000598	0,099444
1A3bii	Road transport: Light duty vehicles	46,5545	0,00008	0,004555	0,000128	0,00493	0,003391	0,000784	0,000097	0,016541
1A3biii	Road transport: Heavy duty vehicles and buses	0,231879	0,000179	0,019005	0,000359	0,030468	0,020432	0,00072	0,000359	0,06455
1A3biv	Road transport: Mopeds & motorcycles	4,77963	0,000006	0,000277	0,00001	0,000201	0,000143	0,000073	0,000006	0,001052
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,817574	0,008477	0,000007	0	0,672913	14,72878	0,106798	0,014468	5,733273
1A3bvii	Road transport: Automobile road abrasion	NA								

1994										
1A3bi	Road transport: Passenger cars	368,5274	0,000511	0,023437	0,000776	0,018785	0,013273	0,005729	0,00053	0,088079
1A3bii	Road transport: Light duty vehicles	41,48862	0,000071	0,00405	0,000114	0,004379	0,003012	0,000698	0,000086	0,01471
1A3biii	Road transport: Heavy duty vehicles and buses	0,206638	0,000159	0,016843	0,000318	0,027002	0,000078	0,000638	0,000318	0,057207
1A3biv	Road transport: Mopeds & motorcycles	4,25953	0,000006	0,000247	0,000009	0,000179	0,000784	0,000065	0,000006	0,000937
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,616205	0,007538	0,000007	0	0,598361	13,09699	0,094966	0,012866	5,098086
1A3bvii	Road transport: Automobile road abrasion	NA								
1995										
1A3bi	Road transport: Passenger cars	379,7585	0,000524	0,02388	0,000794	0,018923	0,013386	0,005893	0,000541	0,089843
1A3bii	Road transport: Light duty vehicles	42,753	0,000071	0,003984	0,000114	0,004209	0,002901	0,000712	0,000085	0,014516
1A3biii	Road transport: Heavy duty vehicles and buses	0,212753	0,000146	0,01542	0,000291	0,024719	0,016577	0,000585	0,000291	0,052374
1A3biv	Road transport: Mopeds & motorcycles	4,389341	0,000006	0,000255	0,000009	0,000184	0,000132	0,000067	0,000006	0,000966
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,59572	0,007443	0,000006	0	0,590777	12,93098	0,093762	0,012702	5,033467
1A3bvii	Road transport: Automobile road abrasion	NA								

1996										
1A3bi	Road transport: Passenger cars	397,5586	0,000548	0,024909	0,00083	0,019665	0,013917	0,006166	0,000565	0,093747
1A3bii	Road transport: Light duty vehicles	44,75692	0,000074	0,004121	0,000118	0,004326	0,002983	0,000744	0,000088	0,015027
1A3biii	Road transport: Heavy duty vehicles and buses	0,222677	0,000148	0,01563	0,000295	0,025056	0,016803	0,000593	0,000295	0,05309
1A3biv	Road transport: Mopeds & motorcycles	4,59508	0,000006	0,000267	0,000009	0,000193	0,000138	0,00007	0,000006	0,001011
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,651083	0,007701	0,000007	0	0,611274	13,37962	0,097015	0,013143	5,208103
1A3bvii	Road transport: Automobile road abrasion	NA								
1997										
1A3bi	Road transport: Passenger cars	422,9142	0,000576	0,025778	0,000869	0,019765	0,01403	0,006532	0,000587	0,097281
1A3bii	Road transport: Light duty vehicles	47,61139	0,000074	0,003881	0,000116	0,003795	0,002632	0,000772	0,000085	0,014276
1A3biii	Road transport: Heavy duty vehicles and buses	0,236393	0,000108	0,011474	0,000217	0,018389	0,012332	0,000436	0,000217	0,038973
1A3biv	Road transport: Mopeds & motorcycles	4,888146	0,004121	0,000284	0,00001	0,000205	0,000147	0,000075	0,000007	0,001075
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,57269	0,007335	0,000006	0	0,58225	12,74436	0,092409	0,012519	4,960824
1A3bvii	Road transport: Automobile road abrasion	NA								

1998										
1A3bi	Road transport: Passenger cars	369,009	0,000502	0,022489	0,000759	0,017241	0,012239	0,005699	0,000513	0,084872
1A3bii	Road transport: Light duty vehicles	41,54277	0,000063	0,003268	0,000099	0,003122	0,00217	0,000669	0,000072	0,012056
1A3biii	Road transport: Heavy duty vehicles and buses	0,206148	0,000083	0,008804	0,000166	0,01411	0,009462	0,000335	0,000166	0,029907
1A3biv	Road transport: Mopeds & motorcycles	4,265097	0,000006	0,000247	0,000009	0,000179	0,000128	0,000065	0,000006	0,000938
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,36959	0,006388	0,000006	0	0,507058	11,09853	0,080475	0,010902	4,320175
1A3bvii	Road transport: Automobile road abrasion	NA								
1999										
1A3bi	Road transport: Passenger cars	418,7792	0,000569	0,025369	0,000858	0,019321	0,013725	0,006462	0,000579	0,0958
1A3bii	Road transport: Light duty vehicles	47,14587	0,000071	0,003649	0,000112	0,003447	0,002398	0,000757	0,00008	0,013478
1A3biii	Road transport: Heavy duty vehicles and buses	0,233894	0,000089	0,009377	0,000177	0,015026	0,010077	0,000357	0,000177	0,03185
1A3biv	Road transport: Mopeds & motorcycles	4,840353	0,000006	0,000281	0,00001	0,000203	0,000145	0,000074	0,000006	0,001065
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,523983	0,007108	0,000006	0	0,564218	12,34966	0,089547	0,012131	4,807185
1A3bvii	Road transport: Automobile road abrasion	NA								

2000										
1A3bi	Road transport: Passenger cars	352,8235	0,00048	0,021518	0,000726	0,016509	0,011719	0,00545	0,00049	0,081202
1A3bii	Road transport: Light duty vehicles	39,72063	0,000061	0,003189	0,000096	0,003088	0,002144	0,000642	0,00007	0,011746
1A3biii	Road transport: Heavy duty vehicles and buses	0,197168	0,000086	0,009078	0,000171	0,014549	0,009757	0,000345	0,000171	0,030835
1A3biv	Road transport: Mopeds & motorcycles	4,078021	0,000005	0,000237	0,000008	0,000171	0,000122	0,000063	0,000005	0,000897
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,356956	0,006329	0,000006	0	0,50238	10,99615	0,079733	0,010802	4,280321
1A3bvii	Road transport: Automobile road abrasion	NA								
2001										
1A3bi	Road transport: Passenger cars	403,6276	0,000549	0,024522	0,000828	0,018736	0,013305	0,006231	0,000559	0,092574
1A3bii	Road transport: Light duty vehicles	45,44011	0,000069	0,003565	0,000108	0,003399	0,002363	0,000732	0,000078	0,013153
1A3biii	Road transport: Heavy duty vehicles and buses	0,225478	0,00009	0,009528	0,00018	0,015269	0,010239	0,000362	0,00018	0,032363
1A3biv	Road transport: Mopeds & motorcycles	4,665227	0,000006	0,000271	0,000009	0,000196	0,00014	0,000072	0,000006	0,001026
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,555472	0,007255	0,000006	0	0,575876	12,60483	0,091397	0,012382	4,906511
1A3bvii	Road transport: Automobile road abrasion	NA								

2002										
1A3bi	Road transport: Passenger cars	437,6726	0,000596	0,026696	0,0009	0,020485	0,01454	0,00676	0,000608	0,10074
1A3bii	Road transport: Light duty vehicles	49,27288	0,000076	0,003982	0,00012	0,003872	0,002687	0,000798	0,000087	0,014657
1A3biii	Road transport: Heavy duty vehicles and buses	0,244609	0,000109	0,011523	0,000218	0,018468	0,012385	0,000438	0,000217	0,03914
1A3biv	Road transport: Mopeds & motorcycles	5,058727	0,000007	0,000293	0,00001	0,000212	0,000152	0,000078	0,000007	0,001113
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,731896	0,008078	0,000007	0	0,641192	14,03449	0,101764	0,013786	5,463015
1A3bvii	Road transport: Automobile road abrasion	NA								
2003										
1A3bi	Road transport: Passenger cars	51,68627	0,00061	0,027423	0,000922	0,02116	0,015011	0,006914	0,000624	0,10343
1A3bii	Road transport: Light duty vehicles	5,818894	0,000079	0,004155	0,000124	0,004095	0,002838	0,000819	0,00009	0,01527
1A3biii	Road transport: Heavy duty vehicles and buses	0,029951	0,00012	0,012654	0,000239	0,020281	0,013601	0,000481	0,000239	0,042981
1A3biv	Road transport: Mopeds & motorcycles	0,597401	0,000007	0,0003	0,00001	0,000217	0,000155	0,000079	0,000007	0,001137
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,818905	0,008484	0,000007	0	0,673405	14,73957	0,106876	0,014479	5,737471
1A3bvii	Road transport: Automobile road abrasion	NA								

2004										
1A3bi	Road transport: Passenger cars	53,80835	0,000636	0,028633	0,000962	0,022163	0,015717	0,007201	0,000652	0,107962
1A3bii	Road transport: Light duty vehicles	6,057806	0,000083	0,004385	0,00013	0,004358	0,003018	0,000855	0,000095	0,016099
1A3biii	Road transport: Heavy duty vehicles and buses	0,031238	0,00013	0,01378	0,00026	0,022088	0,014812	0,000523	0,00026	0,046808
1A3biv	Road transport: Mopeds & motorcycles	0,621929	0,000007	0,000312	0,000011	0,000226	0,000161	0,000083	0,000007	0,001184
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,90051	0,008864	0,000008	0	0,703618	15,40086	0,111671	0,015129	5,994883
1A3bvii	Road transport: Automobile road abrasion	NA								
2005										
1A3bi	Road transport: Passenger cars	52,88674	0,000652	0,03093	0,000998	0,026255	0,018446	0,007183	0,000693	0,11558
1A3bii	Road transport: Light duty vehicles	5,954117	0,000091	0,005341	0,000147	0,005937	0,004076	0,000879	0,000113	0,019325
1A3biii	Road transport: Heavy duty vehicles and buses	0,030317	0,000089	0,009457	0,000179	0,015153	0,010162	0,00036	0,000178	0,032123
1A3biv	Road transport: Mopeds & motorcycles	0,611273	0,000007	0,000307	0,000011	0,000222	0,000159	0,000081	0,000007	0,001164
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,105575	0,009821	0,000009	0	0,779538	17,06261	0,123721	0,016761	6,641731
1A3bvii	Road transport: Automobile road abrasion	NA								

2006										
1A3bi	Road transport: Passenger cars	24,72534	0,000778	0,03615	0,001186	0,029593	0,020866	0,008677	0,000815	0,135578
1A3bii	Road transport: Light duty vehicles	2,783711	0,000103	0,005708	0,000164	0,005959	0,004111	0,001039	0,000123	0,020827
1A3biii	Road transport: Heavy duty vehicles and buses	0,014543	0,000079	0,008348	0,000158	0,013373	0,008968	0,000319	0,000158	0,02836
1A3biv	Road transport: Mopeds & motorcycles	0,285777	0,000009	0,000373	0,000013	0,00027	0,000193	0,000099	0,000009	0,001415
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,340565	0,010917	0,00001	0	0,866538	18,96687	0,137528	0,018632	7,382975
1A3bvii	Road transport: Automobile road abrasion	NA								
2007										
1A3bi	Road transport: Passenger cars	27,28177	0,000873	0,041415	0,001337	0,035104	0,024667	0,009631	0,000928	0,154784
1A3bii	Road transport: Light duty vehicles	3,071592	0,000122	0,007144	0,000197	0,007933	0,005446	0,001178	0,000151	0,025855
1A3biii	Road transport: Heavy duty vehicles and buses	0,016367	0,000119	0,012609	0,000238	0,020204	0,013549	0,00048	0,000238	0,042829
1A3biv	Road transport: Mopeds & motorcycles	0,315323	0,000009	0,000411	0,000014	0,000298	0,000213	0,000109	0,000009	0,001561
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,887079	0,013466	0,000012	0	1,068871	23,39556	0,169641	0,022982	9,106873
1A3bvii	Road transport: Automobile road abrasion	NA								

2008										
1A3bi	Road transport: Passenger cars	28,70765	0,000917	0,043325	0,001402	0,03653	0,025682	0,010125	0,000972	0,162011
1A3bii	Road transport: Light duty vehicles	3,232118	0,000127	0,007377	0,000205	0,008122	0,00558	0,001234	0,000157	0,026729
1A3biii	Road transport: Heavy duty vehicles and buses	0,017169	0,00012	0,012703	0,00024	0,020354	0,01365	0,000484	0,00024	0,04315
1A3biv	Road transport: Mopeds & motorcycles	0,331804	0,00001	0,000433	0,000015	0,000314	0,000224	0,000114	0,00001	0,001642
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,970451	0,013855	0,000012	0	1,099738	24,07117	0,17454	0,023646	9,369859
1A3bvii	Road transport: Automobile road abrasion	NA								
2009										
1A3bi	Road transport: Passenger cars	16,05596	0,00085	0,039976	0,0013	0,033395	0,023499	0,009423	0,000898	0,149626
1A3bii	Road transport: Light duty vehicles	1,80777	0,000116	0,006678	0,000187	0,007251	0,004987	0,001143	0,000142	0,024239
1A3biii	Road transport: Heavy duty vehicles and buses	0,009973	0,000104	0,011042	0,000209	0,017691	0,011864	0,000421	0,000208	0,037508
1A3biv	Road transport: Mopeds & motorcycles	0,185573	0,000009	0,000404	0,000014	0,000292	0,000209	0,000107	0,000009	0,001531
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,766494	0,012903	0,000011	0	1,024227	22,4184	0,162555	0,022022	8,726506
1A3bvii	Road transport: Automobile road abrasion	NA								

2010										
1A3bi	Road transport: Passenger cars	15,84469	0,000844	0,039954	0,001292	0,033764	0,023732	0,009318	0,000896	0,149369
1A3bii	Road transport: Light duty vehicles	1,784003	0,000117	0,006859	0,00019	0,007588	0,005211	0,001138	0,000145	0,024835
1A3biii	Road transport: Heavy duty vehicles and buses	0,009944	0,000113	0,011978	0,000226	0,019194	0,012872	0,000456	0,000226	0,040689
1A3biv	Road transport: Mopeds & motorcycles	0,183131	0,000009	0,000398	0,000014	0,000288	0,000206	0,000105	0,000009	0,001511
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,793941	0,013031	0,000011	0	1,034389	22,64081	0,164168	0,022241	8,813082
1A3bvii	Road transport: Automobile road abrasion	NA								
2011										
1A3bi	Road transport: Passenger cars	15,02467	0,000816	0,039594	0,001257	0,034755	0,024341	0,0089	0,000882	0,147438
1A3bii	Road transport: Light duty vehicles	1,691724	0,000118	0,007214	0,000194	0,008334	0,005705	0,001106	0,000151	0,025962
1A3biii	Road transport: Heavy duty vehicles and buses	0,009309	0,000095	0,010087	0,000191	0,016162	0,010838	0,000385	0,00019	0,034266
1A3biv	Road transport: Mopeds & motorcycles	0,173651	0,000009	0,000378	0,000013	0,000274	0,000195	0,0001	0,000009	0,001433
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,849711	0,013291	0,000012	0	1,055036	23,09275	0,167445	0,022685	8,989002
1A3bvii	Road transport: Automobile road abrasion	NA								

2012										
1A3bi	Road transport: Passenger cars	14,48141	0,000795	0,039041	0,001228	0,034908	0,024406	0,008611	0,000866	0,145092
1A3bii	Road transport: Light duty vehicles	1,63059	0,000118	0,007424	0,000195	0,008788	0,006005	0,001084	0,000155	0,026621
1A3biii	Road transport: Heavy duty vehicles and buses	0,009099	0,000105	0,011063	0,000209	0,017727	0,011888	0,000421	0,000209	0,037579
1A3biv	Road transport: Mopeds & motorcycles	0,167371	0,000008	0,000364	0,000013	0,000264	0,000188	0,000096	0,000008	0,001381
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,899561	0,013524	0,000012	0	1,073492	23,49671	0,170374	0,023081	9,146247
1A3bvii	Road transport: Automobile road abrasion	NA								
2013										
1A3bi	Road transport: Passenger cars	4,563931	0,000757	0,037483	0,001172	0,033923	0,023691	0,008162	0,00083	0,139117
1A3bii	Road transport: Light duty vehicles	0,514095	0,000114	0,007318	0,00019	0,008787	0,005999	0,001036	0,000152	0,026183
1A3biii	Road transport: Heavy duty vehicles and buses	0,003604	0,000107	0,01131	0,000214	0,018124	0,012154	0,000431	0,000213	0,038418
1A3biv	Road transport: Mopeds & motorcycles	0,052743	0,000008	0,000344	0,000012	0,000249	0,000178	0,000091	0,000008	0,001305
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,870313	0,013388	0,000012	0	1,062664	23,2597	0,168656	0,022849	9,053987
1A3bvii	Road transport: Automobile road abrasion	NA								

