2024

INFORMATIVE INVENTORY REPORT OF GEORGIA

1990-2022

Ministry of Environmental Protection and Agriculture of Georgia

Ambient Air Division

Submitted under the Convention on Long-Range Transboundary Air Pollution

LIST OF ABBREVIATIONS

MEPA	– Ministry of Environmental Protection and Agriculture of Georgia
EMEP	– The European Monitoring and Evaluation Programme
EEA	– European Economic Area
GEOSTAT	– National Statistics Office of Georgia
IPCC	– Intergovernmental Panel on Climate Change
CLRTAP	– Convention on Long-Range Transboundary Air Pollution
COPERT 4	– Road transport database
CNG	– Compressed natural gas
IIR	– Informative Inventory Report (UNECE)
LPS	– Large point sources, equals to the definition of E-PRTR installations
NFR	– Nomenclature for reporting (IPCC code of categories)
QA/QC	– Quality assurance/quality control:
UNECE	– United Nations Economic Commission for Europe

Pollutants

As	– Arsenic
Cd	– Cadmium
Cr	– Chromium
Cu	– Copper
CO	– Carbon monoxide
HCB	– Hexachlorobenzene
Hg	– Mercury
HM	– Heavy metals
NH3	– Ammonia
Ni	– Nickel
NMVOC	– Non-methane volatile organic compounds
NO2	– Nitrogen dioxide
NOx	– Nitrogen oxides, nitric oxide and nitrogen dioxide, expressed as nitrogen dioxide
PAH	– Polyaromatic hydrocarbons expressed as the sum of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3,-cd)pyrene
Pb	– Lead
PCDD/PCDF	– Dioxins and furans: 1,2,3,7,8-PeCDD; 2,3,4,7,8-PeCDF; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDF

PCB	– Polychlorinated biphenyls
PCP	– Pentachlorophenol
PFCs	– Perfluorocarbons
PM2.5	– Particulate matter; particles on the order of ~ 2.5 micrometers or less
PM10	– Particulate matter; particles on the order of ~10 micrometers or less
POP	– Persistent organic pollutants
Se	– Selenium
SO_2	– Sulphur dioxide
SOx	– Sulphur oxides, all sulphur compounds expressed as sulphur dioxide
TSP	– Total suspended particulates
Zn	– Zinc

Contents

Executive Summary

Georgia is a party to the 1979 Geneva Convention on Long-range Transboundary Air Pollution since 1999. The present report is the sixth Informative Inventory Report (IIR) submitted by Georgia under the Convention on Long-Range Transboundary Air Pollution. The first IIR was submitted in 2015. The report provides background information on Georgia's emission inventory data.

Georgia reports emissions of NOx, NMVOC, SO_2, NH_3, $PM_{2.5}$, PM_{10}, TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/ PCDF, benzo(a) pyrene, benzo(b) fluoranthene, benzo(k) fluoranthene, Indeno (1,2,3-cd) pyrene, HCB, PCBs, in the following sectors: Energy, Industrial Processes and Product Use, Agriculture and Waste. Georgia also reports emission data from large point sources. The report covers period from 1990 to 2022.

The pollutants reported by Georgia show the following trends:

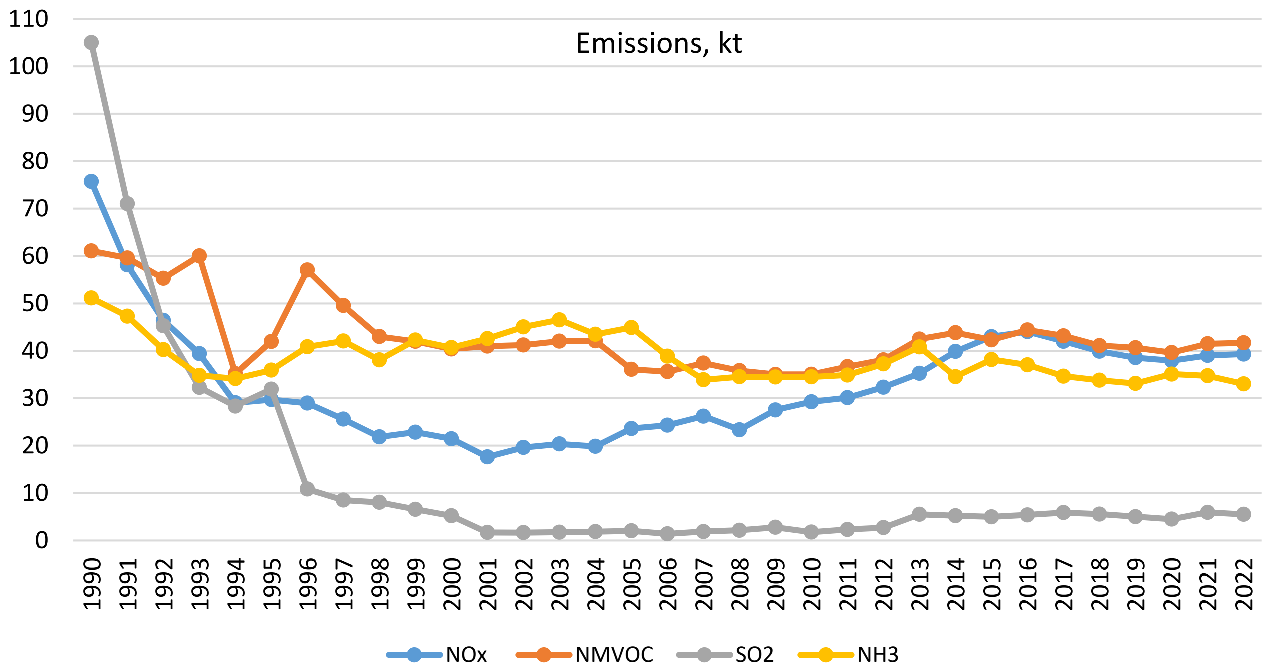

Figure 1.1 Trends of main pollutants, 1990-2022

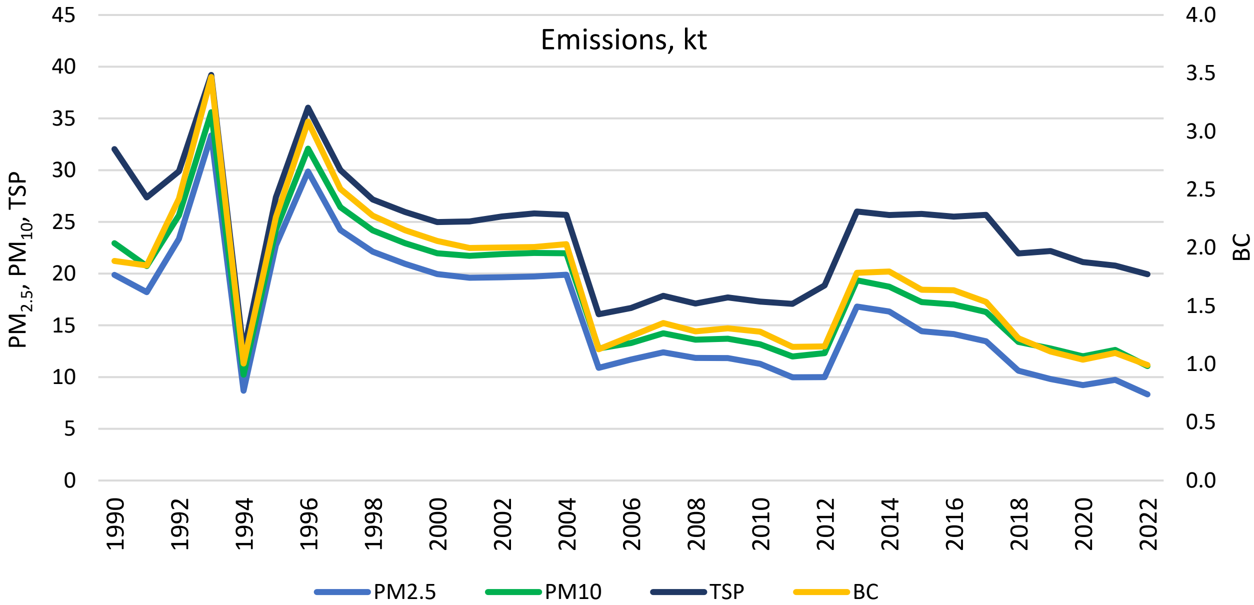

Figure 1.2 Trends of particulate matters, 1990-2022

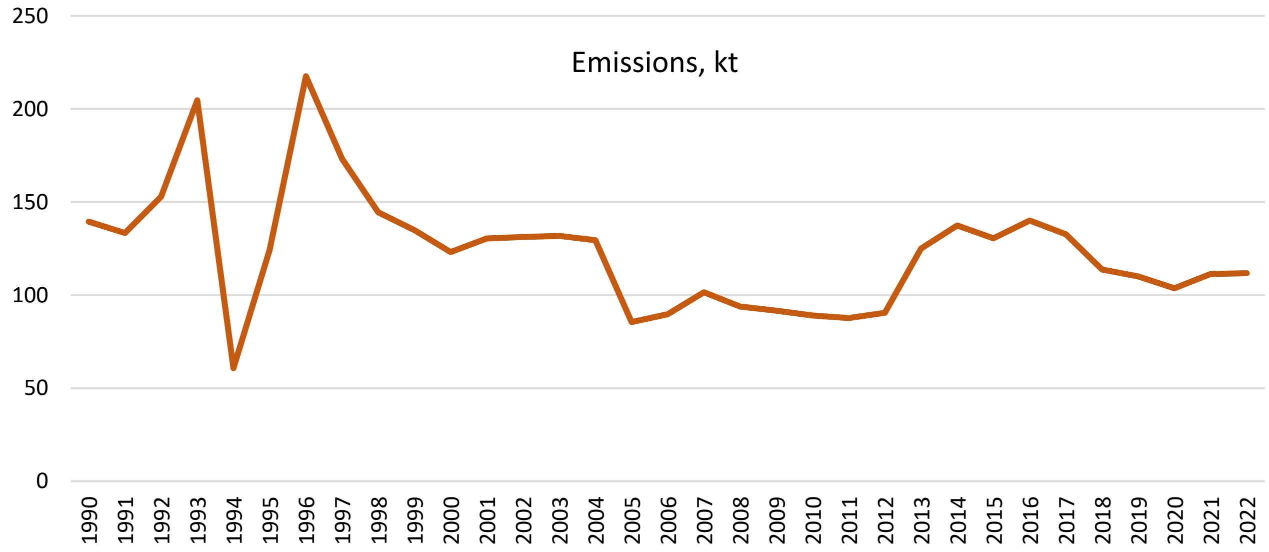

Figure 1.3 Trend of Carbon Monoxide (CO), 1990-2022

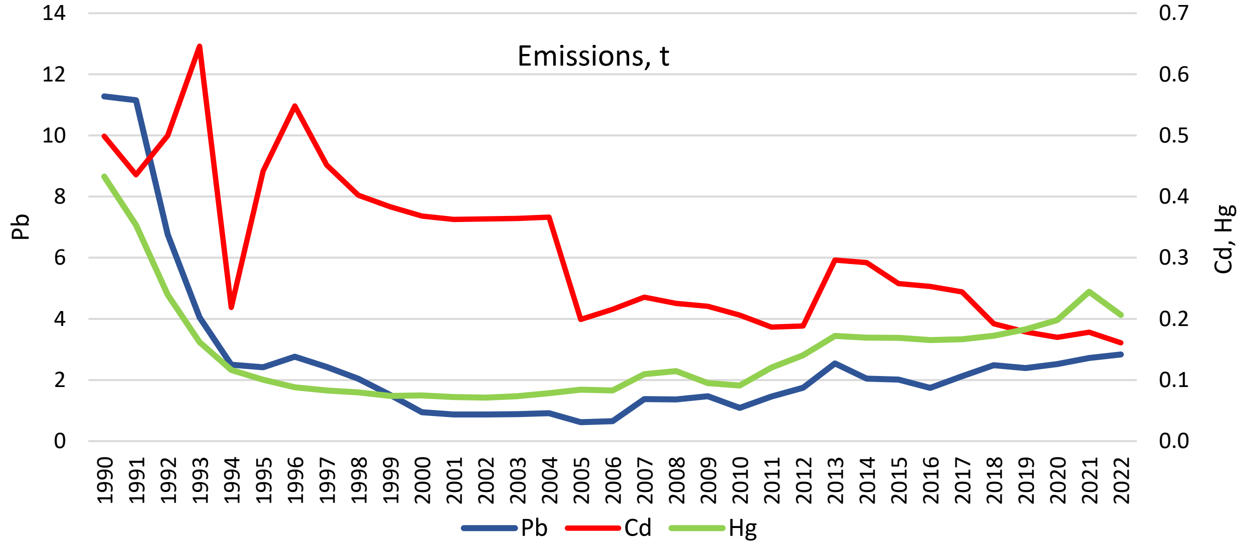

Figure 1.4 Trends of priority heavy metals, 1990-2022

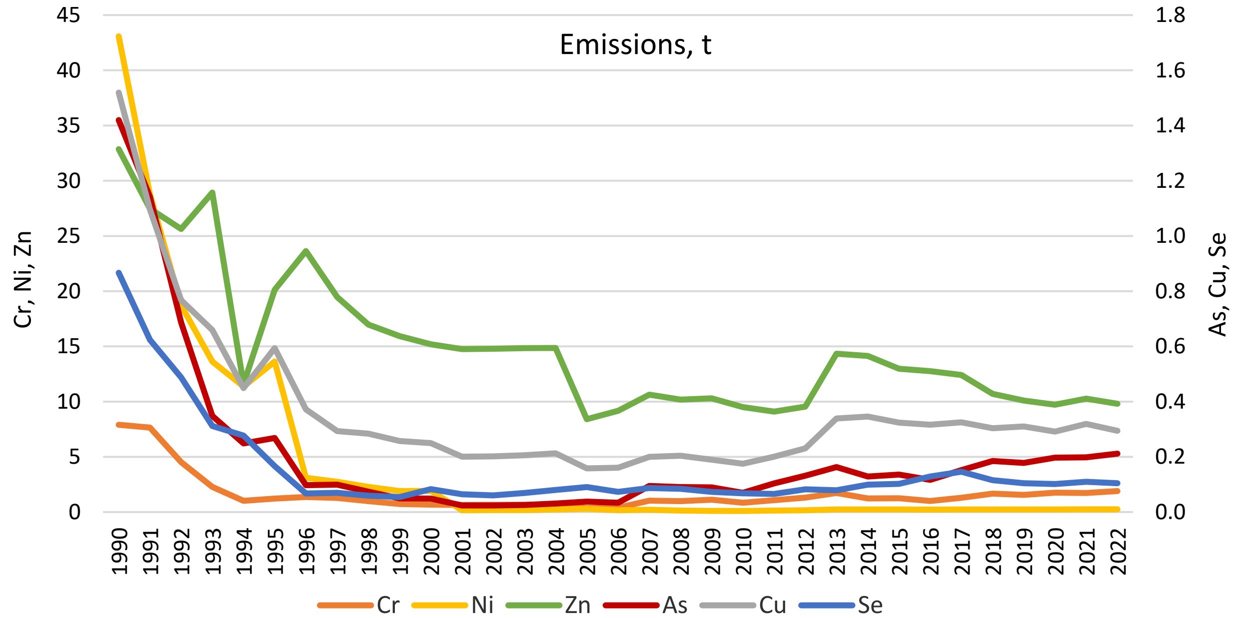

Figure 1.5 Trends of additional heavy metals, 1990-2022

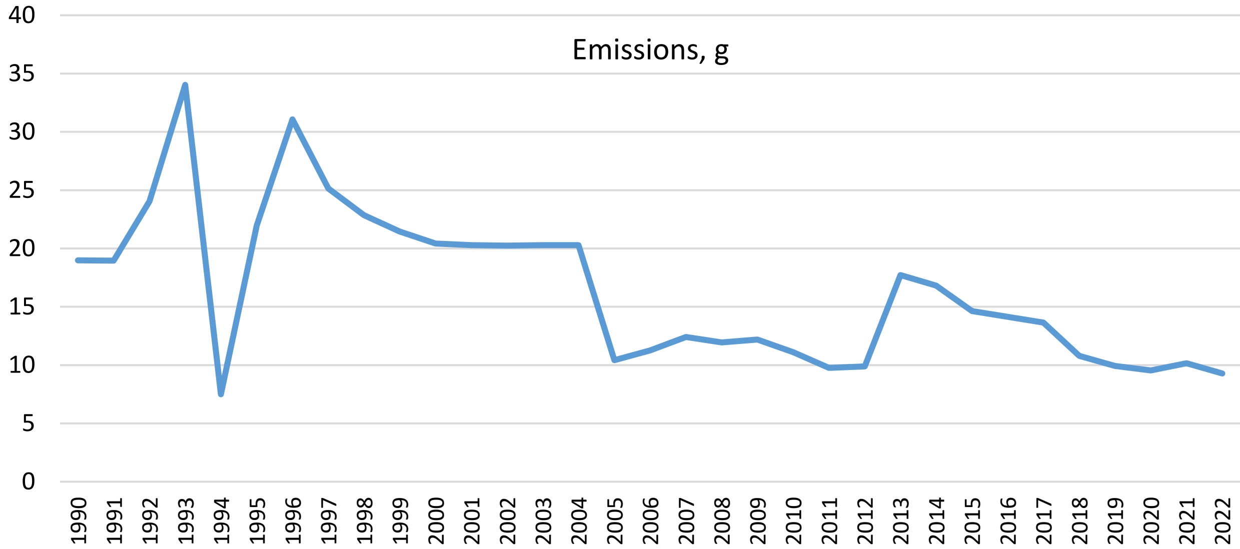

Figure 1.6 Trend of PCDD/ PCDF, 1990-2022

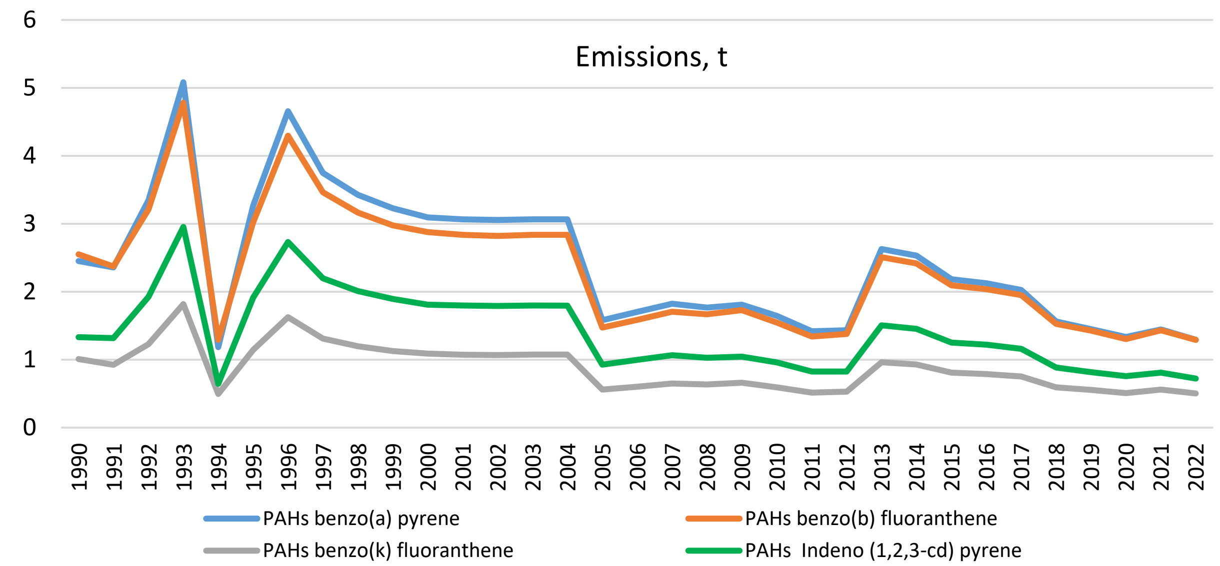

Figure 1.7 Trends of PAHs, 1990-2022

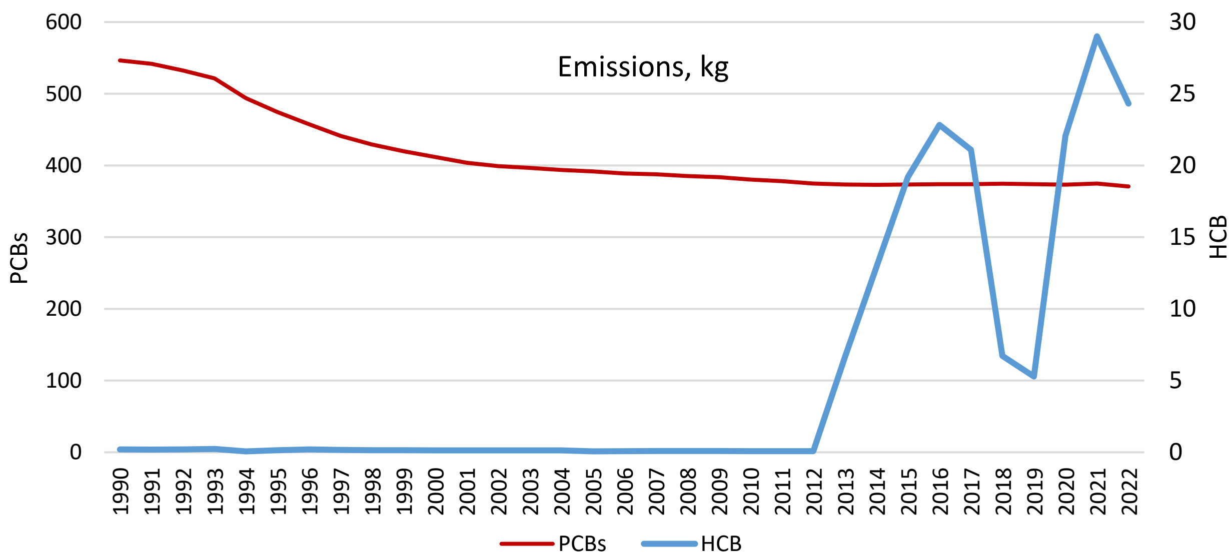

Figure 1.8 Trends of HCB and PCBs, 1990-2022

1. Introduction

1.1. National Inventory Background

Georgia joined the Convention on Long-Range Transboundary Pollution in 1999. Georgia annually provides a national inventory of air pollutants. The following pollutants are covered:

Table 1.1 List of pollutants by sector

Sector	Pollutant / 1990-2022					
Energy	Main Pollutants	PM	CO	Priority Heavy Metals	Additional Heavy Metals	POPs
Industrial Processes and Product Use	Main Pollutants	PM	CO	Priority Heavy Metals	Additional Heavy Metals	POPs
Agriculture	Main Pollutants[1]	PM[2]				
Waste	Main Pollutants	PM	CO	Priority Heavy Metals	Additional Heavy Metals[3]	

1.2. Institutional Arrangements

In Georgia, the Ministry of Environmental Protection and Agriculture (MEPA) is responsible for preparation of the inventory. This task is located within the Ambient Air Division, which collects activity data from the National Statistics Office of Georgia (GEOSTAT), National Environmental Agency (NEA) and various companies. MEPA carries out the emission calculation based on the collected data. Quality checking/control is also carried out by MEPA. MEPA is responsible for reporting emission data to the UNECE as well. The responsibilities for preparing the inventory are described in the following figure.

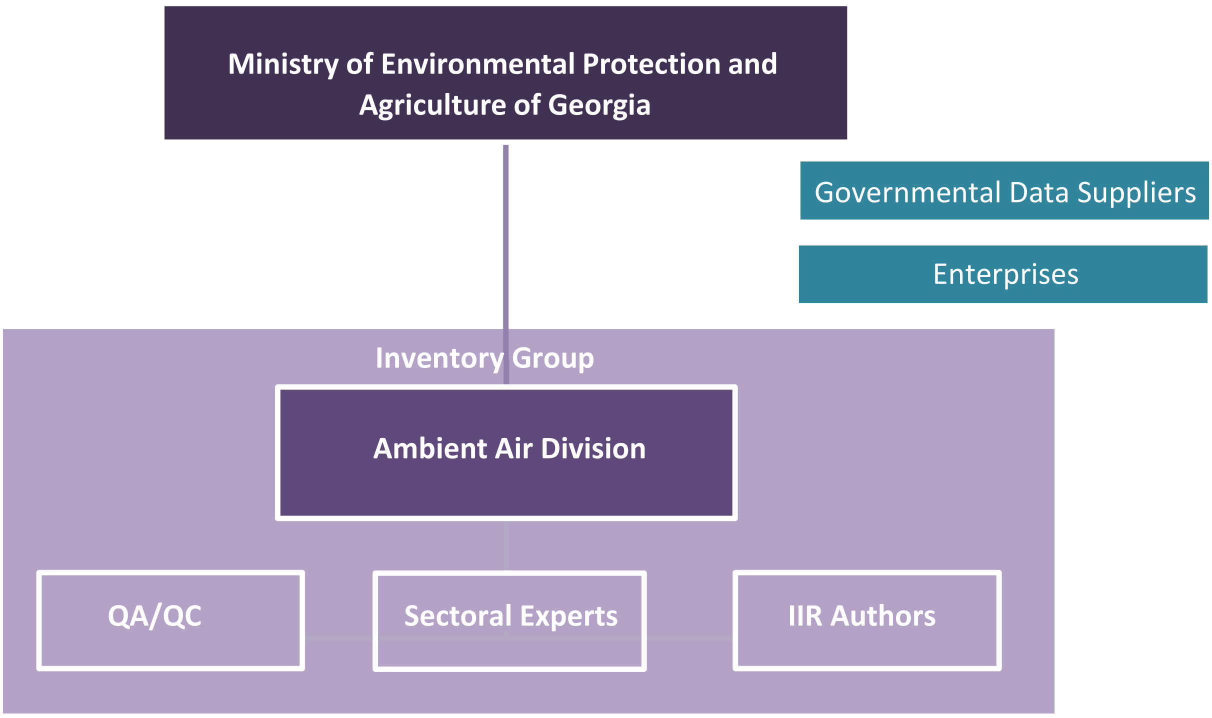

Figure 1.9 Responsibilities for preparing of emission inventory

[1] Except for SOx
[2] Except for BC
[3] Except for Se and Zn

1.3. Inventory preparation process

In the first step of inventory preparation, MEPA obtains data from GEOSTAT and State Registry of Emissions from Stationary Pollution Sources that is managed by the Department of Environmental Assessment of NEA. The same Department provides data on wastewater handling. GEOSTAT on its own collects data from various state institution and companies.

