LITHUANIA'S INFORMATIVE INVENTORY REPORT 2024

Air Pollutant Emissions 1990-2022

under the UNECE CLRTAP and the EU NECD

Part 4 – Industrial processes and product use

Lithuanian Environmental Protection Agency

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Part 4 – Industrial Processes and Product Use

1. Industrial Processes (NFR 2A, 2B, 2C)

The economic structure of Lithuania has gone through noticeable changes. During the period of 1992–1994, the share of industry in the GDP dropped from 35.5 % to 20.4 %, while the share of trade in the GDP structure grew from 4.5 to 23.5 %. Since 1992, economic recession resulted in the reduction of energy consumption, but the latter was slower than the decline in GDP. Therefore, energy demand of the national economy during this period was growing in relative terms. It is evident that the production output varied between different industries. As the most serious decline was observed in the production of electronic equipment, machinery, metalworking, the likelihood of reaching the former levels of production is quite low for these sectors. Since 1991, Lithuania's export to the western countries has increased from 5.1 % to 54.6 % of total exports. It should be noted that the share of imports from these countries into Lithuania has also increased from 9.8 % to 67.1 % of the total imports. The main trading partners of Lithuania are Russia, Germany, Belarus, Latvia, Ukraine, the Netherlands, Poland, and Great Britain.

This chapter covers emissions from industrial processes (NFR sectors 2A,B,C,D). Dominating industry in Lithuania is manufacturing. Manufacturing constituted 87% of the total industrial production (except construction) in 2011. Four most important sectors within Manufacturing cumulatively produced 78% of production:

- Manufacture of refined petroleum products (~30%);
- Manufacture of food products and beverages (~20%);
- Manufacture of wood products and furniture (~10%);
- Manufacture of chemicals and chemical products (~10%).

1.1. Cement production (NFR 2.A.1)

1.1.1. Overview of the sector

Cement is produced in a single company - AB Akmenės Cementas, which is situated in the North Western part of Lithuania. The factory was constructed in soviet times (1947-1974), cement produced in the factory was exported to other Republics of USSR, Hungary, Cuba and Yugoslavia. The total nominal capacity of the plant is about 5 million tonnes cement per year. The data on clinker production and composition were provided by the AB Akmenės Cementas. Activity data is collected on company level.

Cement production emits both fuels burning and process emissions. 2006 The company has made significant progress in introducing new 4,500 t/d dry process clinker production line. From 2014 August the process of using a fully dry process furnace was initiated, while until 2014 it was only using wet process furnace in cement production. Fuel combustion emissions are provided in the energy sector (CRF 1.A.2.f i), with the exception of NOX and SO2 emissions that are provided in sector 2.A.1. The main emissions from cement production are air emissions from the furnace system. Pollutants are emitted from physical and chemical raw material reactions and fuel. The main components of the exhaust gases are nitrogen and excess oxygen from the combustion air stream and carbon dioxide and water from raw materials and the combustion process, which is an integral part of the process. Outgoing gas also has a small amount of air pollutants.

1.1.2. Methodological issues

Activity data: Emissions from the stove are a mixture of combustion and emissions released during the process. The main source of emissions (NOx, SOx, CO, NMVOC, and NH3) as well as HM and POP, it mainly originates from the combustion of fuels, therefore these emissions are provided in sector 1.A.2.f., which deals with the combustion process in the cement production process because it is not possible to separate process and combustion emissions from cement production. Since emission factors are expressed as mass of clinker produced, activity statistics must be converted from cement to clinker production statistics. Most of the cement produced is Portland cement with an average clinker content of 90-97% (IPCC, 2006). The amount of clinker production was obtained from Akmenės cementas since 1990.

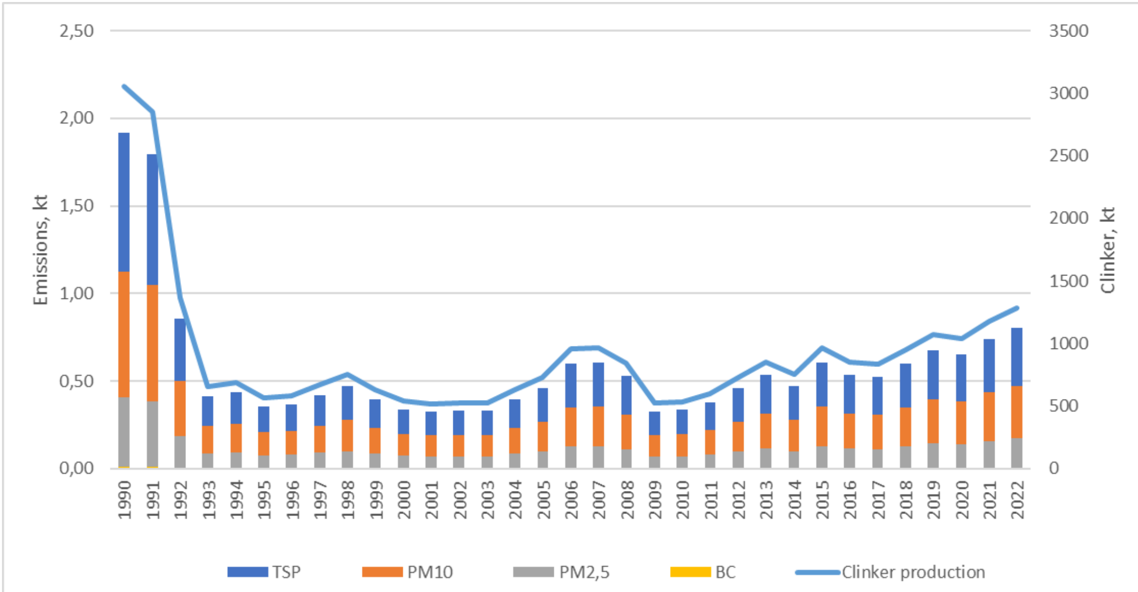

Figure 4-1. Clinker amount and emissions in sector 2.A.1. Cement production.

The Tier 2 approach for process emissions from cement uses the general equation:

$$E_{Pollutant} = AR_{production} \times EF_{pollutant}$$

where:

- $E_{pollutant}$ is the emission of the specified pollutant
- $AR_{production}$ is the activity rate for the cement production
- $EF_{pollutant}$ is the emission factor for this pollutant

This equation is applied at the national level, using annual national total cement production data and EF provided in EMEP/EEA guidebook, 2023.

1.1.3. Uncertainties and time-series consistency

Activity data uncertainty is assumed to be 2%. Data on clinker production provided by the single production company is considered reliable.

1.1.4. Source-specific QA/QC and verification

All quality procedures according to the Lithuanian QA/QC plan have been implemented during the work with this submission.

1.1.5. Source-specific recalculations

No source specific recalculations.

1.1.6. Source-specific planned improvements

No source-specific planned improvements.

1.2. Lime production (NFR 2.A.2)

1.2.1. Overview of the sector

Emissions from the lime production industry include emissions of PM from limestone mining, processing, splitting, sifting and calcination, and emissions of air pollutants from fuel combustion. Since 1999 data on the production of hydrated lime is provided by the Statistics Lithuania. The hydrated lime fraction ranged from 0% to 4%. National statistical data do not include non-commercial data on lime production from sugar undertakings and therefore for the whole period from 1990 onwards the quantities of lime produced were obtained directly from sugar-producing companies (lime deposited and used in agricultural activities).

Emissions from the lime industry are the result of two main processes of lime processing: quarrying, crushing and sizing of minerals; and fuel burning in lime stoves. Emissions from lime production are determined by both processes and fuel combustion. Emissions from combustion are provided in 1.A.2.f.i Stationary combustion in other manufacturing and construction industries. SOx and NOx emissions are provided in (IE) source category 1.A.2.f.i.

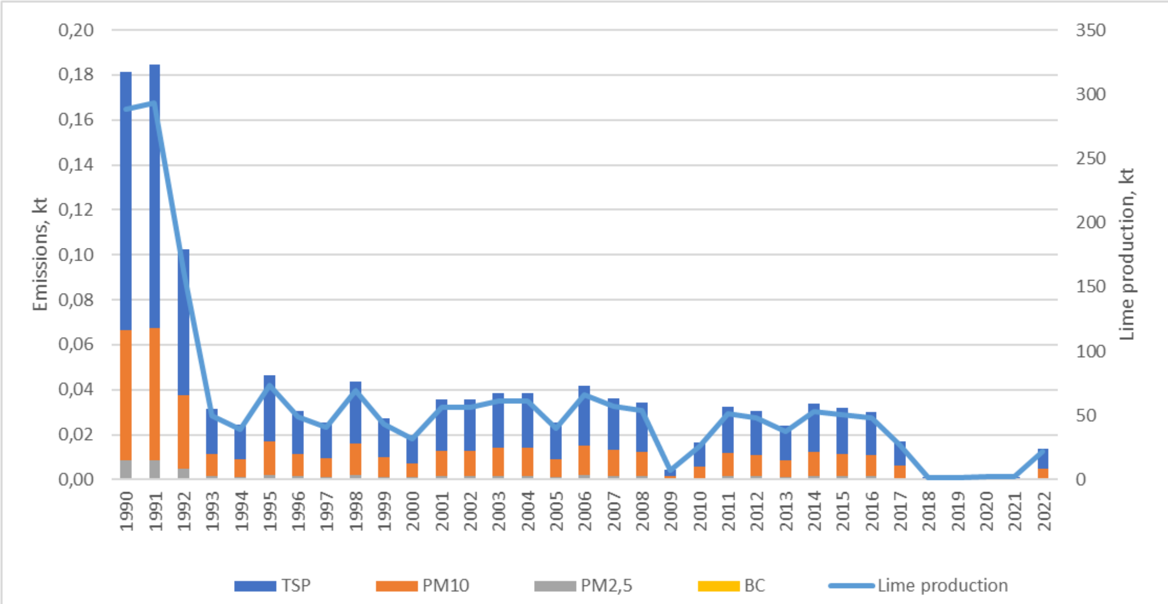

Figure 4-1 Lime production

Since 2005 the best available technologies (BAT) have been introduced in the installations, and emissions from the production processes are controlled. Therefore, since 2005, for particulate matters and BC are used for controlled processes EF from EMEP / EEA 2023.

The Tier 2 approach for process emissions from lime uses the general equation:

$$E_{Pollutant} = AR_{production} \times EF_{pollutant}$$

where:

- $E_{pollutant}$ is the emission of a pollutant (kg)
- $AR_{production}$ is the annual production of lime (in Mg)
- $EF_{pollutant}$ is the emission factor of the relevant pollutant (in kg pollutant / Mg lime produced)

This equation is applied at the national level, using annual national total lime production data and EF provided in EMEP/EEA Guidebook, 2023.

1.2.3. Source-specific QA/QC verification

All quality procedures according to the Lithuanian QA/QC plan have been implemented during the work with this submission.

1.2.4. Source-specific recalculations

No source specific recalculations.

1.2.5. Source-specific planned improvements

No source specific planned improvements.

1.3. Glass production (NFR 2.A.3)

1.3.1. Overview of the sector

NMVOCs, as well as heavy metals (Cr, Cd, Hg, Pb, As), Cu, Zn, Se, Ni, NH_3, $PM_{2.5}$, PM_{10}, TSP and BC, are emitted in small quantities the industrial production of flat glass, container glass, optical glass, glass fibers, and glass wool. Lithuania provides Eurostat statistical database with the mass of domestically manufactured glass by kind (bottles, flat sheets, glass wool, etc.). Summarized emissions from the glass production are presented below (Fig. 4-3A and B). Detailed heavy metal emissions are additionally provided in Fig. 4-4.

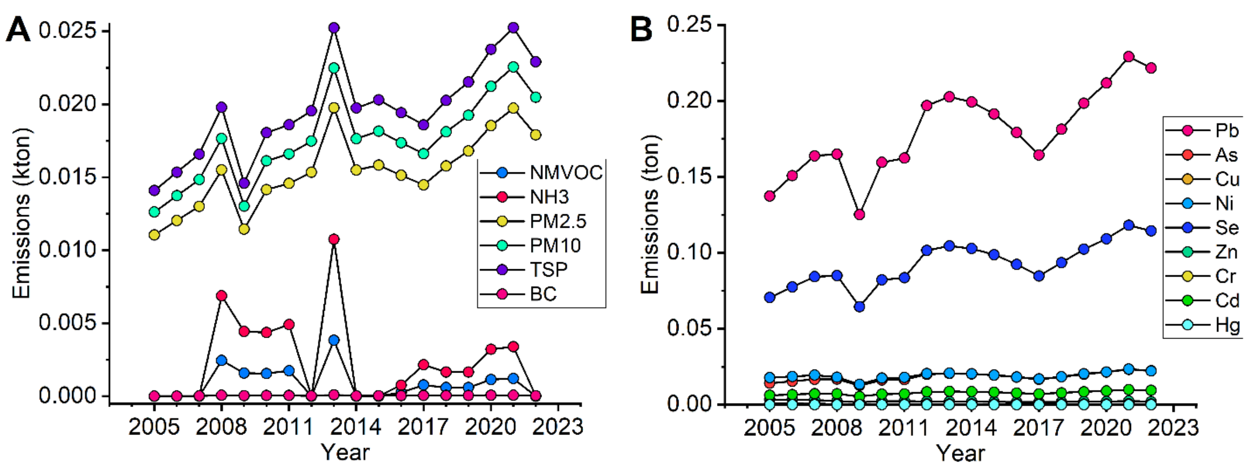

Figure 4-2 Pollutant emissions occuring from the glass production from 2005 to 2022.

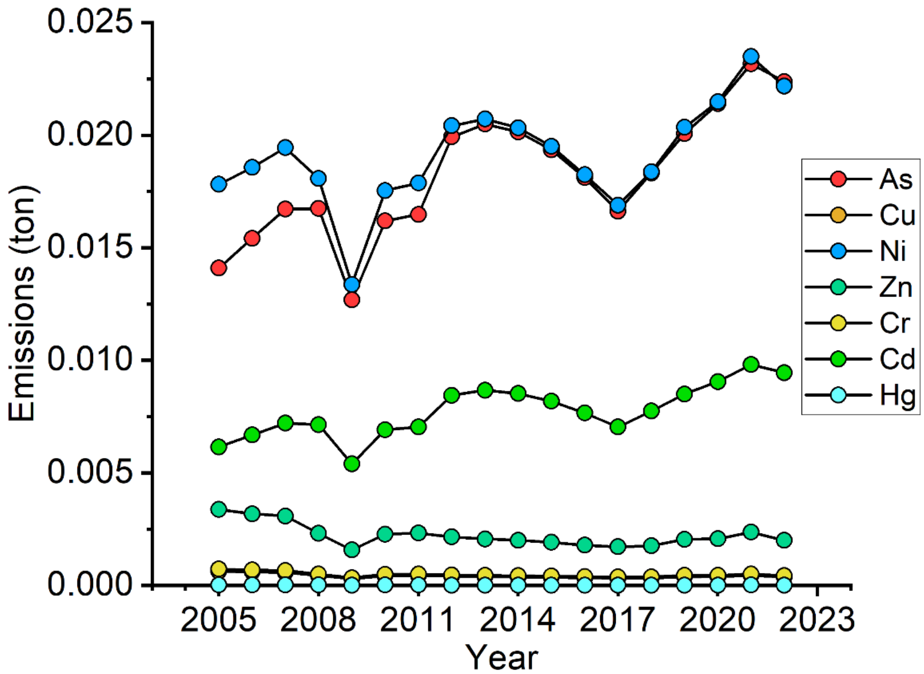

Figure 4-4 Detailed heavy metal emissions occuring from the glass production from 2005 to 2022.