2014										
1A3bi	Road transport: Passenger cars	3,934791	0,00066	0,033082	0,001025	0,030475	0,021249	0,007066	0,00073	0,12254
1A3bii	Road transport: Light duty vehicles	0,443257	0,000102	0,006707	0,000172	0,008214	0,0056	0,000908	0,000138	0,023925
1A3biii	Road transport: Heavy duty vehicles and buses	0,003214	0,000103	0,010884	0,000206	0,017443	0,011698	0,000414	0,000205	0,036971
1A3biv	Road transport: Mopeds & motorcycles	0,045471	0,000007	0,000297	0,00001	0,000215	0,000153	0,000078	0,000007	0,001125
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,650749	0,012363	0,000011	0	0,981375	21,48045	0,155754	0,021101	8,361403
1A3bvii	Road transport: Automobile road abrasion	NA								
2015										
1A3bi	Road transport: Passenger cars	3,061774	0,000521	0,026515	0,000812	0,024954	0,017366	0,005527	0,000583	0,097978
1A3bii	Road transport: Light duty vehicles	0,344941	0,000084	0,005622	0,000141	0,007038	0,004791	0,000722	0,000115	0,019986
1A3biii	Road transport: Heavy duty vehicles and buses	0,00261	0,000091	0,009618	0,000182	0,015415	0,010337	0,000365	0,000182	0,032668
1A3biv	Road transport: Mopeds & motorcycles	0,035382	0,000005	0,000231	0,000008	0,000167	0,000119	0,000061	0,000005	0,000876
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,261725	0,010549	0,000009	0	0,837349	18,32798	0,132896	0,018004	7,134284
1A3bvii	Road transport: Automobile road abrasion	NA								

2016										
1A3bi	Road transport: Passenger cars	2,817418	0,000486	0,025107	0,000761	0,024099	0,016742	0,005113	0,000549	0,092565
1A3bii	Road transport: Light duty vehicles	0,317438	0,00008	0,005539	0,000137	0,007063	0,004802	0,000678	0,000113	0,019633
1A3biii	Road transport: Heavy duty vehicles and buses	0,0025	0,000093	0,009892	0,000187	0,015855	0,010633	0,000376	0,000187	0,033599
1A3biv	Road transport: Mopeds & motorcycles	0,032557	0,000005	0,000212	0,000007	0,000154	0,00011	0,000056	0,000005	0,000806
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	2,326949	0,010853	0,000009	0	0,861497	18,85653	0,136728	0,018523	7,340026
1A3bvii	Road transport: Automobile road abrasion	NA								
2017										
1A3bi	Road transport: Passenger cars	2,371549	0,000409	0,021134	0,00064	0,020286	0,014093	0,004304	0,000463	0,077916
1A3bii	Road transport: Light duty vehicles	0,267202	0,000068	0,004662	0,000115	0,005945	0,004042	0,000571	0,000095	0,016526
1A3biii	Road transport: Heavy duty vehicles and buses	0,002104	0,000079	0,008326	0,000157	0,013346	0,00895	0,000316	0,000157	0,028282
1A3biv	Road transport: Mopeds & motorcycles	0,027405	0,000004	0,000179	0,000006	0,000129	0,000092	0,000002	0,000004	0,000678
1A3bv	Road transport: Gasoline evaporation	NA								
1A3bvi	Road transport: Automobile tyre and brake wear	1,9587	0,009136	0,000008	0	0,725161	15,8724	0,11509	0,015592	6,178435
1A3bvii	Road transport: Automobile road abrasion	NA								

		"PCDD/ PCDF (dioxins/ furans)"	benzo(a) pyrene	benzo(b) fluoranthene	benzo(k) fluoranthene	Indeno (1,2,3- cd) pyrene	HCB	PCBs	Se
		g I-TEQ	t	t	t	t	t	kg	kg
1990									
1A3bi	Road transport: Passenger cars	5,609865	0,07008	0,093893	0,046966	0,102527	0,313466	0,005021	0,001052
1A3bii	Road transport: Light duty vehicles	1,070717	0,014648	0,017212	0,008808	0,017564	0,058232	0,00069	0,000229
1A3biii	Road transport: Heavy duty vehicles and buses	1,966675	0,033449	0,201903	0,225482	0,051815	0,512649	0,001035	0,000356
1A3biv	Road transport: Mopeds & motorcycles	0,085914	0,000931	0,001042	0,000754	0,00133	0,004057	0,000086	0,000083
1A3bv	Road transport: Gasoline evaporation	NE	NE	NE	NE	NE	NE	NE	NE
1A3bvi	Road transport: Automobile tyre and brake wear	NE	NE	NE	NE	NE	NE	NE	NE
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NA	NA	NA	NA
1991									
1A3bi	Road transport: Passenger cars	3,071876	0,045328	0,057752	0,029175	0,061522	0,193777	0,002749	0,000576
1A3bii	Road transport: Light duty vehicles	0,7799	0,013505	0,015103	0,007809	0,014968	0,051385	0,000502	0,000167
1A3biii	Road transport: Heavy duty vehicles and buses	2,182522	0,037123	0,224142	0,250331	0,057505	0,569101	0,001149	0,000395
1A3biv	Road transport: Mopeds & motorcycles	0,04313	0,000931	0,000523	0,000378	0,000668	0,0025	0,000043	0,000041
1A3bv	Road transport: Gasoline evaporation	NE	NE	NE	NE	NE	NE	NE	NE
1A3bvi	Road transport: Automobile tyre and brake wear	NE	NE	NE	NE	NE	NE	NE	NE
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NA	NA	NA	NA

1992									
1A3bi	Road transport: Passenger cars	2,902499	0,04195	0,053773	0,027126	0,057449	0,180298	0,002598	0,000544
1A3bii	Road transport: Light duty vehicles	0,64211	0,010283	0,011679	0,006019	0,011683	0,039664	0,000414	0,000137
1A3biii	Road transport: Heavy duty vehicles and buses	1,575853	0,026803	0,161823	0,180727	0,04152	0,410873	0,00083	0,000285
1A3biv	Road transport: Mopeds & motorcycles	0,041243	0,000447	0,0005	0,000362	0,000639	0,001948	0,000041	0,00004
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
1993									
1A3bi	Road transport: Passenger cars	1,740826	0,025234	0,032317	0,016306	0,034513	0,10837	0,001558	0,000326
1A3bii	Road transport: Light duty vehicles	0,411093	0,006833	0,007702	0,003976	0,007671	0,026182	0,000265	0,000088
1A3biii	Road transport: Heavy duty vehicles and buses	1,074801	0,018281	0,110375	0,123271	0,028319	0,280246	0,000566	0,000195
1A3biv	Road transport: Mopeds & motorcycles	0,024695	0,000268	0,0003	0,000217	0,000382	0,001167	0,000025	0,000024
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

1994									
1A3bi	Road transport: Passenger cars	1,535102	0,021841	0,028124	0,014175	0,030117	0,094257	0,001374	0,000288
1A3bii	Road transport: Light duty vehicles	0,365283	0,006062	0,006836	0,003528	0,006809	0,023235	0,000235	0,000078
1A3biii	Road transport: Heavy duty vehicles and buses	0,952536	0,016202	0,097819	0,109248	0,025097	0,248366	0,000501	0,000173
1A3biv	Road transport: Mopeds & motorcycles	0,022008	0,000239	0,000267	0,000193	0,000341	0,00104	0,000022	0,000021
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
1995									
1A3bi	Road transport: Passenger cars	1,554306	0,021412	0,027836	0,014004	0,02995	0,093202	0,001391	0,000291
1A3bii	Road transport: Light duty vehicles	0,354199	0,005683	0,006451	0,003325	0,006452	0,021911	0,000228	0,000076
1A3biii	Road transport: Heavy duty vehicles and buses	0,872015	0,014832	0,089546	0,100008	0,022976	0,227362	0,000459	0,000158
1A3biv	Road transport: Mopeds & motorcycles	0,022679	0,000246	0,000275	0,000199	0,000351	0,001071	0,000023	0,000022
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

1996									
1A3bi	Road transport: Passenger cars	1,617963	0,022051	0,028758	0,014458	0,030992	0,096259	0,001448	0,000303
1A3bii	Road transport: Light duty vehicles	0,364927	0,0058	0,006597	0,003399	0,006606	0,022402	0,000235	0,000078
1A3biii	Road transport: Heavy duty vehicles and buses	0,883924	0,015035	0,090768	0,101372	0,023289	0,230464	0,000465	0,00016
1A3biv	Road transport: Mopeds & motorcycles	0,023742	0,000257	0,000288	0,000208	0,000368	0,001121	0,000024	0,000023
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
1997									
1A3bi	Road transport: Passenger cars	1,647893	0,02055	0,02755	0,013778	0,030089	0,091967	0,001475	0,000309
1A3bii	Road transport: Light duty vehicles	0,329079	0,00467	0,005442	0,002789	0,005527	0,018428	0,000212	0,00007
1A3biii	Road transport: Heavy duty vehicles and buses	0,648758	0,011034	0,066608	0,074387	0,017093	0,169122	0,000342	0,000118
1A3biv	Road transport: Mopeds & motorcycles	0,025256	0,000274	0,000306	0,000222	0,000391	0,001193	0,000025	0,000024
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

1998									
1A3bi	Road transport: Passenger cars	1,43755	0,017937	0,024026	0,012033	0,02626	0,080256	0,001287	0,00027
1A3bii	Road transport: Light duty vehicles	0,27329	0,003723	0,004379	0,00224	0,004471	0,014813	0,000176	0,000058
1A3biii	Road transport: Heavy duty vehicles and buses	0,497801	0,008467	0,051105	0,057073	0,013115	0,12976	0,000262	0,00009
1A3biv	Road transport: Mopeds & motorcycles	0,022037	0,000239	0,000267	0,000193	0,000341	0,00104	0,000022	0,000021
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
1999									
1A3bi	Road transport: Passenger cars	1,615885	0,019735	0,026621	0,013311	0,029186	0,088853	0,001446	0,000303
1A3bii	Road transport: Light duty vehicles	0,30309	0,004046	0,004781	0,002444	0,004895	0,016166	0,000195	0,000065
1A3biii	Road transport: Heavy duty vehicles and buses	0,530127	0,009016	0,054421	0,060776	0,013967	0,13818	0,000279	0,000096
1A3biv	Road transport: Mopeds & motorcycles	0,025009	0,000271	0,000303	0,000219	0,000387	0,00118	0,000025	0,000024
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

2000									
1A3bi	Road transport: Passenger cars	1,376072	0,017223	0,023038	0,01155	0,02518	0,076991	0,001232	0,000258
1A3bii	Road transport: Light duty vehicles	0,26887	0,003752	0,004389	0,002248	0,004467	0,014856	0,000173	0,000057
1A3biii	Road transport: Heavy duty vehicles and buses	0,513277	0,00873	0,052696	0,05885	0,013523	0,133799	0,00027	0,000093
1A3biv	Road transport: Mopeds & motorcycles	0,02107	0,000228	0,000256	0,000185	0,000326	0,000995	0,000021	0,00002
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
2001									
1A3bi	Road transport: Passenger cars	1,564629	0,019337	0,025957	0,013018	0,028444	0,086756	0,0014	0,000293
1A3bii	Road transport: Light duty vehicles	0,29775	0,004042	0,004758	0,002434	0,00486	0,016094	0,000192	0,000064
1A3biii	Road transport: Heavy duty vehicles and buses	0,538686	0,009162	0,055302	0,06176	0,014193	0,140417	0,000284	0,000098
1A3biv	Road transport: Mopeds & motorcycles	0,024104	0,000261	0,000292	0,000211	0,000373	0,001137	0,000024	0,000023
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

2002									
1A3bi	Road transport: Passenger cars	1,707319	0,021395	0,028591	0,014352	0,031266	0,095604	0,001528	0,00032
1A3bii	Road transport: Light duty vehicles	0,336534	0,00473	0,005524	0,00283	0,005617	0,018701	0,000217	0,000072
1A3biii	Road transport: Heavy duty vehicles and buses	0,651531	0,011081	0,066891	0,074703	0,017166	0,169841	0,000343	0,000118
1A3biv	Road transport: Mopeds & motorcycles	0,026137	0,000283	0,000317	0,000229	0,000405	0,001234	0,000026	0,000025
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
2003									
1A3bi	Road transport: Passenger cars	1,759126	0,02244	0,029814	0,014988	0,032523	0,099765	0,001574	0,00033
1A3bii	Road transport: Light duty vehicles	0,353994	0,00509	0,005914	0,003033	0,005996	0,020033	0,000228	0,000076
1A3biii	Road transport: Heavy duty vehicles and buses	0,715493	0,012169	0,073461	0,082041	0,018851	0,186522	0,000377	0,00013
1A3biv	Road transport: Mopeds & motorcycles	0,026711	0,00029	0,000324	0,000234	0,000414	0,001262	0,000027	0,000026
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

2004									
1A3bi	Road transport: Passenger cars	1,839889	0,023694	0,031392	0,015783	0,034187	0,105056	0,001647	0,000345
1A3bii	Road transport: Light duty vehicles	0,375494	0,005475	0,006342	0,003255	0,006419	0,021491	0,000242	0,00008
1A3biii	Road transport: Heavy duty vehicles and buses	0,779221	0,013253	0,080006	0,089351	0,02053	0,20314	0,00041	0,000141
1A3biv	Road transport: Mopeds & motorcycles	0,027808	0,000301	0,000337	0,000244	0,000431	0,001313	0,000028	0,000027
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
2005									
1A3bi	Road transport: Passenger cars	2,092106	0,034557	0,042637	0,021732	0,044765	0,143691	0,001872	0,000392
1A3bii	Road transport: Light duty vehicles	0,490186	0,008456	0,009463	0,004892	0,009383	0,032194	0,000316	0,000105
1A3biii	Road transport: Heavy duty vehicles and buses	0,534635	0,009093	0,054881	0,061289	0,014086	0,139349	0,000281	0,000097
1A3biv	Road transport: Mopeds & motorcycles	0,027332	0,000296	0,000331	0,00024	0,000423	0,00129	0,000027	0,000026
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

2006									
1A3bi	Road transport: Passenger cars	2,395774	0,036168	0,045712	0,0232	0,048631	0,153711	0,002144	0,000449
1A3bii	Road transport: Light duty vehicles	0,503745	0,007941	0,009048	0,00466	0,009068	0,030717	0,000325	0,000108
1A3biii	Road transport: Heavy duty vehicles and buses	0,471865	0,008025	0,048423	0,054075	0,012431	0,122954	0,000248	0,000085
1A3biv	Road transport: Mopeds & motorcycles	0,033222	0,00036	0,000403	0,000291	0,000514	0,001568	0,000033	0,000032
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
2007									
1A3bi	Road transport: Passenger cars	2,798978	0,046101	0,056896	0,029025	0,059796	0,191818	0,002505	0,000525
1A3bii	Road transport: Light duty vehicles	0,655246	0,011285	0,012634	0,006531	0,012529	0,042979	0,000422	0,00014
1A3biii	Road transport: Heavy duty vehicles and buses	0,712818	0,012123	0,073171	0,081715	0,01878	0,185789	0,000375	0,000129
1A3biv	Road transport: Mopeds & motorcycles	0,036657	0,000397	0,000445	0,000322	0,000568	0,001732	0,000037	0,000035
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

2008									
1A3bi	Road transport: Passenger cars	2,919393	0,047473	0,058796	0,029964	0,061892	0,198125	0,002613	0,000547
1A3bii	Road transport: Light duty vehicles	0,672968	0,011456	0,012854	0,006641	0,012764	0,043715	0,000434	0,000144
1A3biii	Road transport: Heavy duty vehicles and buses	0,718133	0,012214	0,073714	0,082321	0,01892	0,187169	0,000378	0,00013
1A3biv	Road transport: Mopeds & motorcycles	0,038573	0,000418	0,000468	0,000338	0,000597	0,001821	0,000039	0,000037
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
2009									
1A3bi	Road transport: Passenger cars	2,679611	0,042623	0,053075	0,027044	0,056079	0,178821	0,002398	0,000502
1A3bii	Road transport: Light duty vehicles	0,603915	0,010085	0,011358	0,005864	0,011305	0,038612	0,000389	0,000129
1A3biii	Road transport: Heavy duty vehicles and buses	0,624198	0,010616	0,064068	0,071548	0,016445	0,162677	0,000329	0,000113
1A3biv	Road transport: Mopeds & motorcycles	0,035956	0,00039	0,000436	0,000315	0,000557	0,001698	0,000036	0,000035
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