Emissions are calculated based on the standard methods and procedures, such as EMEP/EEA Guidebook, national methodology, country-specific emission factors.

Activity data and emission factors are stored in Excel files. Data is backed-up and archived at MEPA's Ambient Air Division in different computers and virtual server.

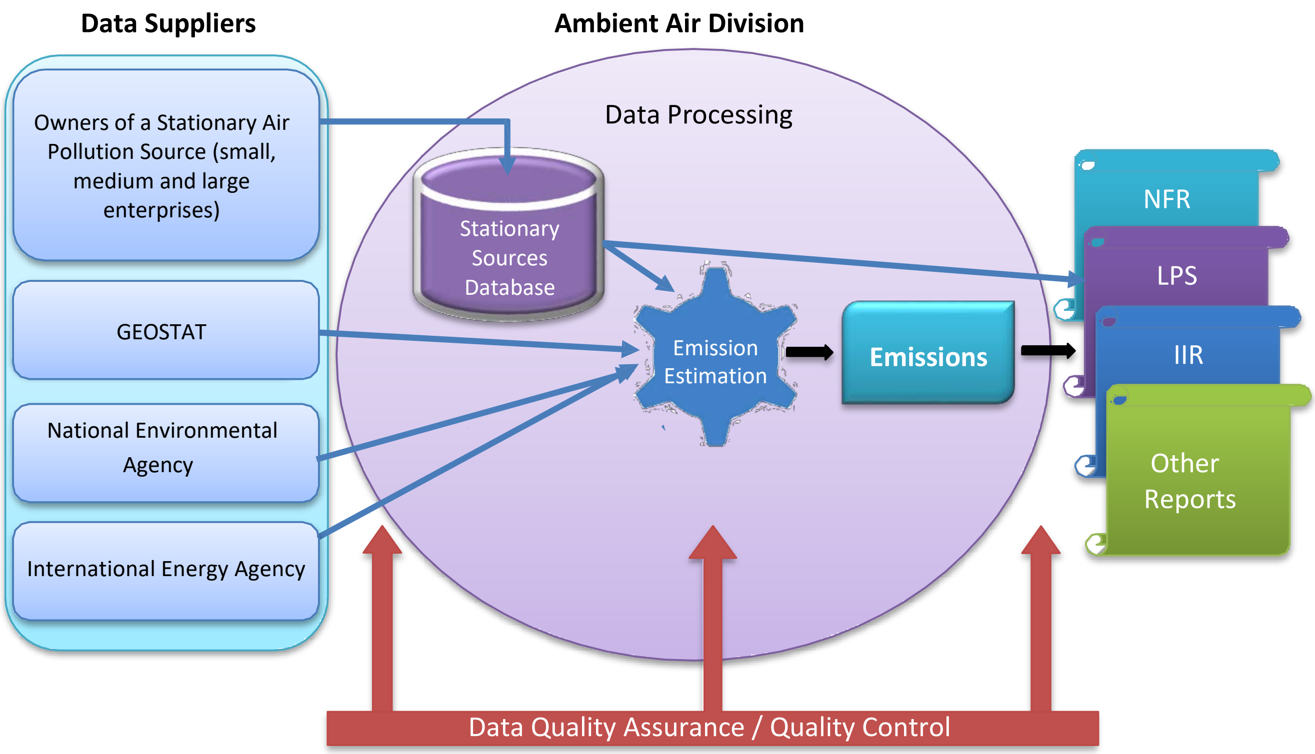

Figure 1.10 Emission inventory structure

1.4. Methods and data sources

Emissions from the Transport and Agriculture sectors are calculated based on Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2023. To estimate emissions from Energy and Industrial sectors Tier 1 and Tier 2 EMEP/EEA methodology were used. For the subcategory 2A6 (concrete and brick production) a national methodology[4] is applied. Emissions from Waste sector Tier 1 EMEP/EEA methodology and plant specific emissions from state reporting system.

1. ENERGY

- 1A1a Tier 1/2 method, EMEP/EEA Guidebook – 2023[5].
- 1A2b, 1A2d, 1A2e, 1A2f: Tier 2 method, EMEP/EEA Guidebook - 2023.
- 1A3b (i-vi), 1A3c and 1A3dii: Tier 1 method, EMEP/EEA Guidebook – 2023.
- 1A2a, 1A4ai[6], 1A4bi, 1A4ci, 1A4cii, 1B1a, 1B1b, 1B2ai, 1B2aiv, 1B2av, 1B2b, 1B2c: Tier 1 method, EMEP/EEA Guidebook – 2023.

2. INDUSTRIAL PROCESSES AND PRODUCT USE

- 2A1, 2A2, 2A3, 2A5a, 2B1, 2B2, 2C1, 2C2, 2D3a, 2D3b, 2D3d[7], 2H1, 2I, 2K: Tier 1 method, EMEP/EEA Guidebook - 2023.
- 2A6: National Methodology for emission calculation from concrete and brick production.
- 2B10a, 2C3, 2C5, 2H2: Tier 2 method, EMEP/EEA Guidebook - 2023.

3. AGRICULTURE

- 3B1a, 3B1b, 3B2, 3B3, 3B4a, 3B4d, 3B4e, 3B4gi, 3B4gii, 3B4giii, 3B4giv, 3Da1, 3Da2a[8], 3Da3, 3Dc, 3De: Tier 1 method, EMEP/EEA Guidebook-2023.

4. WASTE

- 5A, 5D1, 5D2: Tier 1 method, EMEP/EEA Guidebook - 2023.
- 5C1bi, 5C1biii: Tier 1 and 3 (plant specific emissions from state reporting system) method, EMEP/EEA Guidebook - 2023.

Data sources for the inventory mainly comes from GEOSTAT. Data on fuel consumption in 1990-2018 was obtained from International Energy Agency. State Registry of Emissions from Stationary Pollution Sources, which is managed and verified by the Department of Environmental Assessment of NEA, provides information on industrial activity in certain economic sectors. NEA also provides data on wastewater handling. Data on CH_4 emissions from solid waste disposal on land were obtained from Georgia's Biennial Update Reports to the UNFCCC.

1.5. Key categories

This chapter presents the results of key sources analyses.

It is good practice for each country to identify its national key categories in a systematic and objective way. This can be achieved by a quantitative analysis of the relationship between the magnitude of emissions in any one year (level) and the change in the emissions year to year (trend) of each category's emissions compared to the total national emissions.

[4] N435 Order of the Government on instrumental method for determination of actual amounts of emissions into ambient air from stationary pollution source, standard list of emission measuring equipment, and methodology for calculation of actual amounts of emissions into ambient air from stationary pollution source according to technological processes (31/12/13)
[5] Only Tier 2 methods are applied for emissions since 2012
[6] Tier 2 methods are applied for Ni
[7] 1990-2008 have not been estimated due to lack of statistic data
[8] 1990-2013 have not been estimated due to lack of statistic data

Key sources analysis is prepared based on methodology described in Chapter A.2 of the EMEP/EEA air pollutant emission inventory Guidebook 2023. The methodology covers Approaches 1 and 2 for both level and trend assessment. Both approaches identify key categories in terms of their contribution to the absolute level of the national emissions.

For identification of the key categories for level and trend assessment, approach 1 has been selected. In approach 1 the key categories are identified using a predetermined cumulative emissions threshold. Key categories are those which, when summed together in descending order of magnitude, cumulatively add up to 80% of the total level.

Level assessment

The contribution of each source category to the total national inventory level is calculated according to equation (1) (level assessment (Approach 1)):

Key category level assessment = source category estimate / total contribution

$L_{x,t} = E_{x,t} / \sum E_t$

Where:

$L_{x,t}$ = level assessment for source x in latest inventory year (year Gg)

$E_{x,t}$ = value of emission estimate of source category x in year Gg

$\sum E_t$ = total contribution, which is the sum of the emissions in year Gg, calculated using the aggregation level chosen by the country for key category analysis.

Key categories according to equation (1) are those that, when summed together in descending order of magnitude, add up to 80 % of the sum of all $L_{x,t}$. Tables 1.2 - 1.26 present the source category, sorted by largest contribution to national total.

Trend assessment

The purpose of the trend assessment is to identify categories that may not be large enough to be identified by the level assessment, but whose trend contributes significantly to the trend of the overall inventory, and should therefore receive particular attention. The trend assessment is calculated according to equation (2) (level assessment (Approach 1)):

$T_{x,} = (E_{x,} - E_{x,0})/(\sum i\ E_{i,t} - \sum i\ E_{i,0})$

Where:

$T_{x,}$ = trend assessment of source category x in year t as compared to

the base year (year 0) or starting year of the inventory

$E_{x,} - E_{x,0}$ = values of estimates of source category x in year t and 0 respectively

$\sum i\ E_{i,} - \sum i\ E_{i,0}$ = sum of emissions across all n source categories (i = 1, …x, n) (total inventory estimates) in years t and 0, respectively

The trend of a category refers to the change in the source category emissions over time. It is computed as an absolute value for the source category x by subtracting value of the base year, or the starting year (year 0), estimate for source category x from the latest inventory year (year t) estimate and dividing by the overall difference between the target year (year t) and the base year (year 0) total inventories (the inventory trend). The percentage contribution from category x for year t to the trend is then calculated by dividing Tx, by the sum of the trend assessment of all categories of the inventory.

The trend assessment then sorts categories by magnitude (highest to lowest) of their contribution to the trend, regardless of whether category trend is increasing or decreasing. Categories whose cumulative percentage contribution is greater than 80% should be identified as key. The results of trend assessment are given in second sub-tables in Tables 1.2 - 1.26.

Table 1.2 Key categories for NOx emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A3biii	Road transport: Heavy duty vehicles and buses	11.270	28.7%	28.7%
1A3bi	Road transport: Passenger cars	7.487	19.0%	47.7%
2B2	Nitric acid production	4.198	10.7%	58.4%
3Da2a	Animal manure applied to soils	3.433	8.7%	67.1%
1A4bi	Residential: Stationary	2.871	7.3%	74.4%
3Da1	Inorganic N-fertilizers (includes also urea application)	2.607	6.6%	81.1%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A1a	Public electricity and heat production	27.68	1.275	0.642	43.7%	43.7%
1A3bi	Road transport: Passenger cars	5.68	7.487	0.222	15.1%	58.8%
1A3biii	Road transport: Heavy duty vehicles and buses	13.02	11.270	0.221	15.0%	73.8%
1A4ai	Commercial/institutional: Stationary	3.46	0.688	0.054	3.7%	77.5%
1A3c	Railways	1.89	0.068	0.045	3.1%	80.6%

Table 1.3 Key categories for NMVOC emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A3bi	Road transport: Passenger cars	8.070	19.4%	19.4%
1A4bi	Residential: Stationary	5.275	12.7%	32.0%
2D3d	Coating applications	4.923	11.8%	43.8%
2D3a	Domestic solvent use including fungicides	4.426	10.6%	54.4%
2H2	Food and beverages industry	3.860	9.3%	63.7%
3B1a	Manure management - Dairy cattle	3.471	8.3%	72.0%
1A3bv	Road transport: Gasoline evaporation	2.773	6.7%	78.7%
1B2av	Distribution of oil products	2.751	6.6%	85.3%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A3bi	Road transport: Passenger cars	6.45	8.070	0.129	19.7%	19.7%
2H2	Food and beverages industry	10.03	3.860	0.105	16.0%	35.7%

1A3bv	Road transport: Gasoline evaporation	1.00	2.773	0.073	11.2%	46.9%
2D3d	Coating applications	4.47	4.923	0.066	10.0%	56.9%
1B1a	Fugitive emission from solid fuels: Coal mining and handling	2.09	0.117	0.046	7.0%	63.9%
1B2av	Distribution of oil products	2.74	0.9	0.031	4.7%	68.6%
3B4gii	Manure management - Broilers	2.97	1.1	0.029	4.4%	73.1%
1A4bi	Residential: Stationary	8.92	15.1	0.029	4.4%	77.4%
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	1.70	0.8	0.027	4.1%	81.5%

Table 1.4 Key categories for SOx emissions for the year 2022

Level Assessment				
NFR Category Code	**NFR Category**	**Latest Year (2022) Estimate [Gg] $E_{x,t}$**	**Level Assessment $L_{x,t}$**	**Cumulative Total of $L_{x,t}$**
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	4.333	78.6%	78.6%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.633	11.5%	90.1%

Trend Assessment						
NFR Category Code	**NFR Category**	**Base Year (1990) Estimate [Gg] $E_{x,0}$**	**Latest Year (2022) Estimate [Gg] $E_{x,t}$**	**Trend Assessment $L_{x,t}$**	**% Contribution to the trend**	**Cumulative Total of $L_{x,t}$**
1A1a	Public electricity and heat production	82.04	0.007	14.867	44.7%	44.7%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	7.55	4.333	13.613	40.9%	85.6%

Table 1.5 Key categories for NH_3 emissions for the year 2022

Level Assessment				
NFR Category Code	**NFR Category**	**Latest Year (2022) Estimate [Gg] $E_{x,t}$**	**Level Assessment $L_{x,t}$**	**Cumulative Total of $L_{x,t}$**
3B1a	Manure management - Dairy cattle	8.605	24.8%	24.8%
3Da2a	Animal manure applied to soils	8.086	23.3%	48.0%
3Da3	Urine and dung deposited by grazing animals	3.980	11.5%	59.5%
3Da1	Inorganic N-fertilizers (includes also urea application)	3.715	10.7%	70.2%
3B1b	Manure management - Non-dairy cattle	3.243	9.3%	79.5%
5D1	Domestic wastewater handling	2.893	8.3%	87.8%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
3B3	Manure management - Swine	4.87	0.734	0.109	33.6%	33.6%
3B1a	Manure management - Dairy cattle	10.51	8.605	0.062	19.1%	52.7%
3B4gii	Manure management - Broilers	4.90	2.046	0.054	16.7%	69.5%
3Da2a	Animal manure applied to soils	13.15	8.086	0.036	11.0%	80.5%

Table 1.6 Key categories for PM2.5 emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	6.452	77.5%	77.5%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.521	6.3%	83.7%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A1a	Public electricity and heat production	5.33	0.005	0.639	42.4%	42.4%
1A4bi	Residential: Stationary	10.86	6.452	0.545	36.2%	78.6%
2C2	Ferroalloy's production	0.04	0.219	0.058	3.8%	82.4%

Table 1.7 Key categories for PM10 emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	6.625	59.9%	59.9%
2A5a	Quarrying and mining of minerals other than coal	0.868	7.8%	67.7%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.564	5.1%	72.8%
2A2	Lime production	0.458	4.1%	77.0%
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	0.336	3.0%	80.0%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$

1A1a	Public electricity and heat production	3.85	0.004	0.304	35.0%	35.0%
1A4bi	Residential: Stationary	11.15	7.499	0.197	22.6%	57.6%
2C2	Ferroalloy's production	1.32	0.999	0.039	4.5%	62.1%
1A3bvi	Road transport: Automobile tyre and brake wear	1.09	0.330	0.039	4.5%	66.6%
2A2	Lime production	0.06	0.303	0.039	4.5%	71.0%
2A5a	Quarrying and mining of minerals other than coal	0.44	0.1	0.034	3.9%	74.9%
1A4ai	Commercial/institutional: Stationary	0.15	0.1	0.033	3.8%	78.7%

Table 1.8 Key categories for TSP emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	6.970	35.0%	35.0%
2A6	Other mineral products (please specify in the IIR)	3.859	19.4%	54.3%
2A5a	Quarrying and mining of minerals other than coal	1.770	8.9%	63.2%
2A2	Lime production	1.121	5.6%	68.8%
3B4gii	Manure management - Broilers	1.013	5.1%	73.9%
2D3b	Road paving with asphalt	0.675	3.4%	77.3%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.598	3.0%	80.3%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
2A6	Other mineral products (please specify in the IIR)	1.94	3.859	0.214	28.4%	28.4%
1A1a	Public electricity and heat production	3.01	0.005	0.150	20.0%	48.4%
2I	Wood processing	1.32	0.201	0.050	6.7%	55.1%
3B4gii	Manure mangement - Broilers	2.50	1.013	0.044	5.8%	60.9%
2A2	Lime production	1.09	1.121	0.036	4.8%	65.7%
3B3	Manure management - Swine	0.78	0.4	0.029	3.9%	69.6%
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	1.09	1.0	0.028	3.7%	73.3%
1A4bi	Residential: Stationary	11.74	20.1	0.027	3.6%	76.9%
2C2	Ferroalloy's production	0.07	0.0	0.026	3.4%	80.3%

Table 1.9 Key categories for BC emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	0.643	64.8%	64.8%
1A3biii	Road transport: Heavy duty vehicles and buses	0.168	17.0%	81.7%

Trend Assessment						
NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A1a	Public electricity and heat production	0.16	0.000	0.163	20.9%	20.9%
1A4bi	Residential: Stationary	1.08	0.643	0.146	18.7%	39.6%
1A4ai	Commercial/institutional: Stationary	0.15	0.003	0.145	18.6%	58.1%
1A3biii	Road transport: Heavy duty vehicles and buses	0.19	0.168	0.127	16.2%	74.3%
1A3bii	Road transport: Light duty vehicles	0.10	0.085	0.064	8.1%	82.4%

Table 1.10 Key categories for CO emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A3bi	Road transport: Passenger cars	63.704	57.0%	57.0%
1A4bi	Residential: Stationary	35.828	32.1%	89.1%

Trend Assessment						
NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A3bi	Road transport: Passenger cars	53.59	63.704	0.232	47.5%	47.5%
1A4bi	Residential: Stationary	61.16	35.828	0.147	30.1%	77.6%
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	4.75	1.077	0.031	6.2%	83.9%

Table 1.11 Key categories for Pb emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
2C1	Iron and steel production	1.582	55.8%	55.8%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.645	22.8%	78.6%
1A4bi	Residential: Stationary	0.234	8.3%	86.8%

Trend Assessment						
NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	1.12	0.645	0.512	29.3%	29.3%
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	0.97	0.021	0.315	18.0%	47.3%
1A1a	Public electricity and heat production	0.79	0.000	0.278	15.9%	63.2%
1A4bi	Residential: Stationary	0.44	0.234	0.172	9.8%	73.0%
2C1	Iron and steel production	6.75	1.582	0.160	9.1%	82.1%

Table 1.12 Key categories for Cd emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	0.112	69.8%	69.8%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.010	6.2%	76.0%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.009	5.4%	81.4%

Trend Assessment						
NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A1a	Public electricity and heat production	0.20	0.000	1.232	44.4%	44.4%
1A4bi	Residential: Stationary	0.19	0.112	1.003	36.2%	80.6%

Table 1.13 Key categories for Hg emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.061	29.4%	29.4%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.039	18.7%	48.1%
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	0.037	17.9%	66.0%
2C1	Iron and steel production	0.034	16.7%	82.7%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.04	0.061	0.405	30.3%	30.3%
2C1	Iron and steel production	0.15	0.034	0.361	27.0%	57.2%
1A1a	Public electricity and heat production	0.08	0.003	0.351	26.2%	83.5%

Table 1.14 Key categories for As emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
2C1	Iron and steel production	0.138	65.0%	65.0%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.033	15.5%	80.6%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A1a	Public electricity and heat production	0.71	0.003	3.241	49.7%	49.7%
2C1	Iron and steel production	0.59	0.138	1.591	24.4%	74.2%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.02	0.033	0.931	14.3%	88.4%

Table 1.15 Key categories for Cr emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
2C1	Iron and steel production	1.547	81.1%	81.1%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	0.34	0.199	0.256	29.1%	29.1%
1A1a	Public electricity and heat production	0.44	0.000	0.233	26.5%	55.7%
2C1	Iron and steel production	6.60	1.547	0.100	11.3%	67.0%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.04	0.051	0.091	10.4%	77.4%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.11	0.065	0.082	9.3%	86.7%

Table 1.16 Key categories for Cu emissions for the year 2022

Level Assessment				
NFR Category Code	**NFR Category**	**Latest Year (2022) Estimate [Gg] $E_{x,t}$**	**Level Assessment $L_{x,t}$**	**Cumulative Total of $L_{x,t}$**
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.084	28.6%	28.6%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.080	27.2%	55.8%
1A4bi	Residential: Stationary	0.052	17.6%	73.5%
1A3bi	Road transport: Passenger cars	0.031	10.5%	83.9%

Trend Assessment						
NFR Category Code	**NFR Category**	**Base Year (1990) Estimate [Gg] $E_{x,0}$**	**Latest Year (2022) Estimate [Gg] $E_{x,t}$**	**Trend Assessment $L_{x,t}$**	**% Contribution to the trend**	**Cumulative Total of $L_{x,t}$**
1A1a	Public electricity and heat production	0.91	0.000	3.092	44.8%	44.8%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.06	0.080	1.208	17.5%	62.3%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.15	0.084	0.979	14.2%	76.5%
1A4bi	Residential: Stationary	0.10	0.052	0.582	8.4%	85.0%

Table 1.17 Key categories for Ni emissions for the year 2022

Level Assessment				
NFR Category Code	**NFR Category**	**Latest Year (2022) Estimate [Gg] $E_{x,t}$**	**Level Assessment $L_{x,t}$**	**Cumulative Total of $L_{x,t}$**
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.063	25.5%	25.5%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.061	24.7%	50.2%
2C1	Iron and steel production	0.048	19.6%	69.8%
2A3	Glass production	0.031	12.6%	82.4%

Trend Assessment						
NFR Category Code	**NFR Category**	**Base Year (1990) Estimate [Gg] $E_{x,0}$**	**Latest Year (2022) Estimate [Gg] $E_{x,t}$**	**Trend Assessment $L_{x,t}$**	**% Contribution to the trend**	**Cumulative Total of $L_{x,t}$**
1A1a	Public electricity and heat production	39.90	0.000	162.395	47.1%	47.1%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.11	0.063	44.227	12.8%	59.9%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.04	0.061	43.165	12.5%	72.4%

2C1	Iron and steel production	0.21	0.048	33.521	9.7%	82.1%

Table 1.18 Key categories for Se emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
2A3	Glass production	0.050	48.4%	48.4%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.031	30.1%	78.5%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.009	8.4%	86.9%

Trend Assessment						
NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A1a	Public electricity and heat production	0.56	0.000	5.355	48.0%	48.0%
2A3	Glass production	0.16	0.050	2.490	22.3%	70.3%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	0.02	0.031	2.287	20.5%	90.8%

Table 1.19 Key categories for Zn emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	4.424	45.1%	45.1%
1A3bi	Road transport: Passenger cars	1.623	16.6%	61.7%
2C1	Iron and steel production	1.375	14.0%	75.7%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.964	9.8%	85.5%

Trend Assessment						
NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A1a	Public electricity and heat production	13.92	0.000	1.420	43.3%	43.3%
1A4bi	Residential: Stationary	7.44	4.424	0.754	23.0%	66.3%
1A3bi	Road transport: Passenger cars	1.37	1.623	0.415	12.7%	78.9%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	1.70	0.964	0.156	4.8%	83.7%

Table 1.20 Key categories for PCDD/ PCDF emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	6.988	75.3%	75.3%
2C1	Iron and steel production	1.032	11.1%	86.4%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	11.94	6.988	0.252	44.5%	44.5%
2C1	Iron and steel production	4.40	1.032	0.247	43.5%	87.9%

Table 1.21 Key categories for benzo(a)pyrene emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	1.046	80.9%	80.9%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	1.83	1.046	0.115	61.9%	61.9%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.38	0.220	0.027	14.8%	76.8%
1A4ai	Commercial/institutional: Stationary	0.03	0.001	0.025	13.7%	90.4%

Table 1.22 Key categories for benzo(b)fluoranthene emissions for the year 2022

Level Assessment

NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	0.960	74.4%	74.4%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.287	22.2%	96.6%

Trend Assessment

NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	1.73	0.960	0.127	52.8%	52.8%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.51	0.287	0.047	19.7%	72.4%

1A4ai	Commercial/institutional: Stationary	0.05	0.001	0.035	14.6%	87.1%

Table 1.23 Key categories for benzo(k)fluoranthene emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	0.363	72.1%	72.1%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.115	22.9%	95.0%

Trend Assessment						
NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	0.66	0.363	0.136	49.1%	49.1%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.20	0.115	0.062	22.6%	71.8%
1A4ai	Commercial/institutional: Stationary	0.02	0.000	0.033	12.1%	83.9%

Table 1.24 Key categories for Indeno(1,2,3-cd)pyrene emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	0.614	85.0%	85.0%

Trend Assessment						
NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$
1A4bi	Residential: Stationary	1.07	0.614	0.090	62.8%	62.8%
1A4ai	Commercial/institutional: Stationary	0.01	0.000	0.018	12.8%	75.6%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.16	0.090	0.014	9.7%	85.3%

Table 1.25 Key categories for HCB emissions for the year 2022

Level Assessment				
NFR Category Code	NFR Category	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Level Assessment $L_{x,t}$	Cumulative Total of $L_{x,t}$
2C3	Aluminum production	24.246	99.7%	99.7%

Trend Assessment						
NFR Category Code	NFR Category	Base Year (1990) Estimate [Gg] $E_{x,0}$	Latest Year (2022) Estimate [Gg] $E_{x,t}$	Trend Assessment $L_{x,t}$	% Contribution to the trend	Cumulative Total of $L_{x,t}$

1A4bi	Residential: Stationary	0.07	0.043	0.003	53.8%	53.8%
2C1	Iron and steel production	0.04	0.010	0.002	33.0%	86.8%

Table 1.26 Key categories for PCB emissions for the year 2022

Level Assessment				
NFR Category Code	**NFR Category**	**Latest Year (2022) Estimate [Gg] $E_{x,t}$**	**Level Assessment $L_{x,t}$**	**Cumulative Total of $L_{x,t}$**
2K	"Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)"	368.860	99.5%	99.5%

Trend Assessment						
NFR Category Code	**NFR Category**	**Base Year (1990) Estimate [Gg] $E_{x,0}$**	**Latest Year (2022) Estimate [Gg] $E_{x,t}$**	**Trend Assessment $L_{x,t}$**	**% Contribution to the trend**	**Cumulative Total of $L_{x,t}$**
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	541.00	368.860	0.007	48.3%	48.3%
2C1	Iron and steel production	3.67	0.860	0.006	42.6%	90.9%

1.6. QA/QC and verification methods

The following quality control measures are carried out:

Check for transcription errors and data comparison

For point sources, the first check is made during the approval of the submitted annual reports, and then in process of the data analysis. Statistical data is compared to data available from previous years. In case of discrepancies, data from other sources (e.g. from companies) are used. If the data available to the Ministry shows higher levels than the statistical data, the levels available to the Ministry are used. In order to trace inventory estimates back through the calculations to the source data, data providers and used methodology inventory process is documented by compilers.