1.3.2. Activity data

For emission calculations, we evaluated the amount of produced various glass in Lithuania. We obtained the glass production statistics for the flat glass, glass wool, container glass, and glass fibers from the Eurostat database. More precisely, the manufacture of glass fibers, glass mats, glass mirrors, optical glass, safety glass, glass jars, glass bottles, and glass in bulk, as well as slag wool, were used as activity units for emission calculations. The total glass production, depending on the glass type, is summarized in Fig. 4-5.

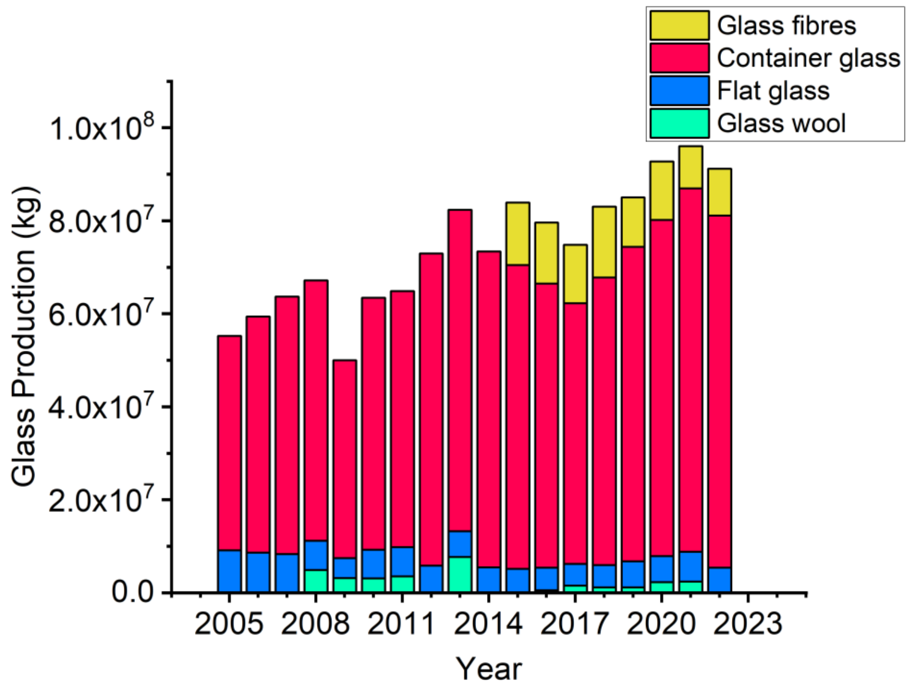

Figure 4-5 Total glass production from 2005 to 2022 (Eurostat database).

1.3.3.Emission factors

We employed the Tier 2 approach to estimate pollutant emissions. In said apprach, we used glass production data (Eurostat data) and aggregated various glass production into four major categories: glass fibre production, flat glass production, container glass production, and glass wool production. For each category, we used standard emission factors from the EMEP/EEA guidebook, 2023, 2.A.3, tables 3.2, 3.3, 3.4, and 3.5. The specific pollutants were estimated by multiplying relevant emission factors (of relevant glass category) with relevant activity (production) data of specific glass type:

$$E_{Pollutant} = AR_{production} \times EF_{pollutant}$$

where:

- $E_{Pollutant}$ is the emission of specific pollutant;
- $AR_{production}$ is production of relvant glass product (from 4 key categories);
- $EF_{pollutant}$ is the emission factor of the relevant pollutant.

1.3.4. Recalculations

There are no recalculations to declare.

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

1.4.1. Overview of the sector

There are several non-metallic minerals quarried in Lithuania: dolomite, limestone, gravel, sand and peat. The occurring emissions from this sector are particulate matters: TSP, PM_{10} and $PM_{2.5}$.

Emissions from the sector are significant at local level, emissions at national level are relatively low and only relevant for relatively particulate fractions. In the course of quarrying, digging and handling excavated minerals (e.g. sifting, shredding) and transferring them, solid particles are emitted to the atmosphere. According to the EMEP/EEA Guidebook (2023) Particulate Control, this process also includes watering and process coverings. In Lithuania, when treating quarries or excavated minerals, equipment is not covered by hoods or similar materials because of the security measures and easier visual inspection of the production.

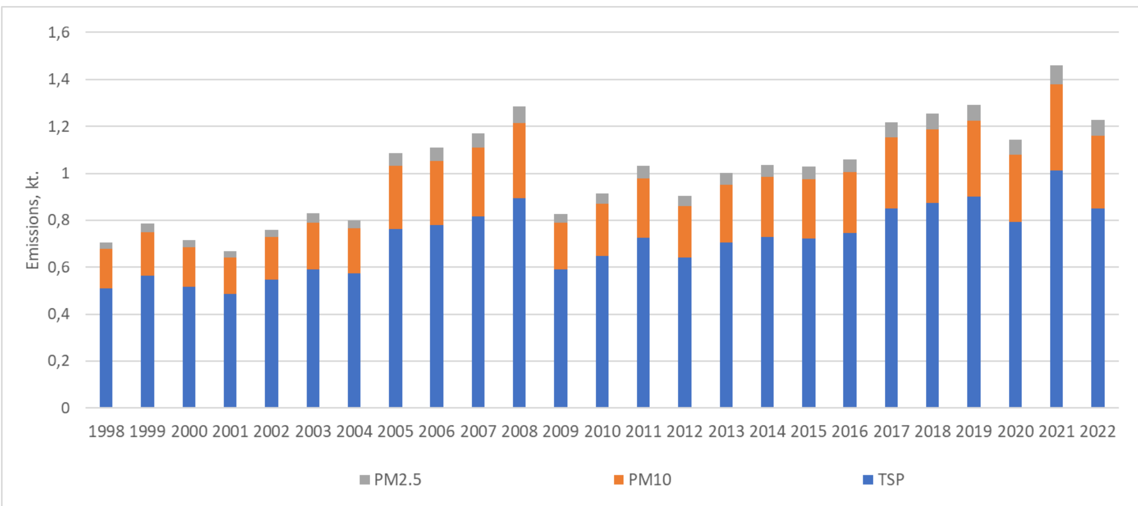

Figure 4-6. Emissions from the sector 2.A.5.a 1998 – 2022.

1.4.2. Methodological issues

The annual amount of extracted minerals is available fom Lithuanian Geological Survey Underground register reports. Emission factors, shown in table 4.1, were calculated using the Tier 2 methodology spreadsheet available from EMEP/EEA (2023).

	UNIT	TSP	PM_{10}	$PM_{2.5}$
CRUSHED ROCK	g/t	33,9	13,6	3,6
SAND AND GRAVEL	g/t	22,8	7,6	1,6
RECYCLED AGGREGATES	g/t	23,2	9,9	2,6

Table 4-1. Emission factors for quarrying and mining of minerals other than coal

All quarries in Lithuania are classified as small quarries, since the annual production in all quarrying sites in Lithuania is below 100 000 kt. The total annual production of minerals in all three categories for period 1998-2022 is between 106 – 18 000 kt.

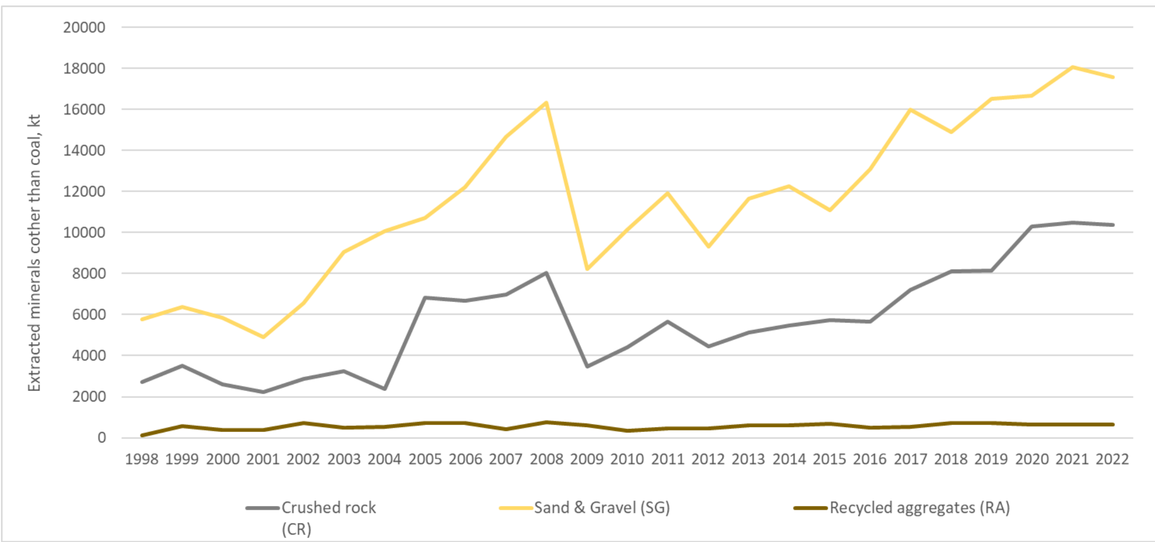

Figure 4-7. Extracted minerals other than coal, kt.

Since Lithuania is a small country, emission factors were calculated as one region. For average wind speed (3,12 m/s), number of days with at least 1 mm natural precipitation (175) and number of days with wind speed > 19,3 km/h (36), best suited for regional conditions default values were used. Due to the complicated collection of required data , default values for additional country specific data were used.

1.4.3. Source-specific recalculations

$PM_{2,5}$, PM_{10} and TSP emissions were recalculated using Tier 2 methodology calculation model spreadsheet (EMEP/EEA, 2023).

1.4.4. Source-specific planned improvements

No source specific planned improvements.

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

The following activities are included in this NFR sector for 2024 submission: Construction of new ground roads, Construction of new bicycle tracks, Non-residential construction, Apartment buildings, Detached single/two family houses. The activity data were taken/derived from the information provided by the Statistics Lithuania indicators database.

Thornthwaite precipitation-evaporation index (PE) in Lithuania was used for all above mentioned activites; values of this index are as follows (the input for calculation of these values was provided by Lithuanian Hydrometeorological Service):

	2005	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*
PE for Lithuania	73,34	62,57	88,14	69,83	80,03	128,32	76,16	112,22	74,54	68,44	61,19	90,52	92,68	59,47	64,18	57,69	73,75	65,02
24/PE	0,33	0,38	0,27	0,34	0,30	0,19	0,32	0,21	0,32	0,35	0,39	0,27	0,26	0,40	0,37	0,42	0,33	0,37

Figure 4-10. Thornthwaite precipitation-evaporation index (PE) in Lithuania, 2005-2022

Soil silt content (s) %, is equal 20 and variable (s/9) has value 2,22 for all years.

Emissions of TSP were evaluated but not reported due to the large values those were obtained (e.g. 20-40 kt per year in construction of new roads) and taking into account the note in the GB2019:

„All emission literature dealing with construction activities states that the estimated emissions by the construction industry are only a first order quantification of the actual emissions and the uncertainty is high, much higher than for most other sources of primary PM“

1.6.1. Recalculations

1) During the TAIEX PEER 2 PEER workshop in May, 2023, the topic of construction of the new roads was discussed. It was concluded that ground movement mostly occurs while preparing the new ground roads. Therefore, only construction of the new ground roads was considered.
2) Construction of the new railways was excluded. A consultation with Lithuanian Railways Administration is necessary regarding the length of the constructed Rail Baltica railway.
3) Construction of the new urban streets was excluded, due to lack of reliable data for 2005.

1.6.2. Construction of new roads: activity, parameters and emission factors

Only ground roads were considered.

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
861	100	365	54	0	700	506	301,0909	9	308	32	370	7	301,0909	0	0	0	0

Parameters. Affected area , (m2/km), was 36000, duration of construction (d), was 1 year , control efficiency of applied emission reduction measures was evaluated as 0,5 for all years 2005-2021.

Emission factors for PM from the Table 3.4 „Tier 1 emission factors for uncontrolled fugitive emissions for source category 2.A.5.b Construction and demolition – Road construction“ (GB2019, chapter 2.A.5.b Construction and demolition) were used.

1.6.3. Construction of new urban streets: activity, parameters and emission factors

This category was excluded from the 2024 submission, due to lack of reliable data for 2005.

1.6.4. Construction of new bicycle tracks: activity, parameters and emission factors

Activity. The length of the new bicycle tracks was derived from Statistics Lithuania published data.

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
11,1	11,1	11,1	11,1	11,1	11,1	94,7	103,4	101,4	45,5	92	41,1	22,6	220,2	59,1	61,2	138,1	118,9

In this case, length of new bicycle tracks is equal to the difference in relation to the last year.

Parameters. Affected area , (m2/km), was 9000 (1/4 of „normal roads“), duration of construction (d), was 1 year , control efficiency of applied emission reduction measures was evaluated as 0,5 for all years 2005-2021.

Emission factors for PM from the Table 3.4 „Tier 1 emission factors for uncontrolled fugitive emissions for source category 2.A.5.b Construction and demolition – Road construction“ (GB2019, chapter 2.A.5.b Construction and demolition) were used.

1.6.5. Construction of new railway tracks: activity, parameters and emission factors

This category was excluded from the 2024 submission, because a consultation with Lithuanian Railways Administration is necessary regarding the length of the constructed Rail Baltica railway.

1.6.6. Construction of new buildings: activity, parameters and emission factor

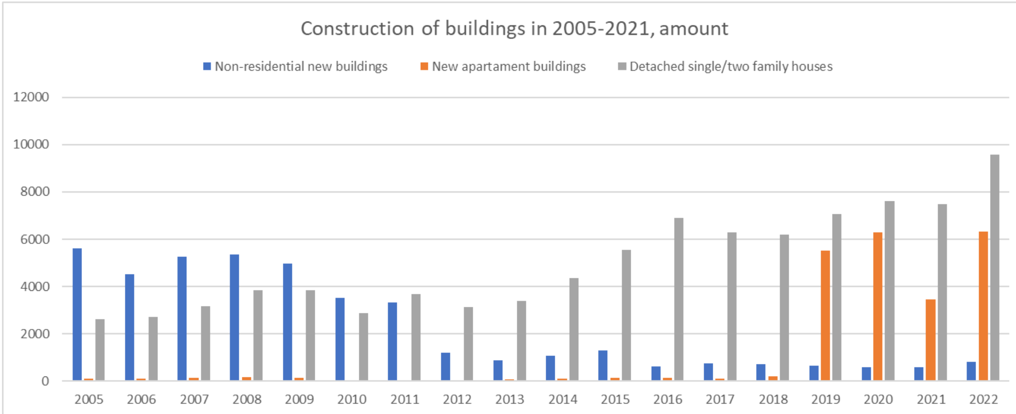

Figure 4-11. Number of new buildings in 2005-2021

The parameters and emission factors those were used: for the new non-residentials buildings, the apartement buildings and residential houses the affected area and duration were default (taken from GB2019). The emission factors for the new non-residentials buildings were taken from the Table 3.3 „Tier 1 emission factors for uncontrolled fugitive emissions for source category 2.A.5.b Construction and demolition – Non-residential construction“, for the apartment buildings - Table 3.2 „Tier 1 emission factors for uncontrolled fugitive emissions for source category 2.A.5.b Construction and demolition – Construction of apartment building“, for the residential houses - Table 3.1 „Tier 1 emission factors for uncontrolled fugitive emissions for source category 2.A.5.b Construction and demolition – Construction of houses“ (GB2019, chapter 2.A.5.b Construction and demolition).