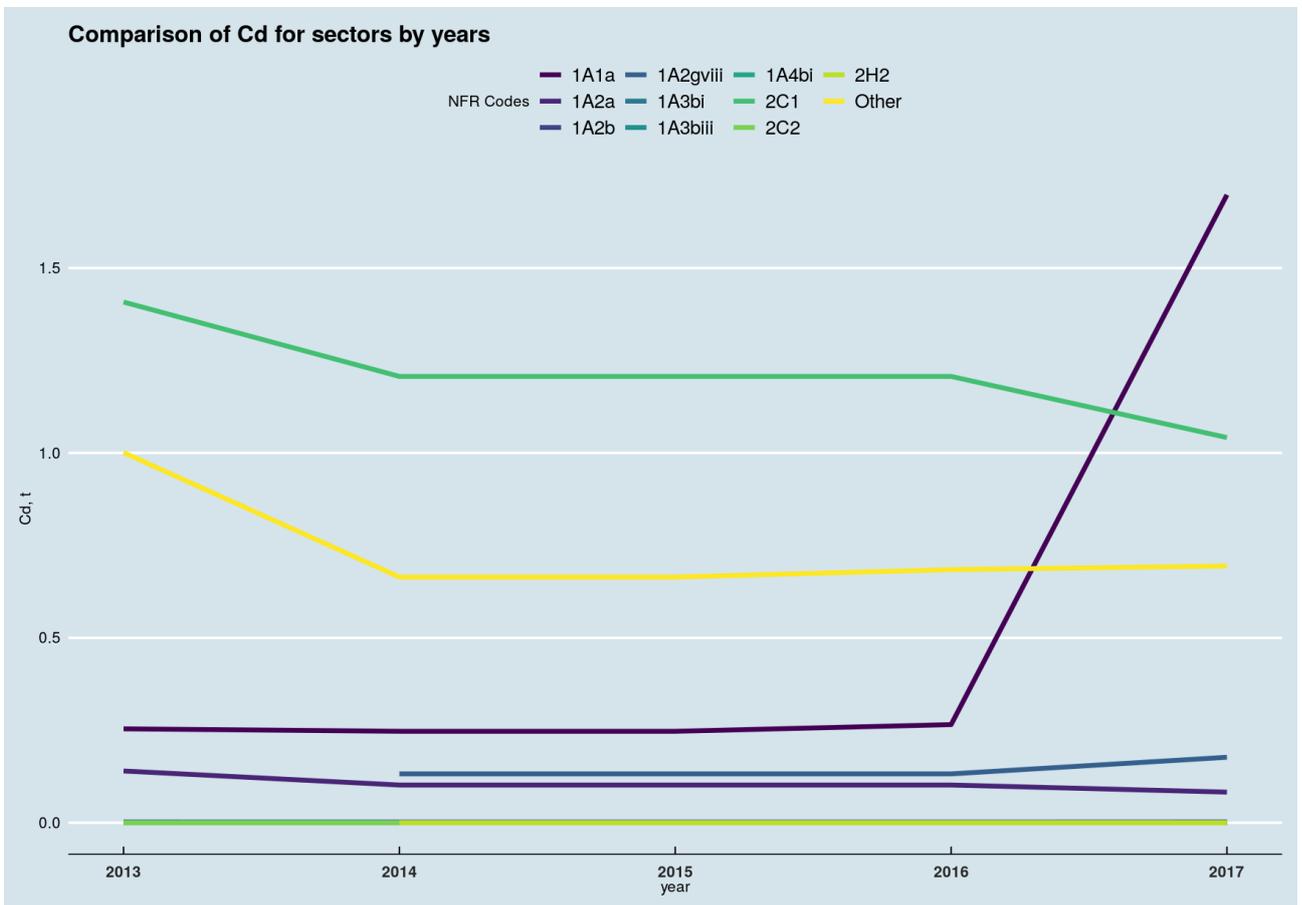
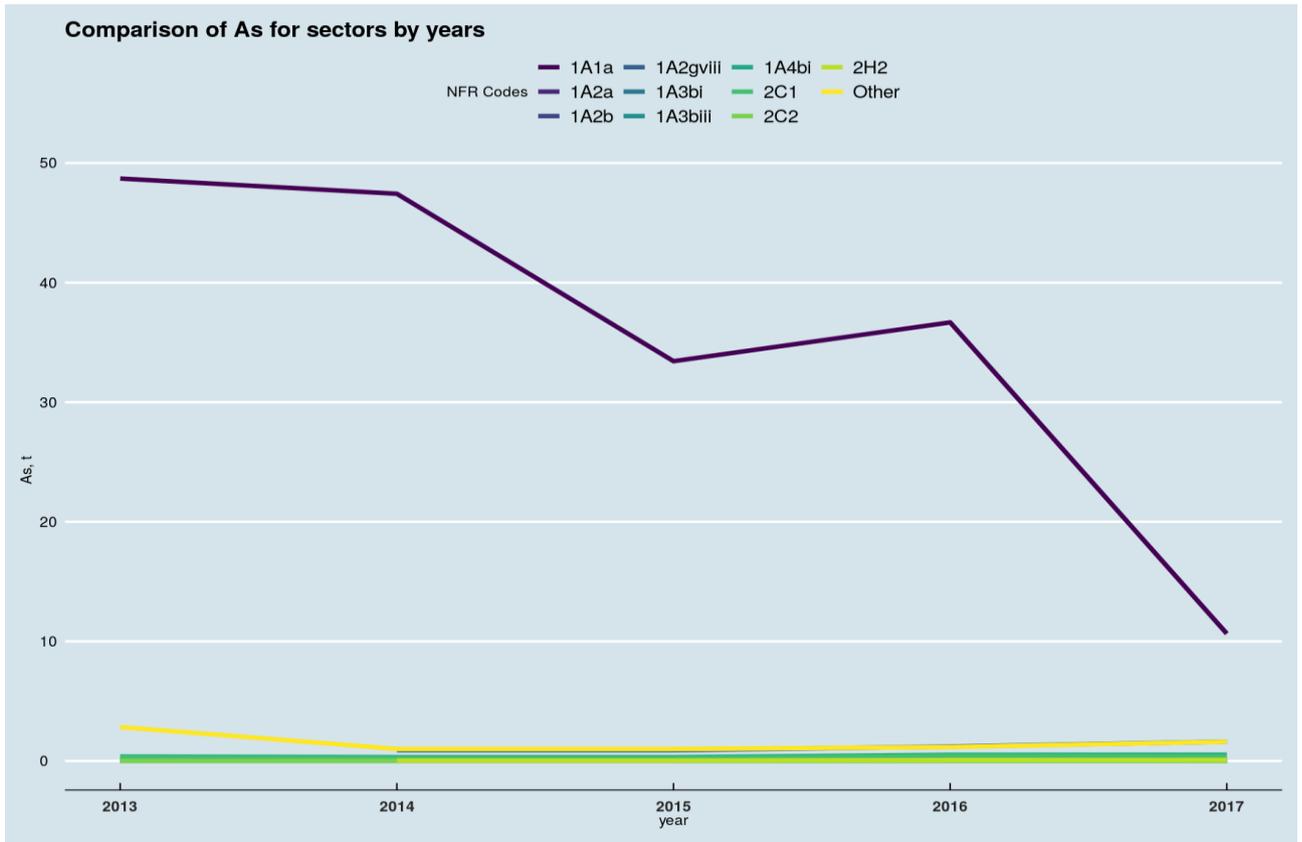
2010									
1A3bi	Road transport: Passenger cars	2,695656	0,044091	0,054507	0,027804	0,057351	0,183753	0,002413	0,000505
1A3bii	Road transport: Light duty vehicles	0,627635	0,010756	0,012053	0,006229	0,01196	0,040998	0,000404	0,000134
1A3biii	Road transport: Heavy duty vehicles and buses	0,677192	0,011517	0,069513	0,077629	0,017841	0,1765	0,000357	0,000123
1A3biv	Road transport: Mopeds & motorcycles	0,035482	0,000385	0,00043	0,000311	0,000549	0,001675	0,000035	0,000034
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
2011									
1A3bi	Road transport: Passenger cars	2,729954	0,048723	0,058905	0,030186	0,061233	0,199047	0,002443	0,000512
1A3bii	Road transport: Light duty vehicles	0,678571	0,012316	0,013653	0,007072	0,013458	0,046499	0,000437	0,000145
1A3biii	Road transport: Heavy duty vehicles and buses	0,570227	0,009698	0,058527	0,06536	0,015023	0,148608	0,0003	0,000103
1A3biv	Road transport: Mopeds & motorcycles	0,033646	0,000365	0,000408	0,000295	0,000521	0,001589	0,000034	0,000032
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

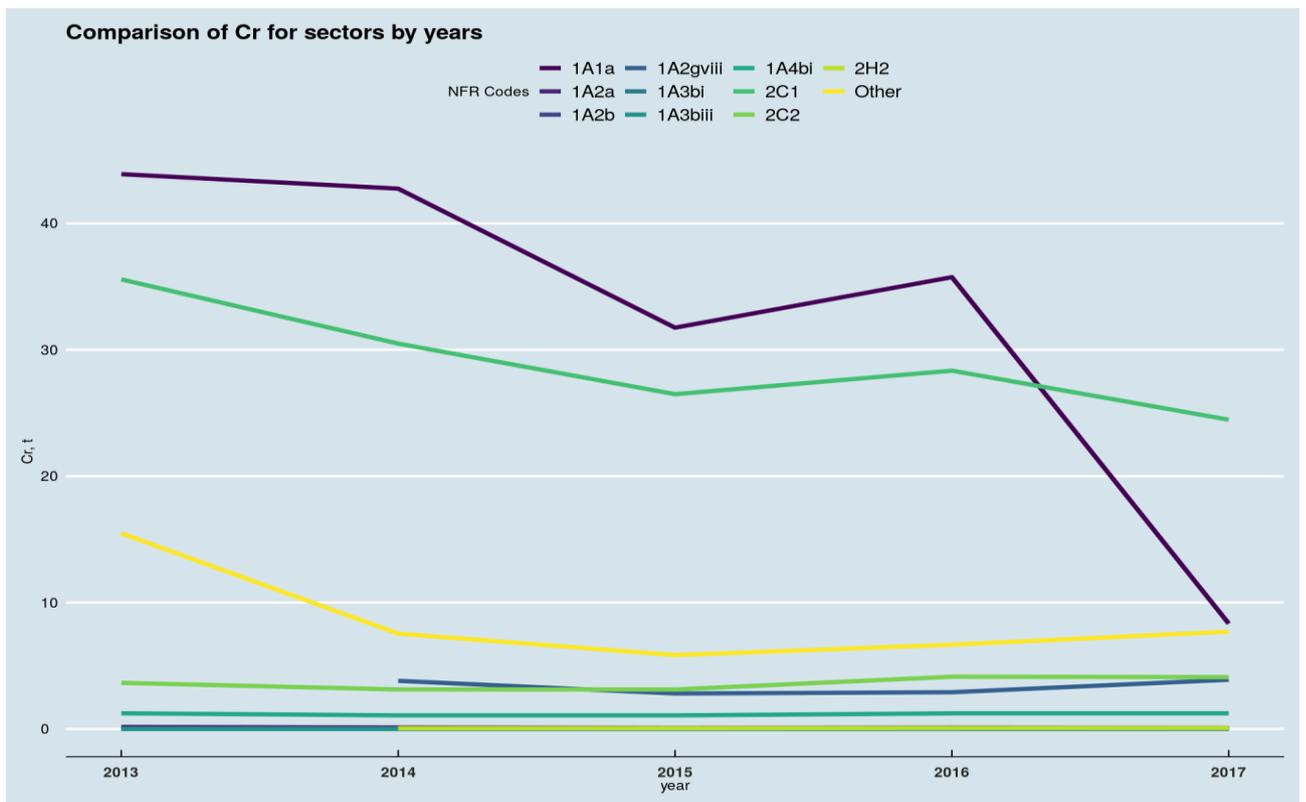
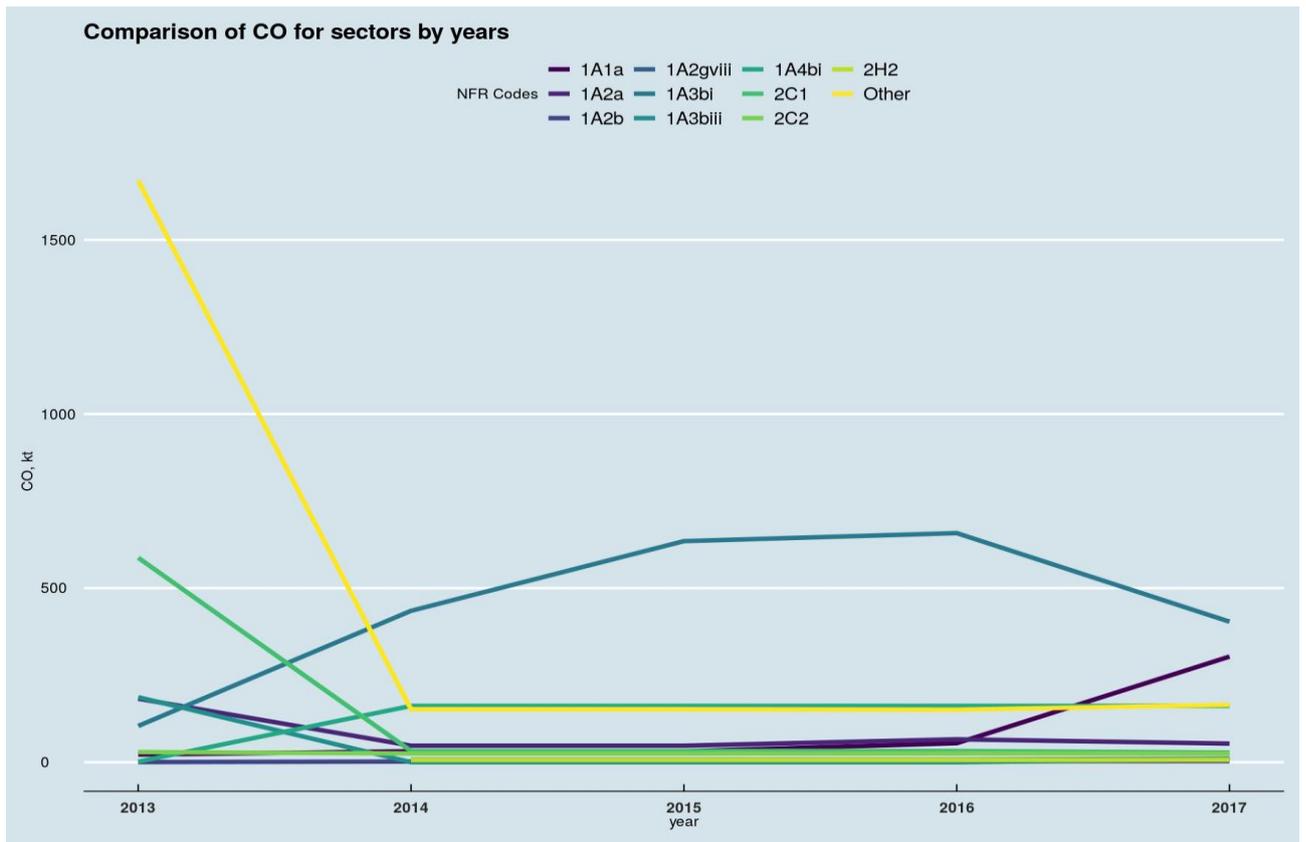
2012									
1A3bi	Road transport: Passenger cars	2,720695	0,05052	0,06049	0,031061	0,062544	0,204615	0,002435	0,00051
1A3bii	Road transport: Light duty vehicles	0,709319	0,013274	0,014634	0,007589	0,014374	0,049871	0,000457	0,000152
1A3biii	Road transport: Heavy duty vehicles and buses	0,625432	0,010637	0,0642	0,071697	0,016478	0,163012	0,000329	0,000113
1A3biv	Road transport: Mopeds & motorcycles	0,032429	0,000351	0,000393	0,000285	0,000502	0,001531	0,000032	0,000031
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
2013									
1A3bi	Road transport: Passenger cars	2,630555	0,050101	0,059614	0,030663	0,061446	0,201824	0,002354	0,000493
1A3bii	Road transport: Light duty vehicles	0,705696	0,01344	0,014771	0,007665	0,01448	0,050356	0,000455	0,000151
1A3biii	Road transport: Heavy duty vehicles and buses	0,639441	0,010875	0,065642	0,073307	0,016847	0,166671	0,000337	0,000116
1A3biv	Road transport: Mopeds & motorcycles	0,030657	0,000332	0,000372	0,000269	0,000475	0,001448	0,000031	0,000029
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