Check of calculated emissions

A staff member who did not make a specific calculation checks the colleague's approach and results. All results are compared to the values of previous years.

Review of methods and emission factors

Emission factors are updated when new EMEP/EEA-Guidebooks are published. For example, emission factors were updated in a given submission after the publication of new – 2023 Guidebook. The national methodology is also updated continuously.

1.7. General assessment of completeness

List of notation keys

In the following table, notation keys are listed (as defined in the updated guidelines for reporting emissions and projection data under CLRTAP (ECE/EB.AIR/150/Add.1):

(a) "NE" (not estimated), for activity data and/or emissions by sources of pollutants which have not been estimated but for which a corresponding activity may occur within a Party. Where NE is used in an inventory to report emissions of pollutants, the Party should indicate why such emissions have not been estimated;

(b) "IE" (included elsewhere), for emissions by sources of pollutants estimated but included elsewhere in the inventory instead of under the expected source category. Where IE is used in an inventory, the Party should indicate where in the inventory the emissions for the displaced source category have been included, and the Party should explain such a deviation from the inclusion under the expected category;

(c) "C" (confidential information), for emissions by sources of pollutants of which the reporting could lead to the disclosure of confidential information. The source category where these emissions are included should be indicated;

(d) "NA" (not applicable), for activities under a given source category that do occur within the Party but do not result in emissions of a specific pollutant;

(e) "NO" (not occurring), for categories or processes within a particular source category that do not occur within a Party or are so small that they are considered insignificant;

(f) “NR” (not relevant). According to paragraph 38 in the Guidelines, emission inventory reporting for the main pollutants should cover all years from 1990 onwards if data are available. However, NR is introduced to ease the reporting where reporting of emissions is not strictly required by the different protocols, e.g., emissions for some Parties prior to agreed base years.

Sources not estimated

The following categories have not been estimated:
List of important sectors with “NE” and short justification why these sectors have not been estimated.

Table 1.27 Sources not estimated (NE)

NFR14 code	Substance(s)	Reason for not estimated
1A1a	NH_3, PCBs, PCDD/F, HCB	Emission occurs, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
1A2a	NH_3	
1A2b	All except for NOx and SOx	
1A2c	All	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in national methodology
1A2d	NH_3	Emission occurs, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
1A2f	NH_3	
1A3ai(i)	NOx, NMVOC, SOx, PMs CO	Emission occurs, but have not been estimated due to lack of statistic data
1A3aii(i)	NOx, NMVOC, SOx, PMs CO	
1A3bi	Hg, As, PCDD/F, HCB, PCBs	Emissions occur, but have not been estimated due to lack of emission factors in methodology
1A3bii	Hg, As, PCDD/F, HCB, PCBs	
1A3biii	Hg, As, PCDD/F, HCB, PCBs	
1A3biv	All	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in methodology
1A3bv	POPs except for total PAHs	Emissions occur, but have not been estimated due to lack of emission factors in methodology
1A3bvi	HMs, PAHs, HCB, PCBs	
1A3bvii	HMs, PAHs, HCB, PCBs	
1A3c	BC, Pb, Hg, As, PCDD/PCDF, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene	Emission occurs, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
1A3dii	NH_3	
1A3ei	All	Emission occurs, but have not been estimated due to lack of statistic data
1A4aii	All	
1A4bii	All	
1A4cii	Hg, As, PCDD/PCDF, Benzo(k)fluoranthene,	

	Indeno(1,2,3-cd)pyrene, HCB, PCBs	Emission occur, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
1A4ciii	All	
1B1a	BC, HMs	
1B2ai	SOx, PCDD/PCDF	
1B2av	SOx, PCDD/PCDF	
1B2b	SOx, PCDD/PCDF	
1B2c	NH_3, PMs, HMs, PCDD/F, PAHs	
2A1	All except for PMs and PCBs	
2A2	NOx, NMVOC, SOx, CO, Pb, Cd, Hg	
2A3	Main Pollutants, CO, POPs except for PCBs	
2A5b	TSP, $PM_{2.5}$, PM_{10}	Emission occurs, but have not been estimated due to lack of statistic data
2A5c	TSP, $PM_{2.5}$, PM_{10}	
2A6	$PM_{2.5}$, PM_{10}, BC, benzo(a) pyrene	Emission occurs, but have not been estimated due to lack of emission factors in national methodology
2B1	NMVOC, SOx, $PM_{2.5}$	Emission occurs, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
2B2	NH_3, $PM_{2.5}$	
2B10a	All except for NH_3 and TSP	
2C1	NH_3, PAHs except for total	
2C2	Main Pollutants, CO, HMs, PCDD/F, PAHs	
2C3	Main Pollutants, CO, HMs, PAHs	
2C5	NMVOC, NH_3, BC, CO, Hg, Cr, Cu, Ni, Se, PAHs, HCB	
2C7d	TSP, $PM_{2.5}$, PM_{10}	Emission occurs, but have not been estimated due to lack of statistic data
2D3a	TSP, $PM_{2.5}$, PM_{10}	Emission occurs, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
2D3b	NOx, SOx, CO, POPs except for PCBs	
2D3c	NOx, NMVOC, PMs, CO, Pb, Cd, Hg, POPs except for PCBs	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in methodology (EMEP-EEA guidebook – 2023)
2D3e	NMVOC, $PM_{2.5}$	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in methodology (EMEP-EEA guidebook – 2023)
2D3f	NMVOC, $PM_{2.5}$	
2D3g	All	
2D3h	NMVOC, $PM_{2.5}$, BC	
2D3i	All	
2G	All	
2H1	NH_3, PAHs, HCB	Emission occurs, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
2H2	PMs	
2I	Main Pollutants, CO, PM_{10}, $PM_{2.5}$, BC, As, Cu	
2K	HMs except for Hg, HCB	

3B4f	NOx, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	Emission occurs, but have not been estimated due to lack of statistic data
3Da1	$PM_{2.5}$, PM_{10}, TSP	Emission occurs, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
3Da2b	NH_3, NOx	Emission occurs, but have not been estimated due to lack of statistic data
3Da2c	NH_3, NOx	
3Da3	NOx	
3Da4	NH_3, NOx	Emission occurs, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
3Db	NOx	
3De	NH_3	
3Df	HCB	Emission occurs, but have not been estimated due to lack of statistic data
3F	All	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in methodology (EMEP-EEA guidebook – 2023)
3I	NH_3	Emission occurs, but have not been estimated due to lack of statistic data
5A	NH_3, $PM_{2.5}$, PM_{10}, TSP, CO, Hg	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in methodology (EMEP-EEA guidebook – 2023)
5B1	Main Pollutants, PMs, CO	
5C1a	All	Emission occurs, but have not been estimated due to lack of statistic data
5C1bi	NH_3, Cd, Cu, Ni, Se, Zn, POPs except for PCBs	Emission occurs, but have not been estimated due to lack of emission factors in national or international methodology (EMEP-EEA guidebook – 2023)
5C1bii	All except for PCBs	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in methodology (EMEP-EEA guidebook – 2023)
5C1biii	NMVOC, NH_3, $PM_{2.5}$, PM_{10}, Se, Zn, POPs	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in national or international methodology (EMEP-EEA guidebook – 2023)
5C1biv	All	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in national or international methodology (EMEP-EEA guidebook – 2023)
5C2	All except for PCBs	
5D1	PMs, HMs	Emission occurs, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2023)
5D2	NH_3, TSP, PM_{10}, $PM_{2.5}$, HMs	
5E	All	Emission occurs, but have not been estimated due to lack of statistic data and emission factors in methodology (EMEP-EEA guidebook – 2023)

Sources included elsewhere

List of important categories with "IE" and short explanation in which category they are included.

Table 1.27 Sources included elsewhere (IE)

NFR14 code	Substance(s)	Included in NFR code
1A2f	$PM_{2.5}$, PM_{10}, TSP, BC	2A1, 2A2, 2A3 and 2A6

2C1	NOx, SOx, CO	1A2a
2C5	NOx, SOx	1A2a
3B4a	NOx, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	3B1b
3B4gi	NOx, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	3B4gii

2. Explanation of key trends

In Georgia, ambient air pollution is mainly caused by emissions from motor vehicles, the energy, industrial and agriculture sectors. Emission trends for main pollutants are presented in figure 2.1.

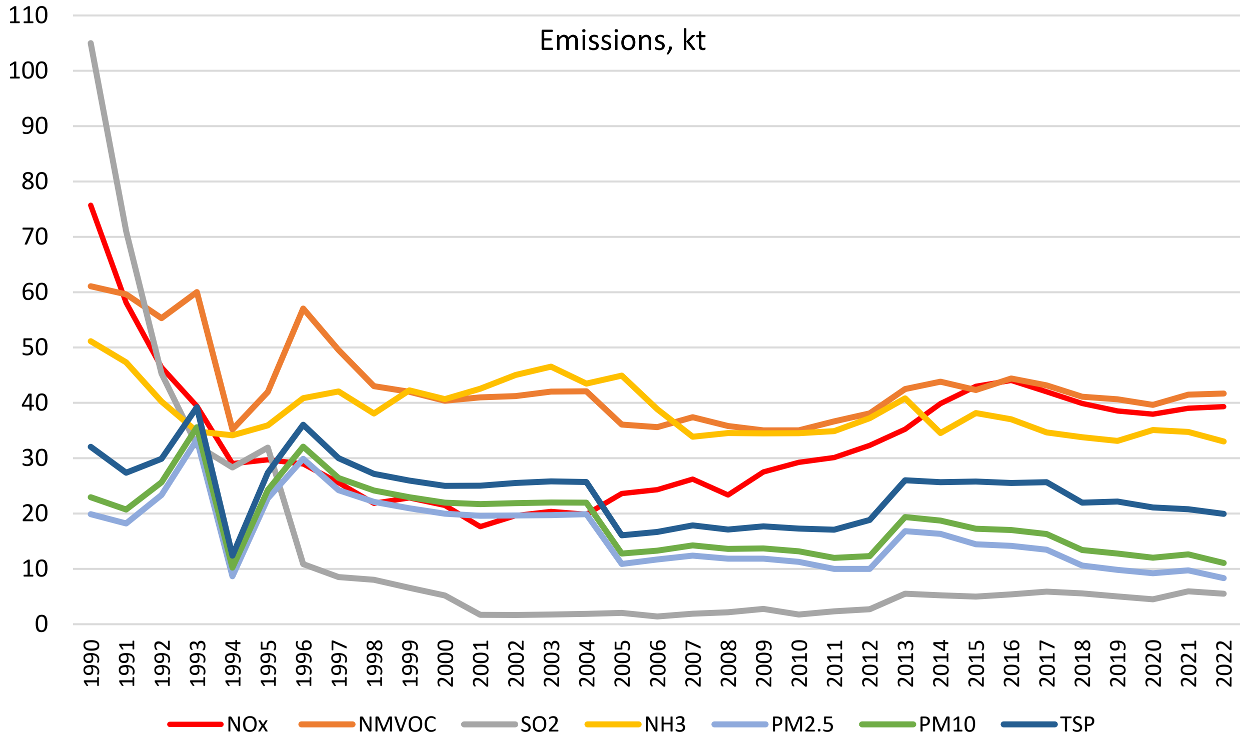

Figure 2.1 Main pollutants, trends over time, 1990-2022.

- The general economic activity decreased in 1990s due to economic crisis caused by dissolution of Soviet Union. Subsequently, emissions of main pollutants declined sharply. Increased economic activity from the middle of 2000s led to increased emissions of most pollutants, but these trends were disproportionate as the latter lagged behind economic trend. The main reason of this was an application of cleaner technologies that abated pollution from various sectors.
- The coronavirus (COVID19) pandemic caused negative economic effects in 2020 that resulted in reduced production and consumption as well as decreased emissions of almost all pollutants. In 2021 economic recovery triggered rising emissions compared to 2020 especially in energy and industrial sectors.
- Intense rise in emissions of NOx from millennium was caused by rapid increase of car fleet in Georgia that remains one of the main sources of nitrogen oxides.
- Sharp rise of emissions of NMVOC in 2013 was caused by introduction of national energy balance that provided slightly different and more precise activity data for residential stationary combustion. Also, the rise in emissions was a result of increased emissions from transport due to rapid expansion of car fleet in Georgia.

- Dramatic rise of SOx emissions in 2013 was caused by increased consumption of coal for iron and steel production. Due to same reason SOx emissions again increased in 2021.
- Trend of NH_3 emissions is mostly dependent on the production in the agricultural sector.
- A sudden growth of particulates emissions in 2013 was caused by launching of national energy balance that provided slightly different and more precise activity data for residential stationary combustion compare to the data of the International Energy Agency, which was used for all previous years. While the reduction trend since 2016 is caused by decreased consumption of firewood in households.

Nitrogen Oxides

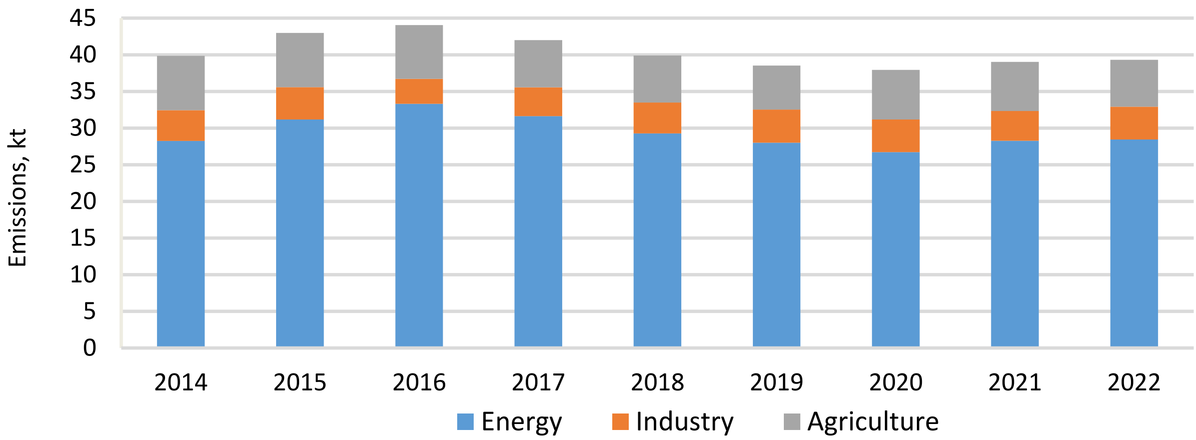

Figure 2.2 Trend of NOx emissions 2014-2022

Energy sector has the biggest share in total NOx emissions (about 72%). Approximately 52% of total NOx emissions and 72% of energy sector emissions comes from transport.

Emissions of NOx from transport had steady decreasing trend in 2016-2020, which was caused by increasing share of new and clean transport types in import of vehicles and in the car fleet as well. The process was supported by increased taxes for the importation of fuel (petrol and diesel) and old cars and by reduction of excise duties for import of cleaner vehicles (electric/hybrid) in 2016-2017. However, in 2021-2022, due to sharp increase of vehicles import in post pandemic period and increased share of old and petrol/diesel engine cars in the import, emissions of NOx were raised by 5.2% compared to 2020. Rising emissions of NOx from transport was counterbalanced by 5.3% reduction in emissions from agriculture. As a result, total emissions of NOx increased slightly (by 3.6%) in 2022 compared to 2020.

Non-methane volatile compounds

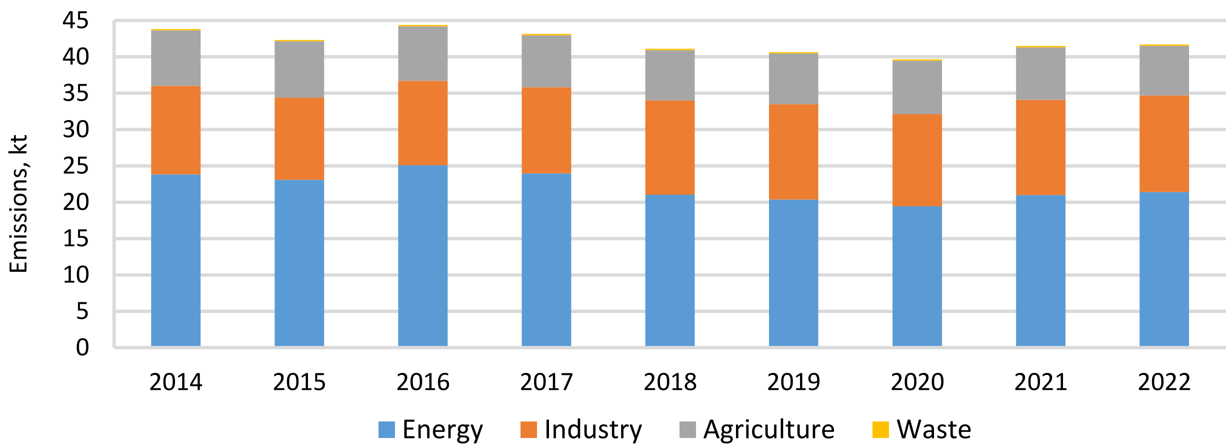

Figure 2.3 Trend of NMVOC emissions 2014-2022

Increased consumption of petrol by passenger cars caused rise in emissions of NMVOC in 2016. In 2016-2020 emissions have decreased stably by 11% due to reduced emissions in energy sector, in particular reduced consumption of biomass by households. However, in 2021-2022, emissions have raised by 5.2% compared to 2020. The reasons of this growth mainly are increased emissions from transport due to expanded car fleet and fuel consumption.

Energy sector is the main source of pollution with NMVOC (about 51%), while road transport within energy sector accounts for 28% of total emissions.

Sulphur Dioxide

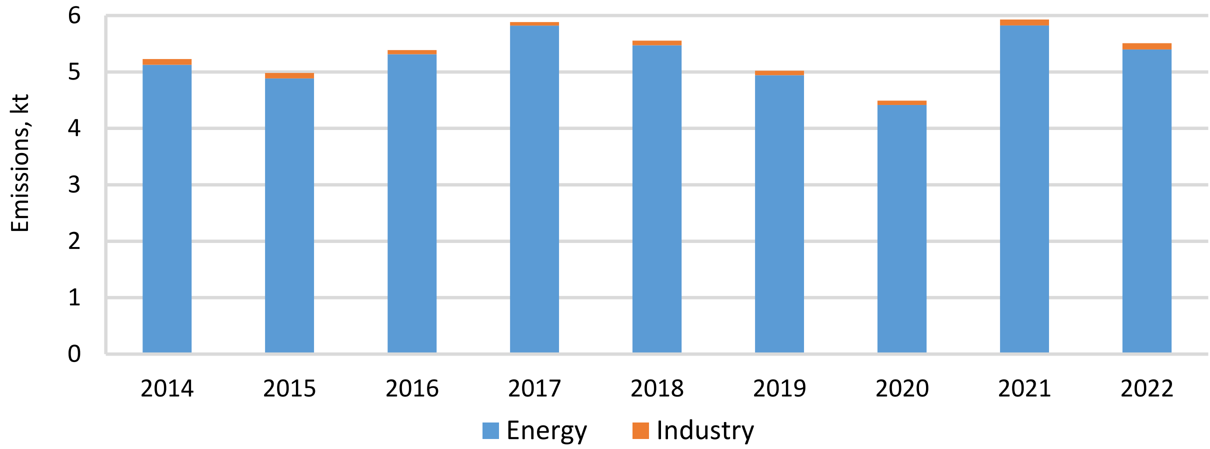

Figure 2.4 Trend of SO_2 emissions 2014-2022

Stationary combustion in manufacturing industries and construction accounted for nearly 93.1% of SOx emissions in 2022.

Significant decrease in 2020 compared to 2017 was caused by diminished and zero consumption of coal for public electricity and heat production (2018-2020), iron and steel (2020), and food production (2020). In 2021 emissions were increased by 32% due to increased consumption of coal in iron and steel production, that was slightly decreased in 2022, resulted in 7% reduction in emissions.

Ammonia

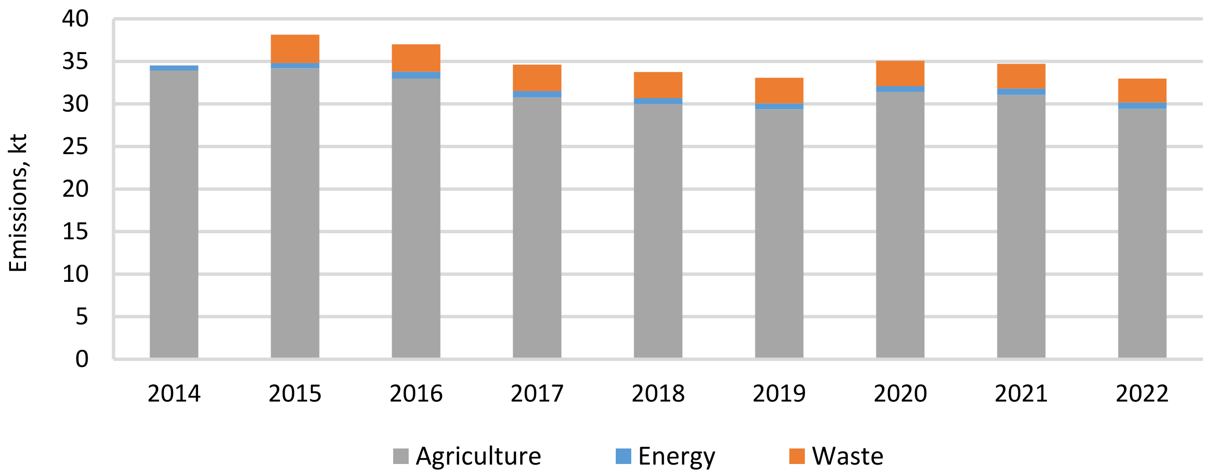

Figure 2.5 Trend of NH_3 emissions 2014-2022

Substantial increase of emissions in 2015 was caused by calculation of NH_3 emissions from domestic wastewater handling which previously was not able due to absence of relevant activity data for past years. Since 2015 NH_3 emissions started decreasing from all sectors and have decreased by 15% in 4-year term. However, emissions from agricultural sector, which accounts for 89% of total NH_3 emissions, increased in 2020 by 5% due to enlarged livestock population size in the sector and slightly decreased in 2022 due to shrinking in population.