Emissions of PM

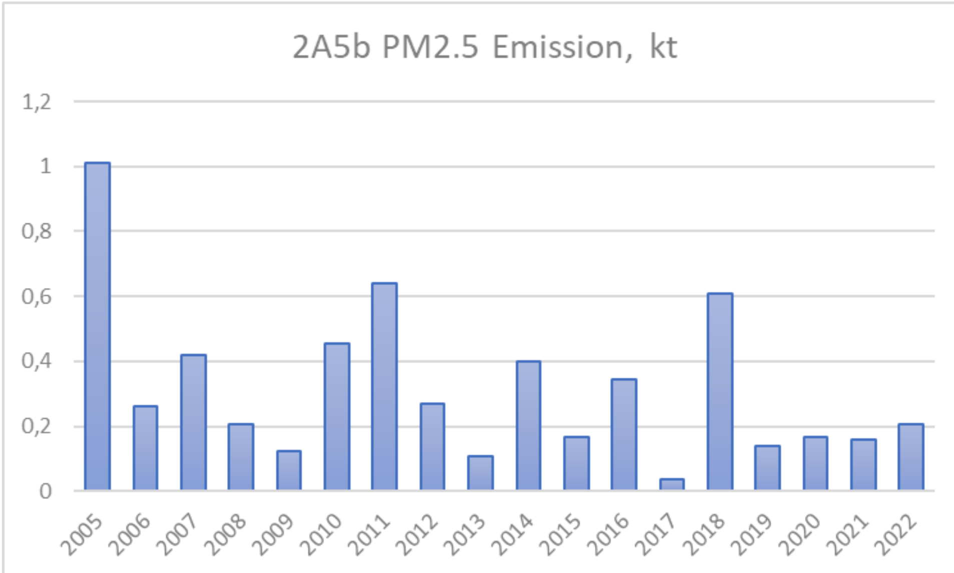

Figure 4-12. PM2.5 emission in 2A5b

Emissions of PM10 were 10 times higher.

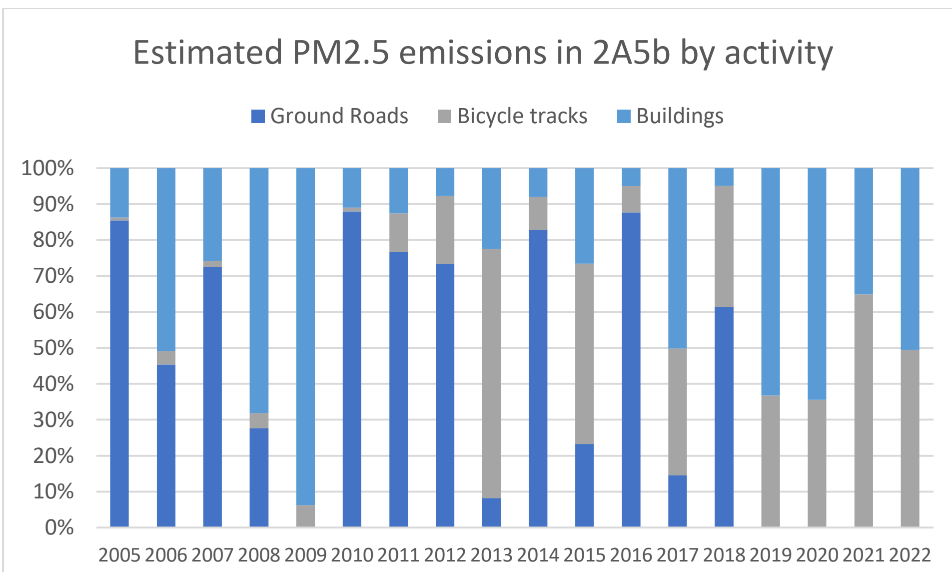

Figure 4-13. PM2.5 emission in 2A5b by activity

1.6.7. Planned improvements

1) To obtain data about the new urban streets from the municipalities of the biggest cities
2) To consult with the Lithuanian Railways Administration regarding the length of the constructed Rail Baltica railway.

1.6. Storage, handling and transport of mineral products and steel production (NFR 2.A.5.c)

1.6.1. Overview of the sector

The emissions for storage, handling and transport of mineral products covers the dry bulk material, handled in main port in Lithuania - Klaipėda state seaport. The emissions from this sector include particulate matters: TSP, PM_{10} and $PM_{2.5}$.

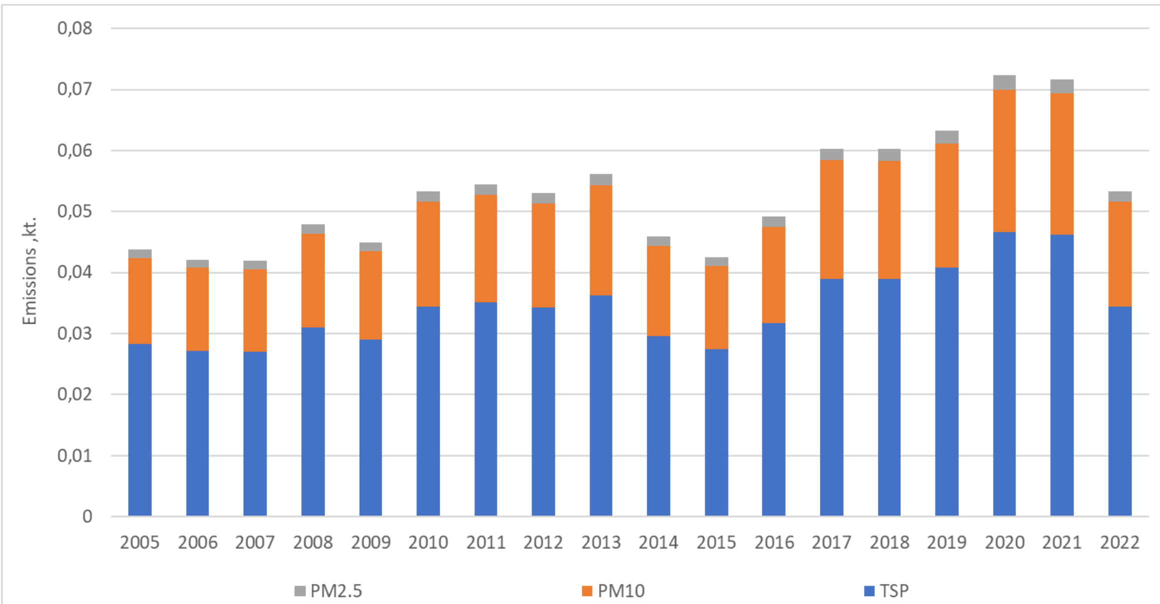

Figure 4-14 . Emissions from the sector 2.A.5.c 2014 – 2022

1.6.2. Methodological issues

Activity data for calculating emissions were taken from Eurostat database in order to cover the period for 2005 – 2014, when national data is not available. Eurostat data is consistent with national statistics. Emission factors were taken from 2023 EMEP/EEA Guidebook. For estimation, Tier 2 methodology was used.

$$E_{Pollutant} = AR_{production} \times EF_{pollutant}$$

Where:

$E_{pollutant}$ – the emission of the specified pollutant

$AR_{production}$ – the activity rate for the storage, handling and transport

$EF_{pollutant}$ – the emission factor for this pollutant

1.6.3. Source-specific QA/QC verification

All quality procedures according to the Lithuanian QA/QC plan have been implemented during the work with this submission.

1.6.4. Source-specific recalculations

Emsissions of $PM_{2,5}$, PM_{10} and TSP were recalculated using dry bulk cargo handled in main port activity data from Eurostat database.

1.6.5. Source-specific planned improvements

No source specific planned improvements.

1.7. Ammonia and Nitric acid production (NFR 2.B.1 and 2.B.2)

1.7.1. Overview of the sector

Ammonia and nitric acid production, in Lithuania, occurs in a single plant AB Achema. The plant mainly produces ammonia and nitric acid is a by-product from ammonia production. For this reason, the emissions from the amonia and nitric acid production are mixed together, as the plant does not provide separate NMVOC, NOx, Sox etc. values for separate processes. The ammnonia is produced at 22.0-24.0 MPa pressure from hydrogen and nitrogen, which are generated at 800-1000 °C by conversion of natural gases (mostly methane). The converted gas is cleaned from CO, CO_2, and H_2O impurities and ammonia synthesis is carried out using vanadium catalytic converters. During the process, NMVOC, NOx, NH3 PM2.5, PM10, TSP, CO, BC, and SOx air pollutants are emitted (Fig. 4-15).

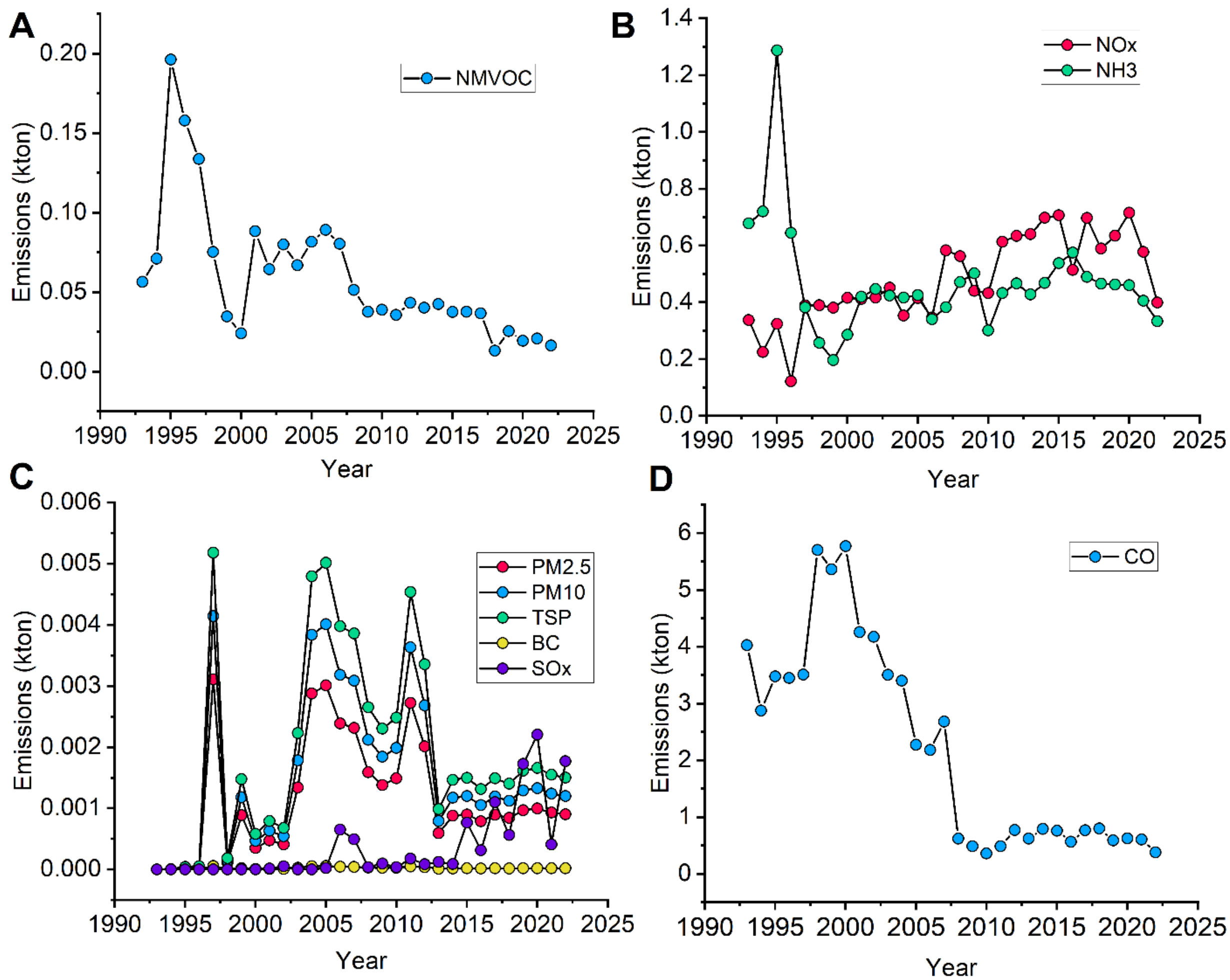

Figure 4-15 . Emissions of all reported pollutants (in kton) from the combined production of ammonia and nitric acid. (A) NMVOC emissions, (B) NOx and NH_3 emissions, (C) TSP, BC, SOx, PM_{10} and $PM_{2.5}$ emissions, (D) CO emissions.

1.7.2. Activity data and emission factors

To estimate pollutant emissions, we used Tier 3 approach, with all pollutant values being reported by the plant in yearly CLRTAP reports. The plant directly measures all air pollutants in multiple chimneys through the use of electrochemical analysis methods. From the reports supplied by the plant, we combined methanol, xylene, toluene, benzene, and butanol (and many other organic solvents) into the NMVOC category. $PM_{2.5}$, PM_{10} and BC values were calculated from the TSP emissions (which are measured by the plant, electrochemically) using Tier 1 approach with standard emission factors provided by the guidebook, namely, $PM_{2.5}$ values were 60% of reported TSP values; PM_{10} values were 80% of reported TSP values; BC values were 1.8% of calculated $PM_{2.5}$ values (EMEP/EEA guidebook, 2023, 2.B.1, table 3.1).

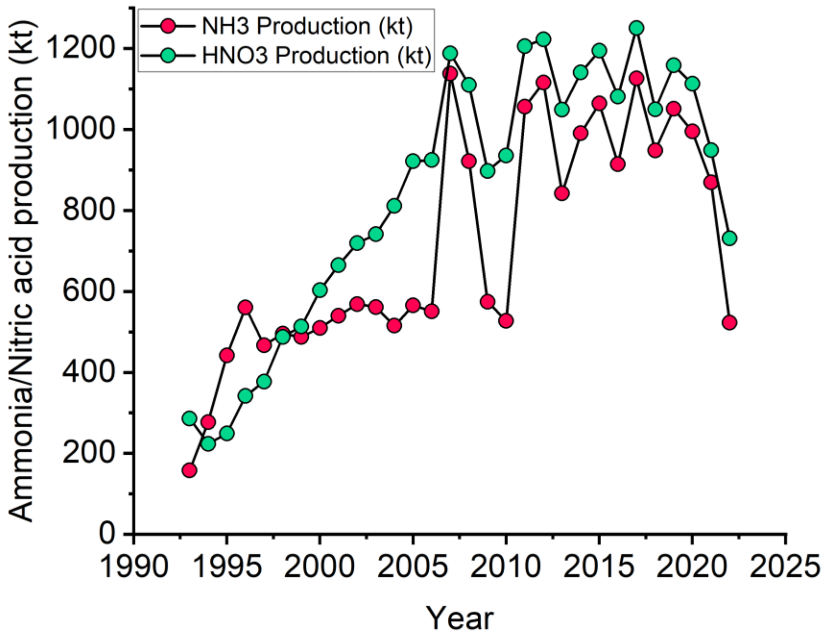

Figure 4-16. Production of ammonia and nitric acid.

1.7.3.Recalculations

There are no recalculations to declare.

1.8. Chemical industry: Other (please specify in the IIR) (NFR 2.B.10A)

1.8.1. Overview of the sector

This sector includes emissions of the pollutants from the production of sulfuric acid. Ammonia, NMVOCs, NOx, SOx, CO, and TSP are the main pollutants directly emitted during the industrial sulfuric acid production. The only sulfuric acid manufacturing plant in Lithuania, AB Lifosa, directly measures and reports all the major pollutant emissions that occur during the manufacturing process. The pollutant cocncentreations are measured at the chimeneys via electrochemical analysis techniques. The main reported pollutants are presented in Fig. 4-17.