2014									
1A3bi	Road transport: Passenger cars	2,345881	0,046316	0,054634	0,02817	0,056068	0,185188	0,0021	0,00044
1A3bii	Road transport: Light duty vehicles	0,655155	0,012774	0,013981	0,007262	0,013671	0,047688	0,000422	0,00014
1A3biii	Road transport: Heavy duty vehicles and buses	0,615401	0,010467	0,063179	0,070557	0,016214	0,160417	0,000324	0,000111
1A3biv	Road transport: Mopeds & motorcycles	0,026431	0,000286	0,000321	0,000232	0,000409	0,001248	0,000026	0,000025
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
2015									
1A3bi	Road transport: Passenger cars	1,904097	0,039201	0,045781	0,02368	0,04676	0,155422	0,001704	0,000357
1A3bii	Road transport: Light duty vehicles	0,557153	0,011141	0,012142	0,006313	0,011839	0,041435	0,000359	0,000119
1A3biii	Road transport: Heavy duty vehicles and buses	0,543817	0,009249	0,055834	0,062355	0,014328	0,141766	0,000286	0,000099
1A3biv	Road transport: Mopeds & motorcycles	0,020566	0,000223	0,000249	0,00018	0,000318	0,00097	0,000021	0,00002
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							

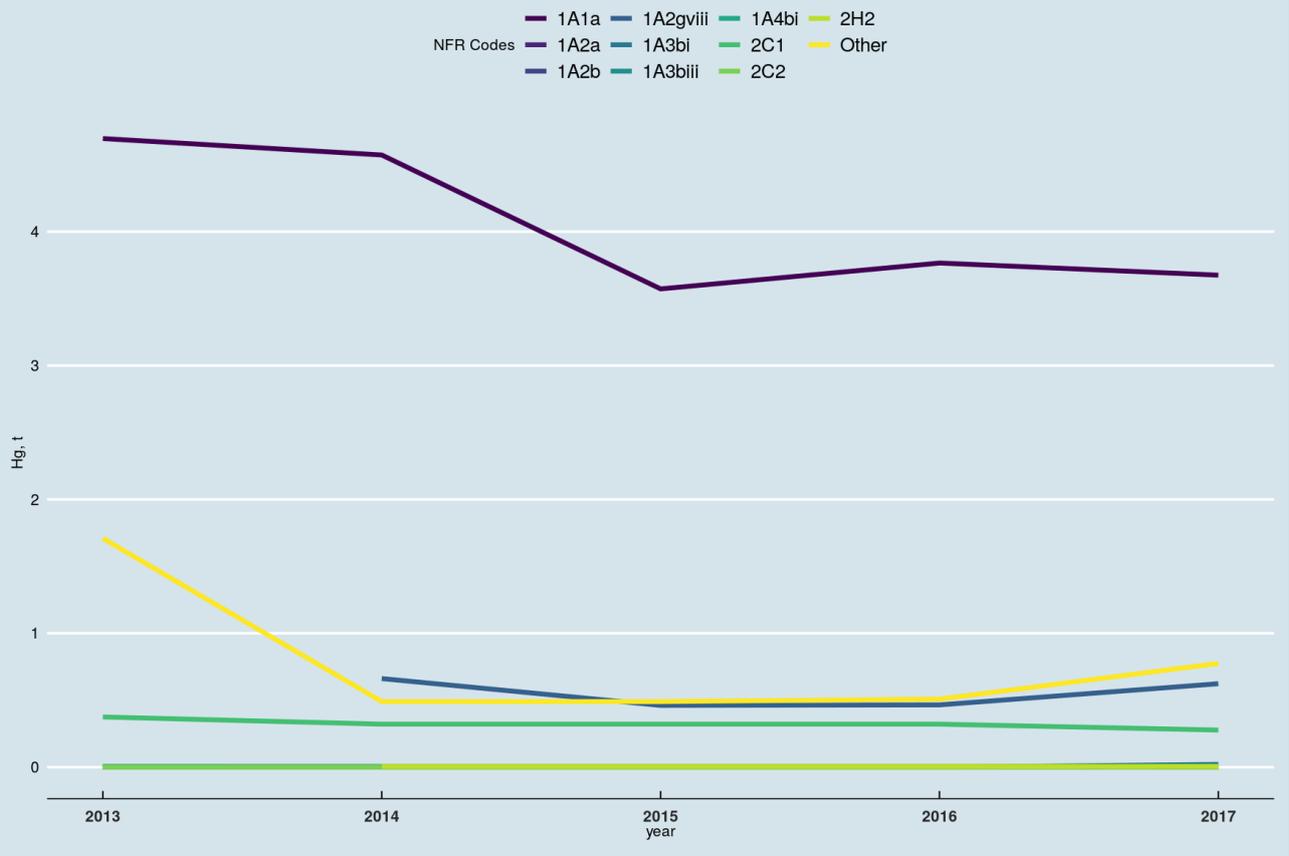
2016									
1A3bi	Road transport: Passenger cars	1,824281	0,038999	0,045124	0,023432	0,045928	0,153483	0,001633	0,000342
1A3bii	Road transport: Light duty vehicles	0,555656	0,011343	0,012318	0,006409	0,011985	0,042055	0,000358	0,000119
1A3biii	Road transport: Heavy duty vehicles and buses	0,559352	0,009514	0,057433	0,064141	0,014737	0,145825	0,000294	0,000101
1A3biv	Road transport: Mopeds & motorcycles	0,018924	0,000205	0,00023	0,000166	0,000293	0,000894	0,000019	0,000018
1A3bv	Road transport: Gasoline evaporation	NE							
1A3bvi	Road transport: Automobile tyre and brake wear	NE							
1A3bvii	Road transport: Automobile road abrasion	NA							
2017									
1A3bi	Road transport: Passenger cars	1,535581	0,032827	0,037983	0,019724	0,038659		0,001374	0,000288
1A3bii	Road transport: Light duty vehicles	0,467721	0,009548	0,010369	0,005395	0,010088		0,000301	0,0001
1A3biii	Road transport: Heavy duty vehicles and buses	0,470832	0,008008	0,048344	0,05399	0,012405		0,000248	0,000085
1A3biv	Road transport: Mopeds & motorcycles	0,015929	0,000173	0,000193	0,00014	0,000247		0,000016	0,000015
1A3bv	Road transport: Gasoline evaporation	NE	NE	NE	NE	NE		NE	NE
1A3bvi	Road transport: Automobile tyre and brake wear	NE	NE	NE	NE	NE		NE	NE
1A3bvii	Road transport: Automobile road abrasion	NA	NA	NA	NA	NA		NA	NA

Dynamics of emissions by some indicators

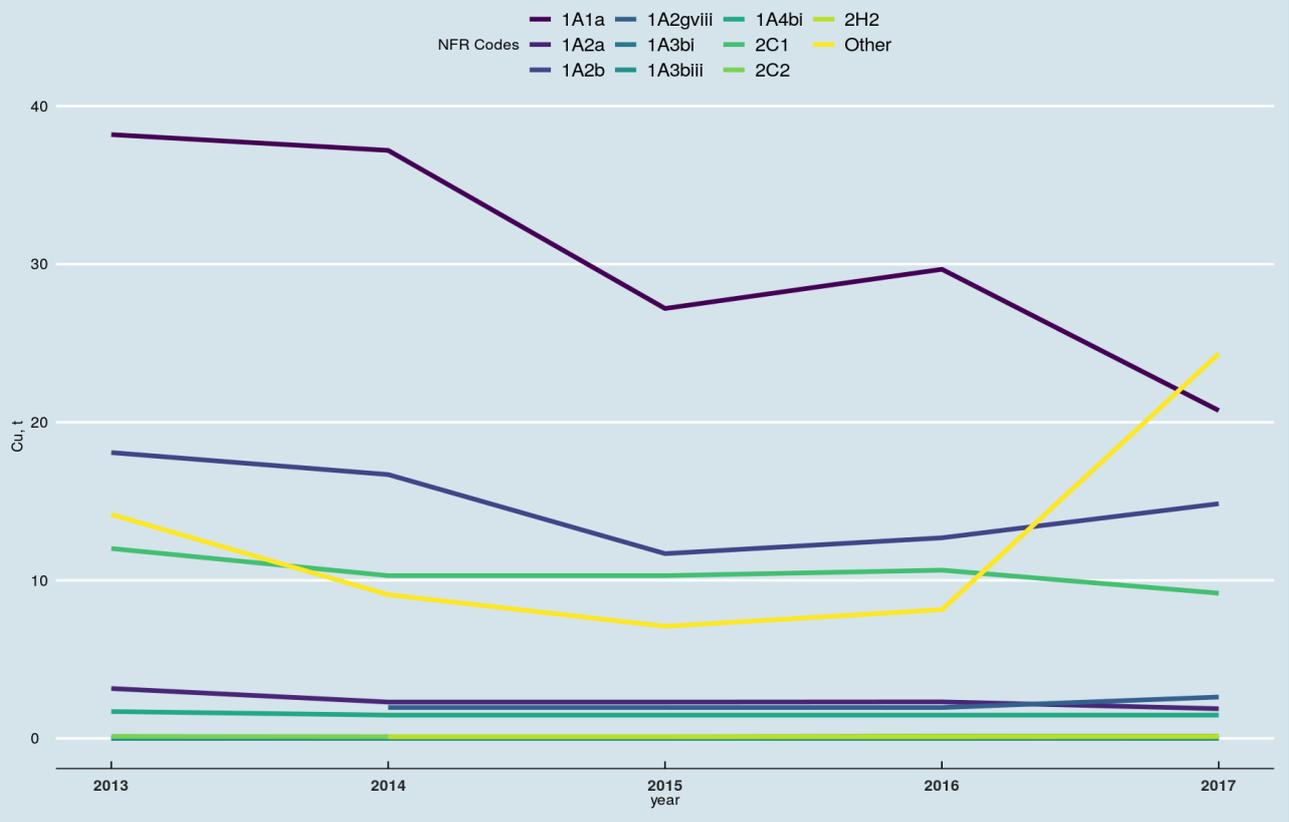




Comparison of Hg for sectors by years



Comparison of Cu for sectors by years



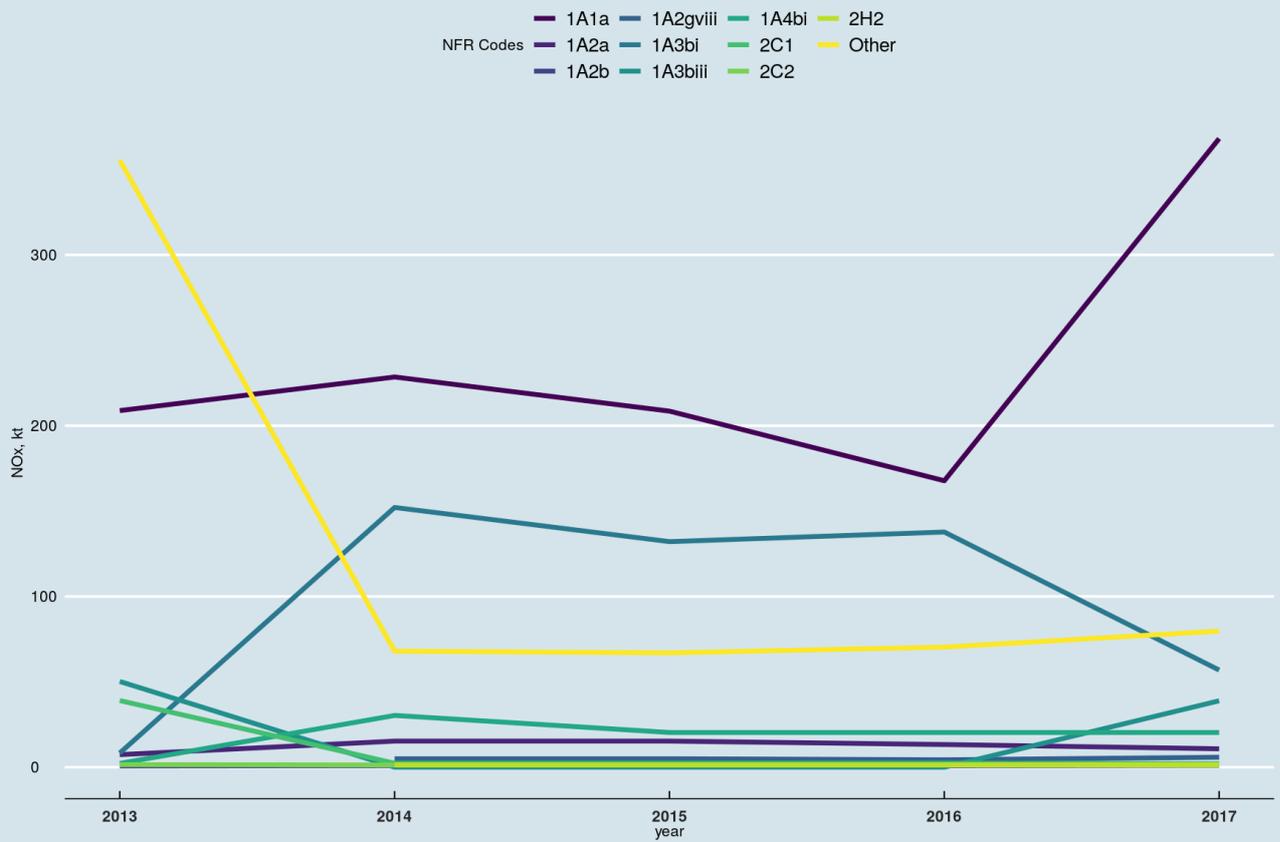
Comparison of Ni for sectors by years



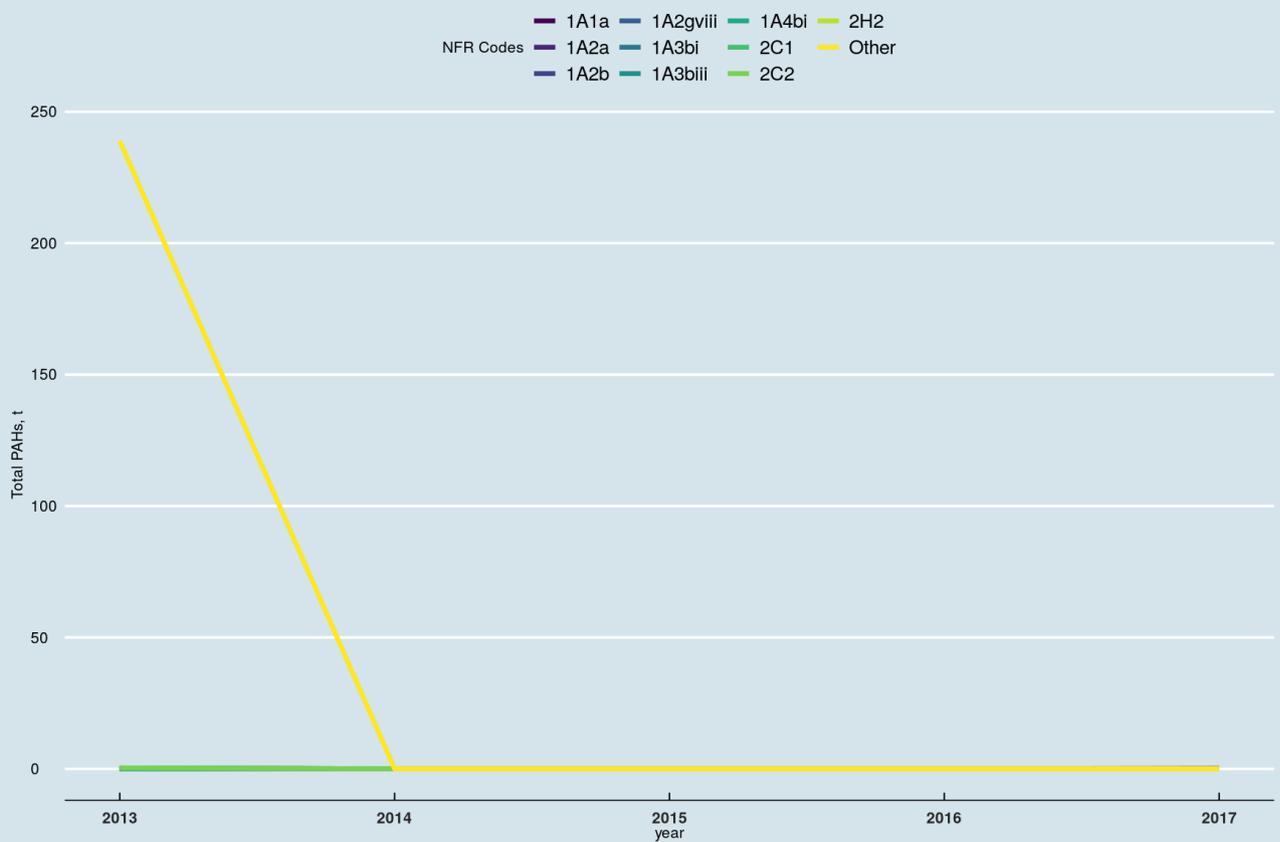
Comparison of NMVOC for sectors by years