Particulates

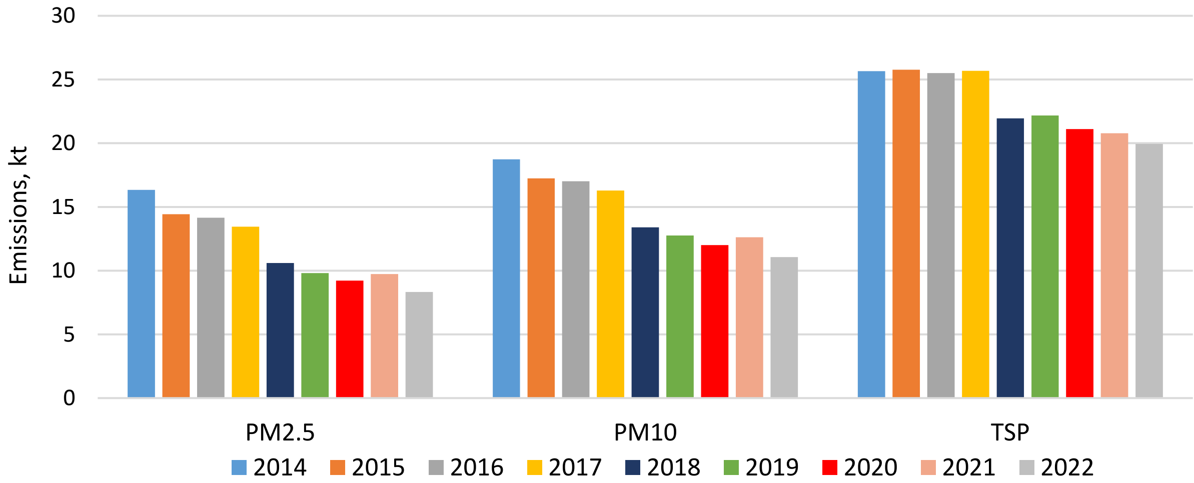

Figure 2.6 Trend of PM2.5, PM10 and TSP emissions 2014-2022

Total emissions of PM2.5 decreased by 49% from 2014 to 2022, PM10 – by 41% and TSP – by 22%. The sharp reduction of particulate matter's emissions since 2014 was mostly achieved by decreasing biomass consumption in households.

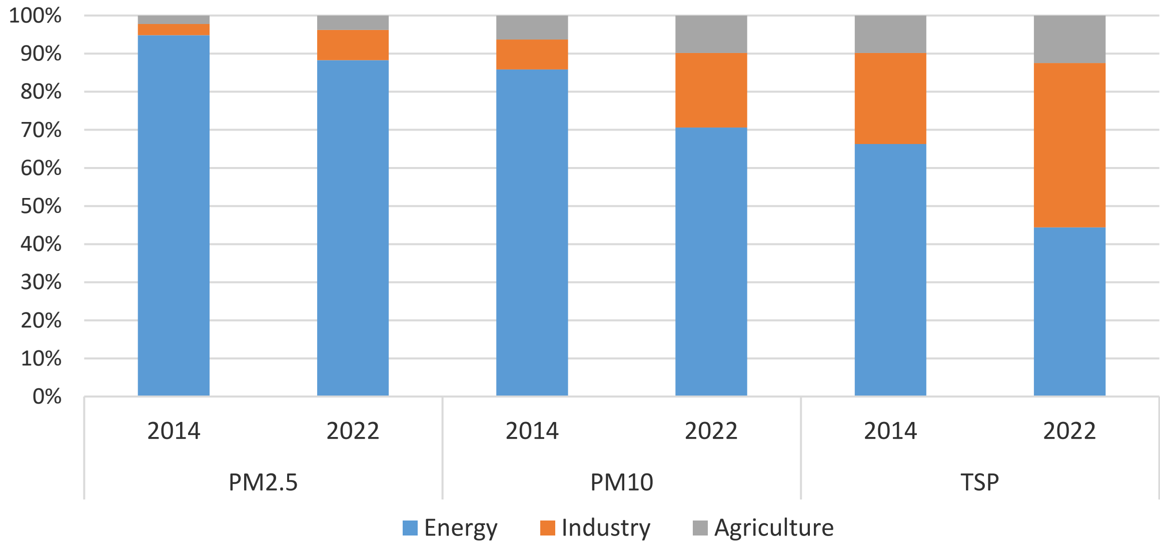

Figure 2.7 Sources of PM2.5, PM10 and TSP emissions in 2014 and 2022

In contrast, PM emissions from industry have rising trend. TSP emissions increased by 40% in 2014-2022 mainly due to increased lime, concrete and asphalt production and quarrying of bigger amount of minerals other than coal.

Energy sector remains as a main source of PM emissions as 88% of PM2.5 emissions, 71% of PM10 emissions and 44% of TSP emissions came from energy sector in 2022. Industry is second biggest polluter responsible for about 8% of PM2.5 emissions, 20% of PM10 emissions and 43% of TSP emissions as of 2022. The share of energy sector in PM emissions decreases year by year due to alteration of solid fuel consumption in residential sector by natural gas, while industry's share increases as a result of increased production and lack of application of modern clean technologies in the sector.

Black Carbon

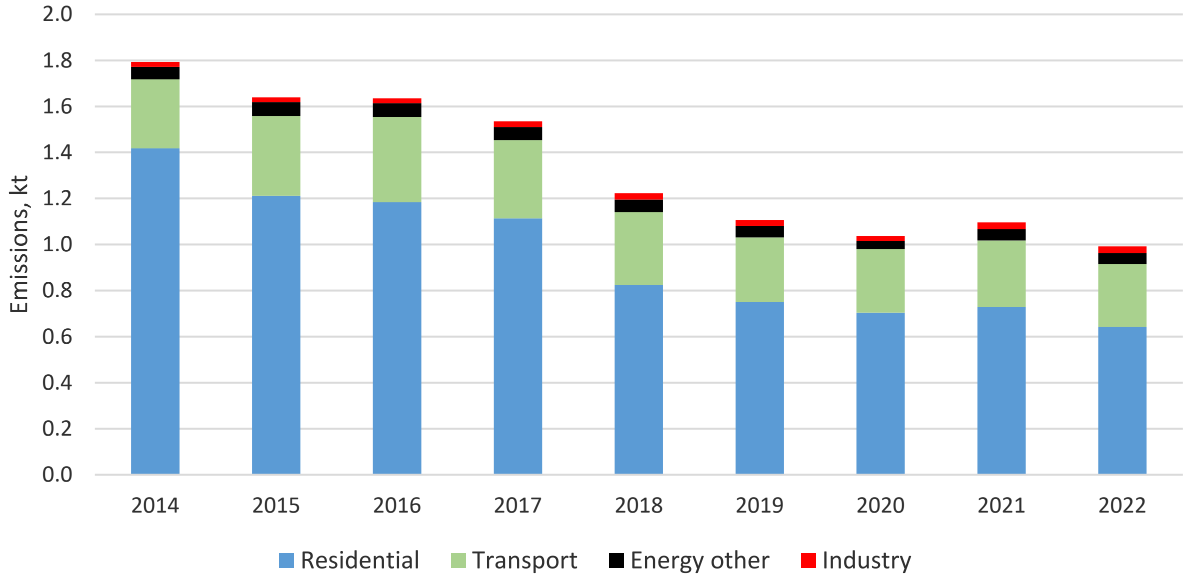

Figure 2.8 Trend of BC emissions 2014-2022

Emissions of BC have decreased since 2014 by 45% due to reduced emissions from residential combustion that is a result of wider application of cleaner energy sources and less consumption of solid fuels by households.

Energy sector is a source for about 97% of BC emissions, while only residential stationary combustion within energy sector is responsible for 65% of total emissions.

Carbon Monoxide

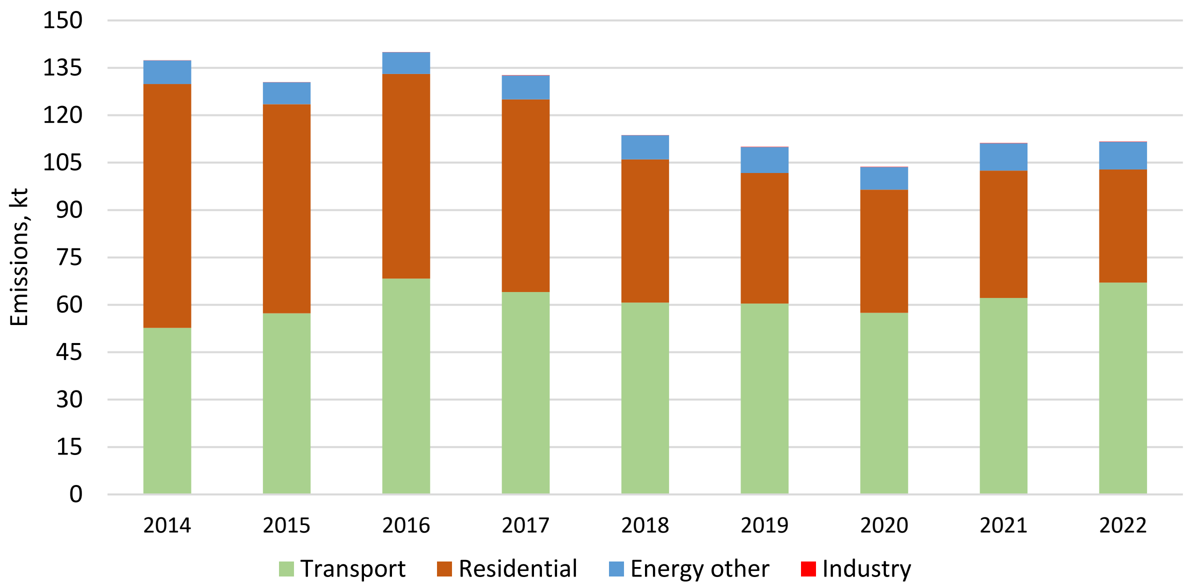

Figure 2.9 Trend of CO emissions 2014-2022

CO emissions were reduced by 17% in 2022 compared to 2014. The reduction of CO emissions was a result of its decreased release from residential sector as emissions from residential combustion have decreased by 54% in 2014-2022.

CO emissions from transport have variable trend: it increases from 2014 to 2016 and decreases from 2017. The reduction was caused by decrease of vehicles import and growing share of new and fuel-efficient vehicles in import that was supported through economic and financial instruments since 2017. However, CO emissions from transport again increases in 2021-2022 by 17% compared to 2020 due to rising import of old and petrol engine cars.

All in all, reduction in emissions from residential sector was counterbalanced by increased emissions from transport in 2022 and total amount remained the same.

Energy sector is a main source of CO emissions. In 2014 the shares of emissions from transport and residential combustion sources were 38% and 56%, since that emissions from transport outnumbered emissions from residential sources and by 2022 the shares are following: 60% to 32%.

Priority Heavy Metals

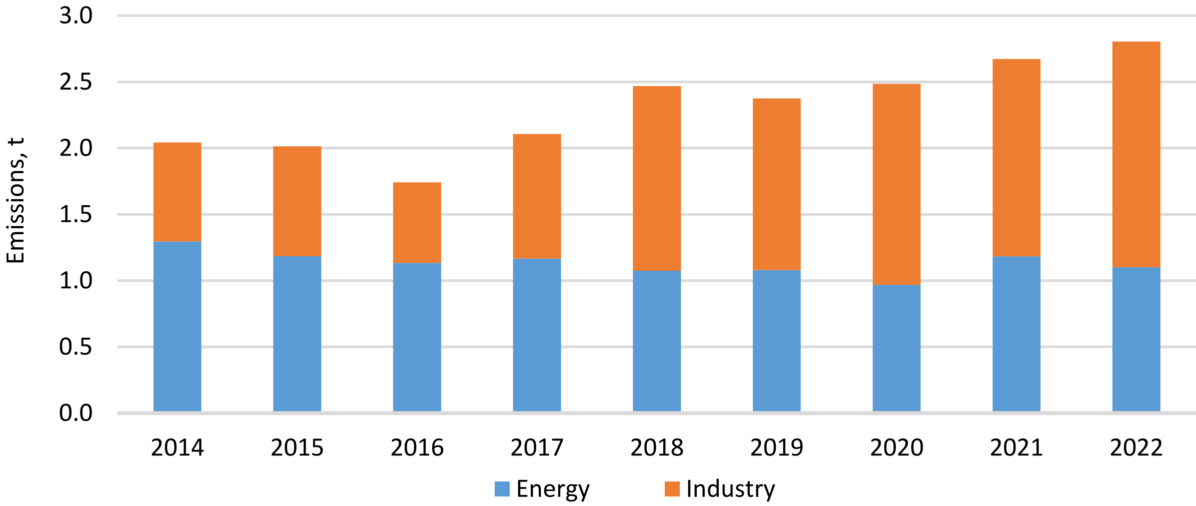

Figure 2.10 Trend of Pb emissions 2014-2022

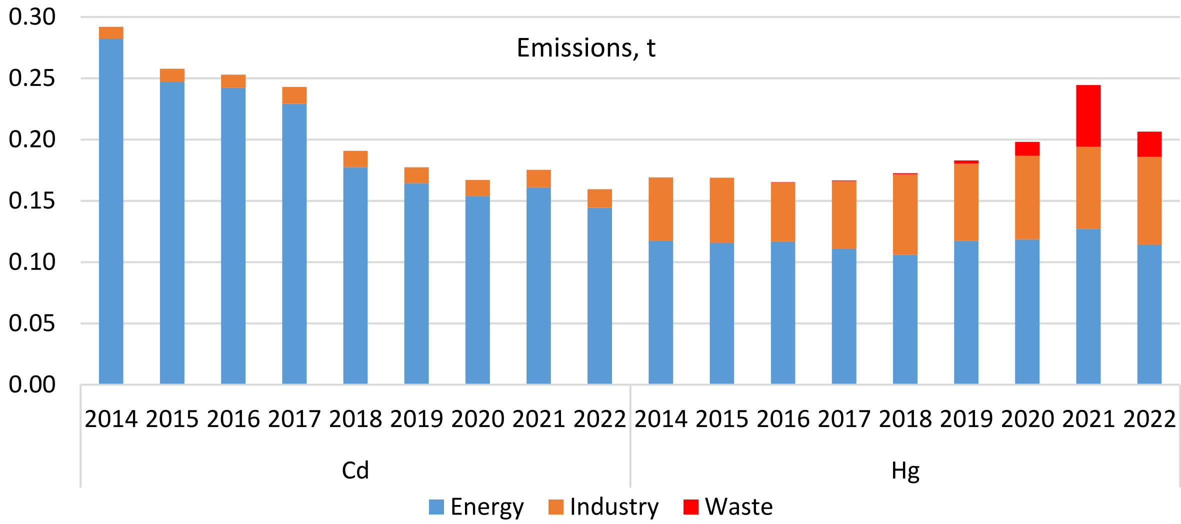

Figure 2.11 Trend of Cd and Hg emissions 2014-2022

There are different trends among priority heavy metals emissions over 8-year period. Pb emissions increased by 39%, Hg emissions increased by 21%, while Cd emissions were reduced by 45%. The main reason for growth of Pb emissions is increased iron and steel production since 2017. Increased Hg emissions in 2017-2019 was caused by rising production of iron and steel in Georgia, while sharp rise in emission in 2020-2021 was further triggered by increased amount of medical waste incinerated that decreased in 2022. In case of Cd emissions, reduction was caused by decreased wood consumption in households.

The main source of Pb emissions is iron and steel production (both combustion and industry sectors) that accounted for 79% of total emissions in 2022. Emissions from energy sector decreased by 15%, while emissions from industry increased by 128% in 2022 compared to 2014.

70% of Cd emissions came from residential stationary combustion in 2022, thought the share was even more in 2014 – 85%. Energy sector, mainly combustion in cement and iron and steel production, is a source for 55% of Hg emissions.

Additional Heavy Metals

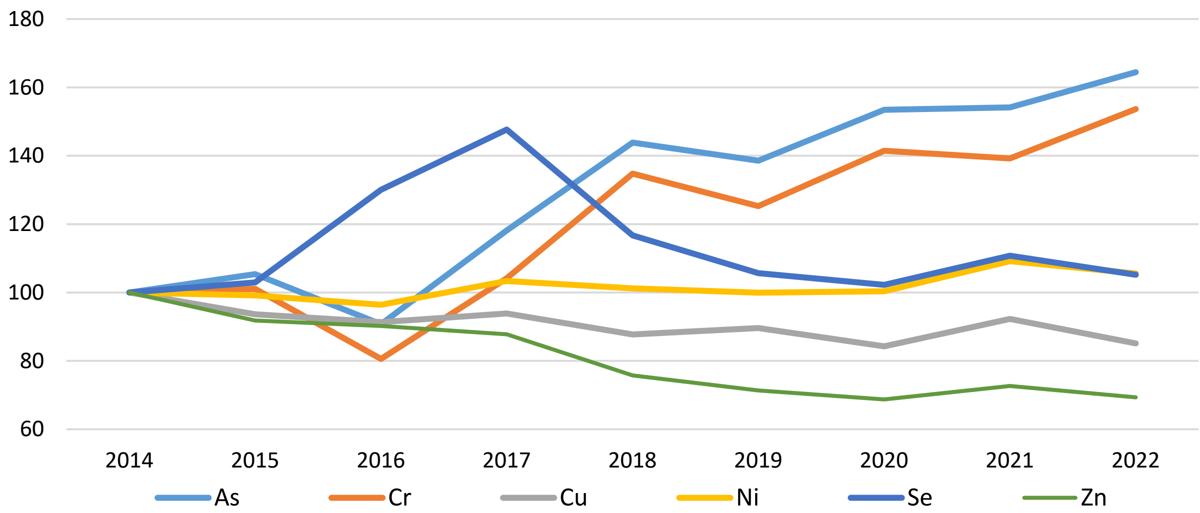

Figure 2.12 Trend of additional heavy metals emissions 2014-2022

In 2022 compared to 2014 emissions of As and Cr increased by 64% and 54% respectively, while emissions of Zn and Cu decreased by 31% and 15%. Emissions of Se have variable trend as it rises in 2015-2017, reduces in 2018-2020 and again increases in 2021 due to increased glass production. Ni emissions are stable until 2021, when it increases by 9% due to increased coal consumption in iron and steel production.

Rising emissions of As and Cr is also connected with the increased production of iron and steel since 2014. Reductions of Cu and Zn emissions are the result of sharply diminished biomass consumption in residential sector. Variability of Se emissions was mainly conditioned by changeable amount of produced glass and consuming coal for public electricity and heat production in 2016-2018.

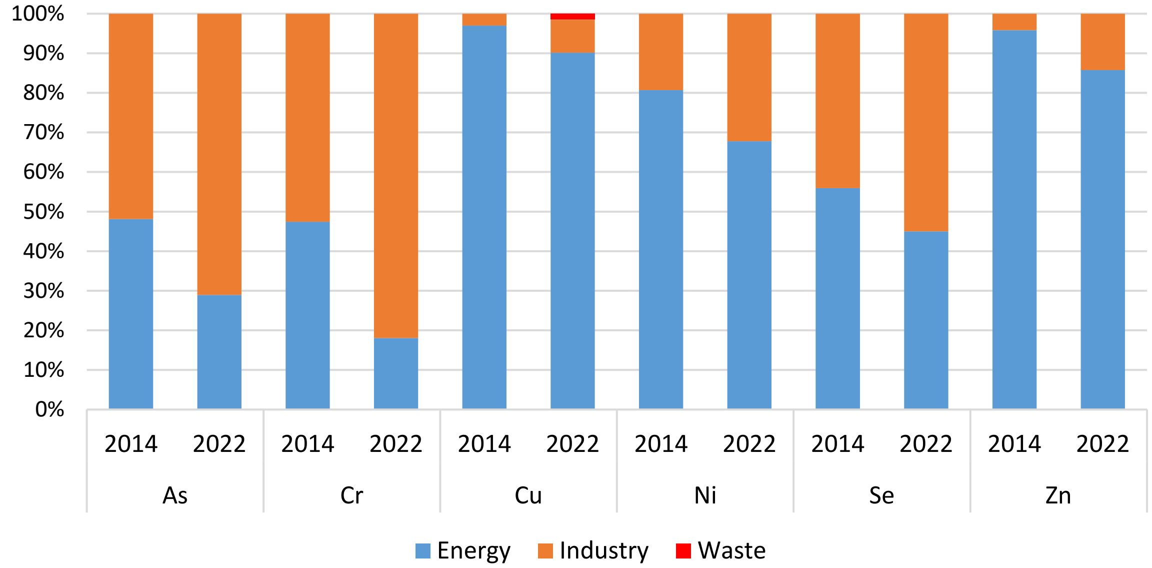

Figure 2.13 Sources of additional heavy metals emissions in 2014 and 2022

As outlined in figure 2.13 the share of energy sector in emissions of additional heavy metals is decreasing year by year, while industry gradually is becoming dominant.

Dioxins/ Furans

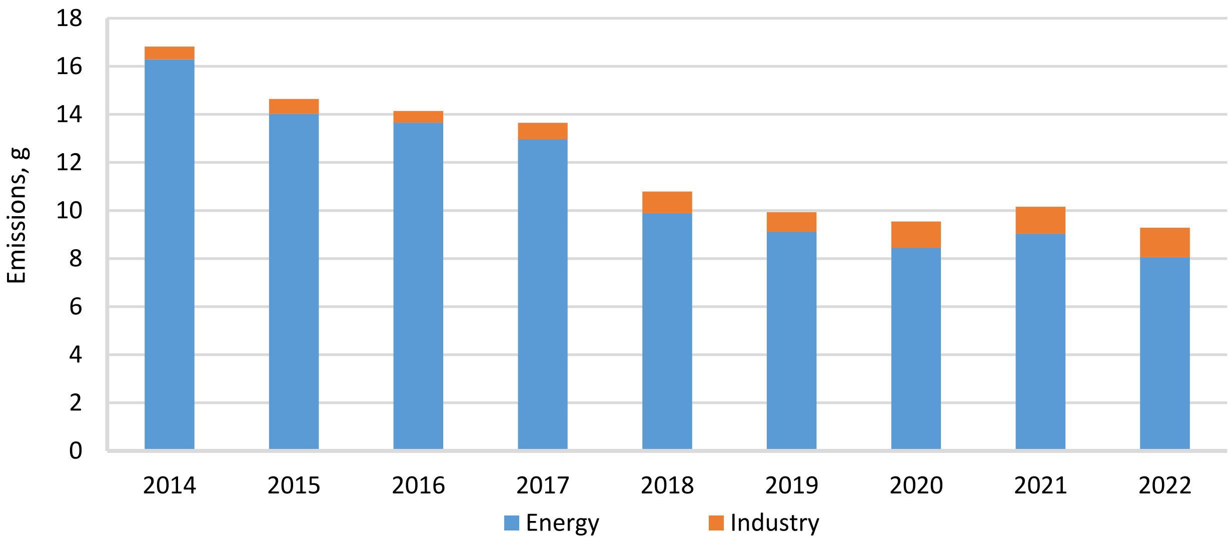

Figure 2.14 Trend of PCDD/ PCDF emissions 2014-2022

PCDD/ PCDF emissions were decreased in 2022 compared to 2021 by 9% due to reduced coal consumption in iron and steel production and decreased consumption of wood in residential sector.

In general, PCDD/PCDF emissions were reduced by 43% in 2022 compared to 2014. The reduction of PCDD/ PCDF emissions was a result of its decreased discharge from residential sector as emissions from residential combustion, which comprise 75% of total emissions as of 2022, have reduced by 54% in 2014-2022. Unlike energy sector, emissions of PCDD/ PCDF from industry have steady increasing trend as it increased by 133% in the mentioned period due to rise in iron and steel production, which constitutes major industrial source of PCDD/PCDF emissions in Georgia.

PAHs / benzo(a)pyrene

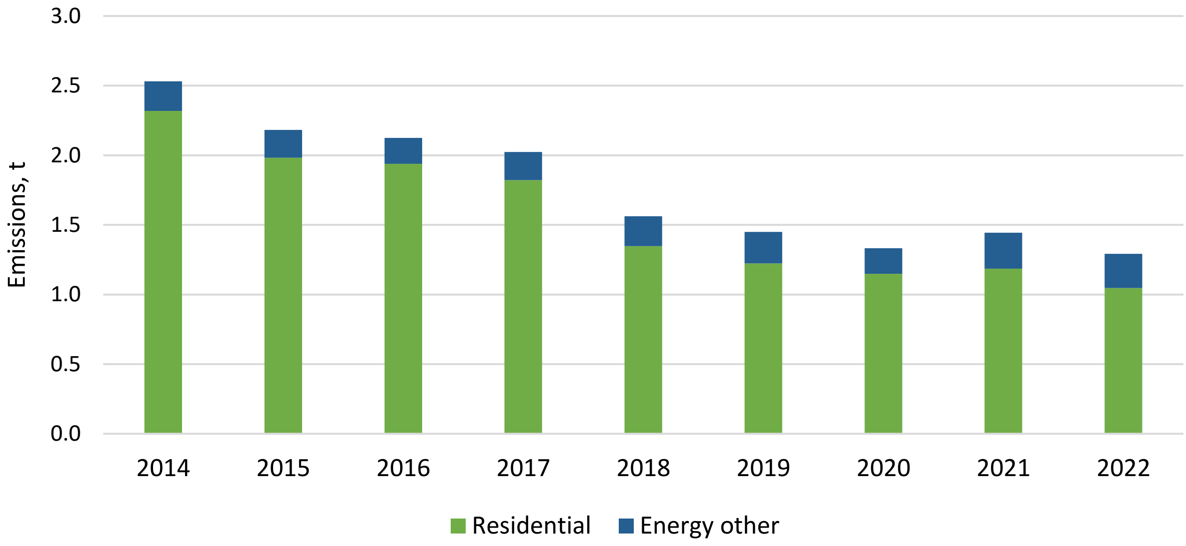

Figure 2.15 Trend of BaP emissions 2014-2022

Benzo(a)pyrene (BaP) is basically emitted from energy sector. BaP emissions were reduced by 49% in 2022 compared to 2014. The reduction of BaP emissions was a result of its decreased discharge from residential sector. Emissions from residential combustion, which comprise 81% of total emissions as of 2022, have decreased by 55% in 2014-2022 due to diminished firewood consumption in households.