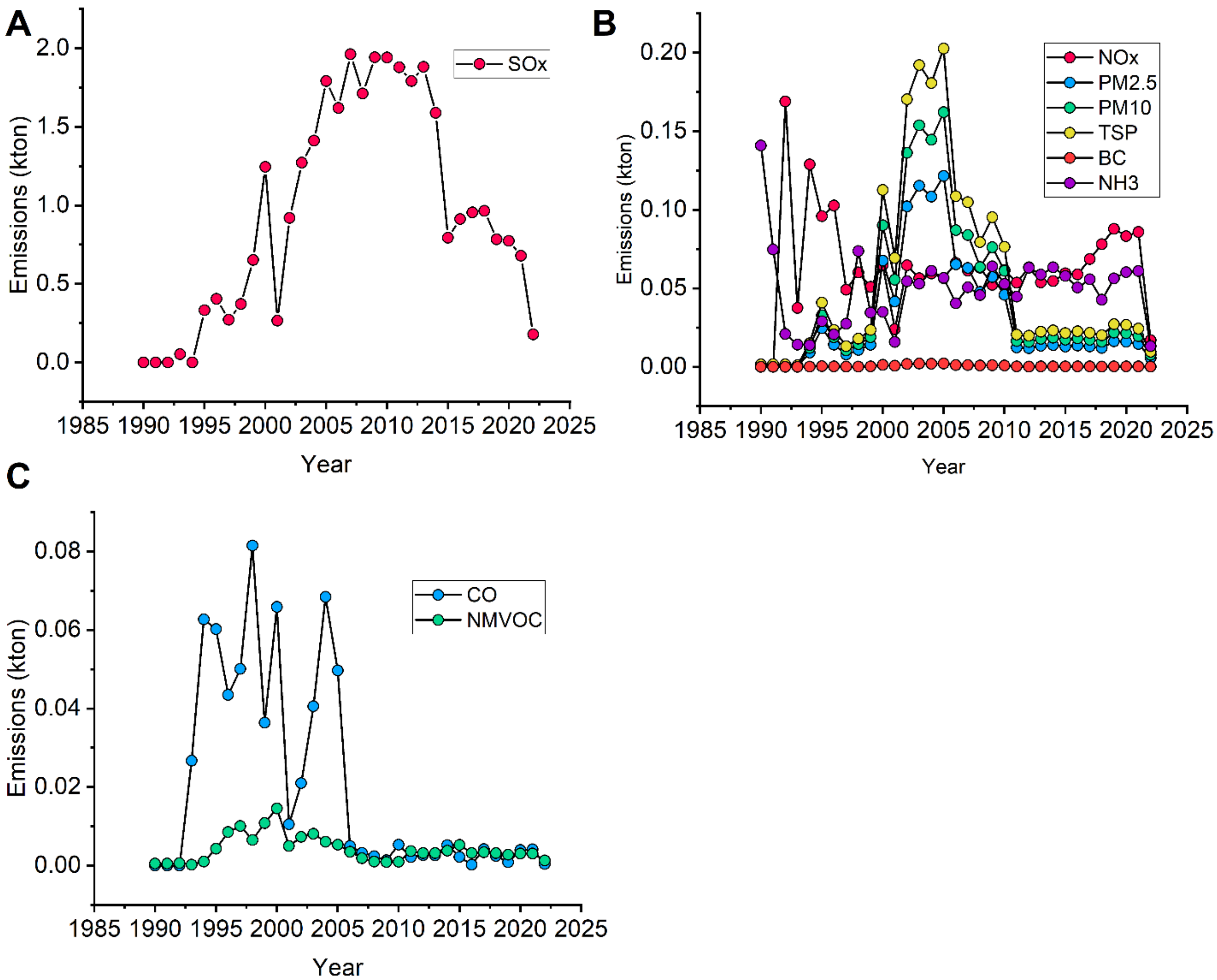

Figure 4-17. Emissions of all reported pollutants (in kton) from the production of sulfuric acid. (A) SOx emissions; (B) NOx, $PM_{2.5}$, PM_{10}, TSP, BC, NH_3 emissions; (C) CO and NMVOC emissions.

1.8.2. Activity data and emission factors

To estimate pollutant emissions, we used Tier 3 approach, with all pollutant values being reported by the plant in yearly CLRTAP reports. The plant directly measures all air pollutants in multiple chimneys through the use of electrochemical analysis methods. From the reports supplied by the plant, we combined methanol, butanol, benzene (and many other organic NMVOCs) into the NMVOC category. $PM_{2.5}$, PM_{10} and BC values were calculated from the TSP emissions (which are measured by the plant, electrochemically) using Tier 1 approach with standard emission factors provided by the guidebook, namely, $PM_{2.5}$ values were 60% of reported TSP values; PM_{10} values were 80% of reported TSP values; BC values were 1.8% of calculated $PM_{2.5}$ values (EMEP/EEA guidebook, 2023, 2.B.1, table 3.1).

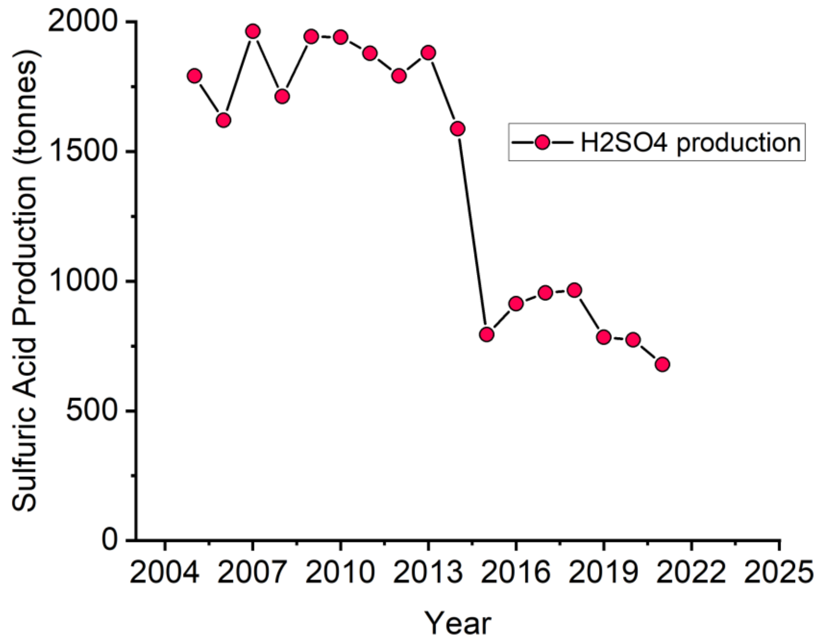

Figure 4-18. Production of sulfuric acid.

1.8.3.Recalculations

There are no recalculations to declare.

1.9. Iron and Steel production (NFR 2.C.1)

1.9.1. Overview of the sector

Three companies were producing cast iron before 2009. After the closure of one factory the other two have been operating in the sector. One of the facilities has been producing cast iron in blast furnace and the other was producing cast iron in blast furnace until 2011, after 2011 it has been using induction furnace. In the blast furnace cast iron is made by remelting scrap pig iron along with coke and limestone. In the induction furnace only, limestone is added.

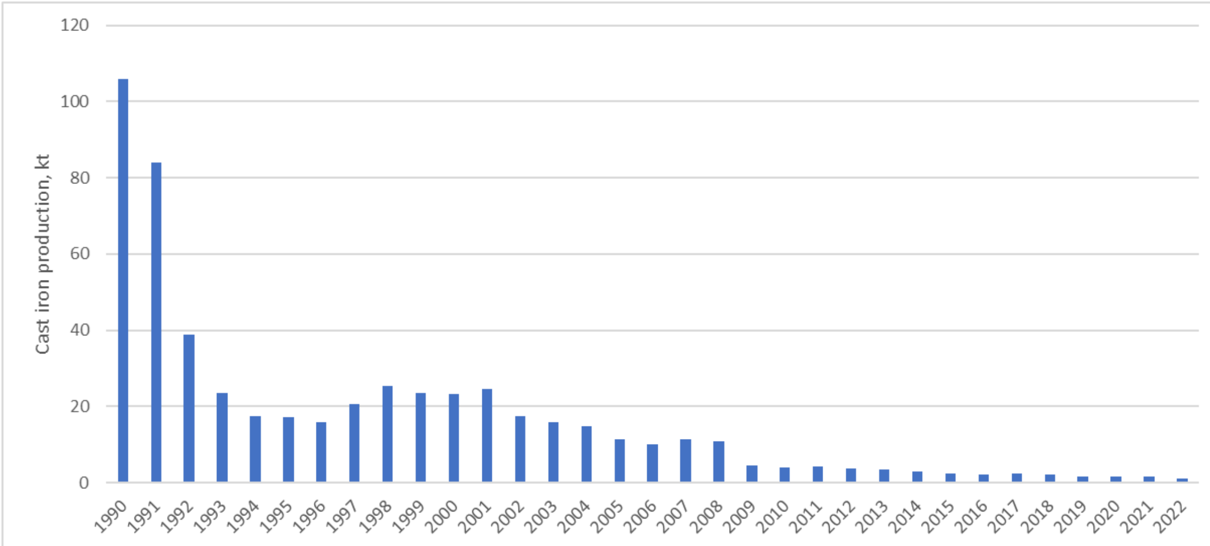

Figure 4-19 . Cast iron production in the period 1990 – 2022

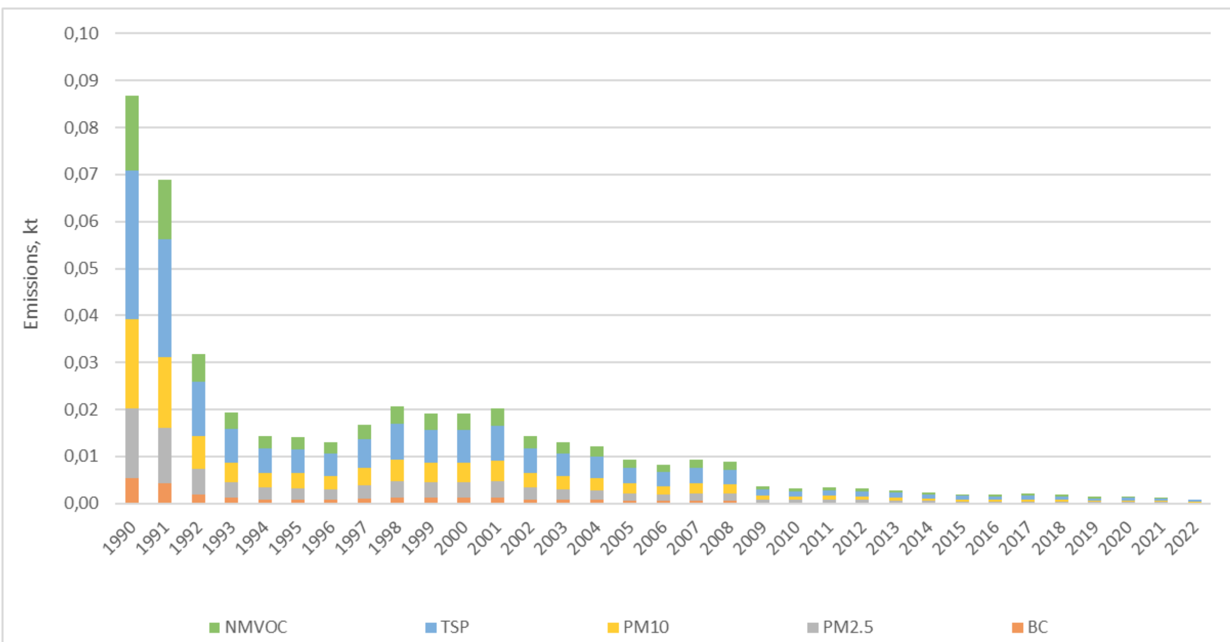

Figure 4-20 . Pollutant emissions in sector 2.C.1. iron and steel production in the period 1990 – 2022

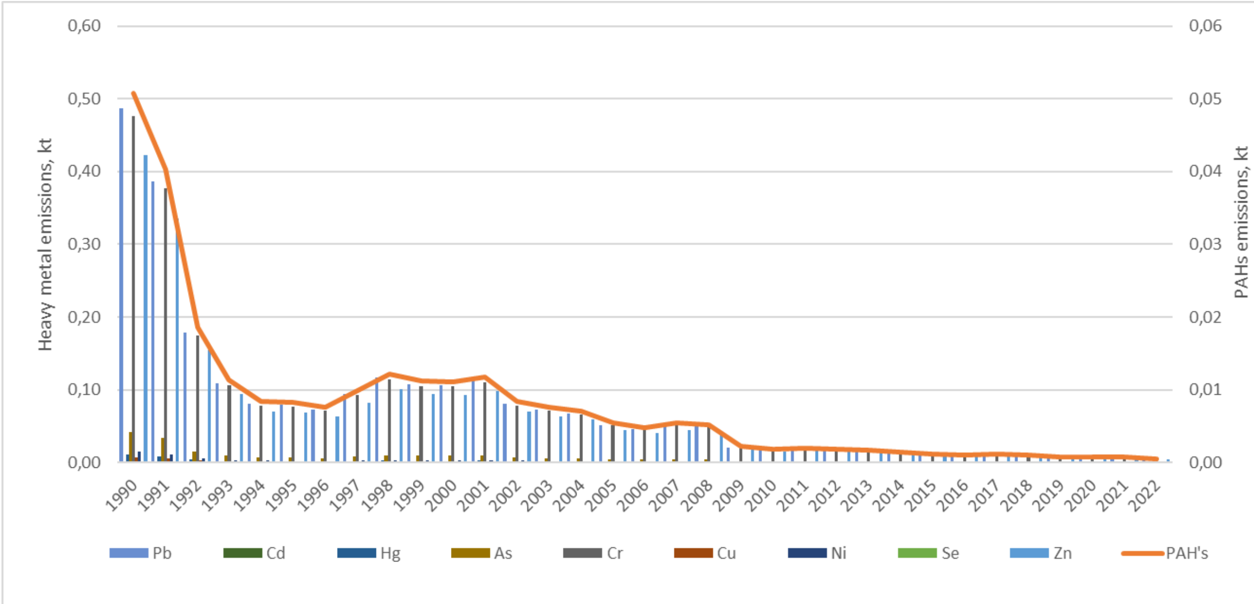

Figure 4-21. Heavy metal and PAHs emissions in sector 2.C.1. Iron and steel production in the period 1990-2022

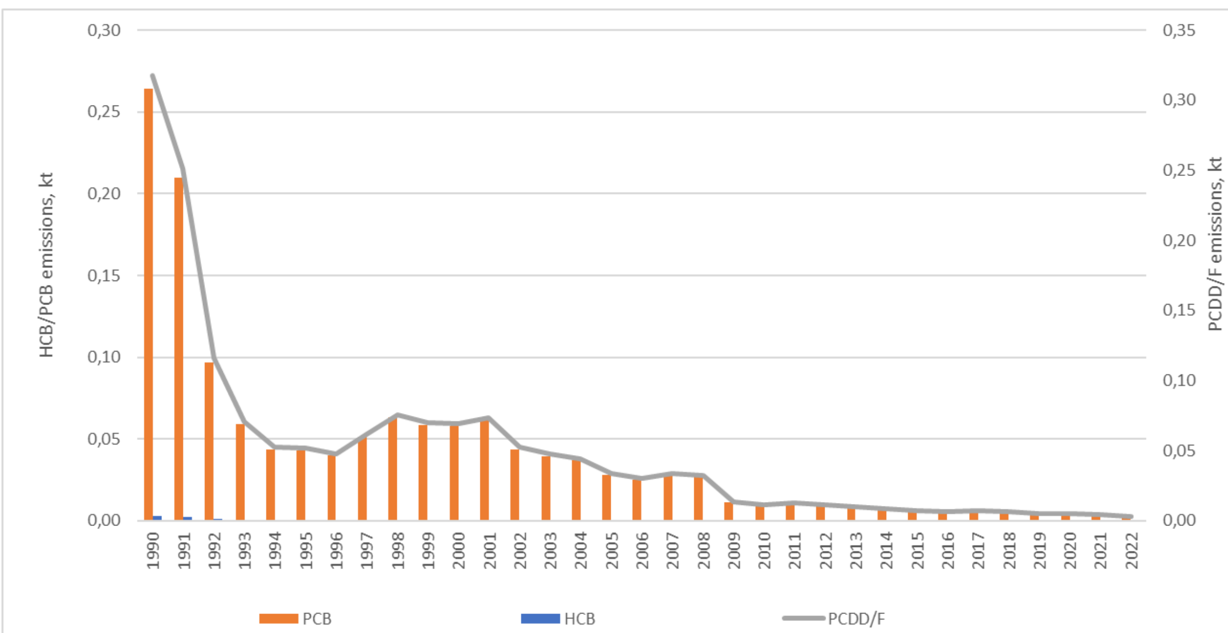

Figure 4-22. PCB, HCB and PCDD/F emissions in sector 2.C.1. iron and steel production in the period 1990-2022

1.9.2. Methodological issues

Activity data for calculating emissions were taken from national GHG report. Under 2C1 sector NMVOC, PM2.5, PM10, TSP, BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn, PCDD/PCDF, total PAHs, HCB emissions from Iron and steel production were reported. Emission factors were taken from 2023 Guidebook, Tier 1 methodology was used.

$$E_{Pollutant} = AR_{production} \times EF_{pollutant}$$

Where:

$E_{pollutant}$ – the emission of the specified pollutant

$AR_{production}$ – the activity rate for the iron and steel production

$EF_{pollutant}$ – the emission factor for this pollutant

1.9.3. Source-specific QA/QC verification

All quality procedures according to the Lithuanian QA/QC plan have been implemented during the work with this submission.