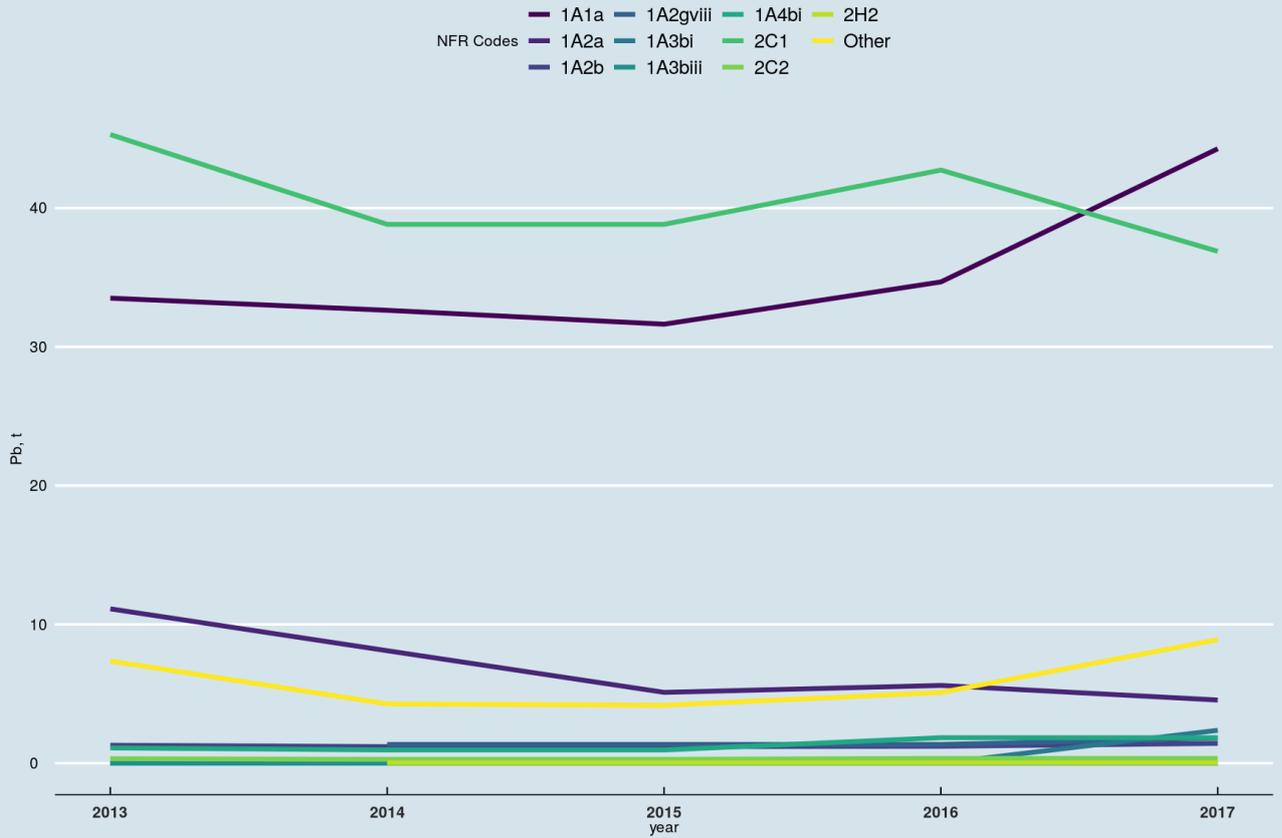
Comparison of NOx for sectors by years



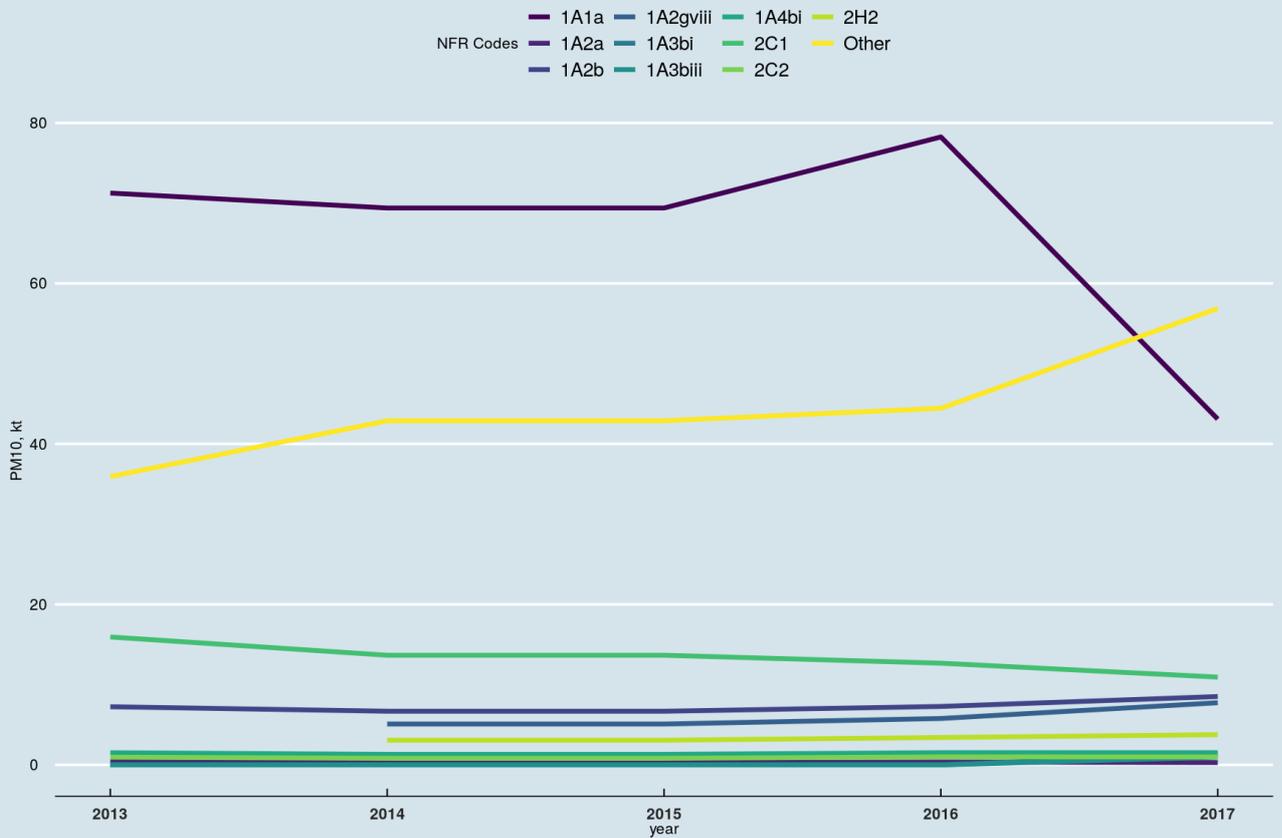
Comparison of total PAHs for sectors by years



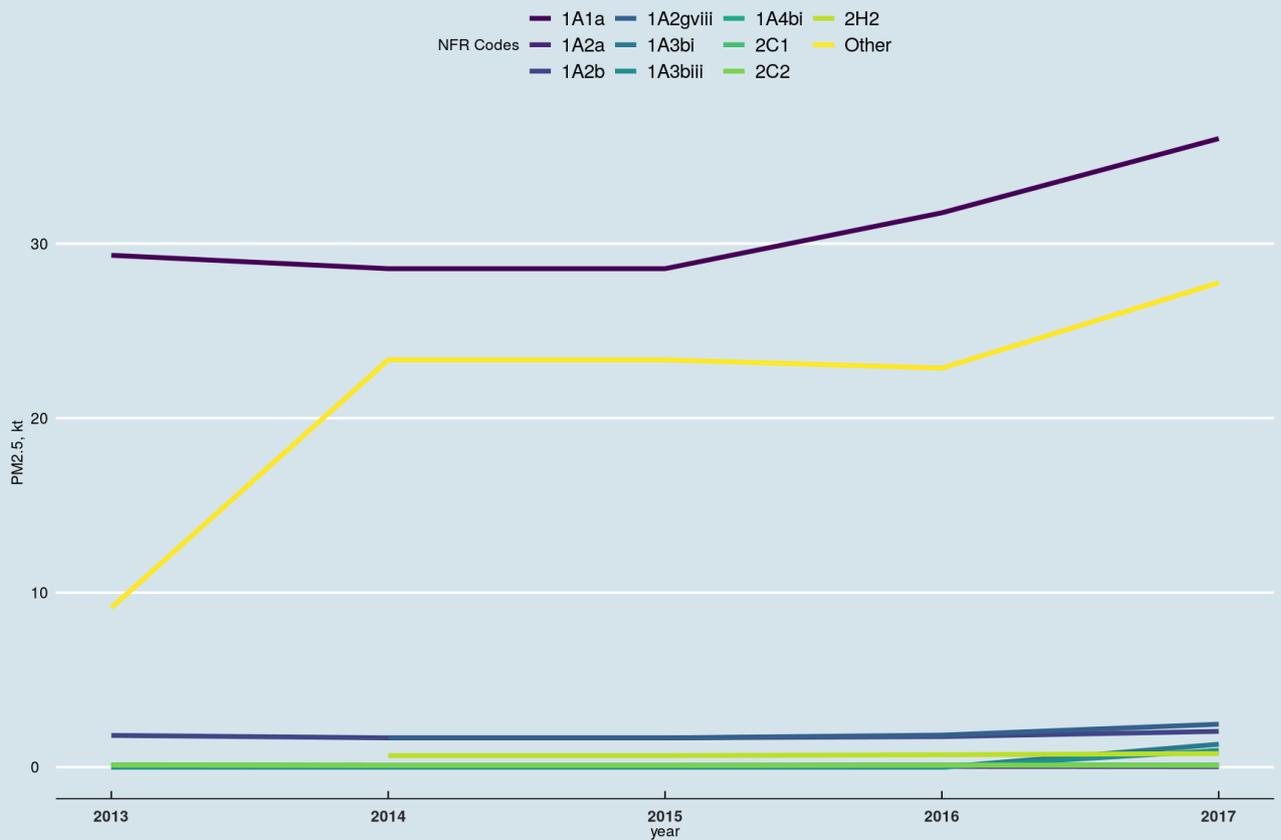
Comparison of Pb for sectors by years



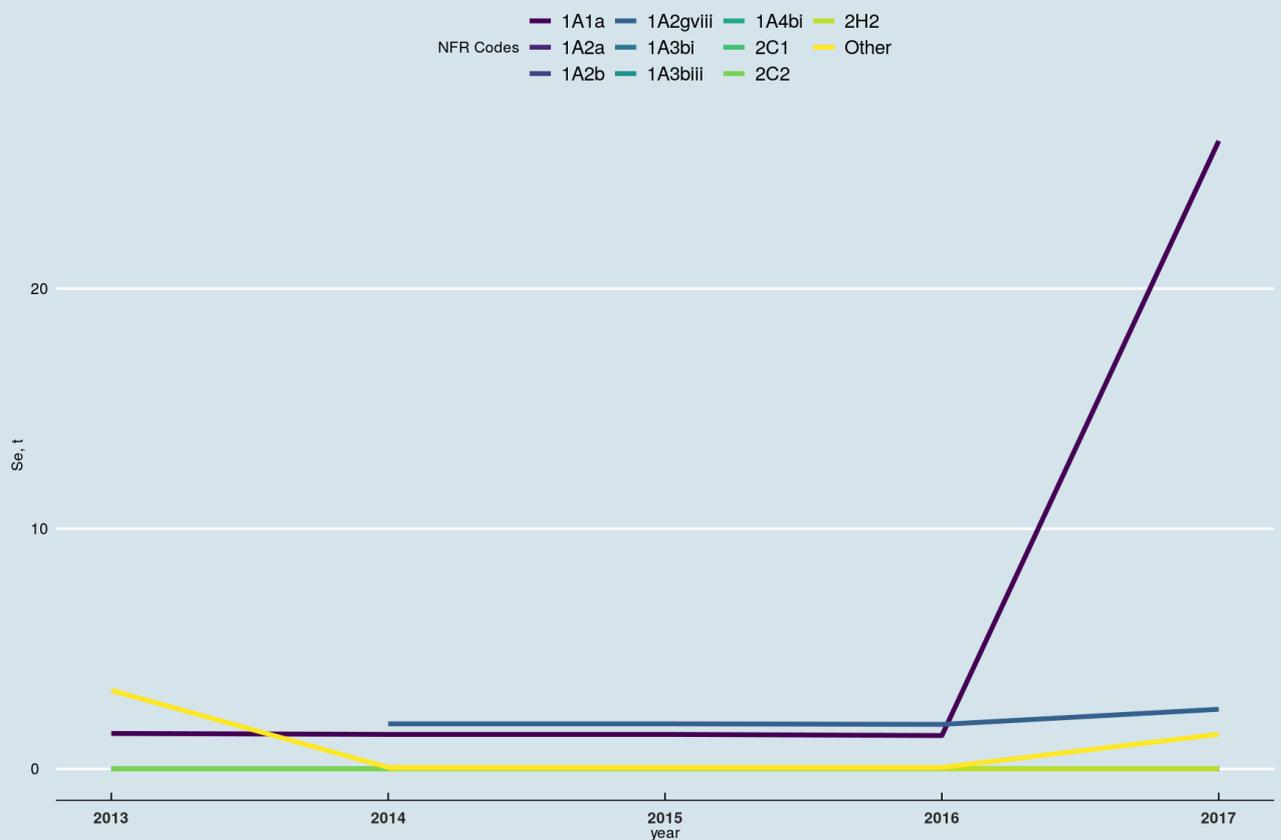
Comparison of PM10 for sectors by years



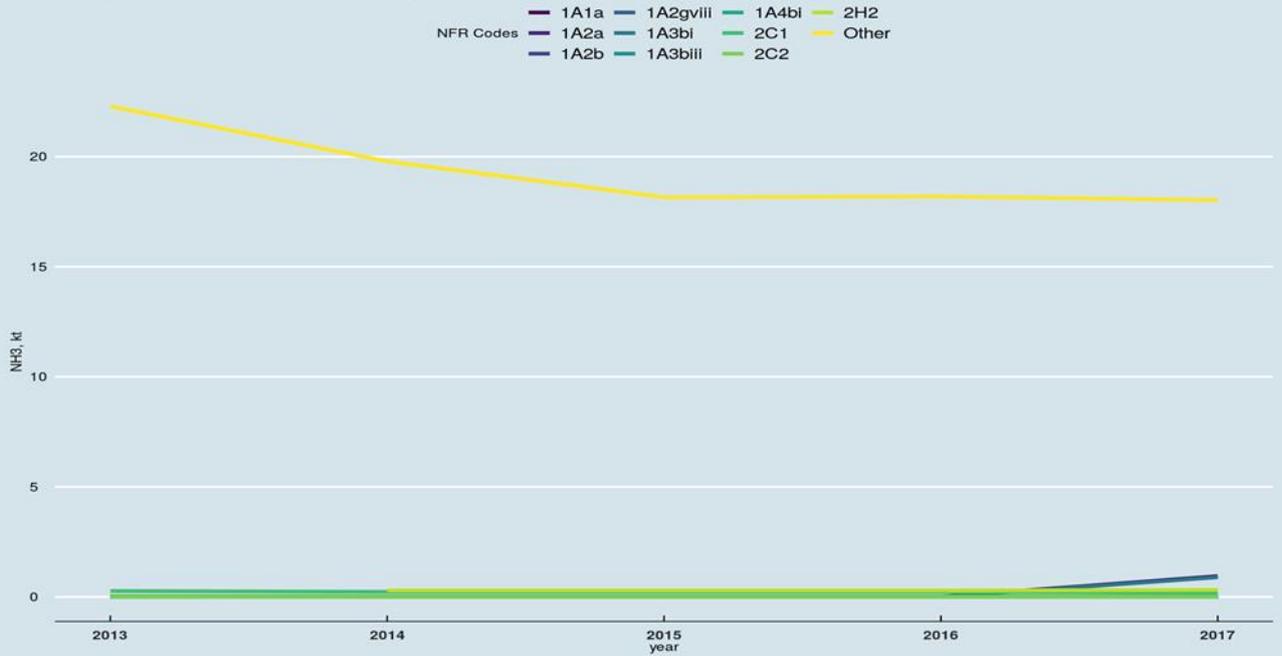
Comparison of PM2.5 for sectors by years