HCB and PCBs

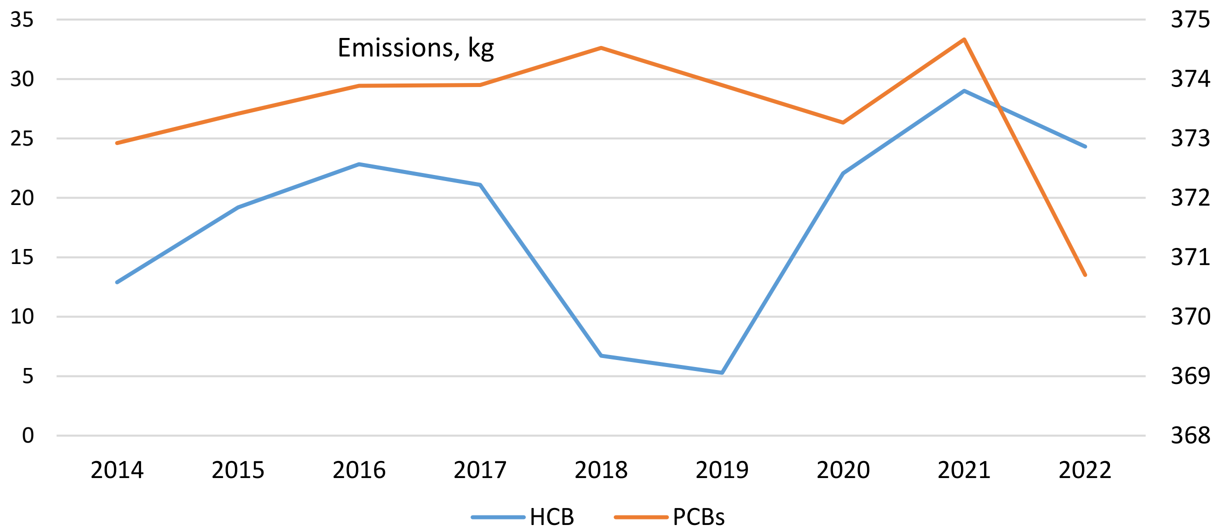

Figure 2.16 Trend of HCB and PCBs emissions 2014-2022

PCBs emissions depends on the demand of the population for POPs and heavy metals. Variability of HCB emissions trend in caused by changeable amount of aluminum production in the mentioned period, which is responsible for more than 99% of emissions.

3. Energy (NFR sector 1)

Present submission includes emission data from activities 1A1a, 1A2a, 1A2b, 1A2d, 1A2e, 1A2f, 1A3b (i-iii, v-vii), 1A3c, 1A3dii, 1A4ai, 1A4bi, 1A4ci, 1A4cii, 1B1a, 1B1b, 1B2ai, 1B2aiv, 1B2av, 1B2b, 1B2c in 1990-2022[9]. Since 2013, GEOSTAT prepares yearly National Energy Balance, which gives more precise activity data for this sector.

Emissions in energy sector mainly come from fuel combustion. Minor fugitive emissions from fuel exploration generated as well. This sector covers five key activities: public electricity and heat production, combustion in manufacturing industries and construction, transport, small combustion and fugitive emissions. The energy sector is the main source of NOx, SO_2, NMVOC, CO and PMs emissions in Georgia. In 2022, this sector contributed 72% of total NOx emissions, 98% of total SO_2 emissions, 51% of total NMVOC emissions, 44% of total TSP emissions and 99.9% of total CO emissions.

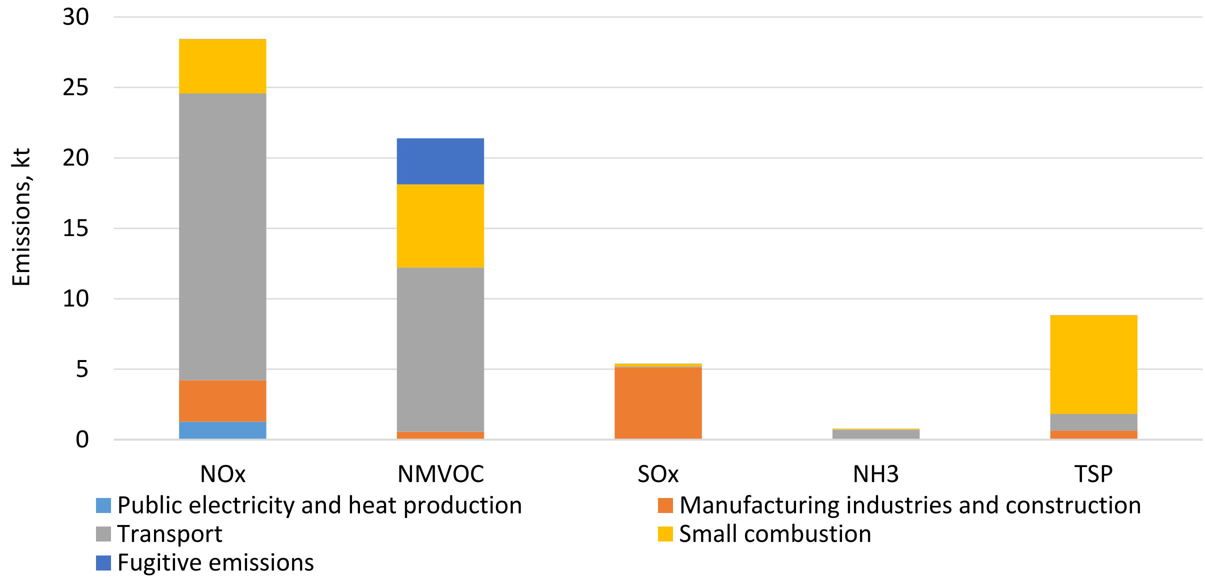

Figure 3.1 Emissions from energy sector in 2022

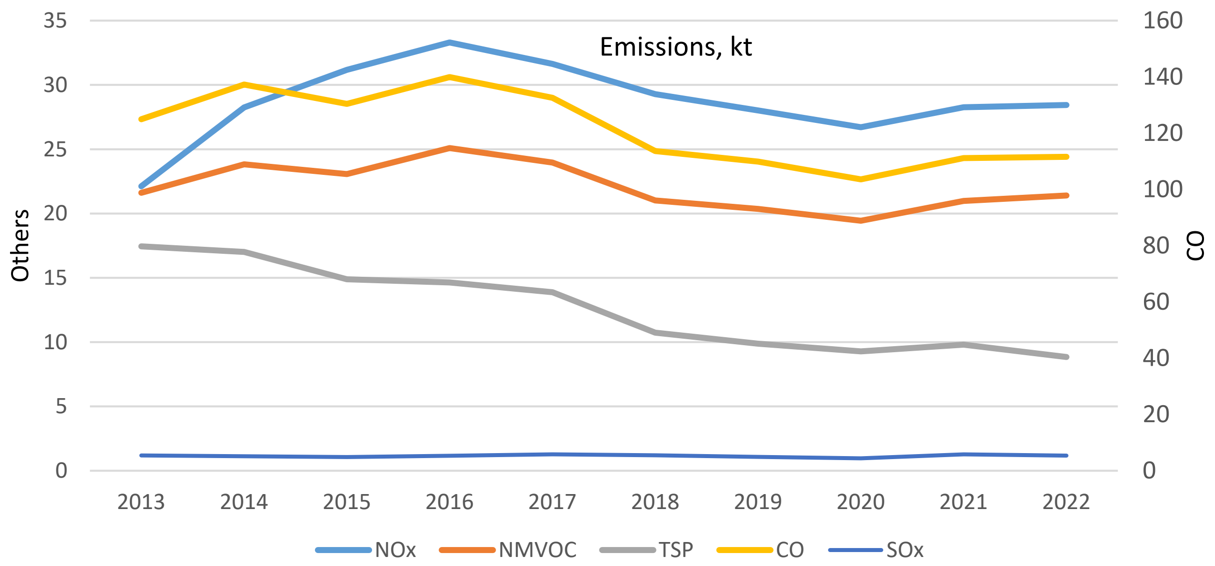

Figure 3.2 Emissions from energy sector in 2013-2022

[9] However, some activities did not occur in some years of the reporting period including 1B1b, which did not occur since 1998.

These emissions have diverse trend during last years. Due to reduced biomass consumption in households for heating and cooking purposes (1A4bi) emissions of PM and CO have decreasing trend. Reduced emissions of NMVOC from residential subsector was counterbalanced by another subsector – transport (1A3) that increased due to 70% rise in Georgian car fleet. The latter was the main reason of increased emissions of NOx emissions but the emissions also increased from residential sector as well because wood was replaced mainly by natural gas in households. SOx emissions remained more or less the same due to unaltered amount of consumed coal in iron and steel production.

Transport is the major contributor of NOx (72.4%), NMVOC (54.5%) and CO (60%) emissions in the energy sector. Share of industrial combustion in total SO_2 emissions in energy sector is 95%. Small combustion is responsible for the 79.3% of TSP in this sector.

Energy industries (1A1)

Source category description

Emissions in this category mostly come from natural gas consumption.

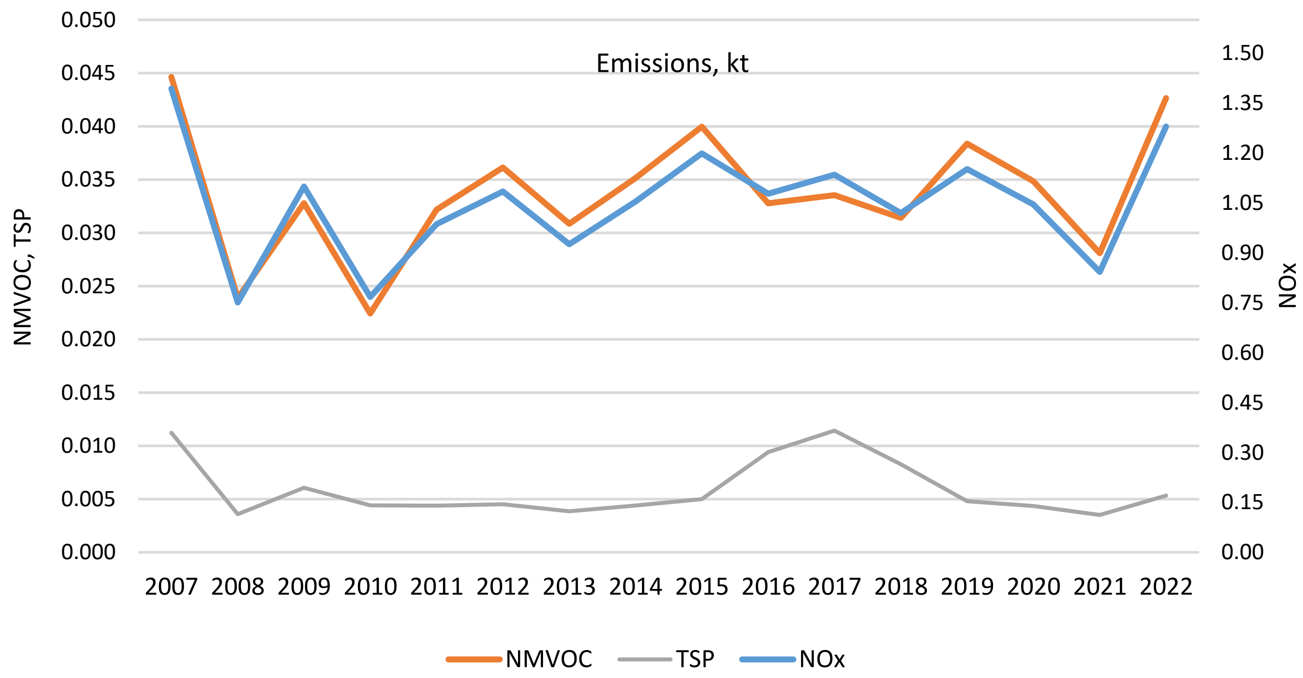

Figure 3.2 Emissions from public electricity and heat production 2007-2022

Temporary Increase of TSP emissions in 2016-2018 is related to consumption of coal by thermal power plant at that time.

Methodology

Emissions are estimated for 1990-2023 using EMEP/EEA Guidebook – 2023, Tier 1/2 approach based on data from International Energy Agency (1990-2018) and National Energy Balance (2019-2022).

Manufacturing industries and construction (1A2)

Source category description

This category covers emissions occurred by combustion processes in industrial sector. The main emission sources in this category are metallurgy and production of mineral materials. The category is responsible for 93.1% of total SOx emissions in the country.

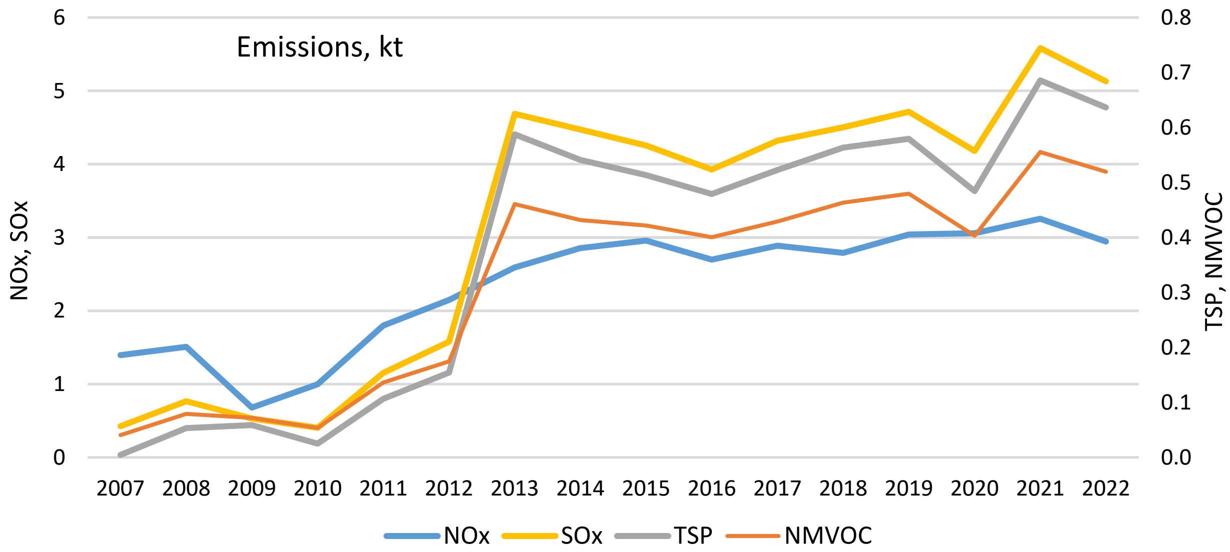

Figure 3.3 Emissions from combustion in manufacturing industries 2007-2022

Increasing trend of SO_2 emissions from 2011 is resulted from increased coal fuel consumption in industry sector (mostly in iron and steel production) and partially by rising cement production, while increase in NOx emissions is caused mainly by expansion in cement production that more than tripled in 2010-2021, and partially by increased coal consumption in iron and steel production. Decreasing emissions of SO_2 in 2014-2016 were related to the reduced consumption of coal and heavy oil within those years, mainly caused by shifting back from coal to natural gas in iron and steel industry. However, coal consumption again increased from 2017, with an exclusion due to pandemic in 2020 that resulted in rising emissions of SOx. TSP and NMVOC emissions also increased in 2021 due to same reason.

Table 3.1 Consumption of coal in iron and steel industry in 2007-2022, tj

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
14	385	428	171	785	1156	4480	4124	3852	3539	3924	4181	4212	3791	5310	4813

Significant increase of TSP and NMVOC emissions from 2011 is also a result of increased coal fuel consumption in iron and steel production. Dramatic rise in SO_2, TSP and NMVOC emissions in 2013 is also related to introduction of national energy balance, which provides detailed information on fuel consumption in categories that was not available before.

Methodology

Emissions are estimated for 1990-2023 using EMEP/EEA Guidebook – 2023, Tier 1/2 approach based on data from International Energy Agency (1A2a, 1A2d, 1A2e - 1990-2018) and from National Energy Balance (1A2a, 1A2d, 1A2e – 2019-2022), national inventory of stationary emission sources (1A2b, 1A2f – 2013-2022[10]), and production data provided by GEOSTAT and GHG emissions reports (1A2f – before 2013).

[10] In 2020-2021, emissions from gypsum production and in 2019 emissions from bricks production under 1A2f were calculated based on production data provided by GEOSTAT.

Transport (1A3)

Source category description

This category includes railways, national navigation (shipping) and all types of vehicles (passenger cars, light duty vehicles, heavy-duty trucks, buses, motorcycles[11]) except off-road transport (agricultural and industrial machinery, etc.). Road transport is the main source of air pollution in Georgia. The number of transport vehicles has doubled within the last decade.

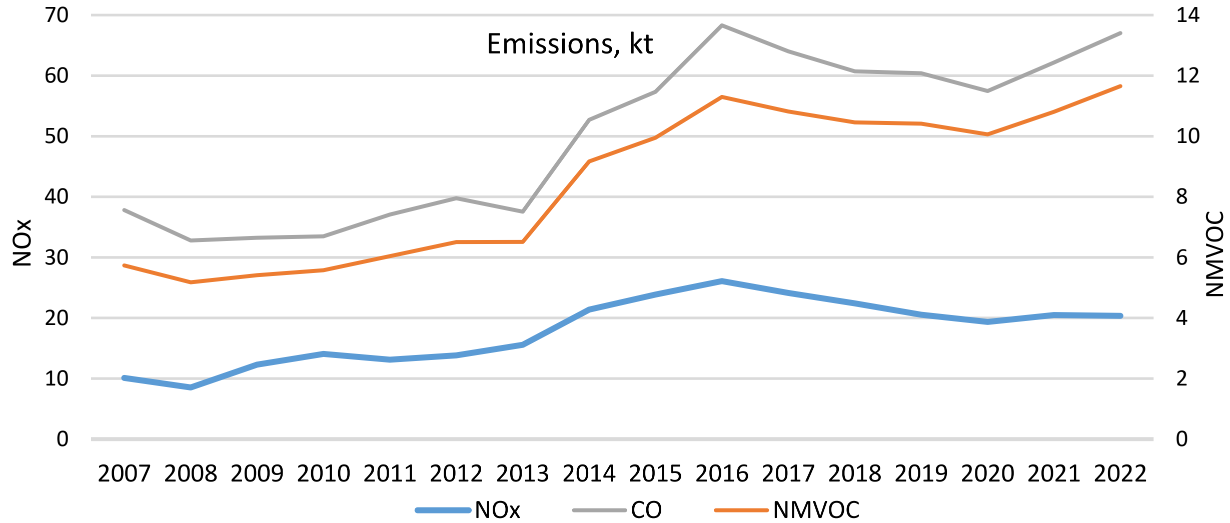

Figure 3.4 Emissions of NOx and NMVOC from transport 2007-2022

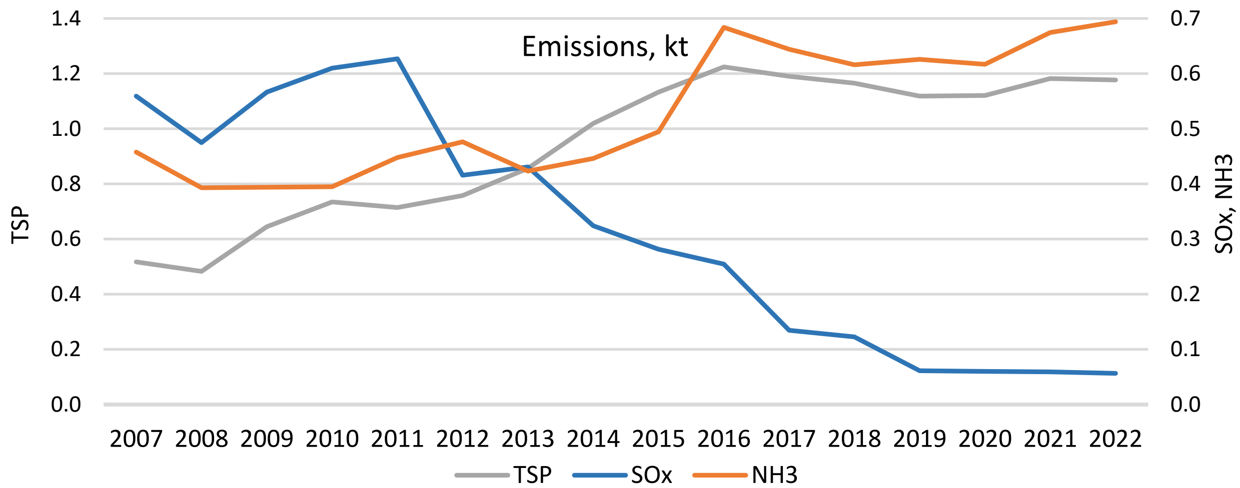

Figure 3.5 Emissions of TSP, SOx and NH3 from transport 2007-2022

Emission trends of NOx, CO, TSP, NMVOC and NH_3 from this sector is gradually increasing (peaked in 2016) alongside growing number of vehicles in the country. From 2007 to 2022, emissions of NOx were increased by 101.5%, TSP by 127.5%, NMVOC by 103.3%, CO by 77.3% and emissions of NH_3 by 51.6 %. Reducing trend in emissions in 2016-2020 was a result of environmental policy in the transport sector. In particular, promotion of cleaner vehicles (hybrid and electric vehicles) and increased environmental taxes for the import of fuel engine and old vehicles. However, in 2021-2022, due to sharp increase of

[11] 1Abiv is not estimated.

vehicles import in post pandemic period and increased share of old and petrol/diesel engine cars in the import, emissions were increased.

Table 3.2 Fuel **c**onsumption in road transport sector (1A3b) in 2007-2022, tj

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Petrol	18323	15725	15680	15680	17875	18995	16435	16747	18602	26251	25204	23706	24173	23911	26182	26830
Diesel	8803	7259	12682	15227	13350	13934	16383	21183	24498	26213	23911	22077	19502	19047	20013	18672
CNG / LPG	1172	1298	963	796	628	993	2059	12345	12751	9692	8914	8181	7506	5795	5757	8537

Reduction of CO and low-level increase in NMVOC emissions in 2013 compared to 2012 were caused by reduction of petrol consumption due to switching of passenger cars from petrol fuel to compressed natural gas (CNG). Increasing emissions since 2013 are related to growing petrol consumption in these years caused by increasing car fleet.

Table 3.3 Georgia's car fleet in 2007-2022, 1000 unit

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Passenger cars	467	501	536	577	621	673	739	821	895	974	1030	1086	1131	1190	1266	1333
Light duty vehicles	58	54	60	66	73	79	84	90	96	100	100	101	102	104	109	111
Heavy duty vehicles and buses	47	43	46	48	49	51	52	53	53	53	54	54	54	55	56	54

Emissions of SOx are gradually decreasing in parallel with reduction of sulphur content limits in national standards for petrol and diesel (for petrol: from 500 ppm to 10 ppm and for diesel: from 500 ppm to 50 ppm). In 2022, these are 9 times less compared to 2007.

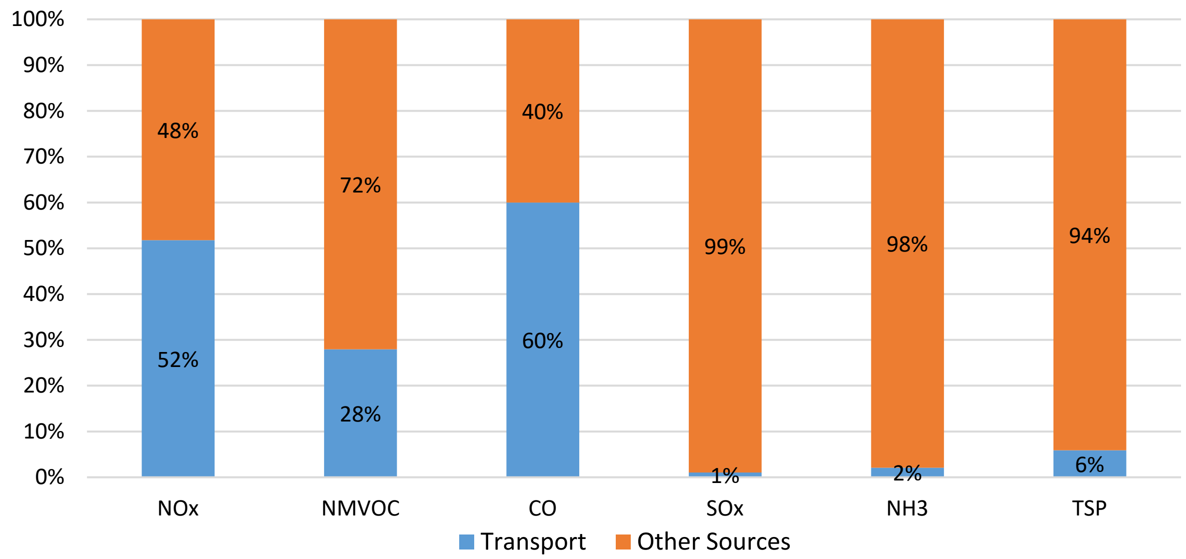

Figure 3.6 Share of emissions from transport in total emissions in 2022

Transport was a source of 52% of NOx emissions, 28% of NMVOC emissions and 60% of CO emissions in 2022.