1.9.4. Source-specific recalculations

No source specific recalculations.

1.4.5. Source-specific planned improvements

No source specific planned improvements .

1.10. Production of ferro-alloys (NFR 2.C.2)

Production of ferro-alloys in Lithuania is not carried out, therefore emissions from source category 2.C.2 Iron alloys are not produced and the marking key "NO" is used.

1.11. Aluminum production (NFR 2.C.3)

1.11.1. Overview of the sector

On a major scale, only the primary aluminum production takes place in Lithuania. Small quantities of CO, NOx, SOx, PM2.5, PM10, TSP, BC, along with benzo(a)pyrene, benzo(b)fluoranthene, Benzo(k)fluoranthene and indeno(1,2,3- cd)pyrene are emitted during the aluminum production. All the data on the local aluminum (alloy bars, plates, foils, tubes, powders and flakes) production is taken from the Eurostat database. Overall, only CO emissions contribute significantly to the total national emissions.

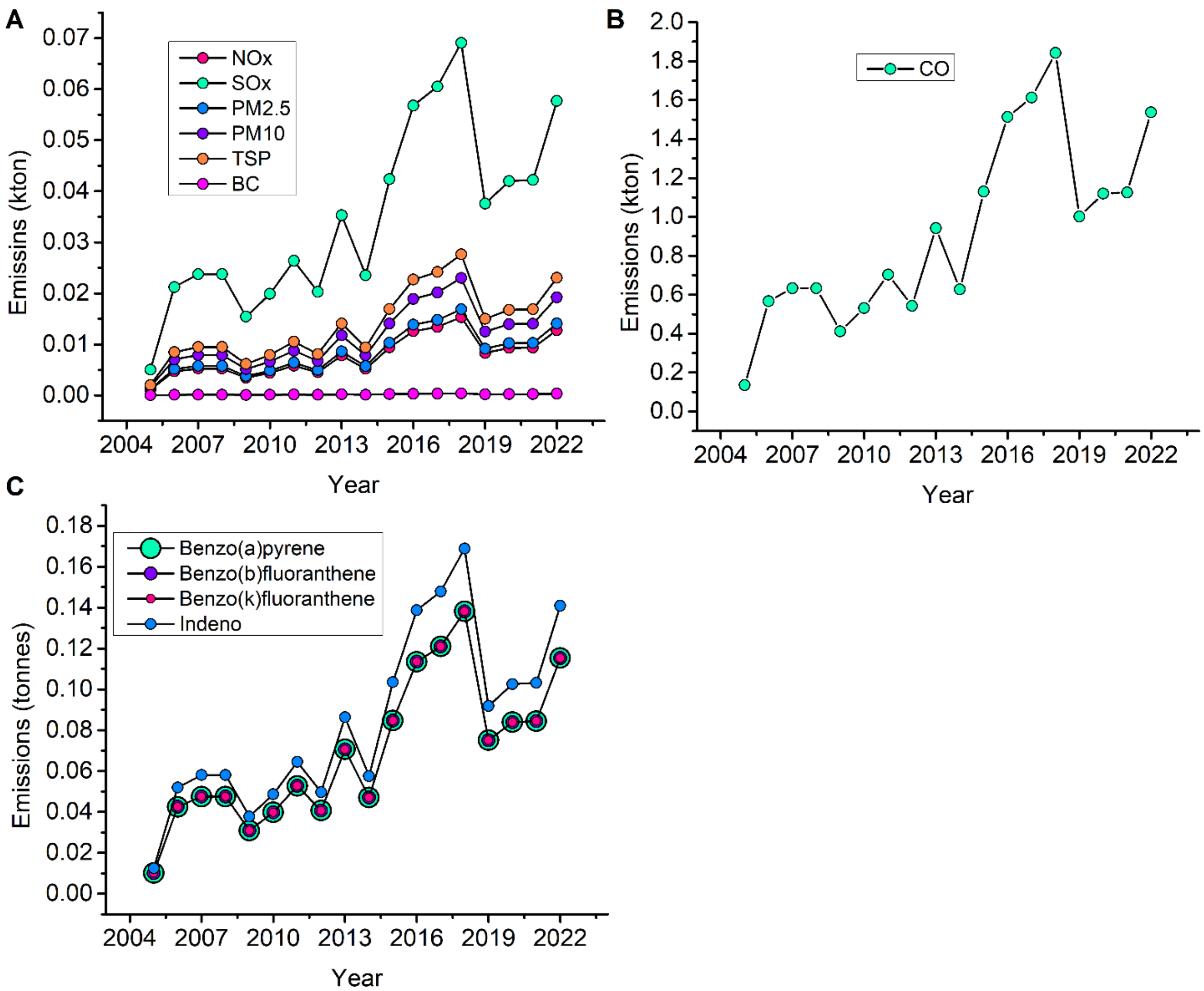

Figure 4-23. Emission of relevant pollutants from aluminum production: (A) NOx, SOx, $PM_{2.5}$, PM_{10}, TSP and BC emission. (B) CO emissions. (C) Polycyclic aromatic hydrocarbon emissions.

1.11.2. Activity data

All statistical data on the aluminum production was taken directly from the Eurostat database. Only the local aluminum production was considered. Production of aluminum alloy bars, plates, sheets, tubes, foil, pipes, powders and flakes was taken into account.

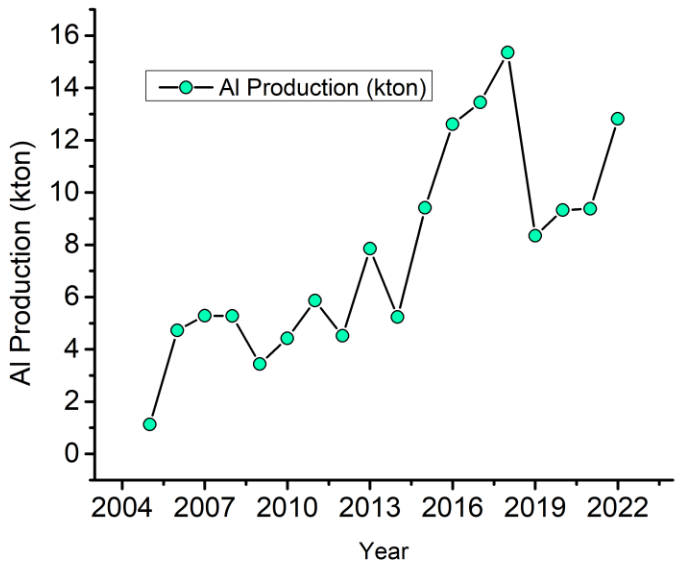

Figure 4-24. Alluminum production.

1.11.3. Emission factors

As the exact methodologies by which aluminum is produced are not known, general Tier 1 approach was chosen for the estimation of pollutant emissions. For each pollutant, relevant emission factor was applied from the EMEP/EEA guidebook, 2023, 2.C.3, table 3.1.

$$E_{pollutant} = AR_{production} * EF_{pollutant}$$

where:

- *Epollutant* is the emission of pollutant (g)
- *ARproduction* – production of primary aluminum (in kg)
- *EFpollutant* is the emission factor of the relevant pollutant (in g pollutant per kg of relevant glass produced)

1.12. Magnesium production (NFR 2.C.4)

Emissions from magnesium production are not occurring in Lithuania so for the category “ source category 2.C.4 Magnesium Production” notation key “NO” is used.

1.13. Lead production (NFR 2.C.5)

Emissions from lead production are not occurring in Lithuania so for the category " source category 2.C.5 Lead Production" notation key "NO" is used.

1.14. Zinc production (NFR 2.C.6)

Emissions from zinc production are not occurring in Lithuania so for the category " source category 2.C.6 Zinc Production" notation key "NO" is used.

1.15. Other (NFR 2.C.7)

Emissions from other production are not occurring in Lithuania so for the category " source category 2.C.7 Other" notation key "NO" is used.

2. Product Use (NFR 2D, 2H, 2I)

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

2.1.1. Overview of the sector

NMVOCs are used in many products sold for use by the public. Overall, more than 200 products contribute to the NMVOC emissions domestically – some of the sources are solvents in perfumes, shampoos, cleaning solutions, brake fluids, antifreezes, paint thinners, glues, shoe polishes, soaps and detergents and so forth.

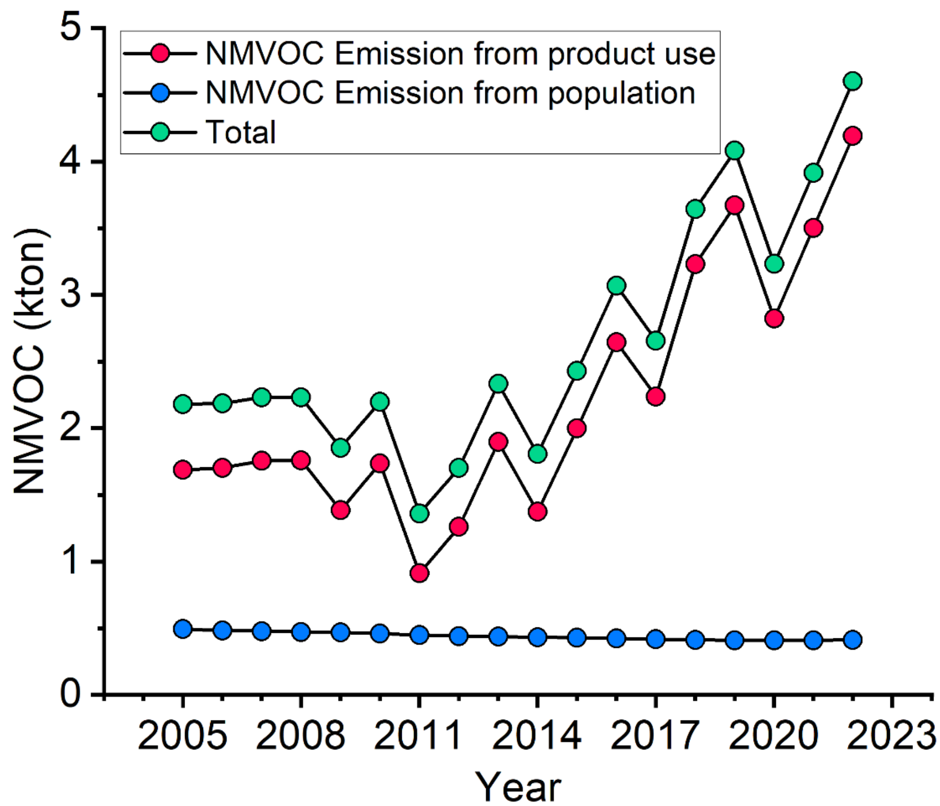

Figure 4-25. NMVOC emissions in Lithuania in sector 2.D.3.a

2.1.2. Activity data

Prior to 2005, NMVOC emissions were calculated using Tier 1 approach by estimating emissions based on the population. From 2005 onwards, selected products or product categories are used for NMVOC calculations using Tier 2 approach. The statistical data on the use of selected products is gathered from the Eurostat database. Some of the products used for calculations are listed below:

- *Perfumes*
- *Scent sprays and similar toilet sprays, and mounts and heads therefor (excluding reservoirs for scent sprays presented separately, rubber bulbs)*
- *Soap in forms excluding bars, cakes or moulded shapes, paper, wadding, felt and non-wovens impregnated or coated with soap/detergent, flakes, granules or powders*
- *Washing preparations and cleaning preparations, with or without soap, p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations*
- *Washing preparations and cleaning preparations, with or without soap, n.p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations*
- *Anti-freezing preparations and prepared de-icing fluids*
- *Fungicides, bactericides and seed treatment based on triazoles or diazoles, put up in forms or packings for retail sale or as preparations or articles (excluding hazardous pesticides)*
- *Disinfectants based on quaternary ammonium salts put up in forms or packings for retail sale or as preparations or articles (excluding hazardous pesticides)*
- *Disinfectants based on halogenated compounds put up in forms or packings for retail sale or as preparations (excluding hazardous pesticides)*

- *Disinfectants put up in forms or packings for retail sale or as preparations or articles (excluding those based on quaternary ammonium salts, those based on halogenated compounds and those being hazardous pesticides)*
- *Polishes, creams and similar preparations, for footwear or leather (excluding artificial and prepared waxes)*
- *Polishes, creams and similar preparations, for the maintenance of wooden furniture, floors or other woodwork (excluding artificial and prepared waxes)*
- *Polishes and similar preparations, for coachwork (excluding artificial and prepared waxes, metal polishes)*
- *Other polishes, creams and similar preparations, n.e.c.*
- *Organic composite solvents and thinners used in conjunction with coatings and inks; based on butyl acetate.*
- *Disinfectants based on halogenated compounds put up in forms or packings for retail sale or as preparations (excluding hazardous pesticides)*
- *Hydraulic brake fluids and other prepared liquids for hydraulic transmission; not containing or containing < 70 % by weight of petroleum oils or oils obtained from bituminous mineral*
- *Toilet waters*
- *Manicure or pedicure preparations*
- *Pre-shave, shaving and after-shave preparations (excluding shaving soap in blocks)*
- *Hair lacquers*
- *Hair preparations (excluding shampoos, permanent waving and hair straightening preparations, lacquers)*
- *Mixtures of odoriferous substances (excluding those of a kind used in the food or drink industries)*

We also note that Lithuania does not collect statistics official statistics on the use of fungicides, pesticides, and similar products, thus we have assumed that emissions from these fungicides were negligibly small. Additionally, we used Tier 1 emissions factors and populations statistics to estimate DIY/building adhesives (76 g NMVOC/person), DIY/building sealants (23 g NMVOC/person) and pharmaceutical product (48 g NMVOC/peson) emissions (EMEP/EEA Guidebook 2023, 2.D.3.a, Table 3.5).