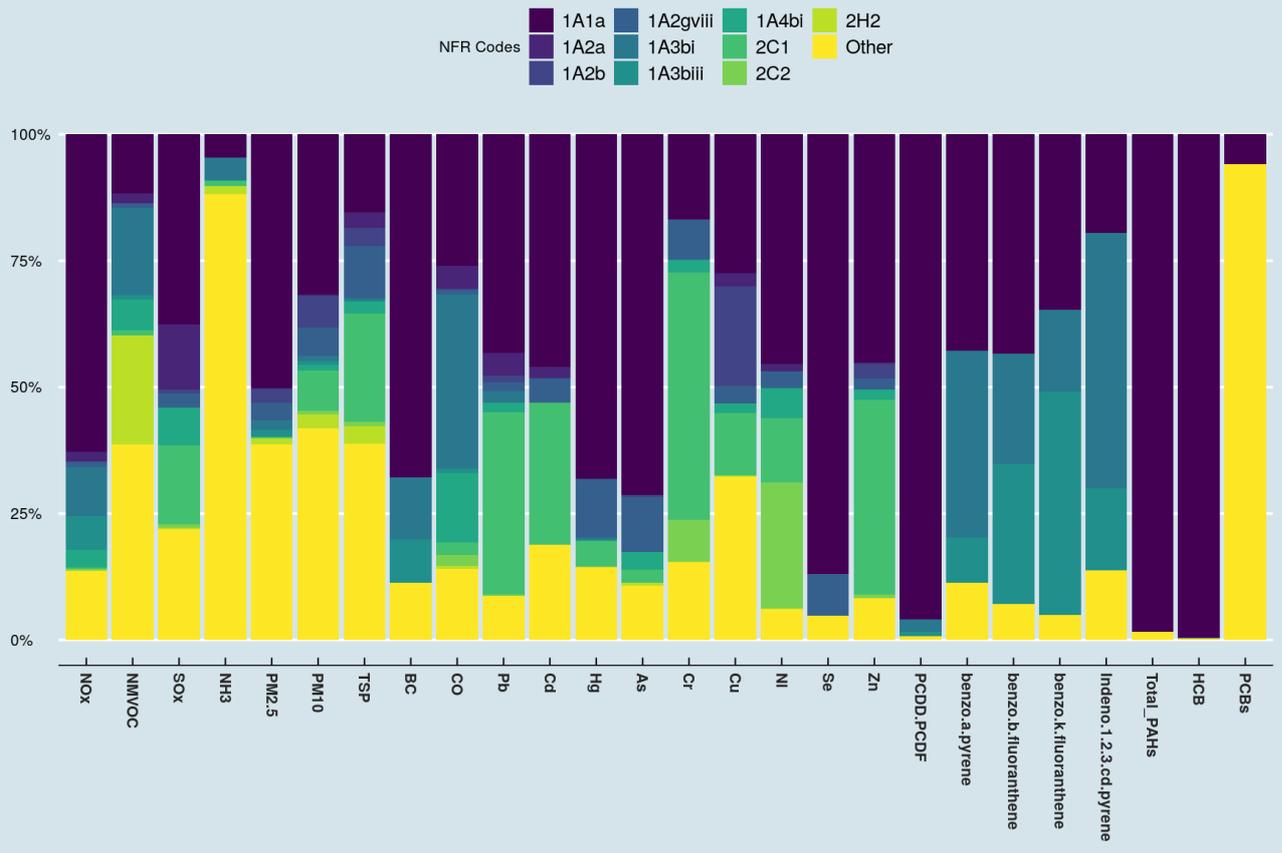
Comparison of Se for sectors by years



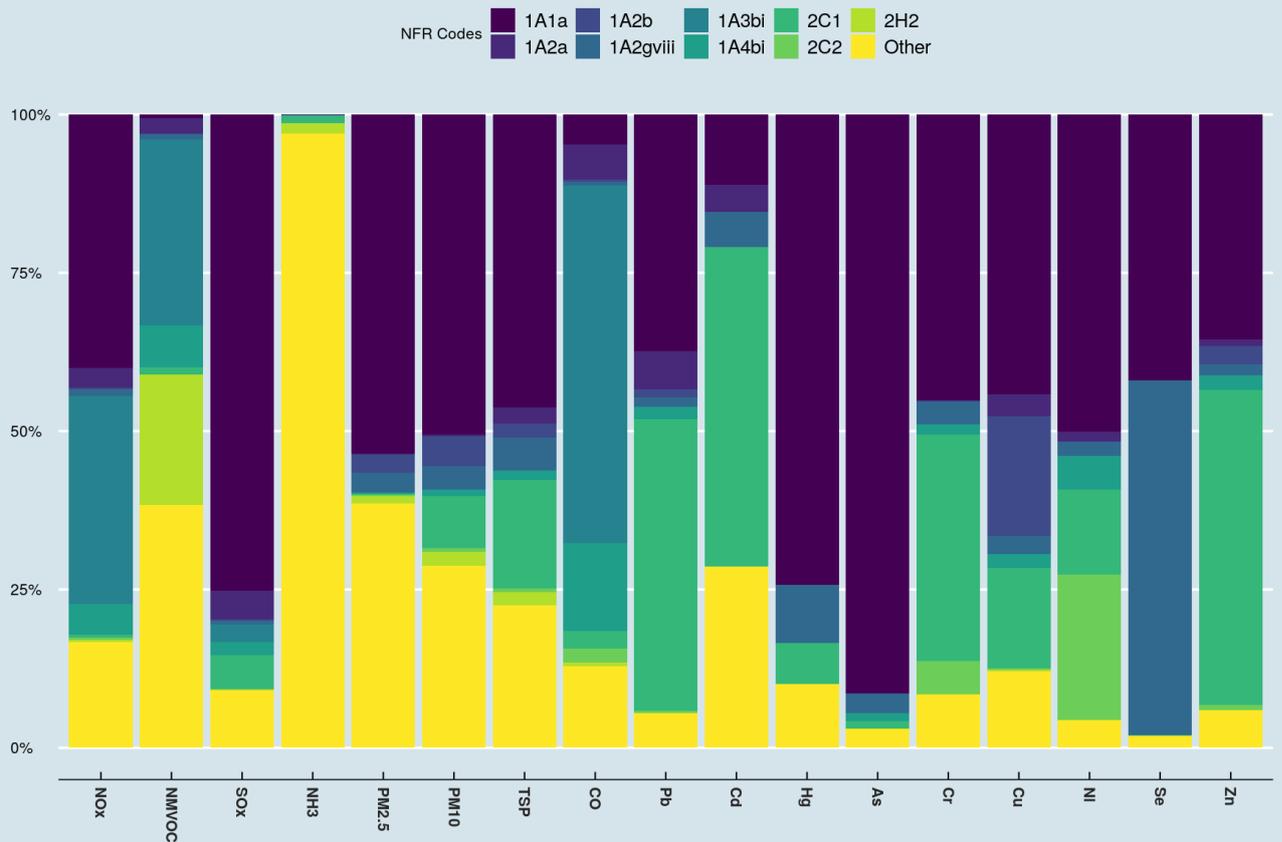
Comparison of NH3 for sectors by years



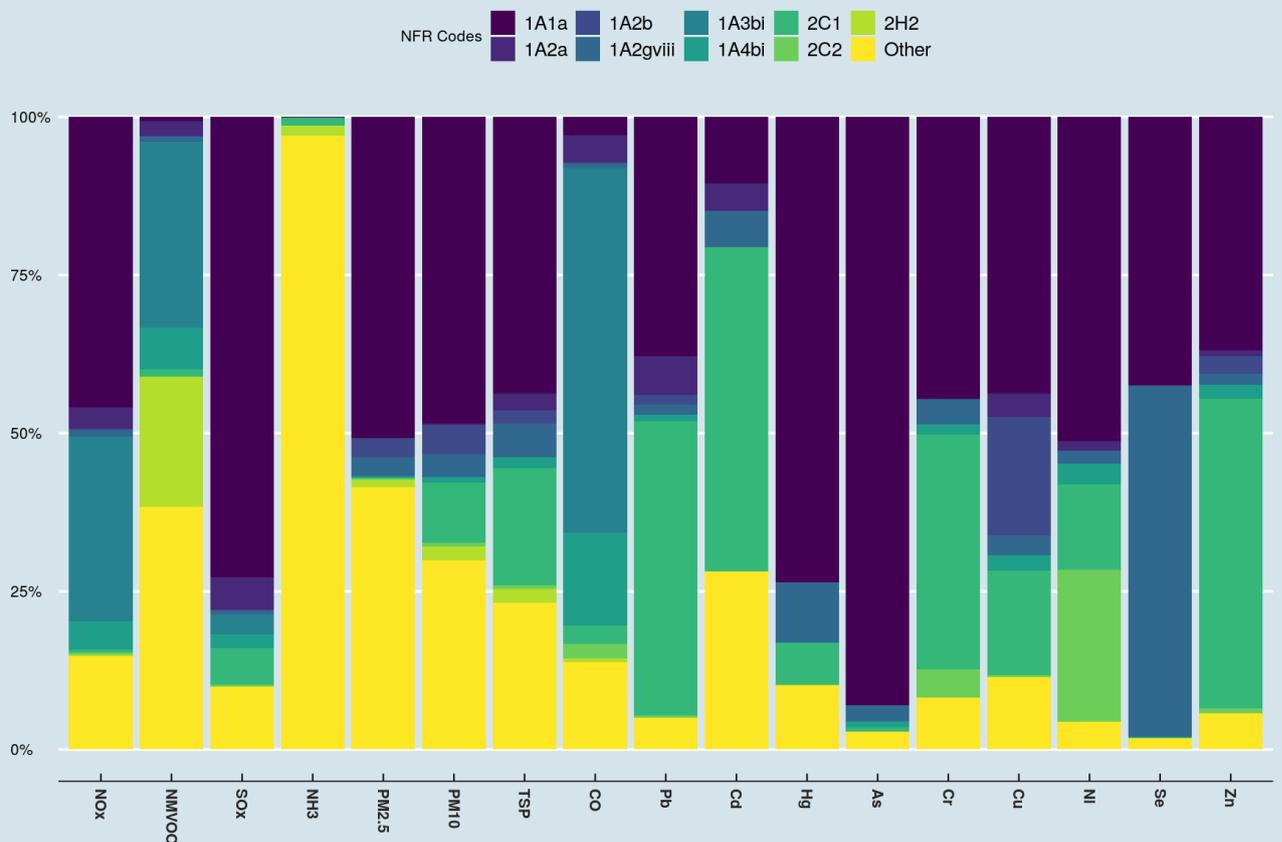
Comparison of sectors for all substances in 2017



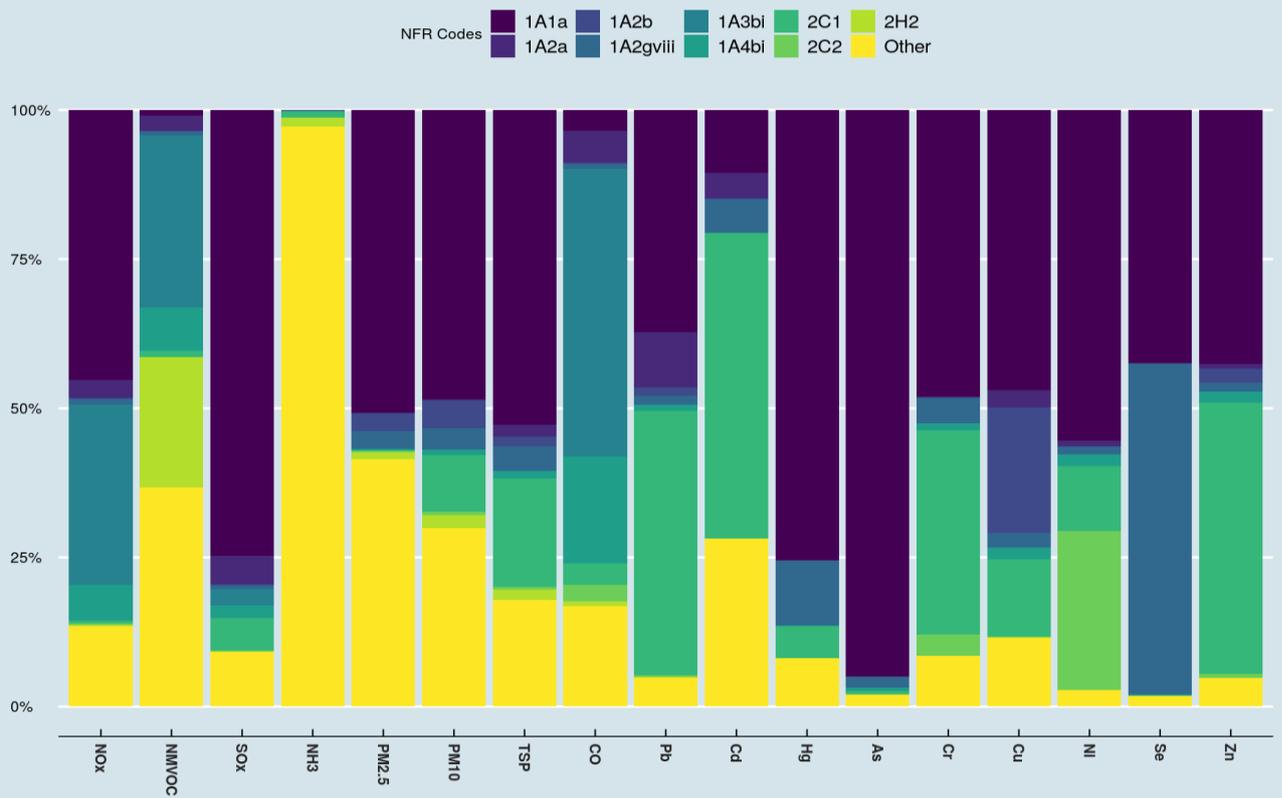
Comparison of sectors for all substances in 2016



Comparison of sectors for all substances in 2015



Comparison of sectors for all substances in 2014



Comparison of sectors for all substances in 2013



Comparison of TSP for sectors by years



Comparison of SOx for sectors by years



Chapter 4: INDUSTRIAL PROCESSES AND PRODUCT USE ((NFR sector 2)

(to be updated when there have been major changes since the last report)

Suggestions to include in this section:

- Date when this section was last updated.
- Identification of major changes (recalculations) in estimation methodologies for key categories.
- Presentation of activity statistics e.g. production statistics for key categories, solvents and paints consumed, % solvent based paints for key categories etc.
- Explanation of methods used to calculate emission estimates for key categories and other sources. Including:
 - Source category explanations of methods used to calculate emission estimates for key categories and other sources. Including: use of country specific emission factors, activity statistics, assumptions and methods and reference to default EMEP/EEA guidebook factors used for other sectors per NFR code or sector group as appropriate and where transparency permits.
 - Quantitative or qualitative assessment of uncertainties per NFR or sector group.
 - Planned improvements.

Emissions in category “Fuel Combustion” include emissions from fuel combustion for heat and electricity, industrial processes, transportation, etc. However, fuel is also used for non-energy purposes (for example, as solvents, lubricants, etc.; as a feedstock for production of ammonia, rubber, plastics, etc.; as a reducing agent - coke in blast furnaces). Emissions from non-energy fuel use are presented under sector “Industrial Processes” in the following categories:

€ “Ammonia production” (category 2.B.1) - natural gas as feedstock in the ammonia production;

2B1	Ammonia production	Виробництво аміаку
-----	--------------------	--------------------

€

€ “Pig iron” (CRF category 2.C.1.2) - coke in the production of pig iron in the blast furnace process;

B_Industry	2C1	Iron and steel production	Виробництво чавуну і сталі
B_Industry	2C2	Ferroalloys production	Виробництво феросплавів

€ “Aluminum and Ferroalloys Production” (CRF category 2.C.5) - coke in the production of ferroalloys.

More detailed data on production, export, import and consumption of coal for coking process, coke, as well as on the consumption of coke oven gas

In addition, there are losses of fuel during its transportation and storage, as well as conversion, reprocessing or for other reasons. These losses should be regarded as non-energy use.