Methodology

Road transport emissions are calculated by Tier 1 method of the EMEP/EEA Guidebook – 2023. Emissions from railways and national navigation (shipping) are estimated using EMEP/EEA Guidebook – 20, Tier 1 approaches based on data from International Energy Agency (1990-2012) and from National Energy Balance (2013-2022).

Small combustion (1A4)

Source category description

Emissions in this category come from stationary combustion in commercial/institutional, residential and agriculture/forestry/fishing, plus from off-road vehicles and other machinery of agriculture/forestry/fishing.

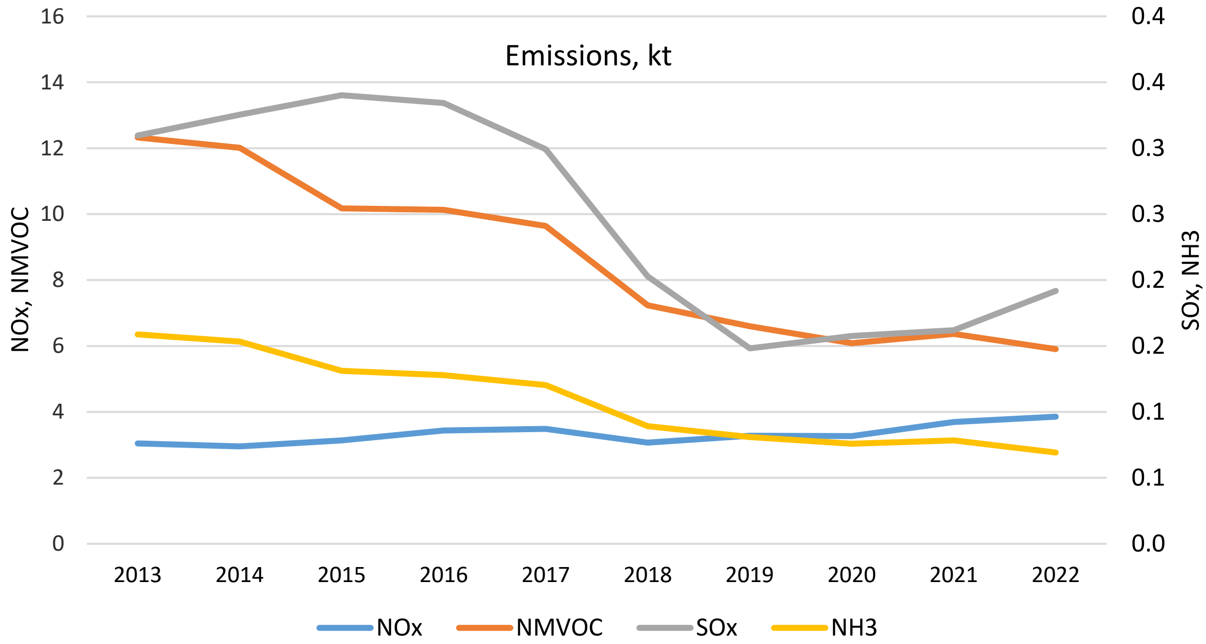

Figure 3.7 Emissions of main pollutants from small combustion in 2013-2022

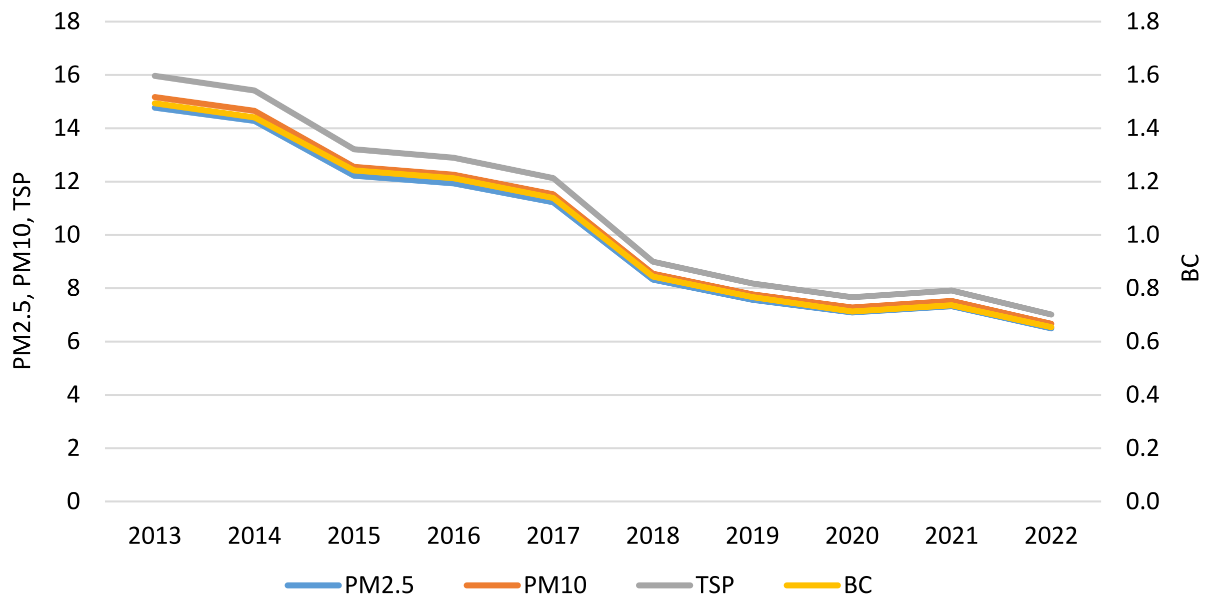

Figure 3.8 Emissions of particulate matters from small combustion in 2013-2022

Due to reduction in biomass and coal consumption in residential sector, emissions of NMVOC, SOx, NH_3, PMs and CO have decreased. Emissions of NOx remains stable for years since increased consumption of alternative fuels (mainly gas) still constitutes source for significant amount of NOx.

Table 3.4 Fuel consumption in residential sector (1A4bi) in 2013-2022, tj

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Liquid Fuels	358	430	478	430	358	454	418	418	418	418
Solid Fuels	15	16	15	35	23	8	10	3	0	4
Gaseous Fuels	28356	21623	25094	28322	31570	30576	35221	39967	43552	47401
Biomass	19799	19131	16355	15955	15007	11117	10097	9485	9797	8639

Biomass consumption has decreased in residential sector by 56% in 2013-2022.

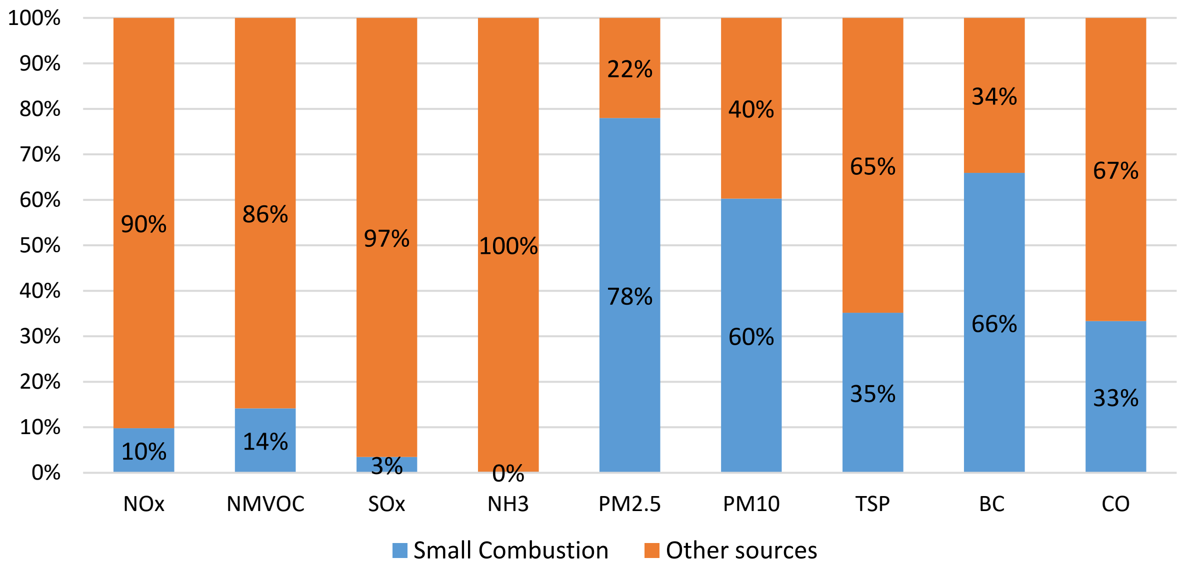

Figure 3.9 Share of emissions from small combustion in total emissions in 2022

PMs are mainly emitted from small combustion sector. In addition, the sector is responsible for 33% of CO, 14% of NMVOC and 10% of NOx emissions.

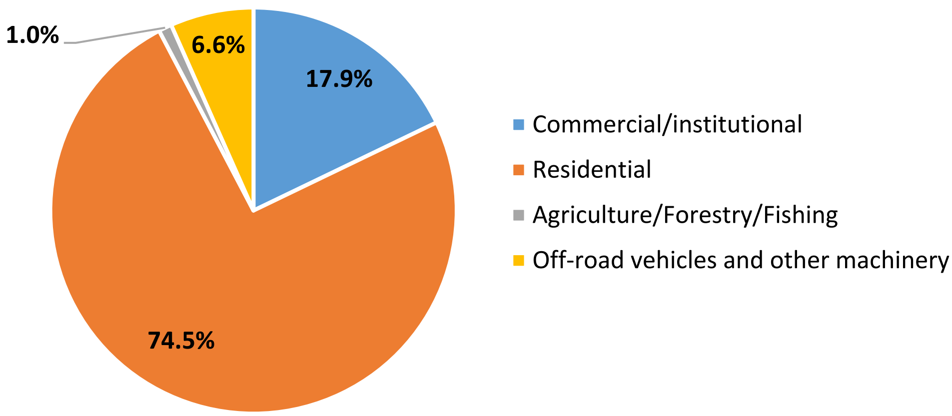

Figure 3.10 NOx emissions by sources of pollution in small combustion sector in 2022

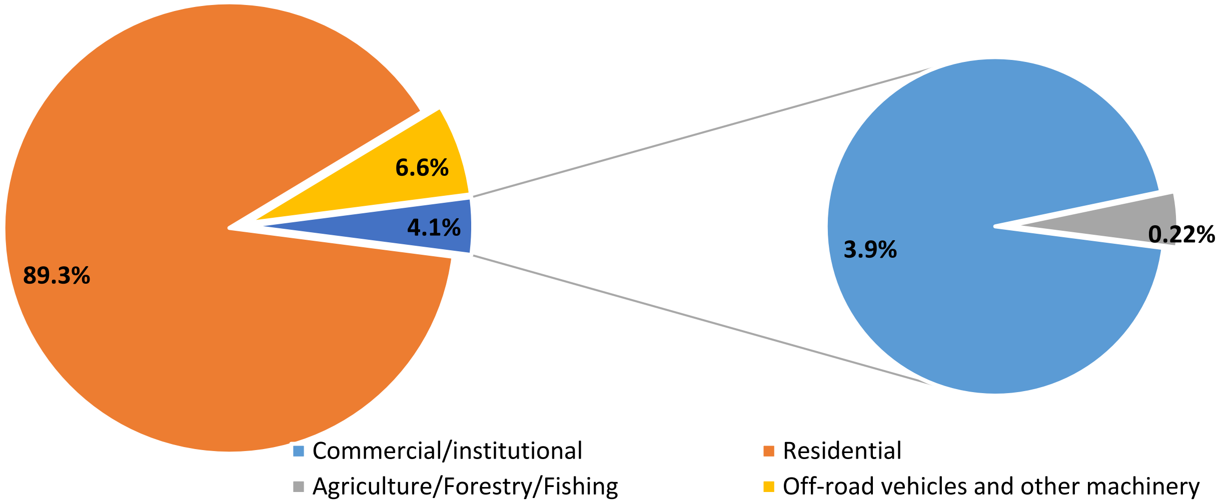

Figure 3.11 NMVOC emissions by sources of pollution in small combustion sector in 2022

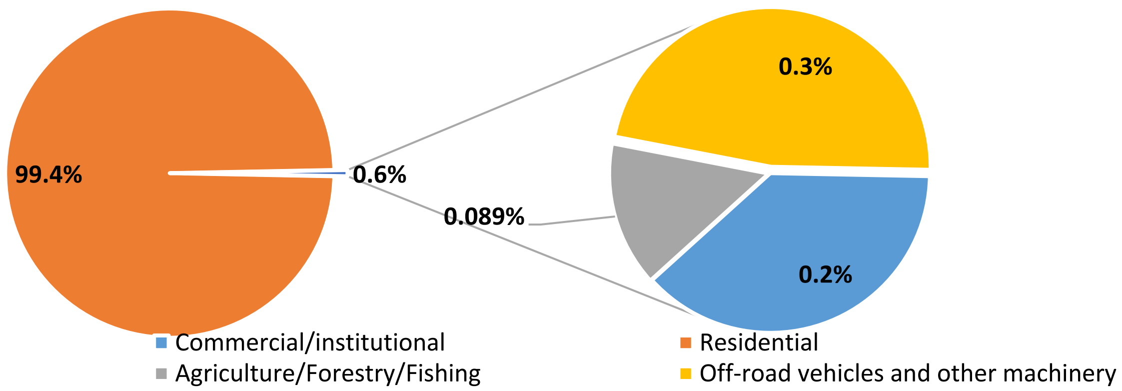

Figure 3.12 TSP emissions by sources of pollution in small combustion sector in 2022

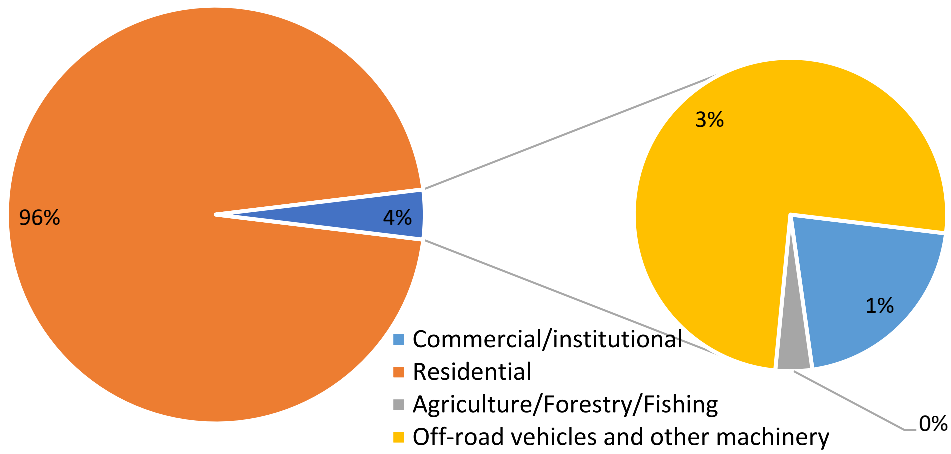

Figure 3.13 CO emissions by sources of pollution in small combustion sector in 2022

Residential stationary combustion within small combustion sector is a main emission source of NOx, NMVOC, SOx, NH_3, CO and TSP. Also, 70% of Cd, 18% of Cu, 45% of Zn, 75% of dioxins/furans and 50% of PAHs are emitted from this subcategory.

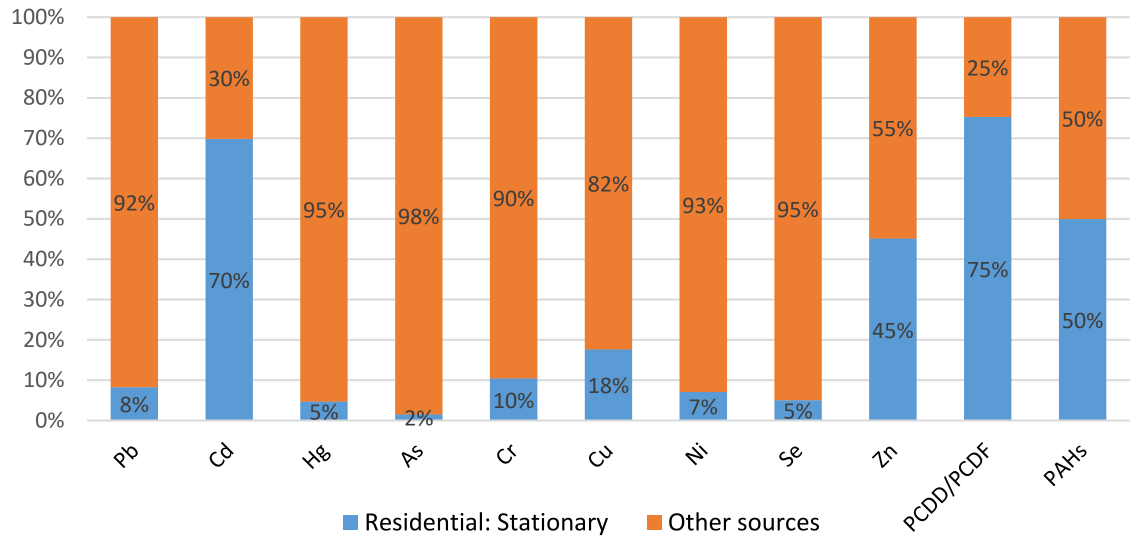

Figure 3.14 Share of HMs and POPs emissions from residential combustion in total emissions in 2022

Methodology

Emissions are estimated according to EMEP/EEA Guidebook – 2023, Tier 1 approach based on the activity data from International Energy Agency (1990-2012) and National Energy Balance (2013-2022)[12].

Fugitive emissions from fuels (1B)

This category covers fugitive emissions from coal mining and handling, solid fuel transformation, oil and natural gas exploration.

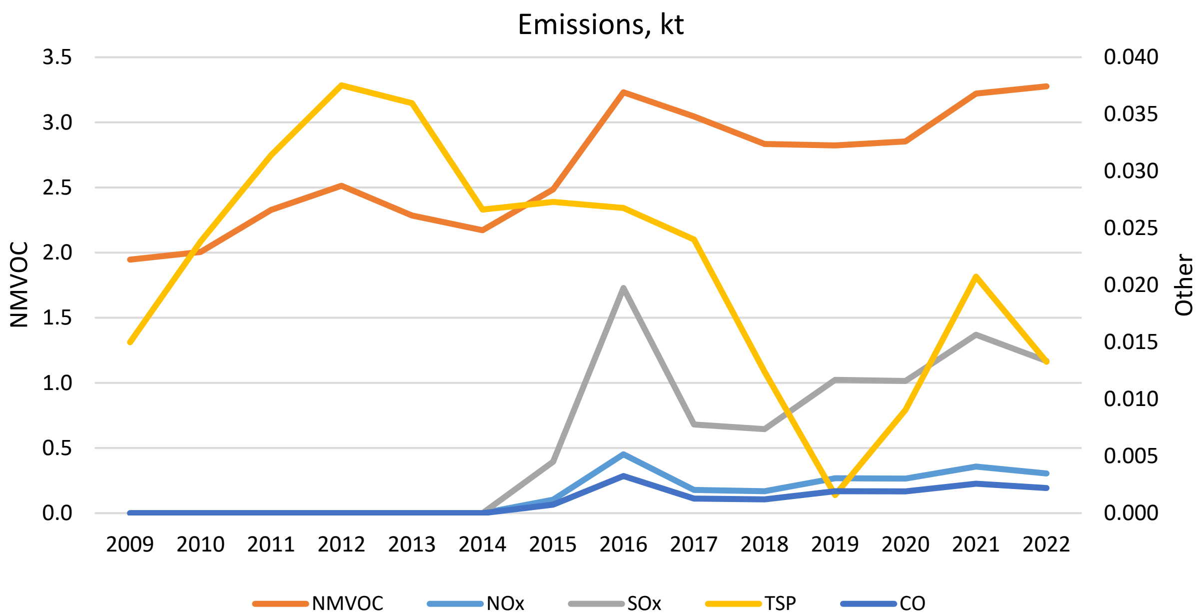

Figure 3.15 Fugitive emissions of NMVOC, NOx, SOx, TSP and CO in 2009-2022

1B emits meaningful amount of NMVOC only, which is dependent on oil consumption and coal mining. Hence, emissions of NMVOC peaked in 2016 and again in 2021 because of increased oil consumption and coal mining. TSP emissions mainly comes from coal mining and handling. Emissions of NOx, SOx

[12] In case of 1A4bi liquid fuel data was taken from International Energy Agency for the years of 2013-2018.

and CO from 2015 is related to resumed oil refining and gas flaring in oil refineries in Georgia. While significant reduction in TSP emissions is caused by decreased amount of produced coal.

Methodology

Emissions are estimated by EMEP/EEA Guidebook – 2023, Tier 1 approach based on the activity data from International Energy Agency (1B2av in 1990-2012), National Energy Balance (1B2aiv, 1B2av and 1B2c in 2013-2022) and from GEOSTAT (1B1a, 1B1b, 1B2ai, 1B2aiv in 1990-2012, 1B2b, 1B2c in 1990-2012).

4. Industrial processes and product use (NFR sector 2)

Dissolution of the Soviet Union accompanied with the collapse of the economy in the 1990s resulted in a significant decrease of industrial activities in Georgia. There has been some growth in this sector in more recent years. The main activities in this sector are manufacturing of mineral products, chemical industry, metal production as well as paper, wood and food industries.

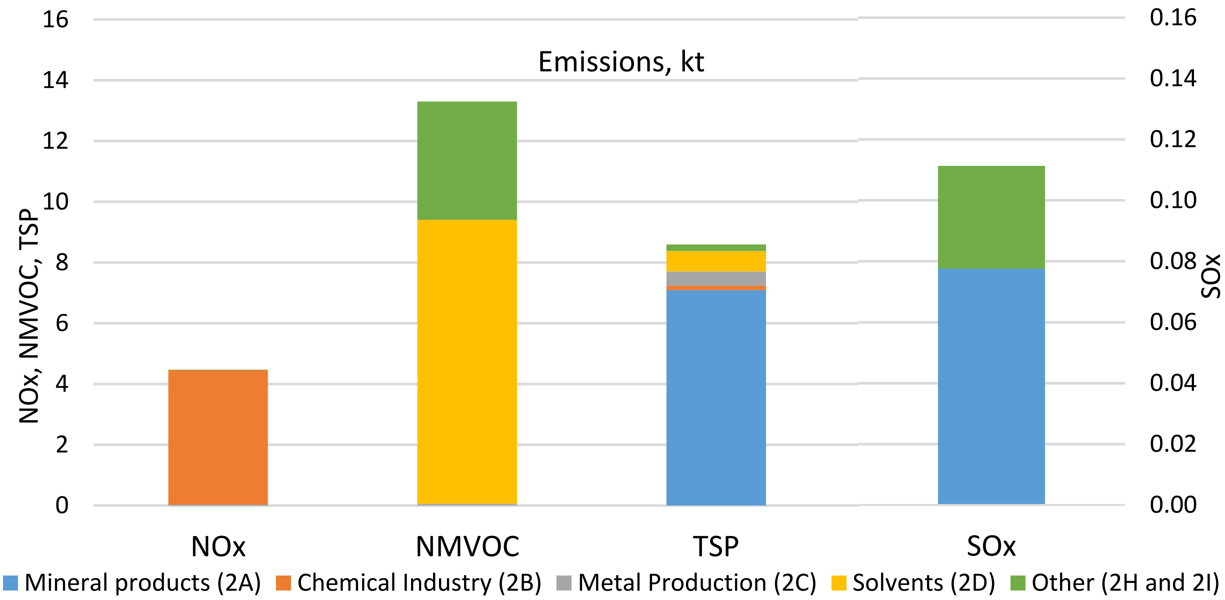

Figure 4.1 Emissions from industry sector in 2022

Share of chemical industry in total NOx emissions in industry sector is 99.2%. Solvent subsector is responsible for 70.3% of NMVOC emissions. Manufacturing of mineral products is the major contributor of SOx (69.7%) and TSP (82.5%) emissions from this sector.

Mineral Products (2A)

Source category description

In this category, cement, lime, bricks, concrete, gypsum, gravel and glass production are reported.