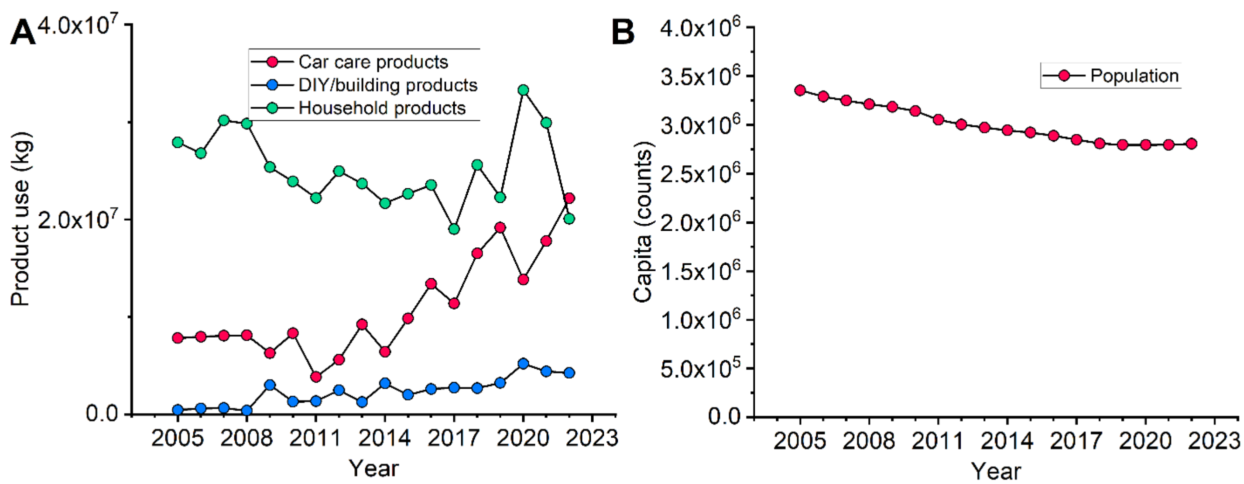

Figure 4-26. (A) Product usage and (B) population capita in Lithuania.

2.1.3.Recalculations:

We have used Tier 1 approach to additionally estimate pharmaceitucal product, adhesive and sealant consumption. Original estimate:

Year	NMVOC
2005	1.688
2019	3.672
2020	2.823
2021	3.503

Recalculated NMVOC values:

Year	NMVOC
2005	2.181
2019	4.082
2020	3.233
2021	3.914

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

2.2.1. Overview of the sector

Asphalt is commonly referred to as bitumen, asphalt cement, asphalt concrete or road oil. This sector covers emissions from asphalt paving operations as well as subsequent releases from the paved surfaces. Asphalt roads are a compacted mixture of aggregate and an asphalt binder. Statistics Lithuania collects data on production of bitumen (data available for 2002-2022), but not on consumption of bitumen, therefore data available from Statistics Lithuania, was used to extrapolate consumption of bitumen for the period 2002-2006. To extrapolate data on the consumption of bitumen in 1990-2002 the data on installed, rebuilt and modified asphalt roads (1989-2000) were used. This data was taken from 2002-2015 program on the maintenance and development of the Lithuanian state roads (UNFCCC submission, 2022).

Table 4-3 Trend (%) of 2.D.3.b emissions (kt)

	Bitumen consumption, Gg	$PM_{2.5}$	PM_{10}	TSP	BC	NMVOC
1990	50.436	5.0E-05	1.0E-03	7.6E-03	2.9E-06	8.1E-04
1995	39.590	4.0E-05	7.9E-04	5.9E-03	2.3E-06	6.3E-04
2000	42.673	4.3E-05	8.5E-04	6.4E-03	2.4E-06	6.8E-04
2005	68.491	6.8E-05	1.4E-03	1.0E-02	3.9E-06	1.1E-03
2010	80.000	8.0E-05	1.6E-03	1.2E-02	4.6E-06	1.3E-03
2015	100.000	9.0E-05	1.8E-03	1.4E-02	5.1E-06	1.4E-03
2016	100.000	1.0E-04	2.0E-03	1.5E-02	5.7E-06	1.6E-03
2017	100.000	1.0E-04	2.0E-03	1.5E-02	5.7E-06	1.6E-03
2018	100.000	1.0E-04	2.0E-03	1.5E-02	5.7E-06	1.6E-03
2019	100.000	1.0E-04	2.0E-03	1.5E-02	5.7E-06	1.6E-03
2020	100.000	1.0E-04	2.0E-03	1.5E-02	5.7E-06	1.6E-03

2021	100.000	1.0E-04	2.0E-03	1.5E-02	5.7E-06	1.6E-03
2022	100.000	1.0E-04	2.0E-03	1.5E-02	5.7E-06	1.6E-03
2005-2022, %	**46.00**	**46.00**	**46.00**	**46.00**	**46.00**	**46.00**
1990-2022, %	**98.27**	**98.27**	**98.27**	**98.27**	**98.27**	**98.27**

2.2.2.Methodological issues

According to GHG emissions inventory NMVOC emissions from road paving with asphalt are calculated based on annual consumption of bitumen. NMVOC emission was calculated using default emission factor 0.016 kg/tonne of asphalt (EMEP/EEA Guidebook 2023, 2.D.3.b Road paving with asphalt). Abetment for PMs was applied – 99%. The emission factor represents an average between the batch mix and the drum mix hot mix asphalt plants.

NMVOC	TSP	PM10	PM2.5	BC
16	15000	2000	100	5.7% of $PM_{2.5}$

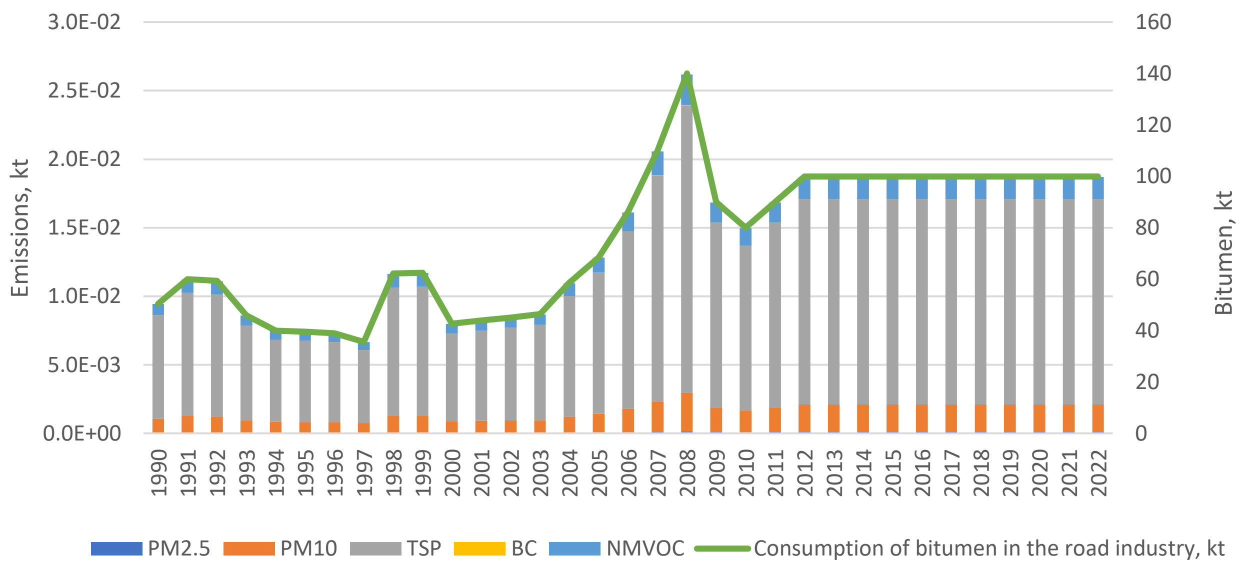

Figure 4-27 Pollutant emissions and bitument consumption in sector 2.D.3.b

2.2.3.Uncertainties and time-series consistency

All uncertainty estimates of activity data and emission factors have so far been based on expert judgment (UNFCCC submission, IIR Lithuania (2023). The data on consumption of bitumen obtained from the European Asphalt Pavement Association are reliable. However, it covers only the period 2007-2015. Historic data for 1990-2006 are expert evaluation and may be less reliable. It was assumed that overall uncertainty of road paving with asphalt activity data is 20. Emission factor uncertainty is assumed to be 50%. Combined uncertainty is 53.8%.

2.2.4. Source-specific QA/QC and verification

All quality procedures according to the Lithuanian QA/QC plan have been implemented during the work with this submission.

2.2.5. Source-specific planned improvements

No source-specific improvements.

2.2.6. Source-specific recalculations

No recalculations were done.

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

2.3.1. Overview of the sector

There is only one manufacturer in Lithuania producing asphalt roofing materials: flexible roofing tiles of different modifications, thickness and bitumen flexible roofing tiles of different geometric shapes for pitched roofs as well as membrane roofing for flat roofs. Activity data on production of roofing materials was provided by the producer for the period 2001-2022. Production of the asphalt roofing materials in 1990-2000 was estimated based on annual average use of bitumen.

Table 4-1 Trend (%) of 2.D.3.c emissions (kt)

	NMVOC	CO	TSP	PM10	PM2.5	BC	Production of asphalt roofing, kt
1990	0.0066	0.0005	0.0024	0.0006	0.0001	0.0000	50
1995	0.0013	0.0001	0.0005	0.0001	0.0000	0.0000	10
2000	0.0022	0.0002	0.0008	0.0002	0.0000	0.0000	17
2005	0.0068	0.0005	0.0025	0.0006	0.0001	0.0000	52
2010	0.0049	0.0004	0.0018	0.0005	0.0001	0.0000	38
2011	0.0044	0.0003	0.0016	0.0004	0.0001	0.0000	34
2012	0.0047	0.0003	0.0017	0.0004	0.0001	0.0000	36
2013	0.0047	0.0003	0.0017	0.0004	0.0001	0.0000	36
2014	0.0048	0.0004	0.0018	0.0004	0.0001	0.0000	37
2015	0.0044	0.0003	0.0016	0.0004	0.0001	0.0000	34
2016	0.0039	0.0003	0.0014	0.0004	0.0001	0.0000	30

2017	0.0041	0.0003	0.0015	0.0004	0.0001	0.0000	32
2018	0.0039	0.0003	0.0014	0.0004	0.0001	0.0000	30
2019	0.0043	0.0003	0.0016	0.0004	0.0001	0.0000	33
2020	0.0059	0.0004	0.0022	0.0005	0.0001	0.0000	45
2021	0.0064	0.0005	0.0024	0.0006	0.0001	0.0000	49
2022	0.0062	0.0005	0.0023	0.0006	0.0001	0.0000	48
1990/2022	**--4.79%**	**-4.79%**	**-4.79%**	**-4.79%**	**-4.79%**	**-4.79%**	**-4.79%**
2005/2022	**-8.20%**	**-8.20%**	**-8.20%**	**-8.20%**	**-8.20%**	**-8.20%**	**-8.20%**
2021/2022	**-2.11%**	**-2.11%**	**-2.11%**	**-2.11%**	**-2.11%**	**-2.11%**	**-2.11%**

Weight of the asphalt roofing material was calculated using area to weight ratio provided by the production company: 9.6 kg/m2 for bitumen tiles and 4.9 kg/m2 for roll roofing material. Amount of bitumen used for production of asphalt roofing is 2 kg/m2 for bitumen tiles and 2.6 kg/m2 for roll roofing (UNFCCC submission, IIR, 2023. Production of the asphalt roofing materials in 1990-2000 was estimated based on annual average use of bitumen. During the period between 2001 and 2010 production of asphalt roofing materials annually consumed on average 13% of the bitumen used for non-energy uses.

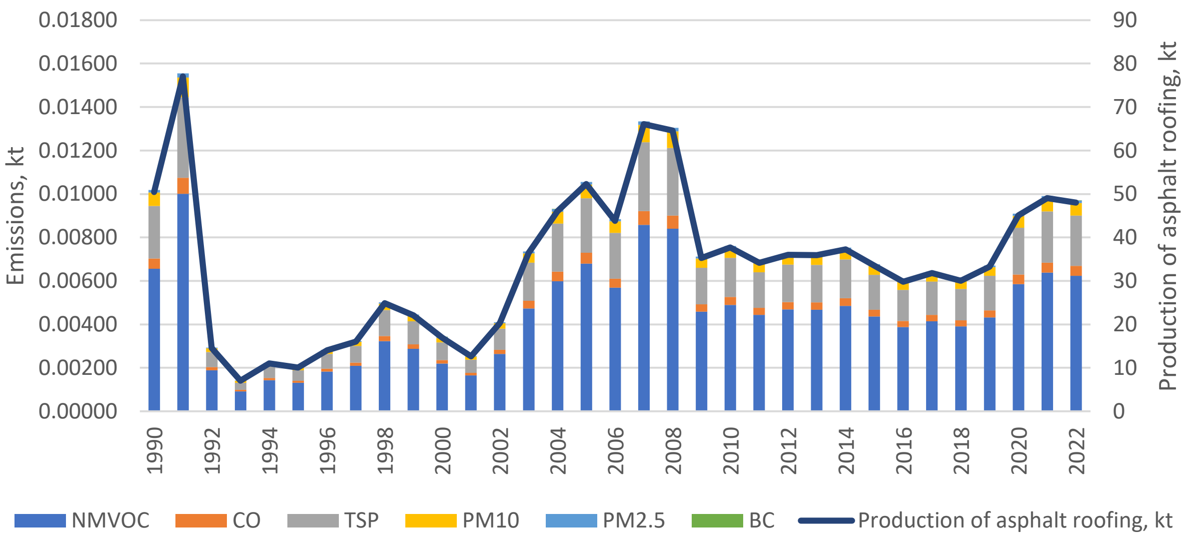

Figure 4-28 Pollutant emissions in sector 2.D.3.c

2.3.2.Methodological issues

Emissions were calculated using Tier 2 approach, emission factors were taken from 2023 EMEP/EEA guidebook, chapter 2.D.3.b Road paving with asphalt (Table 3.3 Tier 2 emission factors or source category 2.D.3.c, Asphalt roofing, spray / dip saturator). Abetment for PMs was applied – 97%.

2.3.3. Uncertainties and time-series consistency

All uncertainty estimates of activity data and emission factors have so far been based on expert judgment (UNFCCC submission, IIR Lithuania (2023). The data on production of asphalt roofing materials and raw materials consumption obtained from the production company are reliable and precise. However, they cover only the period after reconstruction of the plant (from 2001). Historic data for 1990-2000 are expert evaluation and may be less reliable. It was assumed that overall uncertainty of asphalt roofing activity data is 5%. Emission factor uncertainty is assumed to be 25%. Combined uncertainty is 25.4%.

2.3.4. Source-specific QA/QC and verification

All quality procedures according to the Lithuanian QA/QC plan have been implemented during the work with this submission.

2.3.5. Source-specific planned improvements

No source-specific improvements.

2.3.6. Source-specific recalculations

No recalculations were done.

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

2.4.1. Overview of the sector

The sector of coating applications covers the use of paints and varnishes in both industrial and domestic applications. Most paints contain organic solvents, which evaporate during paint curing/drying, producing substantial NMVOC emissions. Overall, paints and varnishes in 2.D.3.d category are used in:

- Decorative coating applications
- Industrial coating applications

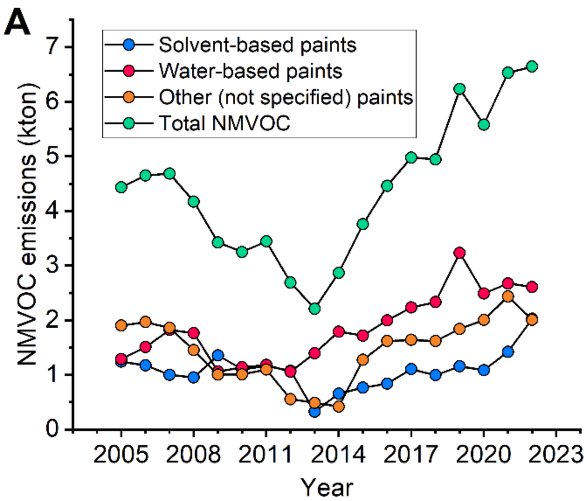

Figure 4-29 (A) NMVOC emissions (kton) from coating applications based on paint type. (B) Consumption of various paints.