The amount of fuel used for non-energy needs was determined based on the data of Statistical Reporting Forms #4-MTP (column 1, section 4). In accordance with instructions for completing Form #4-MTP, enterprises fill this column with the information on the amount of fuels that are used as raw materials for chemical, petrochemical and other non-fuel products, accounting for losses during processing, as well as material for non-fuel use. Fuel losses were determined according to the data of Statistical Reporting Form #4-MTP (columns 3, 4, 6, section 5), being also attributed to the non-energy fuel use in the calculation with the reference approach. In accordance with instructions for completing Form #4-MTP, the enterprises fill these columns with information on the losses of fuel for transportation, distribution and storage, on the losses in the conversion of fuels, losses due to failures to use and for other reasons.

Thus, amounts of fuel combustion are not considered when calculating non-energy use. Therefore, in the calculation of carbon stored in the assessment of CO₂ emissions in the “Energy” sector using the reference approach, fraction of the carbon stored are assumed to be 1.0 for all fuels other than oil and lubricants, for which the IPCC default factor of 0.5 value is used.

B_Industry	2A1	Cement production	Виробництво цементу
B_Industry	2A2	Lime production	Виробництво вапна
B_Industry	2A3	Glass production	Виробництво скла
B_Industry	2A5a	Quarrying and mining of minerals other than coal	Кар'єр та добування інших корисних копалин, ніж вугілля
B_Industry	2A5b	Construction and demolition	Будівництво та знесення
B_Industry	2A5c	Storage, handling and transport of mineral products	Зберігання, обробка та транспортування корисних копалин
B_Industry	2A6	Other mineral products (please specify in the IIR)	Інші мінеральні продукти (будь ласка, вкажіть у IIR)
B_Industry	2B1	Ammonia production	Виробництво аміаку
B_Industry	2B2	Nitric acid production	Виробництво азотної кислоти
B_Industry	2B3	Adipic acid production	Виробництво кислоти адипінової
B_Industry	2B5	Carbide production	Виробництво карбіду
B_Industry	2B6	Titanium dioxide production	Виробництва діоксиду титану
B_Industry	2B7	Soda ash production	Виробництві кальцинованої соди
B_Industry	2B10a	Chemical industry: Other (please specify in the IIR)	Хімічна промисловість: Інше (вказіть будь ласка в IIR)
B_Industry	2B10b	Storage, handling and transport of chemical products (please specify in the IIR)	Зберігання, обробка та транспортування хімічної продукції (будь ласка, вкажіть у IIR)
B_Industry	2C1	Iron and steel production	Виробництво чавуну і сталі

B_Industry	2C2	Ferroalloys production	Виробництво феросплавів
B_Industry	2C3	Aluminium production	Виробництво алюмінію
B_Industry	2C4	Magnesium production	Виробництво магнію
B_Industry	2C5	Lead production	Виробництво свинцю
B_Industry	2C6	Zinc production	Виробництво цинку
B_Industry	2C7a	Copper production	Виробництво міді
B_Industry	2C7b	Nickel production	Виробництво нікелю
B_Industry	2C7c	Other metal production (please specify in the IIR)	Інше виробництво металу (будь ласка, вкажіть у IIR)
B_Industry	2C7d	Storage, handling and transport of metal products (please specify in the IIR)	Зберігання, обробка та транспортування металопродукції (будь ласка, вкажіть у IIR)
E_Solvents	2D3a	Domestic solvent use including fungicides	Побутове використання розчинників, включаючи фунгіцидів
B_Industry	2D3b	Road paving with asphalt	Дорожнього покриття асфальтом
B_Industry	2D3c	Asphalt roofing	Асфальт для покрівель
E_Solvents	2D3d	Coating applications	Нанесення покриттів
E_Solvents	2D3e	Degreasing	Знежирення
E_Solvents	2D3f	Dry cleaning	Хімічстка
E_Solvents	2D3g	Chemical products	Хімічні товари
E_Solvents	2D3h	Printing	Друк
E_Solvents	2D3i	Other solvent use (please specify in the IIR)	Інша розчинник використання (будь ласка, вкажіть у IIR)
E_Solvents	2G	Other product use (please specify in the IIR)	Інше використання продукту (будь ласка, вкажіть у IIR)
B_Industry	2H1	Pulp and paper industry	Целюлозно-паперова промисловість

B_Industry	2H2	Food and beverages industry	Їжа та напої промисловості
B_Industry	2H3	Other industrial processes (please specify in the IIR)	Інші промислові процеси (будь ласка, вкажіть у IIR)
B_Industry	2I	Wood processing	Деревообробка
B_Industry	2J	Production of POPs	Виробництво СОЗ
B_Industry	2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	Споживання СОЗ і важких металів (наприклад, електричне і наукове обладнання)
B_Industry	2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)	Інше виробництво, споживання, зберігання, перевезення чи звернення сипучих продуктів (будь ласка, вкажіть у IIR)

2I Wood processing

The table below shows the initial data on procurement, import and export of harvested wood products in Ukraine for 1961-2013 years. The main source of data is the FAO data as well as data from the State Statistics Committee and State agency of forest resources.

For historical data from the information provided by FAO to the USSR for 1961-1990, workpiece factor HWP was launched in Ukraine from the total coliform-operation HWP. For this data circular logging (Roundwood) were used (grayed out), obtained by the Ukrainian State Agency of forest resources and FAO data on the Soviet Union during the same period. These relations were used for historical data in cases where there were no in-formation from national sources.

In some cases (marked in red) interpolation method was used for insulation-continuous series of data available for the previous and the next year-guides. Panels include a number of components. In a number of national data were obtained. Therefore, part of FAO data were full-up national data (shown in dark green).

Chapter 5 AGRICULTURE (NFR sector 3)

(to be updated when there have been major changes since the last report)

Suggestions to include in this section:

- Date when this section was last updated.
- Identification of major changes (recalculations) in estimation methodologies for key categories.
- Presentation of activity statistics e.g. animal population and fertilizer statistics for key categories.
- Explanation of methods used to calculate emission estimates for key categories and other sources, including use of country specific emission factors, activity statistics, assumptions and methods and with reference to default EMEP/EEA guidebook factors used for other sectors per NFR code or sector group as appropriate and where transparency permits.
- Quantitative or qualitative assessment of uncertainties per NFR or sector group.
- Planned improvements.

K_AgriLivestock	3B1a	Manure management - Dairy cattle	Управління гною - молочна худоба
K_AgriLivestock	3B1b	Manure management - Non-dairy cattle	Управління гною - Номери для молочної худоби
K_AgriLivestock	3B2	Manure management - Sheep	Управління гною - Вівці
K_AgriLivestock	3B3	Manure management - Swine	Управління гною - Свинячий
K_AgriLivestock	3B4a	Manure management - Buffalo	Управління гною - Буффало
K_AgriLivestock	3B4d	Manure management - Goats	Управління гною - Кози
K_AgriLivestock	3B4e	Manure management - Horses	Управління гною - Коні
K_AgriLivestock	3B4f	Manure management - Mules and asses	Управління гною - Мули і віслюки
K_AgriLivestock	3B4gi	Manure management - Laying hens	Гній Management – кури несучки
K_AgriLivestock	3B4gii	Manure management - Broilers	Гній Management - бройлери
K_AgriLivestock	3B4giii	Manure management - Turkeys	Гній Management - Індички
K_AgriLivestock	3B4giv	Manure management - Other poultry	Управління гною - Інше птиці
K_AgriLivestock	3B4h	Manure management - Other animals (please specify in IIR)	Управління гною - Інші тварини (будь ласка, вкажіть в IIR)
L_AgriOther	3Da1	Inorganic N-fertilizers (includes also urea application)	Неорганічні N-добрива (включає також застосування сечовини)
L_AgriOther	3Da2a	Animal manure applied to soils	Внесення гною в ґрунт

L_AgriOther	3Da2b	Sewage sludge applied to soils	Осад стічних вод у ґрунт
L_AgriOther	3Da2c	Other organic fertilisers applied to soils (including compost)	Інші органічні добрива в ґрунт(у тому числі компосту)
L_AgriOther	3Da3	Urine and dung deposited by grazing animals	Сеча і екскременти пасовищних тварин
L_AgriOther	3Da4	Crop residues applied to soils	Рослинні залишки в ґрунт
L_AgriOther	3Db	Indirect emissions from managed soils	Непрямі викиди з оброблюваних ґрунтів
L_AgriOther	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	На рівні ферми і сільськогосподарські підприємства, включаючи зберігання, обробки і транспортування сільськогосподарської продукції
L_AgriOther	3Dd	Off-farm storage, handling and transport of bulk agricultural products	Викл-ферми для зберігання, обробки та транспортування сипучих сільськогосподарських продуктів
L_AgriOther	3De	Cultivated crops	Просапних культур
L_AgriOther	3Df	Use of pesticides	Використання пестицидів
L_AgriOther	3F	Field burning of agricultural residues	Спалювання сільськогосподарських залишків
L_AgriOther	3I	Agriculture other (please specify in the IIR)	Сільське господарство Інші (будь ласка, вкажіть у IIR)

Chapter 6 WASTE (NFR sector 5)

(to be updated when there have been major changes since the last report)

Suggestions to include in this section:

- Date when this section was last updated.
- Identification of major changes (recalculations) in estimation methodologies for key categories.
- Presentation of activity statistics e.g. municipal waste and clinical waste generation, % waste incinerated for key categories.
- Explanation of methods used to calculate emission estimates for key categories and other sources. Including: use of country specific emission factors, activity statistics, assumptions and methods and reference to default EMEP/EEA guidebook factors used for other sectors per NFR code or sector group as appropriate and where transparency permits.
- Quantitative or qualitative assessment of uncertainties per NFR or sector group.
- Planned Improvements.

J_Waste	5A	Biological treatment of waste - Solid waste disposal on land	Біологічне очищення відходів - захоронення твердих відходів на землі
J_Waste	5B1	Biological treatment of waste - Composting	Біологічне очищення відходів - Компостування
J_Waste	5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	Біологічне очищення відходів - анаеробного травлення в біогазових установках
J_Waste	5C1a	Municipal waste incineration	Муніципальних відходів
J_Waste	5C1bi	Industrial waste incineration	Промислові відходи спалювання
J_Waste	5C1bii	Hazardous waste incineration	Спалювання небезпечних відходів
J_Waste	5C1biii	Clinical waste incineration	Клінічна спалювання відходів
J_Waste	5C1biv	Sewage sludge incineration	Спалювання каналізаційного мулу
J_Waste	5C1bv	Cremation	Кремація
J_Waste	5C1bvi	Other waste incineration (please specify in the IIR)	Інші відходи (будь ласка, вкажіть у IIR)
J_Waste	5C2	Open burning of waste	ВІРрите спалювання відходів
J_Waste	5D1	Domestic wastewater handling	Побутові стічні води
J_Waste	5D2	Industrial wastewater handling	Промислові стічні води
J_Waste	5D3	Other wastewater handling	Інше звернення стічних вод
J_Waste	5E	Other waste (please specify in IIR)	Інші відходи (будь ласка, вкажіть у IR)

Chapter 7 Other and Natural emissions

(to be updated when there have been major changes since the last report)

Suggestions to include in this section:

- Date when this section was last updated.

Other (NFR 6A, 6B)

- Identification of major changes (recalculations) in estimation methodologies for key categories.
- Presentation of activity statistics
- List of sources included in Other indicating which are included in national totals and which are not included and why.
- Explanation of methods used to calculate emission estimates for key categories and other sources. Including: use of country specific emission factors, activity statistics, assumptions and methods and reference to default guidebook factors used for other sectors per NFR code or sector group as appropriate and where transparency permits.
- Quantitative or qualitative assessment of uncertainties per NFR or sector group.
- Planned Improvements.

z_Memo	6B	Other not included in national total of the entire territory (please specify in the IIR)	Інше, не включене в національні підсумки в цілому на всій території (вказіть будь ласка в IIR)
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Natural emissions (11A, 11B, 11C)

- Identification of major changes (recalculations) in estimation methodologies
- Presentation of activity statistics e.g forest land , grassland etc. ,
- Explanation of methods used to calculate emission estimates
- Quantitative or qualitative assessment of uncertainties per NFR or sector group.

N_Natural	11A	Volcanoes	Вулкани
N_Natural	11B	Forest fires	Лісові пожежі
N_Natural	11C	Other natural emissions (please specify in the IIR)	Інші природні викиди (будь ласка, вказіть у IIR)

11B Forest fires

In Ukraine, forest fires are divided into 3 groups according to the burnt biomass:

- **ground fire** - burns only litter, wood is not damaged or slightly damaged, therefore excluded from the calculation;

- **crown fires** - burn litter and wood;

- **Underground fire** - burns the organic matter (peat).

Data on fires for the year 1990-2013 are presented in Table below.

Table . The area covered by forest fires and completely burned harvested forest products

Year	area covered by forest fires hectares				burnt and damaged standing timber, m3
	ground fire	crown fires	Underground fire	Sum area	
1990	1366	1022	1	2389	79909
1991	1042	665	10	1717	38252
1992	3318	672	111	4101	77758
1993	2415	712	51	3178	174499
1994	6061	3432	537	10030	391999
1995	1695	1416	26	3137	147647
1996	7163	5466	42	12671	315088
1997	1355	110	2	1467	11850
1998	3208	1208	2	4418	123360
1999	2896	2632	14	5542	166721
2000	1386	232	2	1620	20647
2001	1992	1770	3	3765	139604
2002	4245	657	64	4966	59625
2003	2409	359	49	2817	20071
2004	536	37	2	575	1944
2005	2057	293	9	2359	34260
2006	3729	557	1	4287	53119
2007	6238	7549	-	13787	1308223
2008	4218	1311	-	5529	395257
2009	5300	1010	5	6315	223764
2010	2697	966	5	3668	343840

Chapter 8: Recalculation and Improvements (to be updated each year)

10.1 Recalculations

Suggestions to include in this section:

- Summary of recalculations (by sector, year and pollutant)
- Highlight implications for the inventory totals and trends with reference to the new methods documented in Sector methodology section.
- Identify new sources added to the inventory (reference new methods on the methodology chapter)
- Overview of recalculations that have occurred since the base year of each Protocol (relevant for assessment of compliance with each Protocol) (including a description of sources that were not included in the base year but have been added since or sources that were included in the base year and are no longer applicable)

10.2 Planned improvements

Suggestions to include in this section:

- Summary of planned programmes of improvement. (Reference detailed descriptions in sectoral chapters 3 – 9 above)

Chapter 9: Projections

Suggestions to include in this section:

- Description by source sector of general methods (models), data sources and assumptions used for estimating projected emissions and activity data reported in Annex IV Tables 2A and 2B. Include references to detailed documentation (where this is available).

e.g.

Overview of data sources, methods and models

- a) projections with measures (WM) ;
- b) projections with additional measures WAM (where appropriate)
- Explanations of circumstances justifying emissions that are temporarily higher than the ceilings established for it for one or more pollutants (after 2010)
 - Sensitivity
 - Time series consistency (including with historic inventory)

Sectoral Methods

- 9.1 Energy
 - 9.1.1 Stationary Combustion
 - 9.1.2 Mobile Combustion
- 9.2 Industrial Processes and Product Use
- 9.3 Agriculture
- 9.4 Waste

Chapter 10 Reporting of gridded emission and LPS

(to be updated every 2 years or when there have been major changes since the last report)

Suggestions to include in this section:

- Date when this section was last updated.
- List gridded data and LPS years/pollutants provided to CEIP
- Identification of major changes (recalculations - - see Chapter 8) in estimation methodologies for individual GNFR categories pollutants and quantification and national totals.
- Brief description of methods used in the country to grid sectoral emission. (list surrogate data used for gridding?)
- Description of LPS reporting , completeness assessment of LPS information.
- Planned Improvements.

Chapter 11

Executive Body decisions 2012/3 and 2012/12 concern adjustments to emission reduction commitments or to inventories under the 2012 amended Gothenburg Protocol. The decisions include the detailed lists of supporting information which must be provided in an IIR or in a separate report. The lists of required information are therefore not repeated here.

Paragraph 6 of Decision 2012/3 lists the extraordinary circumstances under which adjustments may be applied.

Paragraph 2 of Decision 2012/12 lists the supporting documentation required for a Party applying for an adjustment to its emission inventory or emission reduction commitment.

Paragraphs 8-13 of Decision 2012/12 lists the information that Parties applying an adjustment to annually reported emission inventories shall provide.

For each individual emission source category for which an adjustment procedure is relevant, Parties shall report the adjusted emission estimate using the template available as a separate Annex to the Emission Reporting Guidelines. Each Party shall also prepare and report the ‘adjusted’ national total emission estimate in the main worksheet of the NFR reporting template.

In particular, in a separate Adjustments chapter of their Informative Inventory Report (this section), or in a separate report, Parties that report adjusted emission estimates shall detail the methodology, data and emission factors for each year used in preparing the adjusted emission estimate. The adjusted emission estimates documented in the Informative Inventory Report shall be identical to those reported in the main worksheet of the NFR reporting template.