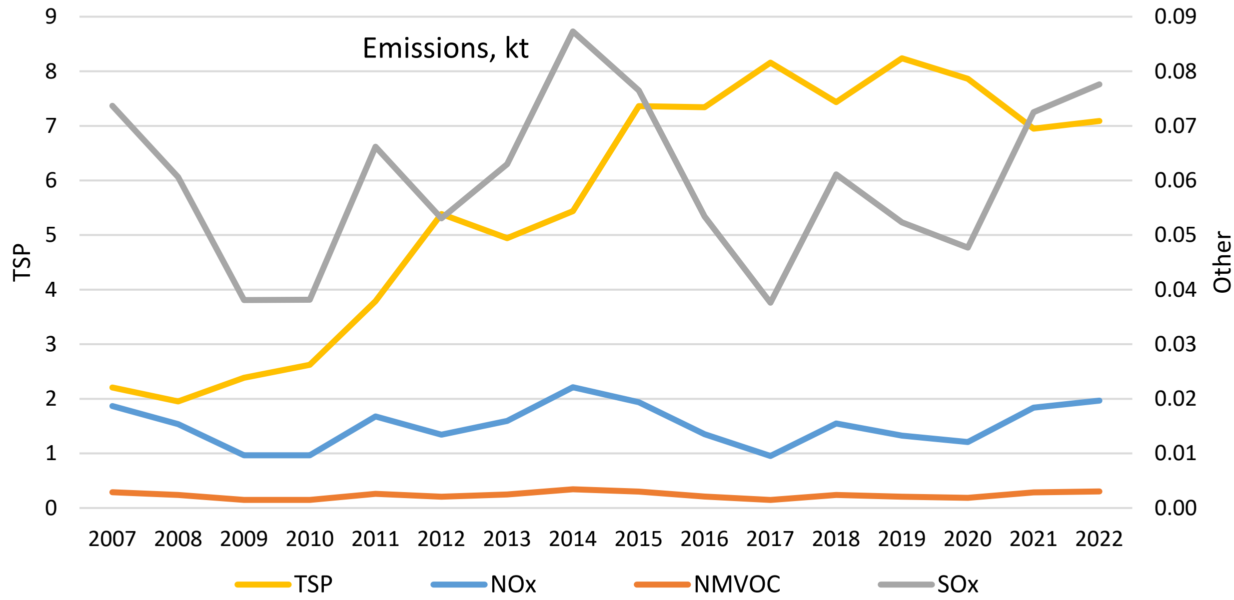

Figure 4.2 Emissions from mineral products 2007-2021

The most important pollutant emitted from this category is particulate matters. TSP emissions from 2A increased by 3-times in 2007-2022 and accounted for 36% of total TSP emissions in 2022. Increasing trend of this pollutant's emissions since 2008 is caused by rising amount gravel, concrete and gypsum production. However, emissions of TSP decreased in 2020-2022 mainly due to reducing amount of gypsum, lime (2020-2021) and cement (2022) production.

Table 4.1 Production of construction materials in Georgia in 2007-2022, kt[13]

Construction material / year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cement	815	881	230	489	940	1156	1153	1372	1395	1231	1266	1189	1411	1543	1454	1239
Lime	26	18	35	43	34	39	44	27	53	39	31	61	57	55	49	51
Minerals other than coal	4753	2776	7173	6631	9738	13806	10712	12349	17475	21319	22106	18505	20939	18195	19985	17350
Brick	37	31	19	19	33	27	32	44	39	27	-	31	26	24	37	39
Concrete	1268	1542	1466	1459	3171	5020	4029	5417	6649	7613	8724	8243	9833	10487	9249	10488
Gypsum	14	15	16	19	37	56	60	69	89	71	97	58	62	48	43	46

Methodology

Emissions are estimated based on EMEP/EEA Guidebook – 2023, Tier 1 approach (2A1, 2A2, 2A3, 2A5) and national methodology (2A6). In case of cement production abatement coefficients were defined considering country and plant specifics. Activity data came from GEOSTAT, state reporting system for stationary sources and GHG emissions reports.

Chemical Industry (2B)

Source category description

This category covers emissions from ammonia, nitric acid and fertilizer production.

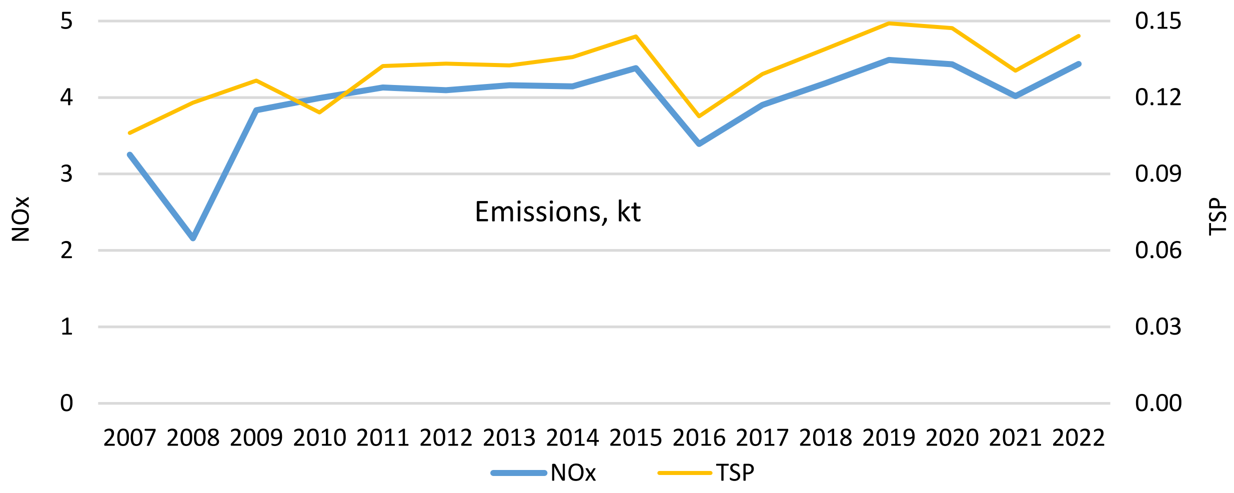

Figure 4.3 Emissions from chemical industry 2007-2022

Chemical industry emitted 11.3% of total NOx emissions in 2022. The main source from the category in this regard is nitric acid production (2B2) that decreased in 2020-2021 resulting reducing emissions of NOx. Significant decrease of emissions in 2016 was caused by switching to production data that is retrieved from state reporting system for stationary sources. The main source of TSP emissions from the sector is fertilizer production that is reported under 2B10a.

[13] Glass production is confidential.

Methodology

Emissions are estimated based on EMEP/EEA Guidebook – 2023, Tier 1/2 approach. Activity data came from GEOSTAT (1990-2005), state reporting system for stationary sources (2016-2022), GHG emissions reports (2006-2013) and through extrapolation (2014-2015).

Metal Production (2C)

Source category description

In Georgia, there is ferroalloys and secondary iron/steel, lead and aluminum production.

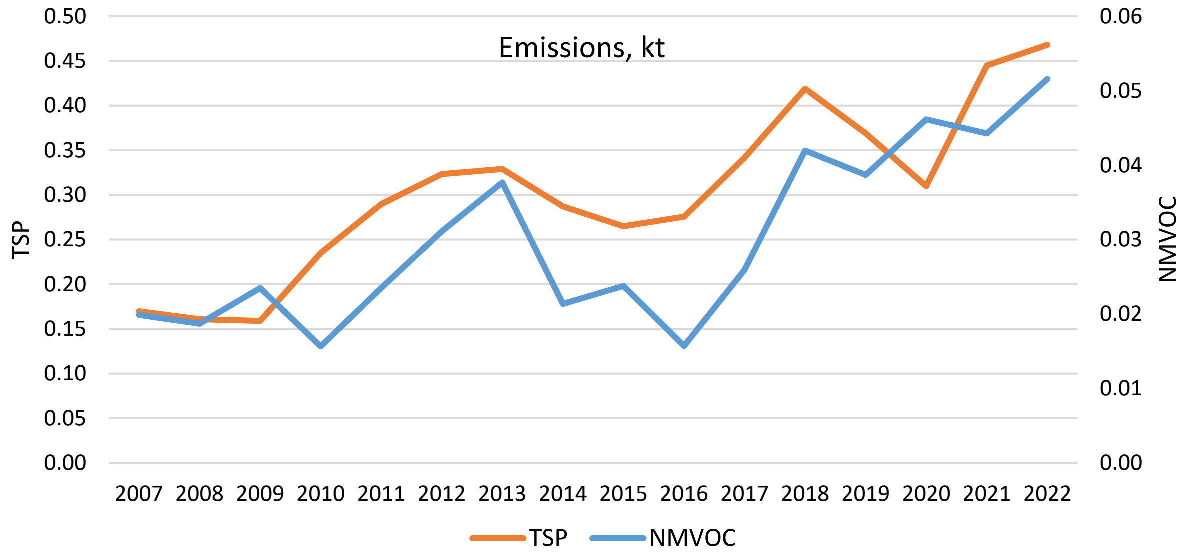

Figure 4.4 Emissions from metal production 2007-2022

Ferroalloys production (2C2) is main source of TSP emissions, while iron and steel production is an only source for NMVOC in this category.

Table 4.2 Production in metallurgy in Georgia in 2007-2022, kt

Production in Metalurgy / year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Iron and steel	133	125	157	104	157	207	251	142	158	105	173	280	258	308	295	344
Ferroalloys	130	123	112	204	243	261	253	244	217	244	290	335	292	217	356	365
Aluminium	NO	NO	NO	NO	NO	NO	Conf	Conf	Conf	Conf	Conf	Conf	Conf	4	6	5
Lead	NO	NO	NO	NO	NO	NO	Conf	Conf	Conf	Conf	Conf	Conf	Conf	2	4	3

Therefore, increased TSP emissions in 2016-2018 was caused by rising ferroalloys production in Georgia. Ferroalloys production sharply decreased in 2020 due to the effects of the coronavirus pandemic and reduced prices for the relevant materials. Production again increased in 2022 as a result of rising prices and demand for the product that conditioned growth in emissions of TSP.

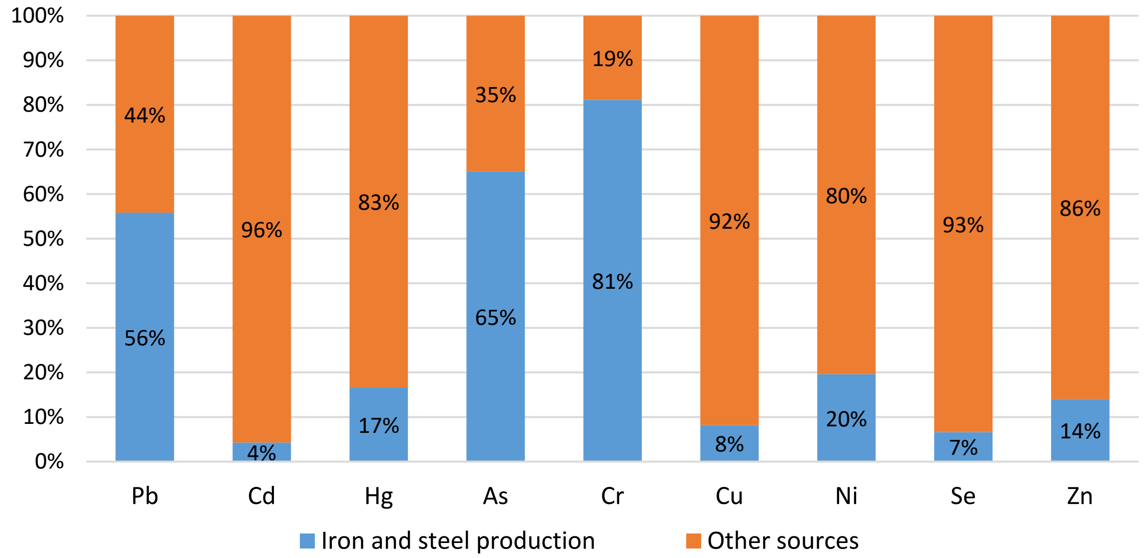

Figure 4.5 Share of heavy metals emissions from iron and steel production in total emissions in 2022

Iron and steel production (2C1) is a key source of heavy metals emissions especially Pb (56%), As (65%) and Cr (81%). Aluminum production (2C3) is responsible for 99.7% of HCB emissions in Georgia.

Methodology

Emissions from are estimated using EMEP/EEA Guidebook – 2023, Tier 1/2 approaches. In case of aluminum and lead abatement coefficients were defined considering country and plant specifics. Activity data came from GEOSTAT, state reporting system for stationary sources and GHG emissions reports.

Solvents (2D)

Source category description

This category covers only three activities - road paving with asphalt, coating application and domestic solvent use including fungicides.

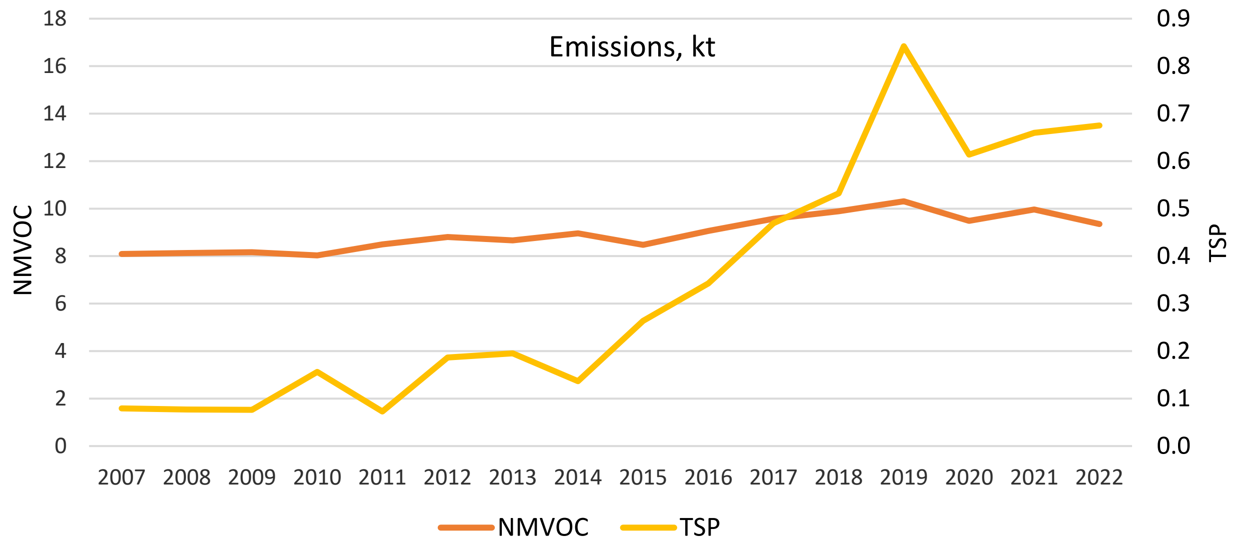

Figure 4.6 Emissions from solvents 2007-2022

NMVOC is the most important pollutant from this category as 22.4% of total emissions comes from 2D as of 2022. It increases due to rising quantity of applied paints year-by-year. In 2022 emissions decreased due to reduced levels of coating application.

Source of emissions of another important pollutant TSP is asphalt production. TSP emissions increases from 2014 as a result of increased production of asphalt for road paving.

Sharp reduction in emissions of both pollutant in 2020 is related to economic effects of the coronavirus pandemic and decreased consumption of the relevant products.

Methodology

Emissions from are estimated using EMEP/EEA Guidebook – 2023, Tier 1 approach. In case of road paving with asphalt abatement coefficients are defined considering country and plant specifics. Activity data came from GEOSTAT and state reporting system for stationary sources. As for the coating application, data for 2009-2022 is retrieved from GEOSTAT. The activity data before 2009 was calculated through interpolation.

Other (2H, 2I and 2K)

Source category description

This category covers pulp and paper, food and drink industry, wood processing and consumption of POPs and heavy metals.

In Georgia, there is secondary paper processing only. Food comprises bread production, sugar production, margarine production, flour production, animal feed production, coffee processing, fish processing, meat processing. Under drink production, beer, wine, spirits and brandy are included.

In the past large wood processing companies existed in Georgia. Nowadays small plants remain which process logs and produce wooden boards etc.

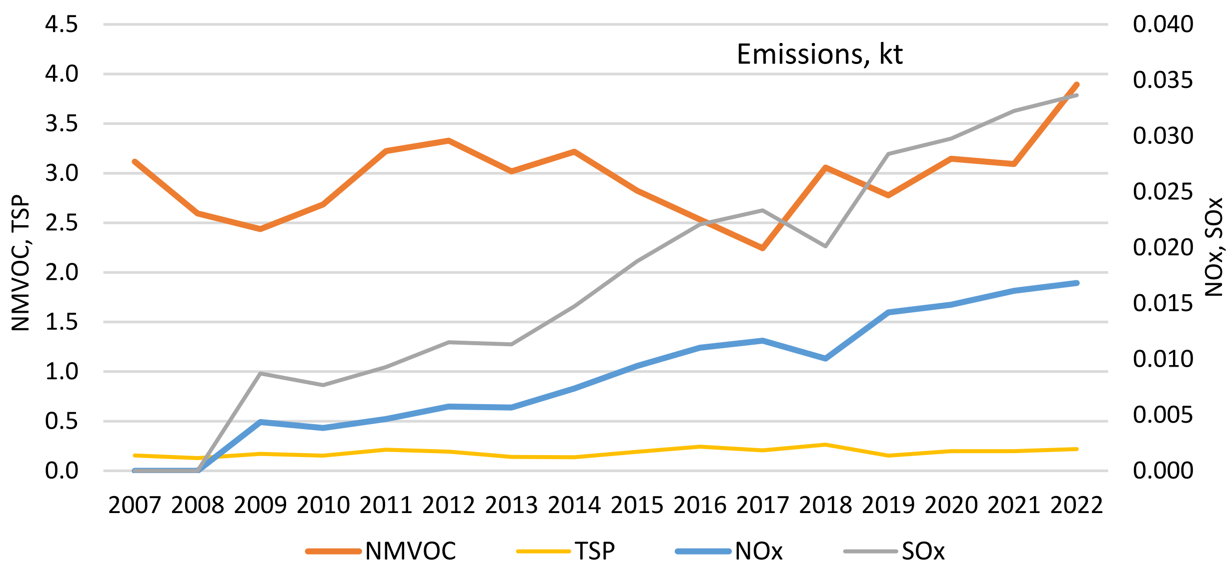

Figure 4.7 Emissions from other industrial processes 2007-2022

Reductions of NMVOC and TSP emissions from this sector in 2008 related to the global economic crisis. Further reduction of NMVOC emissions since 2015 is caused by a sharp decline in sugar production, which was reduced to zero in 2017. Sharp increase in 2018 resulted from the reintroduction of sugar production. Rising NOx and SOx emissions from the category is caused by increased secondary paper processing.

Food and beverages industry is a responsible for 9.3% of NMVOC emissions as of 2022. Additionally, consumption of POPs and heavy metals is a source for 99.5% of total PCBs emissions.

Methodology

Emissions from are estimated using EMEP/EEA Guidebook – 2023, Tier 1 (2H1, 2I, 2K) and Tier 2 (2H2) approaches. In case of wood processing abatement coefficients are defined considering national methodology. Activity data came from GEOSTAT and state reporting system for stationary sources. Activity data to estimate emissions from consumption of POPs and heavy metals is a number of population in Georgia.

5. Agriculture (NFR sector 3)

Emission inventory from agriculture sector includes animal husbandry, the application of inorganic and organic fertilizers, farm-level agricultural operations and crops cultivation.

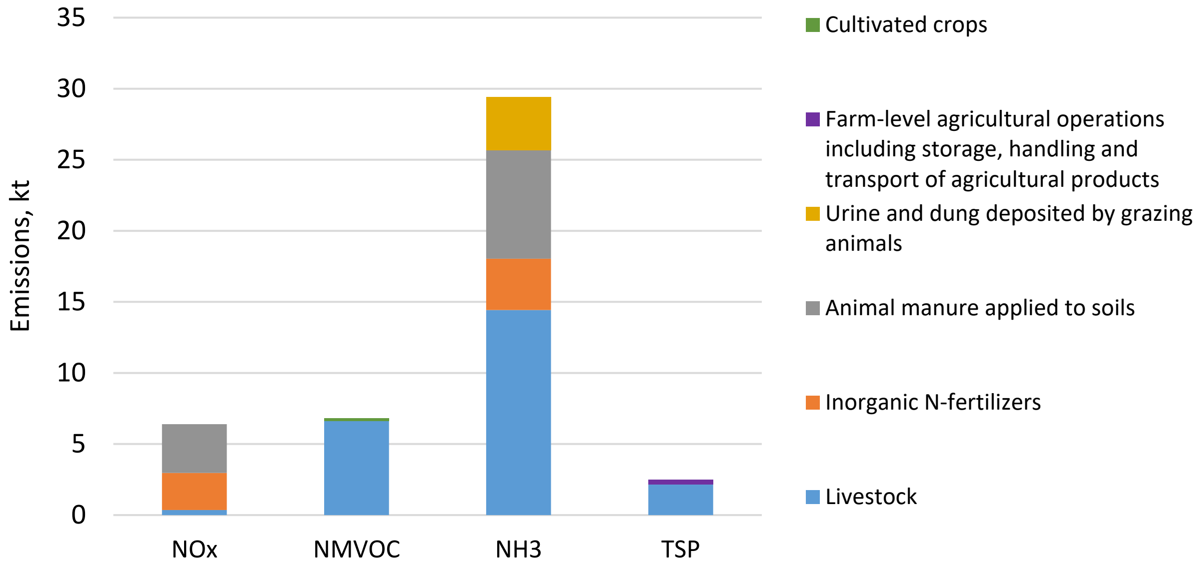

Figure 5.1 Emissions from agriculture sector in 2022

Agriculture sector is the main emitter of ammonia (89%) in the country. It also accounts for 16% of total NOx emissions and 16% of total NMVOC emissions as of 2022.

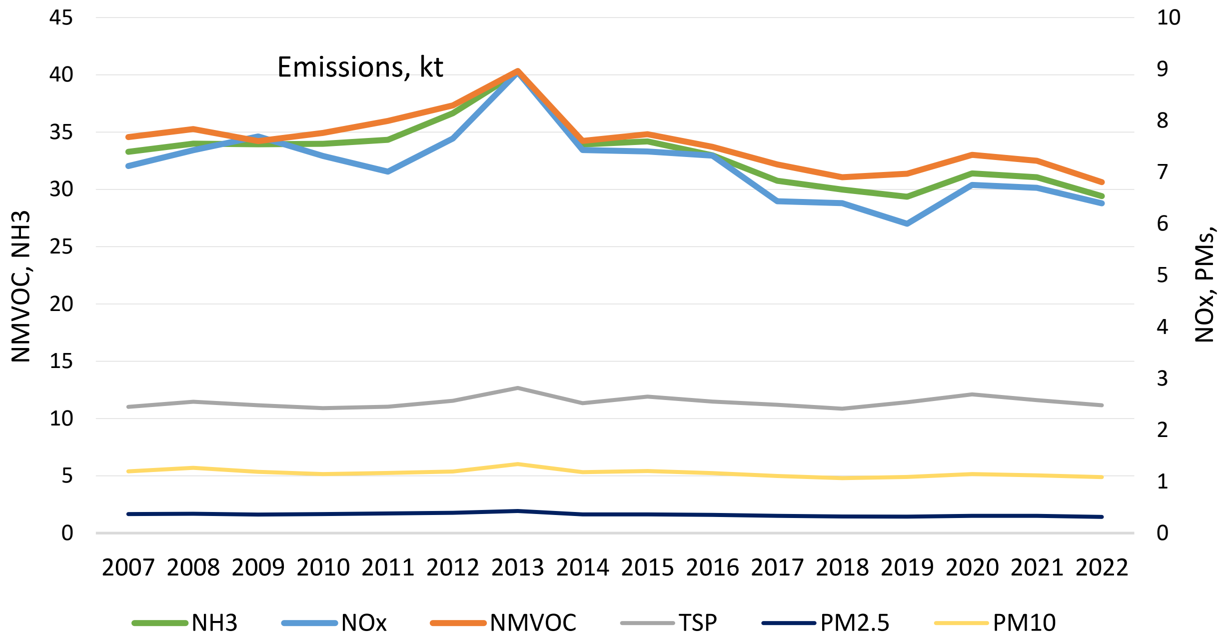

Figure 5.2 Emissions from agriculture 2007-2022

Sharp drop in emissions in 2014 is related to recalculations of activity data in agriculture sector by GEOSTAT in 2017 for the years of 2014-2015 based on the results of the census. Recalculations of previous years (2002-2013) were not implemented because a lack of human and financial resources in GEOSTAT. Emissions of ammonia have decreasing trend since 2014 mainly due to reducing production in animal husbandry and reduced levels of fertilizers consumption.

Manure Management (3B)

Source category description

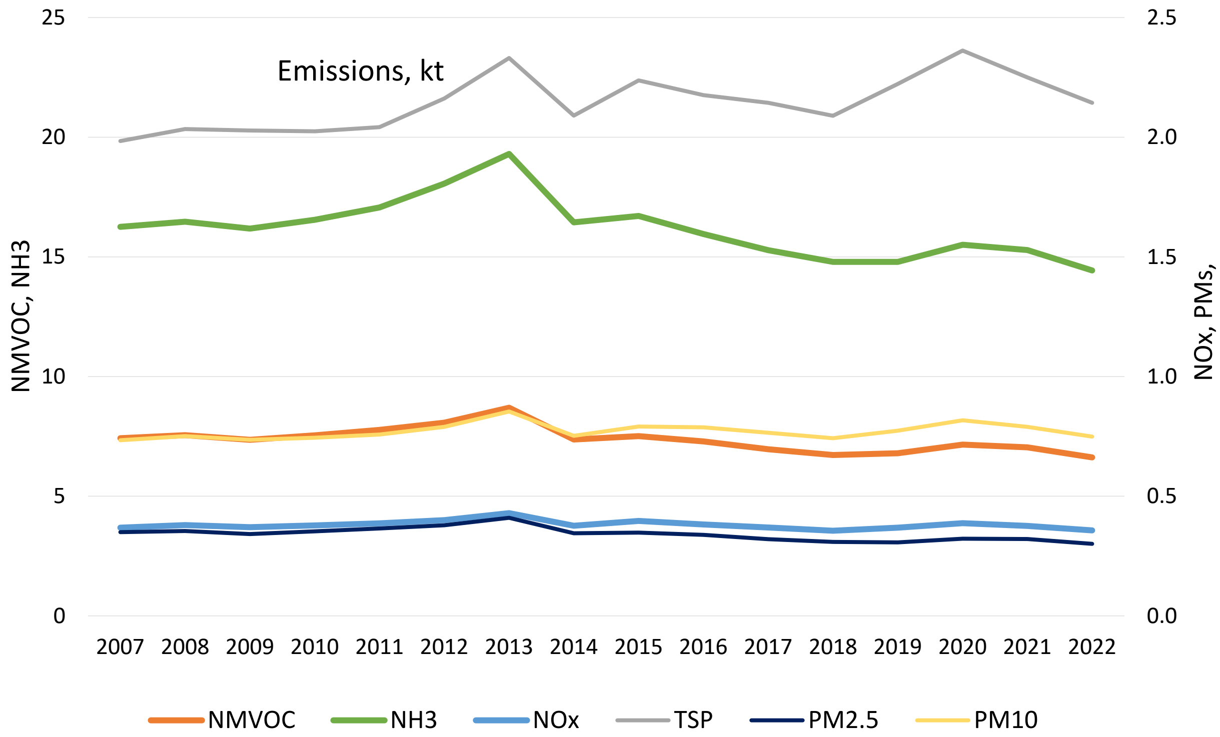

Figure 5.3 Emissions from livestock manure management 2007-2022

Manure management is the most significant source of ammonia emissions as it accounts for 44% of total NH_3 emissions. It is also responsible for 97% of NMVOC and 86% of TSP emissions from agriculture.