2.4.2. Activity data

Currently (2005-onwards), the activity data is based on Eurostat paint usage (Import-Export+Production). Overall, paints and varnishes can be divided into three main categories: solvent-based paints, water-based paints and unspecified paints. This method was suggested by an expert Rianne Dröge during the country review in 2022. The expert Rianne Dröge also assumed that 50% of the paints used are consumed in industry and 50% are used for decorative purposes.

2.4.3.Emission factors

Decorative paint applications			
Solvent-based paints	230	g/kg paint	EMEP/EEA Guidebook 2023, 2D3d, table 3-4 and 3-5
Water-based paints	80.5	g/kg paint	EMEP/EEA Guidebook 2023, 2D3d, table 3-4 and 3-5, combined with abatement efficiency of 65.2% (EMEP/EEA Guidebook 2023, 2D3d, table 3-17)
Other (not specified)	155.25	g/kg paint	Average of solvent-based and water-based paints
Industrial paint applications			
Solvent-based paints	685	g/kg paint	Average of: EMEP/EEA Guidebook 2023, 2D3d, table 3-7, table 3-8, table 3-9 and table 3-16
Water-based paints	239.75	g/kg paint	Average of: EMEP/EEA Guidebook 2023, 2D3d, table 3-7, table 3-8, table 3-9 and table 3-16, combined with abatement efficiency of 65% (average of: EMEP/EEA Guidebook 2023, 2D3d, table 3-18, table 3-20, table 3-22,

			table 3-23, table 3-24, table 3-25, table 3-26, abatement for water-based coatings)
Other (not specified)	462.375	g/kg paint	Average of solvent-based and water-based paints

In addition, we have applied 40% abatement for all the industrial coating applications, as we assumed that most of the paints are used for car refinishing and repairs in the industry (EMEP/EEA Guidebook 2023, 2D3d, table 3-18, p. 28). Consequently, all car repair shops in Lithuania use at least thermal incinerators along with activated carbon adsorption spray booths for efficient NMVOC capture during car painting.

2.4.4. Source specific planned improvements

Currently, large amount of paints use fall into the "non-specified" category, meaning that it is unclear whether these paints are solvent-free, or whether they are water-based or largely solvent-based. In the future, we are planning on collecting statistics on solvent free paints, to eliminate to eliminate a likely overestimation of NMVOC emissions from "non-specified" paints.

2.4.5. Recalculations

We have recalculated statistical errors that occured in year 2013. We provide original emissions and acitivity data along with recalculted amounts:

Original:

Year	Solvent-based paints, kg	Water-based paints, kg	Other (non-specified) paints, kg
2005	3874643	11502474	8798108
2006	3666230	13449760	9091123
2007	3124974	16258686	8604935
2008	2970886	15743127	6722433
2009	4240644	9466612	4640962
2010	3436207	10163067	4669931
2011	3635196	10536623	5069082
2012	3349968	9450022	2574807
2013	1015933	12454098	0
2014	2053655	15959774	1940279
2015	2389200	15322006	5893071
2016	2625000	17831142	7488371
2017	3447300	19919092	7579743
2018	3103100	20786781	7482923
2019	3611473	28823996	8513521

2020	3392408	22182714	9274923
2021	4435297	23835380	11258200
2022	6324960	23277507	9278041

Year	NMVOC: solvent-based (kton)	NMVOC: water-based (kton)	NMVOC: other (kton)	Total NMVOC emissions (kton)
2005	1.241823082	1.290290021	1.903360689	4.435473792
2006	1.175026715	1.508726828	1.966750822	4.650504365
2007	1.001554167	1.823818102	1.861570126	4.686942395
2008	0.952168963	1.765985271	1.454314349	4.172468583
2009	1.359126402	1.061917201	1.004014117	3.42505772
2010	1.101304344	1.140042041	1.010281198	3.251627582
2011	1.165080318	1.181945685	1.096632527	3.44365853
2012	1.073664744	1.060056218	0.557027309	2.690748271
2013	0.325606527	1.397038443	0	1.72264497
2014	0.658196428	1.790287648	0.419755108	2.868239184
2015	0.7657386	1.718746023	1.274892247	3.759376871
2016	0.8413125	2.000208354	1.620015461	4.461536315
2017	1.10485965	2.234424145	1.639782651	4.979066446
2018	0.99454355	2.331757159	1.618836855	4.945137563
2019	1.157477097	3.233331751	1.841793849	6.232602697
2020	1.087266764	2.488345943	2.006513655	5.582126361
2021	1.421512689	2.673733752	2.435570843	6.530817283
2022	2.02714968	2.611154348	2.007188195	6.645492223

Recalculated:

Year	Solvent-based paints, kg	Water-based paints, kg	Other (non-specified) paints, kg
2005	3874643	11502474	8798108
2006	3666230	13449760	9091123
2007	3124974	16258686	8604935
2008	2970886	15743127	6722433
2009	4240644	9466612	4640962
2010	3436207	10163067	4669931
2011	3635196	10536623	5069082
2012	3349968	9450022	2574807
2013	1015933	12454098	2257543
2014	2053655	15959774	1940279

2015	2389200	15322006	5893071	
2016	2625000	17831142	7488371	
2017	3447300	19919092	7579743	
2018	3103100	20786781	7482923	
2019	3611473	28823996	8513521	
2020	3392408	22182714	9274923	
2021	4435297	23835380	11258200	
2022	6324960	23277507	9278041	

Year	NMVOC: solvent-based (kton)	NMVOC: water-based (kton)	NMVOC: other (kton)	Total NMVOC (kton)
2005	1.241823082	1.290290021	1.903360689	4.435473792
2006	1.175026715	1.508726828	1.966750822	4.650504365
2007	1.001554167	1.823818102	1.861570126	4.686942395
2008	0.952168963	1.765985271	1.454314349	4.172468583
2009	1.359126402	1.061917201	1.004014117	3.42505772
2010	1.101304344	1.140042041	1.010281198	3.251627582
2011	1.165080318	1.181945685	1.096632527	3.44365853
2012	1.073664744	1.060056218	0.557027309	2.690748271
2013	0.325606527	1.397038443	0.488391209	2.211036178
2014	0.658196428	1.790287648	0.419755108	2.868239184
2015	0.7657386	1.718746023	1.274892247	3.759376871
2016	0.8413125	2.000208354	1.620015461	4.461536315
2017	1.10485965	2.234424145	1.639782651	4.979066446
2018	0.99454355	2.331757159	1.618836855	4.945137563
2019	1.157477097	3.233331751	1.841793849	6.232602697
2020	1.087266764	2.488345943	2.006513655	5.582126361
2021	1.421512689	2.673733752	2.435570843	6.530817283
2022	2.02714968	2.611154348	2.007188195	6.645492223

2.5. Degreasing (NFR 2.D.3.e)

2.5.1. Overview of the sector

The main users of solvent degreasing are the metalworking industries (printing and production of chemicals, plastics, rubber, textiles, glass, paper and electric power) and covers a wide range of activities carried out in either open-top or closed tanks. The open top tanks have been phased out in the European Union due to the Solvent Emissions Directive 1999/13/EC (only small facilities, using not more than 1 or 2 tonnes of solvent per year (depending on the risk profile of the solvent) are still allowed to use open top tanks) and closed tanks offer much better opportunities for recycling of solvents. Degreasing within the major users of solvent degreasing are the metal-working industries. It is very difficult to get a reliable picture of the penetration of the different techniques.

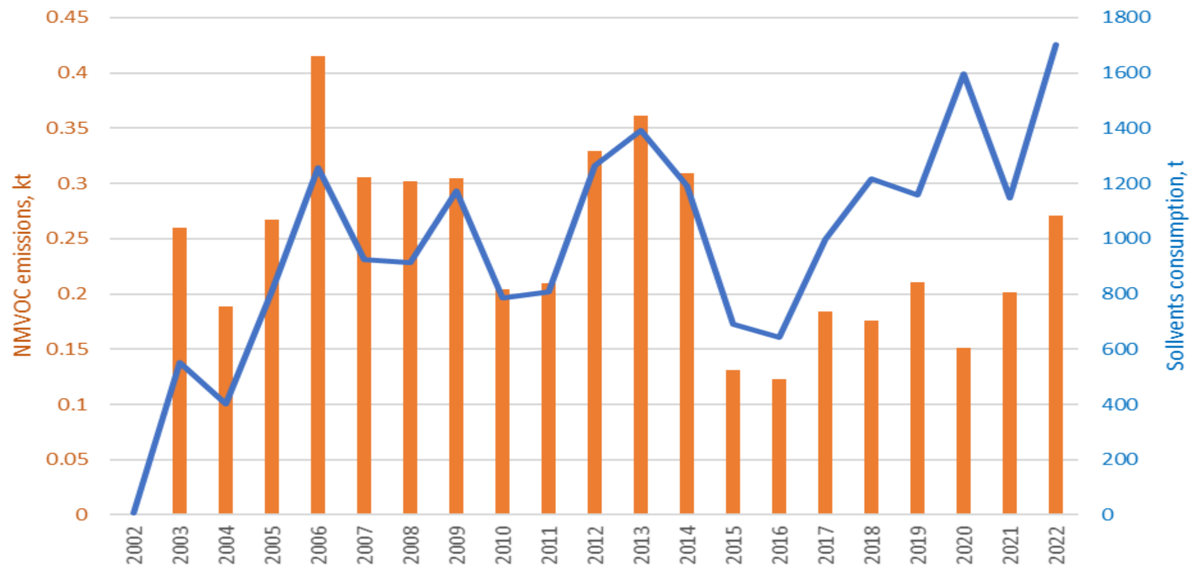

Figure 4-30 NMVOC emissions and solvents consumption in sector 2.D.3.e

During LRTAP in-depth review of national emission inventories in 2019 Solvent Use sector experts Ardi Link and Kristina Saarinen (personal communication) provided organic solvents list needed to incorporate to NMVOC emissions evaluation:

– methylene chloride (MC)
– tetrachloroethylene (PER)*
– trichloroethylene (TRI)[1]
– xylenes (XYL).

* As **PER** is also used for dry cleaning, this **is not included** as a degreaser.

2.5.2. Methodological Issues

By the year 2018 this method was considered obsolete because essential assumptions about EFs were out of date. For calculations the algorithm was revised and a new become available data source using direct Lithuanian solvent user consumer's reports and Statistics Lithuania data on Production of Commodities 2002-2022. The EMEP/EEA Guidebook 2023 Tier 2 (presented in the Chapter '2.D.3.e Degreasing' of the EMEP/EEA Guidebook 2023, Table 3-2, p. 10) emission factor of 710 g/kg cleaning products for the open-top degreaser is used for NMVOC emission calculations taking into account the

[1] The use of 1,1,1,-trichloroethane (TCA) has been banned since the Montreal Protocol and replaced by trichloroethylene (TRI).

penetration of different technologies and replacing the technology-specific emission factor with an abated emission factor as given in the formula:

$EF_{technology,abated} = (1 – η_{abated}) \times EF_{technology}$, where

$EF_{technology,abated}$ - emission factor for specific technology taking into account the abatement efficiency;

$EF_{technology}$ - emission factor for specific technology;

$η_{abated}$ - abatement efficiency;

Five different process types are taken into account which are:

- Open-top degreaser;
- Semi open-top degreaser;
- Semi open-top degreaser with activated carbon;
- Sealed chamber system using chlorinated solvents;
- Cold cleaner.

As there is no information on emission factors for all of those technologies, it is assumed that the emission factor for those technologies is the same as presented in the EMEP/EEA Guidebook 2023 for the open-top degreasers with appropriated abatement efficiencies.

Table 4-2 Tier 2 NMVOC emission factors and abatement efficiencies for degreasing activities

Abatement technology	**$EF_{technology}$, g/kg cleaning product**	**Efficiency, %**	**$EF_{technology,abated}$, g/kg cleaning product**
Open-top degreaser	710	0	710
Semi open-top degreaser and good housekeeping	710	25	533
Semi open-top degreaser and good housekeeping with activated carbon	710	85	107
Sealed chamber system using chlorinated solvents	710	95	39
Cold cleaner	710	89	78

There is also no information available how different degreasing process types are stratified in Estonia, but an expert opinion (Estonia NIR, 2023) has been applied on the penetration of different technologies within the degreasing industry could have been evolved and is provided in the table below.

Table 4-3 Expert judgement-based distribution between abatement technologies, %

	Open-top degreaser	Semi open-top degreaser	Semi open-top degreaser and good	Sealed chamber system	Cold cleaner

		and good housekeeping	housekeeping with activated carbon	using chlorinated solvents	
1990	25	5	0	10	60
1995	20	15	0	10	60
2000	15	10	5	10	60
2005	5	10	10	10	65
2010	0	10	15	5	70
2015	0	5	20	5	70
2020	0	0	25	0	75
2021-	0	0	26	0	74

The emissions for 1990-2002 have been calculated with per capita activity data (0.7 kg/cap).

2.5.3. Source-Specific QA/QC and Verification

Statistical quality checking related to the assessment of data including comparison to previous years to detect calculation errors were carried out. The reasons behind any large fluctuation in the emission figures are studied.

2.5.4. Source-Specific Planned Improvements

No improvements are planned for the next submission

2.5.5. Recalculations

Recalculations were done for 2002-2022 due to new activity data and share of technology penetration.

	Submission 2023	Submission 2024	Absolute difference, Gg NMVOC	Relative difference, %
2002	0.00	0.00	0.00	-35.32
2003	0.26	0.12	0.14	-54.07
2004	0.19	0.09	0.10	-54.07
2005	0.27	0.12	0.14	-53.30
2006	0.42	0.19	0.22	-53.30
2007	0.31	0.14	0.16	-53.30
2008	0.30	0.14	0.16	-53.30
2009	0.30	0.18	0.12	-40.73
2010	0.20	0.10	0.11	-51.58
2011	0.21	0.10	0.11	-51.58
2012	0.33	0.16	0.17	-51.58
2013	0.36	0.18	0.19	-51.58
2014	0.31	0.15	0.16	-51.58

2015	0.13	0.07	0.06	-44.95
2016	0.12	0.07	0.06	-44.95
2017	0.19	0.10	0.09	-44.95
2018	0.23	0.13	0.10	-44.95
2019	0.22	0.12	0.10	-44.95
2020	0.20	0.09	0.11	-55.13
2021	0.22	0.09	0.12	-57.23

2.6. Dry cleaning (NFR 2.D.3.f)

2.6.1. Overview of the sector

Dry Cleaning refers to any process to remove contamination from furs, leather, down leathers, textiles or other objects made of fibers, by using organic solvents. Emissions arise from evaporative losses of solvent, primarily from the final drying of the clothes, known as deodorization. Emissions may also arise from the disposal of wastes from the process. Please note that for EU Member States, the European Solvent Directive 1999/13/EC has led to a phase-out of the open-circuit machine, because their emissions exceed the limits. In the European Union, the dry-cleaning sector is essentially made up of small units, using one to two machines of 10/12 kg capacity. In Lithuania close-circuit machines used from 1990.