IIR References (To be updated each year)

References

Classification of the Kinds of Economic Activity. Adopted and Implemented by the Decree of Derzhspozhyvstandard of Ukraine of 26 December 2005 p. #375.

Eastern Europe, Caucasus and Central Asia (Highlights)

http://www.iea.org/publications/freepublications/publication/INOGATE_Summary_FINAL.pdf

Energy Policies beyond IEA Countries - Ukraine 2012

<http://www.iea.org/publications/freepublications/publication/energy-policies-beyond-iea-countries--ukraine-2012.html>

Energy Policies Beyond IEA Countries - Ukraine 2012 (Ukrainian version)

Energy Policies Beyond IEA Countries - Ukraine 2006

Energy Policies Beyond IEA Countries - Ukraine 2006 (Ukrainian version)

1. Regulation of the National electronic register of anthropogenic emissions and removals of greenhouse gases approved under Order of the Cabinet of Ministers of Ukraine dated May 28, 2008 No.504 (<http://zakon2.rada.gov.ua/laws/show/504-2008-%D0%BF>).
2. Order of the Cabinet of Ministers of Ukraine dated July 30, 2008 No.1028-p “On introduction into circulation of assigned amount units” (<http://zakon2.rada.gov.ua/laws/show/1028-2008-%D1%80>).

Participating organisations

Eastern Europe, Caucasus and Central Asia (Highlights)

Reporting under UNFCCC

National communications

NC 1 Submission date: 21/03/98 <http://unfccc.int/resource/docs/natc/ukrnc1.pdf>

NC 2 (Russian) Submission date: 27/06/06 <http://unfccc.int/resource/docs/natc/ukrnc2r.pdf>

NC 3, 4 & 5 (Russian) Revised version: 8/2/10 Submission date: 29/12/09

http://unfccc.int/resource/docs/natc/ukr_nc5rev.pdf

Ukraine. Ukraine’s report on demonstrable progress under the Kyoto Protocol:

<http://unfccc.int/resource/docs/dpr/ukr1.pdf>

NC6 (Russian) Submission date: 30/12/2013

[http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/6nc_v7_final_\[1\].pdf](http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/6nc_v7_final_[1].pdf)

NC6 addendum (Russian) Submission date: 28/10/2014

http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/addendum.pdf

Submitted Biennial Reports

BR1 (6720 kB) (Annex to NC6)

http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/6nc_v7_final_11.pdf

BR1 CTF (823 kB)

http://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/ukr_2014_v1.0_formatted1.pdf

Submission date: 30/12/2013

Annual national inventory reports and addendums under Kyoto Protocol

(current year-2=reporting year)

15. NIR 21 May 2008

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip (Russian)

16. NIR 25 May 2009

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip (Russian)

17. NIR 22 May 2010

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip (Russian)

18. NIR 08 June 2011

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip (Russian)

19. NIR 13 April 2012

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip (Russian)

20. NIR 15 April 2013

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2013-nir-15apr.zip (Russian)

NIR 12 April 2014

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2014-nir-15apr.zip (Russian)

Kyoto protocol LULUCF 01 November 2014

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2014-kplulucf-01nov.zip (English)

Kyoto protocol Common Report Format 01 November 2014

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2014-crf-01nov.zip (English)

NIR 14 August 2015

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2015-nir-14aug.zip (Russian)

Kyoto protocol Common Report Format 14 August 2015

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2015-crf-14aug.zip (English)

Status report of the annual inventory of Ukraine <http://unfccc.int/resource/docs/2015/asr/ukr.pdf> (English)

Annual reports on avoires and transactions carried out in the Ukrainian registry in standard electronic format (SEF)

21. SEF 14 May 2009

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_sef_14may.zip

22. SEF 9 July 2010

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-sef-9jul.zip

23. SEF 14 April 2011

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-sef-14apr.zip

24. SEF 13 April 2012

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-sef-13apr.zip

25. SEF 12 April 2013

http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2013-sef-12apr.zip

Reports by independent experts on evaluation of the work of the national registry

26. Initial IAR

http://unfccc.int/files/kyoto_protocol/registry_systems/independent_assessment_reports/application/pdf/ua - iar v1.0 final.pdf

27. SIAR 2010 Part 1

http://unfccc.int/files/kyoto_protocol/registry_systems/independent_assessment_reports/application/pdf/ukr_siar_part1_assessment_report_v2.0.pdf

28. SIAR 2010 Part 2

http://unfccc.int/files/kyoto_protocol/registry_systems/independent_assessment_reports/application/pdf/ukr_siar_part2_assessment_report_v2.0.pdf

29. SIAR 2011 Part 1

http://unfccc.int/files/kyoto_protocol/registry_systems/independent_assessment_reports/application/pdf/2011_ukr_siar_part1_v2.0.pdf

30. SIAR 2011 Part 2

http://unfccc.int/files/kyoto_protocol/registry_systems/independent_assessment_reports/application/pdf/2011_ukr_siar_part2_v2.0.pdf

31. SIAR 2012 Part 1

http://unfccc.int/files/kyoto_protocol/registry_systems/independent_assessment_reports/application/pdf/ukr_siar_part_1_assessment_report_v2.0.pdf

32. SIAR 2012 Part 2

http://unfccc.int/files/kyoto_protocol/registry_systems/independent_assessment_reports/application/pdf/ukr_siar_part_2_assessment_report_v2.0.pdf

33. SIAR 2013 Part 1

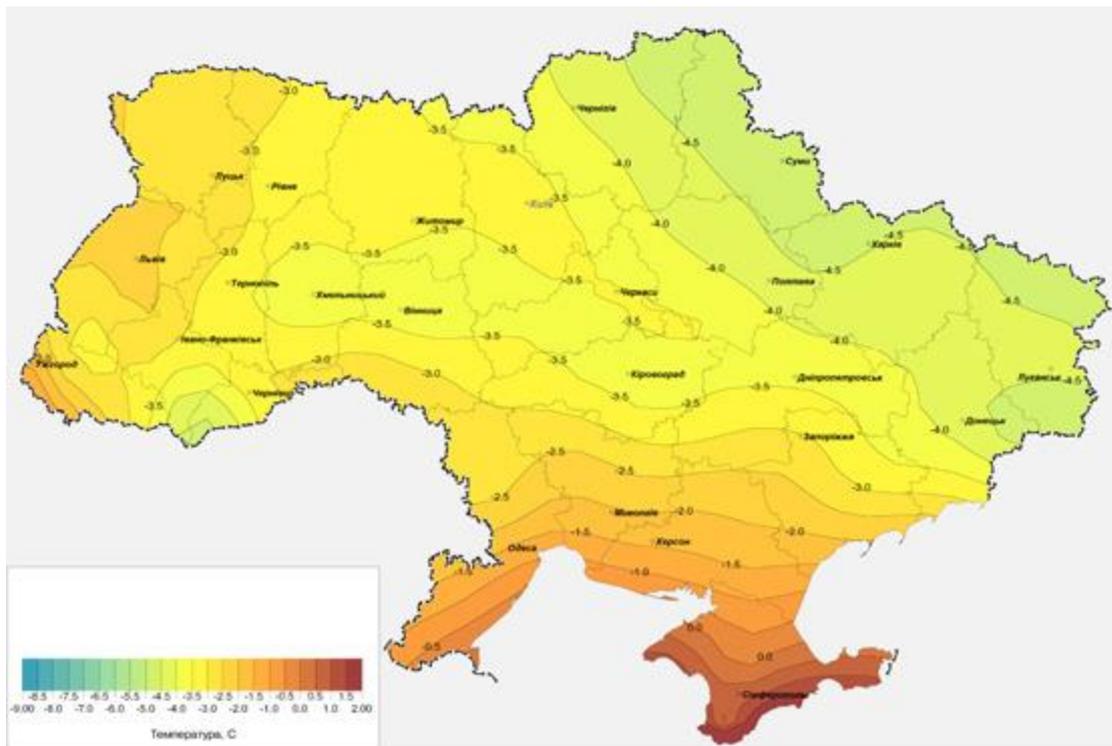
http://unfccc.int/files/kyoto_protocol/registry_systems/independent_assessment_reports/application/pdf/iar_2013_ukr_1_1.pdf

34. SIAR 2013 Part 2

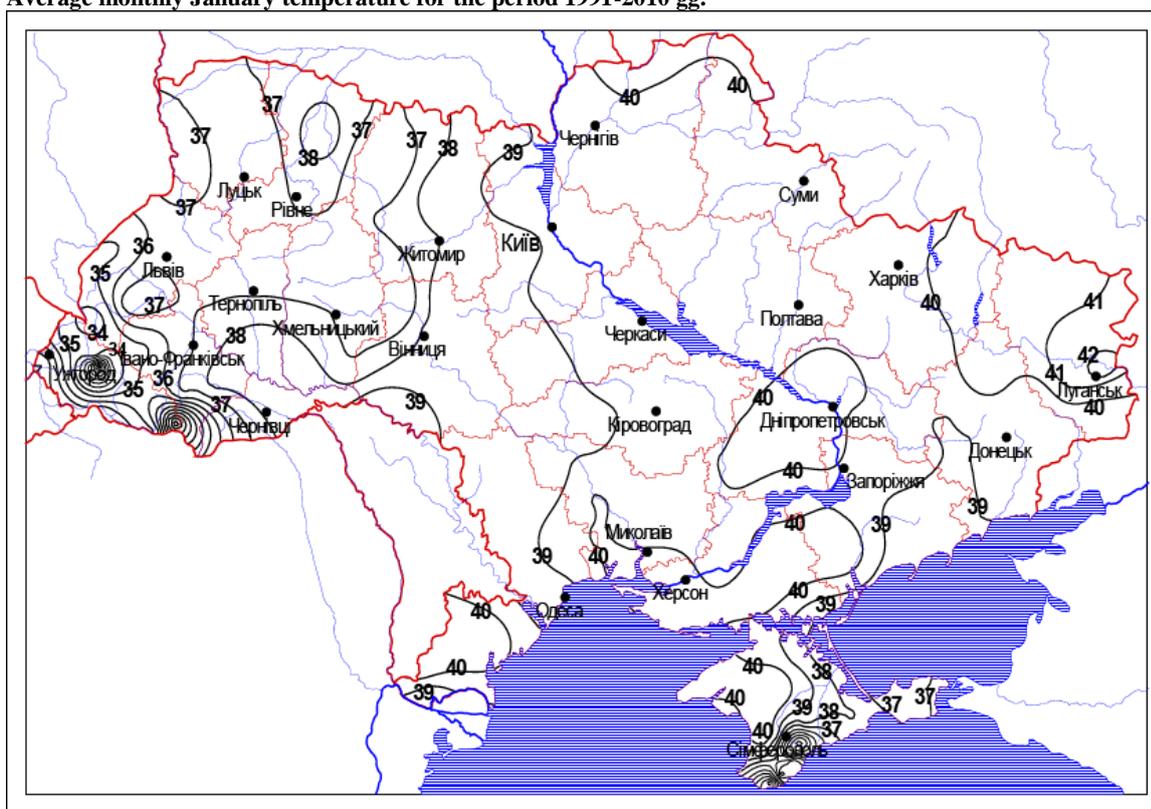
http://unfccc.int/files/kyoto_protocol/registry_systems/independent_assessment_reports/application/pdf/iar_2013_ukr_2_1.pdf

IIR Appendices (to be updated as appropriate)

- Appendix 1: Key category analysis
- Appendix 2: Detailed methodological descriptions for individual source categories (where relevant)
- Appendix 3: Further elaboration of completeness, uses of NE & IE and (potential) sources of air pollutant emissions excluded (where relevant)
- Appendix 4: National energy balance (optional - useful for review process)
- Appendix 5: Additional information to be considered part of the IIR submission (where relevant) or other useful information
- Appendix 6: Other appendices (any other relevant information – optional)



Average monthly January temperature for the period 1991-2010 gg.



The absolute maximum air temperature (° C.).



The absolute minimum air temperature (0 C). Year

Нафтопровідна система України



The oil transport system of Ukraine



Ukrainian gas transportation system



The scheme of the objects of the nuclear fuel cycle in Ukraine

Приложение А

Таблица А.1 – Таблица соответствия кодов секторов формы статистической отчетности 4-МТП (до 2001 г.) и общепринятого формата отчетности

Код сектора в общепринятом формате отчетности	Код сектора в форме 4-МТП
A. Fuel Combustion Activities (Sectoral Approach)	
1. Energy Industries	
a. Public Electricity and Heat Production	111002
b. Petroleum Refining	112203
c. Manufacture of Solid Fuels and Other Energy Industries	112002-112203+121603
2. Manufacturing Industries and Construction	
a. Iron and Steel	121002+121093
b. Non-Ferrous Metals	122002+129993
c. Chemicals	130002
d. Pulp, Paper and Print	153003+194002
e. Food Processing, Beverages and Tobacco	180002
f. Other (please specify)	124103+124114+140002+600001+152003+154003+159993+161002+165002+170002+191002+192002+193002+197002+199002+150002-153003
3. Transport	
a. Civil Aviation	153003
b. Road Transportation	511203
c. Railways	511103
d. Navigation	512003
e. Other Transportation (please specify)	500001+520002+514003+511303
4. Other Sectors	
a. Commercial/Institutional	700001+910001+920001+930001+950001+995001+995001+800001+810001+870001+999991
b. Residential	900001+ Графа 10 Раздела 4 формы 4-МТП по Украине в целом
c. Agriculture/Forestry/Fisheries	400001+200001+300001
5. Other	

Таблица А.2 – Таблица соответствия кодов секторов формы статистической отчетности 4-МТП (начиная с 2001 г.) и общепринятого формата отчетности

Код сектора в общепринятом формате отчетности	Код сектора в форме 4-МТП
A. Fuel Combustion Activities (Sectoral Approach)	
1. Energy Industries	
a. Public Electricity and Heat Production	40.1+40.3
b. Petroleum Refining	23.2
c. Manufacture of Solid Fuels and Other Energy Industries	CA +23.1+23.3 + 40.20.1+41
2. Manufacturing Industries and Construction	
a. Iron and Steel	27.1+27.2+27.3
b. Non-Ferrous Metals	27.4
c. Chemicals	DGDH
d. Pulp, Paper and Print	DE
e. Food Processing, Beverages and Tobacco	DA
f. Other (please specify)	CB+DB+DC+DD+DI+DK+DL+DM+DN+F+27.5+28
3. Transport	
a. Civil Aviation	62
b. Road Transportation	60.23+60.21.1+60.21.3+60.24
c. Railways	60.1+60.21.2+60.21.4
d. Navigation	61
e. Other Transportation (please specify)	63+64+60.22+60.30.1+(60.30.2+40.20.2)
4. Other Sectors	
a. Commercial/Institutional	G+H+J+K+L+M+N+O+88.88.8
b. Residential	Графа 10 Раздела 4 формы 4-МТП по Украине в целом
c. Agriculture/Forestry/Fisheries	A+B
5. Other (please specify)	

Приложение Б

Таблица Б.1 - Таблица соответствия видов топлива в форме статистической отчетности 4-МТП и в таблицах общепринятого формата отчетности

Вид топлива в общепринятом формате отчетности	Вид топлива в форме 4-МТП	Код топлива
Жидкое топливо	Нефть сырая	004
	Газовый конденсат	014
	Авиационный бензин	031
	Автомобильный бензин	032
	Газойль (дизельное топливо)	033
	Газотурбинное топливо бензинового типа	034
	Газотурбинное топливо керосинового типа	035
	Моторное топливо	036
	Керосин технический	037
	Керосин для освещения	038
	Мазут топочный	039
	Мазут флотский	040
	Топливо печное бытовое	041
	Нефтебитум	042
	Нефтяной кокс	043
	Масла и смазки	045
	Отработанные нефтепродукты	051
	Сжиженный газ	052
Другие виды нефтепродуктов	053	
Твердое топливо	Каменный уголь	001
	Коксующийся уголь	002
	Бурый уголь (лигниты)	003
	Сланцы горючие	006
	Торф топливный (при условной влажности)	007
	Термоантрацит	022
	Кокс, коксик, коксовая мелочь	023
	Каменноугольные брикеты	024
	Торфяные брикеты и полубрикеты (при условной влажности)	025
	Буроугольные брикеты	026

Вид топлива в общепринятом формате отчетности	Вид топлива в форме 4-МТП	Код топлива
Газообразное топливо	Природный газ	005
	Нефтезаводской газ	061
	Доменный газ	062
	Коксовый газ	063
	Ферросплавный газ	065
Биомасса	Дрова	008
Другие виды топлива	Другие виды топлива	009