Table 5.1 Livestock in Georgia in 2007-2022, 1000 unit

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Dairy cattle	541	561	538	562	588	602	641	563	545	509	477	458	442	451	452	431
Non-dairy cattle	508	485	477	488	500	526	589	407	447	453	432	421	428	475	477	422
Sheep	711	690	602	597	577	688	796	866	842	876	856	819	842	896	904	864
Swine	110	86	135	110	105	204	191	170	162	136	151	163	156	166	153	150
Goats	86	79	72	57	54	54	61	54	50	61	51	50	50	50	53	50
Horses	34	35	34	35	37	38	40	35	34	32	30	29	28	29	29	28
Broilers	6150	6682	6675	6522	6360	6159	6761	6658	8309	8046	8220	7942	9298	9980	9092	8812
Turkeys	NE	NE	NE	NE	NE	NE	NE	NE	NE	80	74	66	74	79	79	67
Other poultry	NA	NA	NA	NA	NA	NA	NA	NA	NA	90	84	97	84	77	74	74

Drop of trend in 2014 is related to recalculations of activity data in agriculture sector by GEOSTAT. Emissions increases in 2020 due to increased output of agricultural sector that was slightly reduced in 2021-2022.

Methodology

Emissions are calculated using the EMEP/EEA Guidebook – 2023, tier 1 approach.

Agricultural Soils (3D)

Source category description

Under this category, NOx and NH_3 emissions from application of inorganic and organic fertilizers and particulate matters emissions from farm-level agricultural operations (storage, handling and transport of agricultural product) are provided. Additionally, emissions of NMVOC have occurred from grain fields.

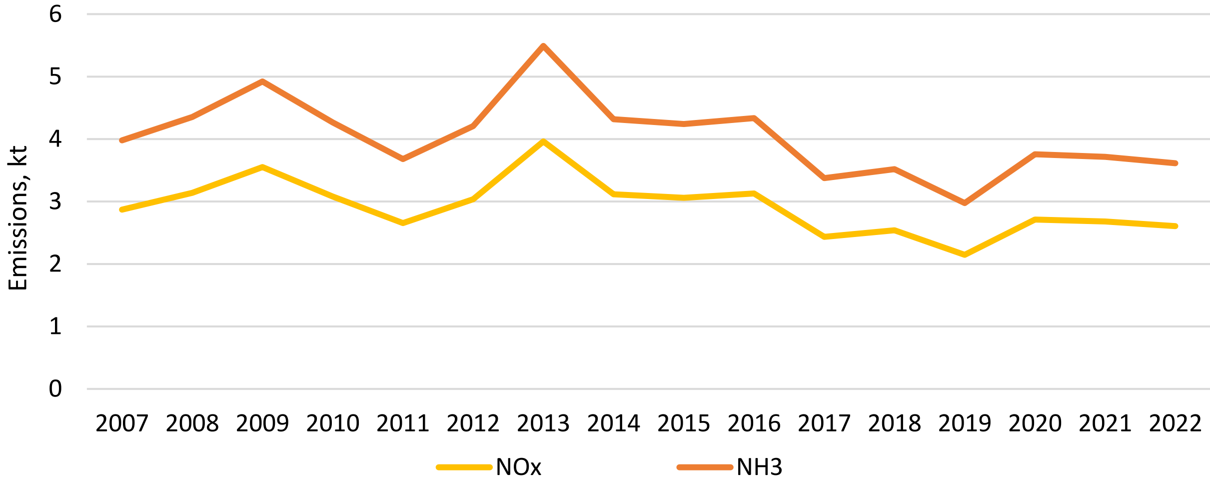

Figure 5.4 Emissions from use of inorganic N-fertilizers 2007-2022

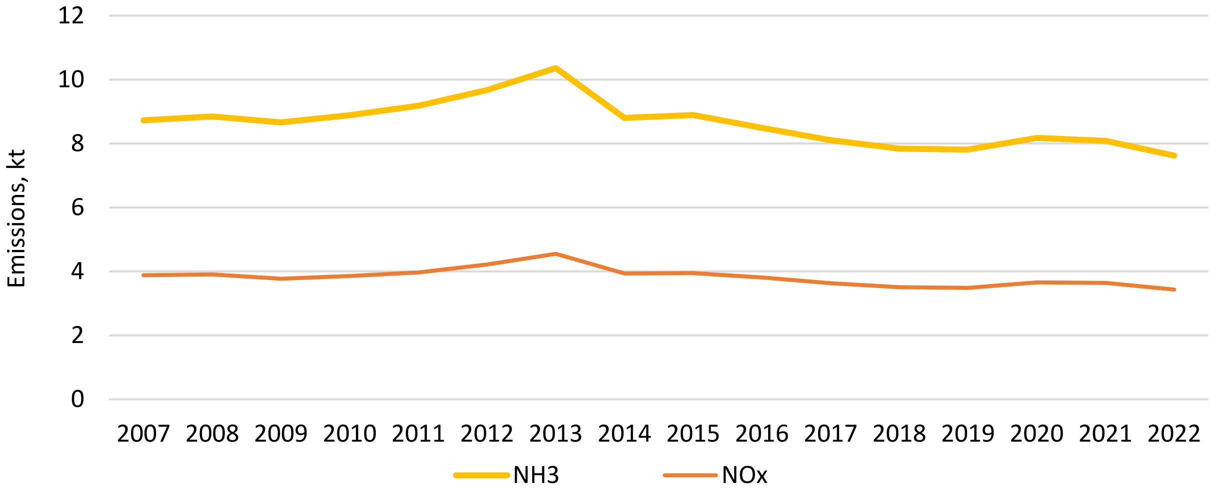

Figure 5.5 Emissions from application of animal manure to soils 2007-2022

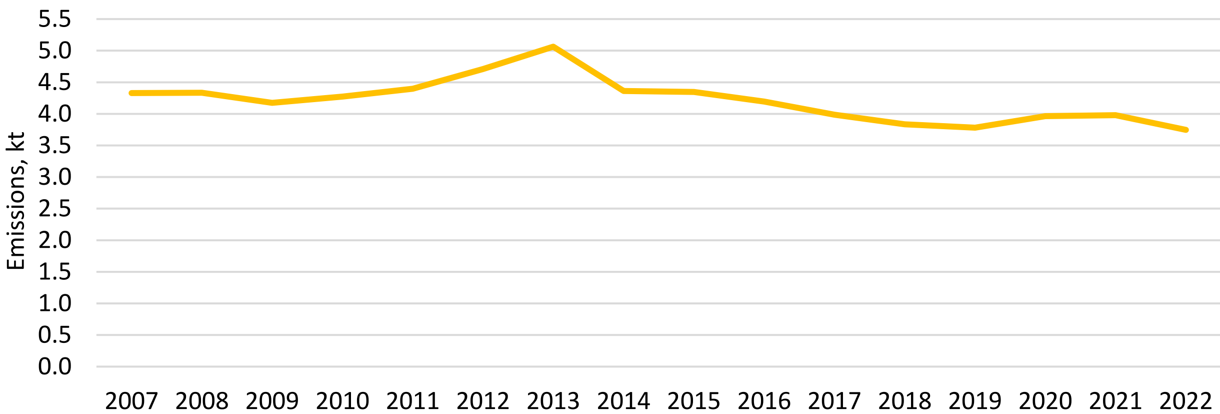

Figure 5.6 Emissions from urine and dung deposited by grazing animals 2007-2022

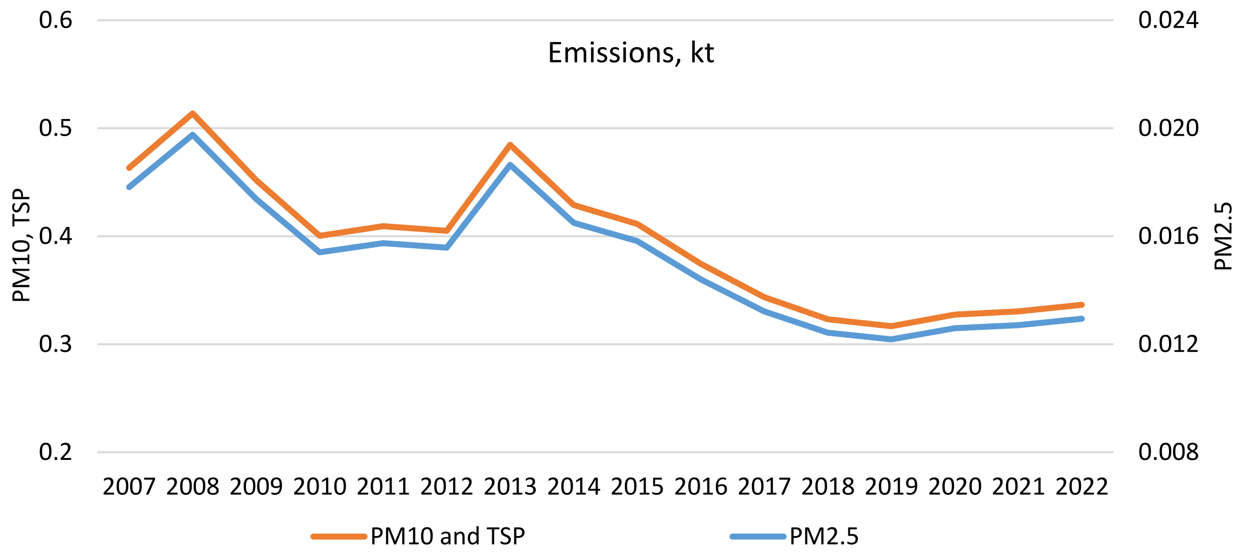

Figure 5.7 Emissions from farm-level agricultural operations including storage, handling and transport of agricultural products 2007-2022

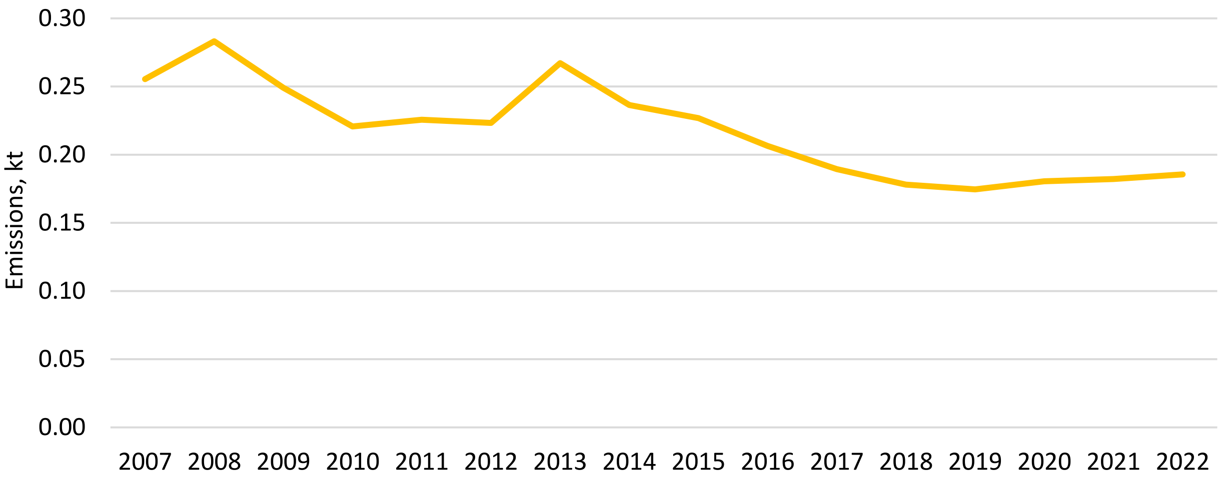

Figure 5.8 Emissions of NMVOC from cultivated crops 2007-2022

Crop production and agricultural soils is a source for 45% of total ammonia emissions. Almost all (94%) NOx emissions from agriculture comes from this subsector, which accounts for 16% of total NOx emissions as of 2022. Subcategory - manure application to soils (3Da2a) - is only responsible for 9% of total NOx and 23% of total NH_3 emissions. In addition, 54% of NOx emissions and 26% of NH_3 emissions from agriculture comes from 3Da2a.

Drop of emissions in 2014 is related to recalculations of activity data in agriculture sector by GEOSTAT. Further decrease of NOx emissions from use of inorganic N-fertilizers in 2017 (figure 5.3) are resulted by sharp reduction of use of fertilizers.

Methodology

Emissions are calculated using the EMEP/EEA Guidebook – 2023, tier 1 approach.

6. Waste (NFR sector 5)

This sector covers solid waste disposal on land, waste incineration and wastewater handling categories. The biggest polluting category in this sector is solid waste disposal on land from where comes about 97.3% of NMVOC emissions.

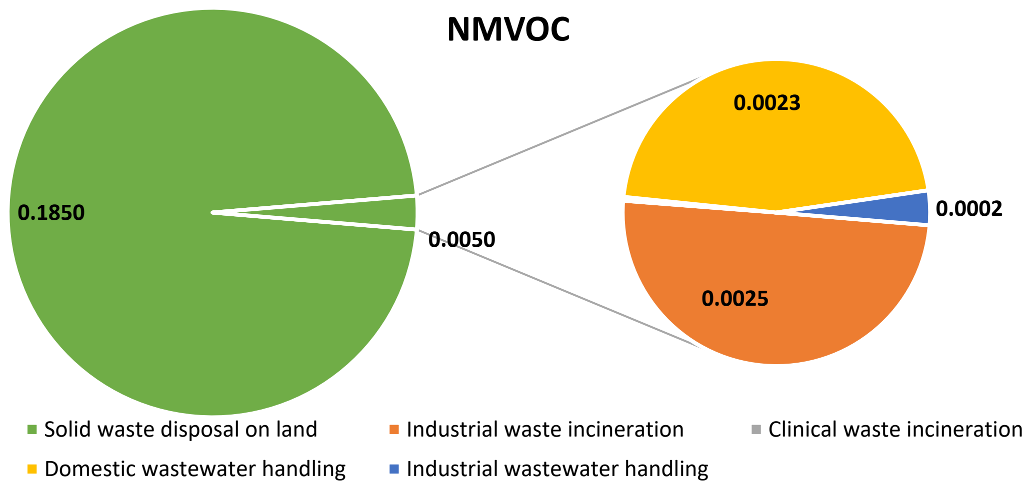

Figure 6.1 Emissions of NMVOC from waste sector in 2022 (kt)

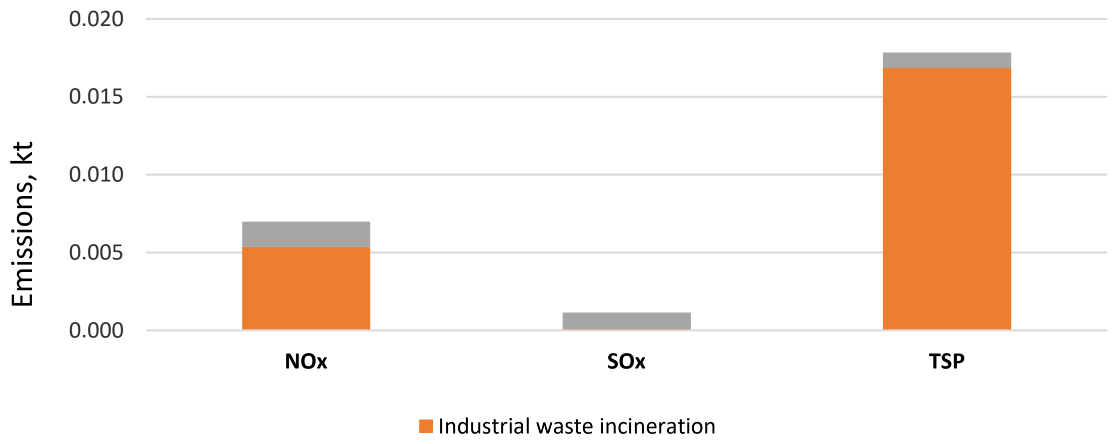

Figure 6.2 Emissions of NOx, SOx and TSP from waste sector in 2022

Solid waste disposal on land (5A)

Source category description

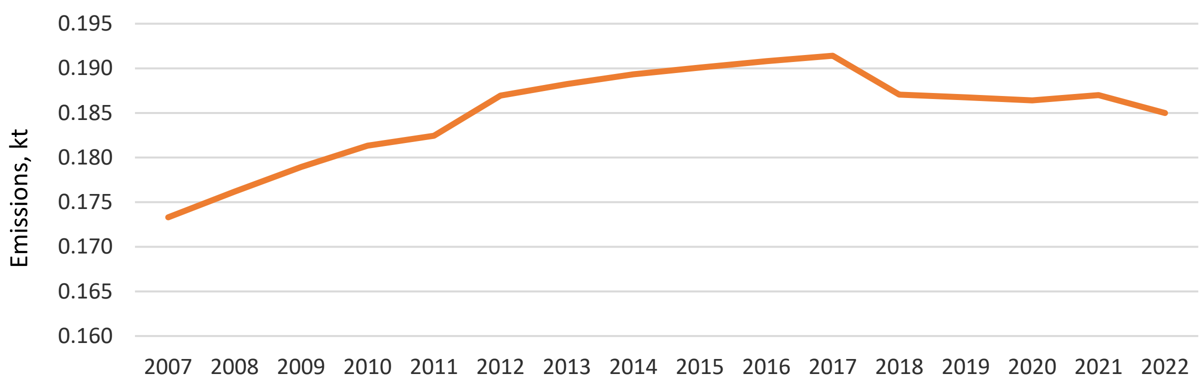

Figure 6.3 Emissions from solid waste disposal on land 2014-2022

In general, emissions of NMVOC from solid waste disposal is rising due to increased accumulation of wastes on landfills.

Methodology

Emissions are calculated using EMEP/EEA Guidebook – 2023, Tier 1 approach. Data on CH_4 emissions from solid waste disposal on land were obtained from Georgia's Biennial Update Reports (BUR) to the UNFCCC. Emissions for 2018-2022 were extrapolated, since data on CH_4 emissions in BUR is available until 2018.

Waste incineration (5C)

Source category description

This category includes industrial waste incineration and clinical waste incineration. Due to lack of activity data emissions from this category were estimated only from 2013.

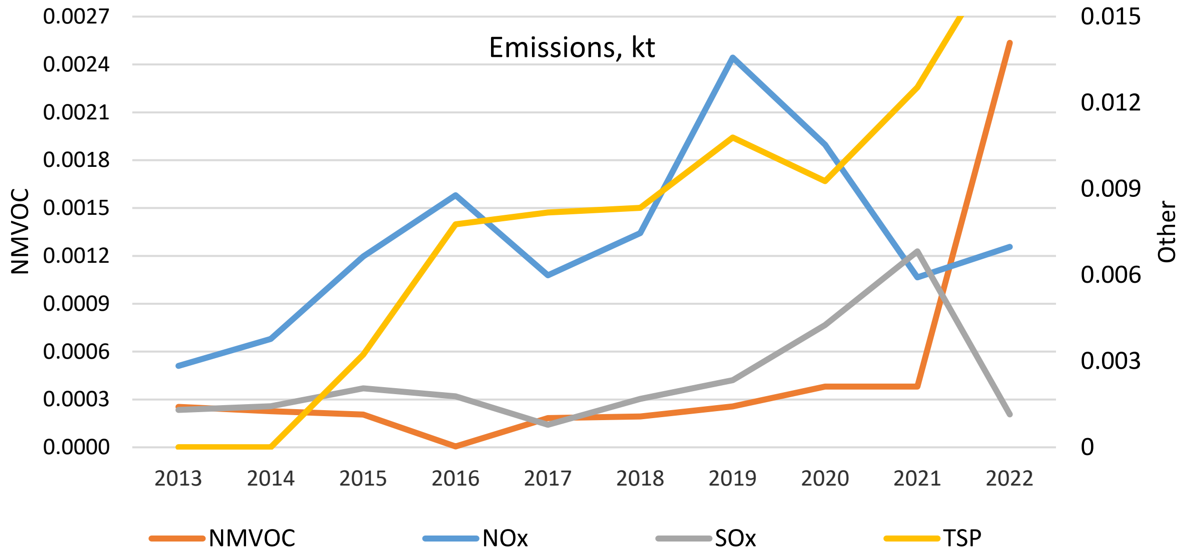

Figure 6.4 Emissions from waste incineration 2014-2022

Increased emissions in this category are related to installing of new incinerators and consequently, increased amount of waste incinerated.

Methodology

Emissions are estimated based on plant specific emissions (from state reporting system for stationary sources).

Wastewater handling (5D)

Source category description

This category covers industrial domestic wastewater handling and industrial wastewater handling.

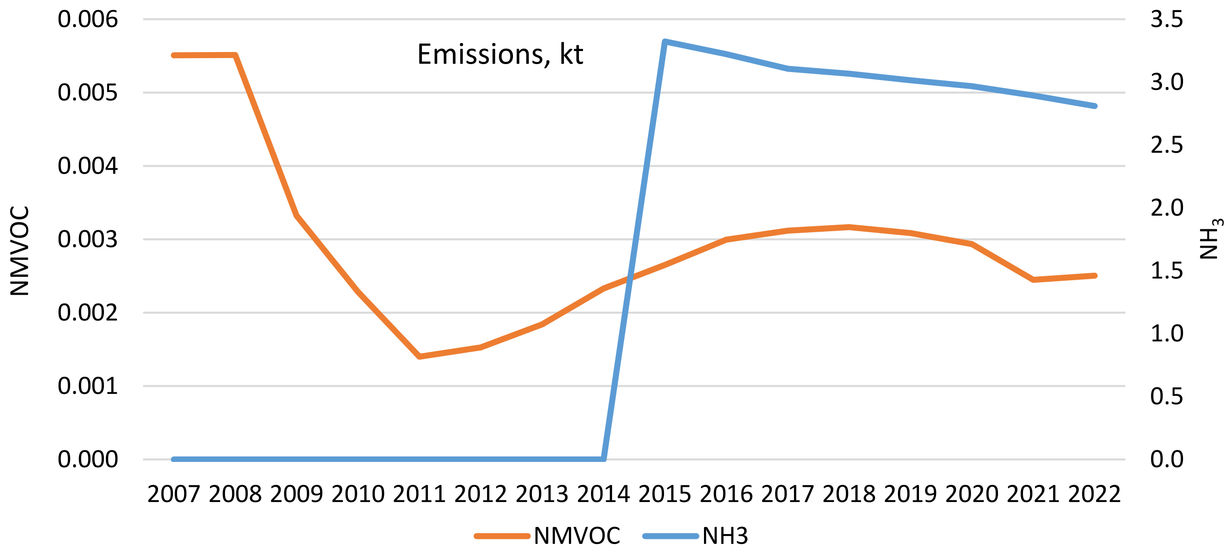

Figure 6.5 Emissions from wastewater handling 2007-2022

Until 2012 wastewater treatment infrastructure in Georgia had been gradually demolished. Since 2012 new WWTPs were built and in parallel, amount of treated wastewater was increased. As a result, emissions of MNVOC from this category started increasing and almost doubled in 2011-2022.

Due to lack of activity data on a number of population not connected to centralized wastewater collection system NH_3 emissions from this category were estimated only from 2015.

Methodology

Emissions are calculated using EMEP/EEA Guidebook – 2023, Tier 1 approach. Activity data were gained from the Integrated Management Division of NEA.

7. Recalculations and improvements

Recalculations

The following emissions were recalculated throughout 1990-2021 due to changes in emission factor in 2023 EMEP-EEA Methodology:

- SOx emissions in 1A1a, 1A4ai and 1A4ci;
- NH_3 emissions in 1A2e, 1A4ai, 1A4bi, 1A4ci and 3Da1;
- NOx, CO, NMVOC, SOx, TSP, PM10, PM2.5, Cu and Se emissions in 1A3dii;
- As emissions in 1A4bi;
- NMVOC emissions in 1B2ai, 1B2av and 1B2b;
- All emissions in 1B2aiv.

Activity data for coating application in 1990-2008 were calculated through interpolation method and relevant NMVOC emissions were calculated for the same period.

Planned improvements

For the next year, it is planned to calculate emissions from construction and demolition, and recalculate emissions from road transport using more modern software tool COPERT 5. Also, it is planned to develop updated gridded emissions report and include relevant chapter in the IIR.

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