2.6.2 Methodological issues

Chlorinated organic solvent tetrachloroethylene is not produced in Lithuania, all used amount are imported. The most widespread solvent used in dry cleaning, accounting for about 90% of total consumption, is **tetrachloroethene** (also called tetrachloroethylene or perchloroethylene (PER)). The most significant pollutants from dry cleaning are NMVOCs, including chlorinated solvents. Heavy metals and POPs emissions are unlikely to be significant. The sales figures of tetrachloroethylene use in 2.D.3.f in EPA database are obtained each year from operator's report.

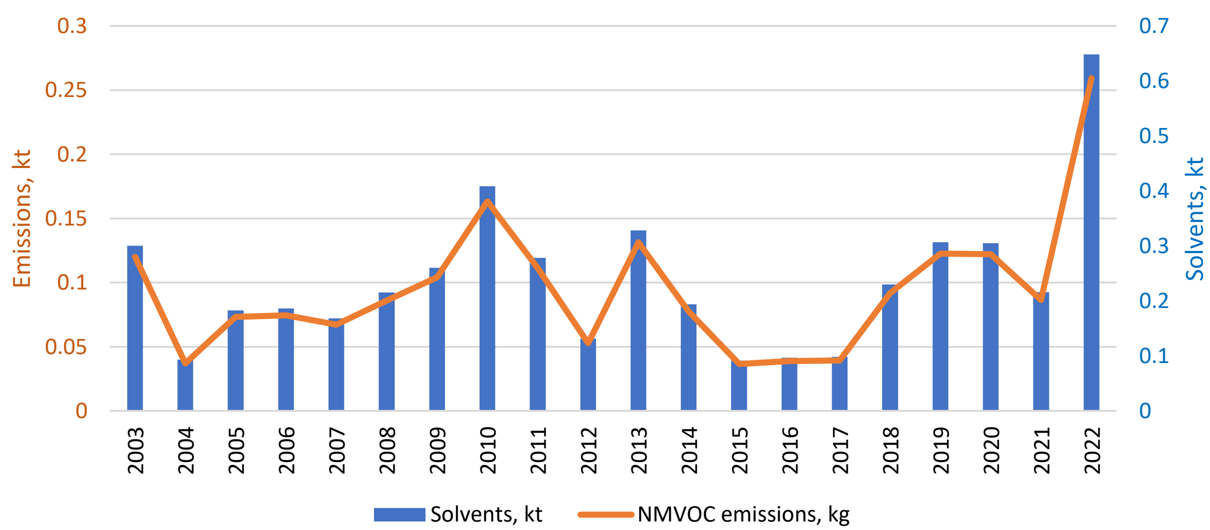

Figure 4-31 NMVOC emissions and tetrachloroethene consumption in sector 2.D.3.f

EF of 400 g/kg was used (Estonia NIR) for dry cleaning activity. The emissions of NMVOC from solvents and other product use are calculated using a simplified version of the detailed methodology EMEP/EEA air pollutant emission inventory guidebook 2023. It represents a mass balance per PER amount. Where emissions are calculated by multiplying relevant activity data with an EF, according to the equation:

$$Consumption = Production + Import + Export$$
$$Emission = Consumption \times EF_{(\text{fraction emitted.control strategies applied})}$$

Information regarding emissions when using Best Available Techniques is available from the BREF documents for the Surface Treatment of Metals and the Surface Treatment using Organic Solvents. 1990 – 2003 NMVOC emissions were calculated by IIASA.

1.11.1. Source-specific QA/QC and Verification

Normal statistical quality checking related to the assessment of trends has been carried out comparing to previous years for outliers.

1.11.2. Source-Specific Planned Improvements

No improvements are planned for the next submission

1.11.3. Source-specific recalculations

No recalculations were done.

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

2.7.1. Overview of the sector

The sector of chemical products includes many activities, however, many of these activities are considered insignificant, as the emissions from these activities contribute less than 1 % to the national total emissions for every pollutant. To avoid double counting Asphalt blowing is included in sector 2.D.3.c. Emissions from activities such as the use of fireworks and use of tobacco products are included in 2.D.3.i. Emissions from bitumen processing are covered in 2.D.3.b. and 2.D.3.c.

Generally, activities such as polystyrene and rubber processing, manufacture of paints, glues and inks, production of footwear, manufacture of drugs, manufacture of adhesive tapes and polyurethane processing release small amount of NMVOCs. In the case of shoes, NMVOCs are released during sole gluing process, production of drugs requires organic solvents, some of which inevitably evaporate, processing of polymers also usually takes place in organic solvent media.

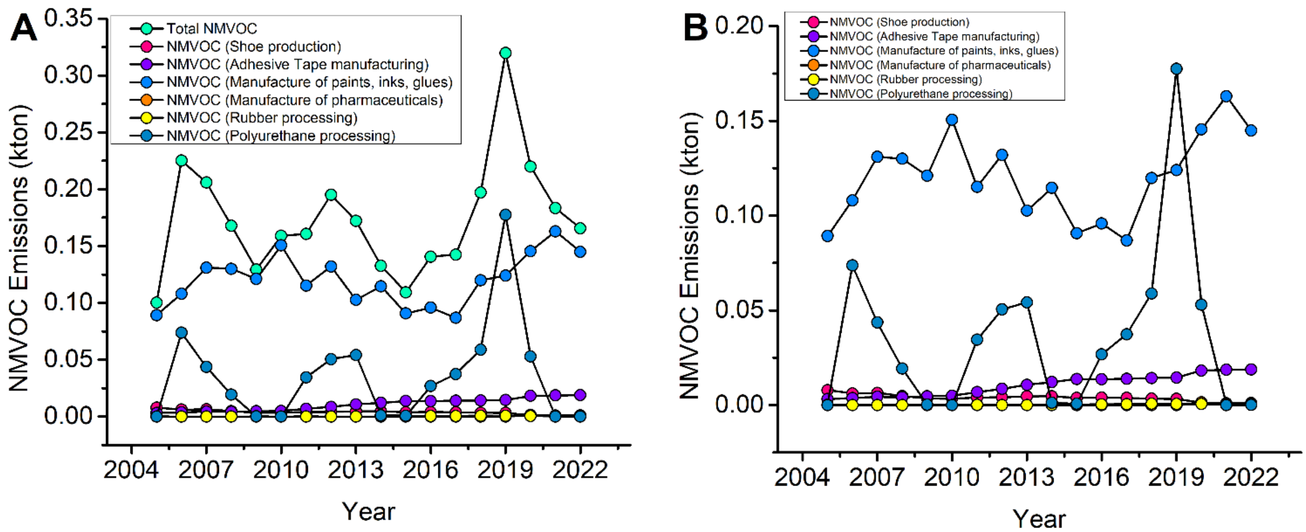

Figure 4-32 NMVOC emissions from 2.D.3.g sector. (A) Total NMVOC emissions and (B) NMVOC emissions by manufacturing type.

2.7.2. Activity data

All the statistics on manufacture of chemical products were collected from the Eurostat database. In Lithuania, the production of polyester fibers and manufacture of tyres occurs on a very small scale and are not covered in Eurostat statistics. In the production of polyurethane, emissions of NMVOCs occur during polymer foam activation, when the foaming agents evaporate. Similarly, production of rubber, polystyrene and pharmaceutical goods occur on a very small scale. In the case of drug production, Eurostat data is only available from 2020. Leather tanning is practically non-existent in Lithuania, thus, the statistics on leather tanned are not collected. Overall, the main contributors to NMVOC emissions come from the glue, ink, and paint production, and from the manufacture of adhesive tapes.

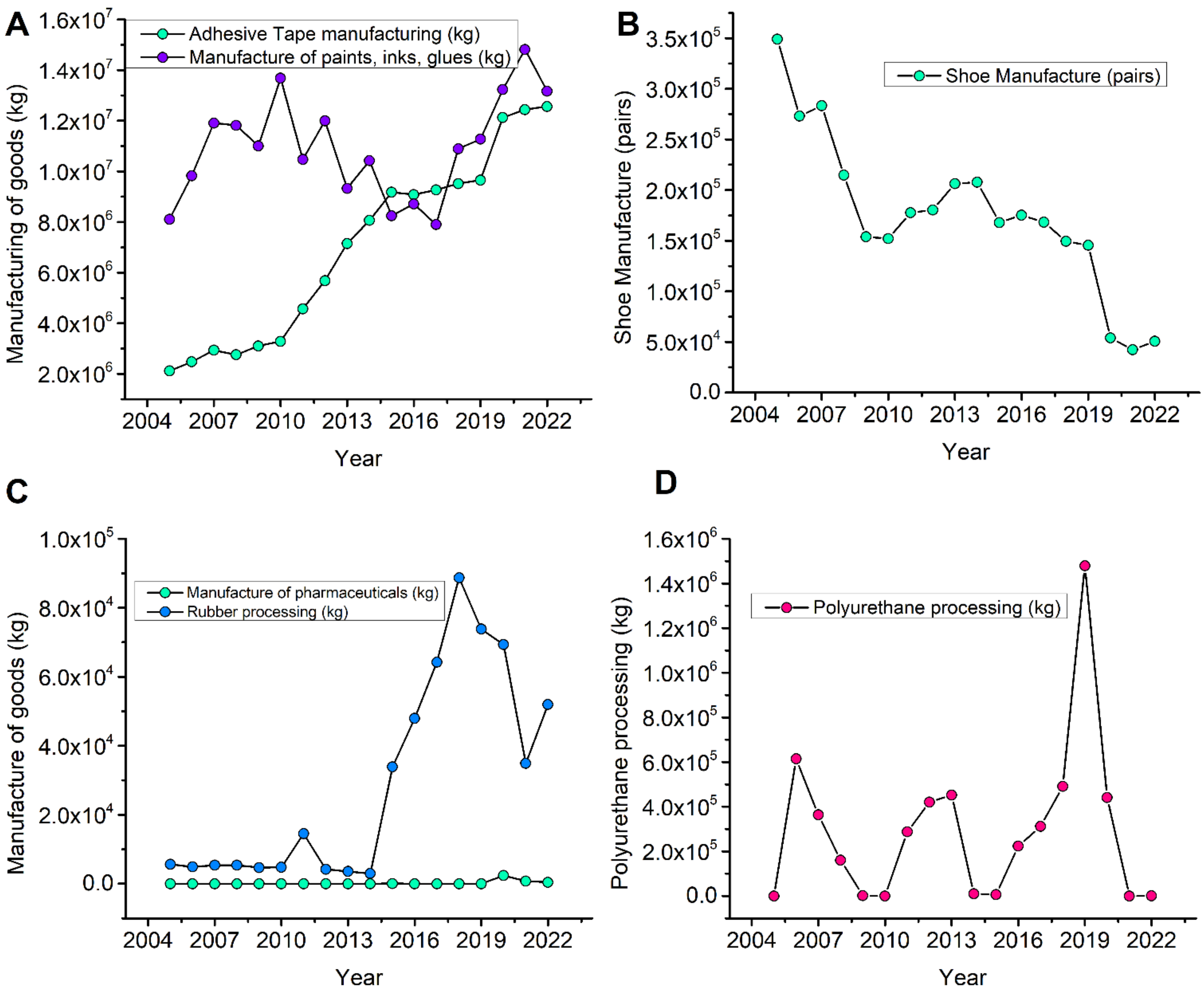

Figure 4-33 Activity data for 2.D.3.g

2.7.3. Emission factors

Tier 2 approach was used in calculating NMVOC emission. For this purpose, we have collected Eurostat production data for polyurethane foam production, production of inks, glues, and adhesives, total amount of manufactured adhesive tapes, number of shoes produced, amount of pharmaceutical goods synthesized, polystyrene and rubber processed. For each product, we have applied its own specific Tier 2 emission factor, which is associated with manufacturing technology used. Briefly, for polyurethane foam processing we used 120 g NMVOC/kg polyurethane processed (EMEP/EEA Guidebook 2019, 2D3g, table 3-3), 60 g NMVOC/kg polystyrene produced (EMEP/EEA Guidebook 2019, 2D3g, table 3-4), 8 g NMVOC/kg rubber processes (EMEP/EEA Guidebook 2019, 2D3g, table 3-5), 300 g NMVOC/kg of pharmaceutical good produced (EMEP/EEA Guidebook 2019, 2D3g, table 3-7), 11 g NMVOC/kg of paints, ink and adhesives manufactured (EMEP/EEA Guidebook 2019, 2D3g, table 3-11), 3 g NMVOC/m^2 of adhesive tapes manufactured (EMEP/EEA Guidebook 2019, 2D3g, table 3-12), 0.045 g NMVOC/pair of manufactured shoes (EMEP/EEA Guidebook 2019, 2D3g, table 3-13).

$$Emission = Production \times EF_{(\text{technology}-\text{specific})}$$

2.8. Printing (NFR 2.D.3.h)

2.8.1. Overview of the sector

We have used Tier 2 approach to estimate the production of NMVOCs during the industrial printing. In order to do so, we have estimated the ink usage with regard to the printing process. We have collected Eurostat data on the industrial printing machines sold in Lithuania during 2005-2021 period. The results indicate that about 83% of the industrial printing machines operate by heat offset printing and about 17% of the machines operate by flexography. Thus, we have assumed that 17% of the total inks used for printing are being consumed in the flexography printing process and the rest, 83%, are being used in the heat offset printing.

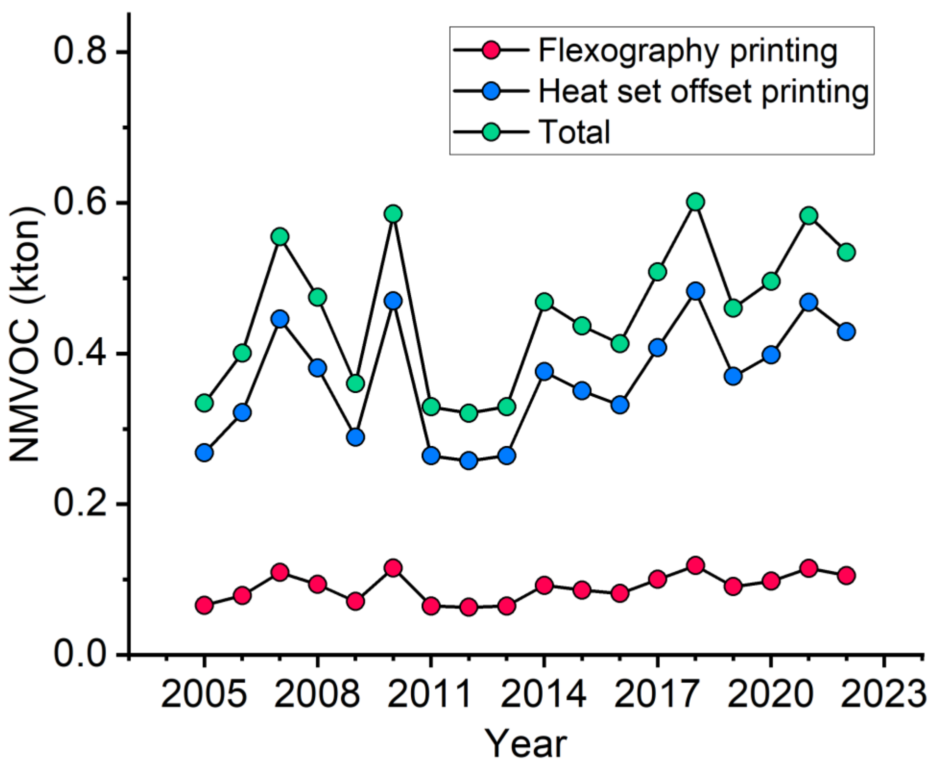

Figure 4-34. Printing ink consumption along with NMVOC release

2.8.2. Activity data

Data on the total ink consumption for printing are taken directly from the Eurostat (Export Import+Production). Overall, black, and non-black ink consumption was taken into account, as the statistics on water-based inks are not collected and emissions from water-based inks are considered insignificant.

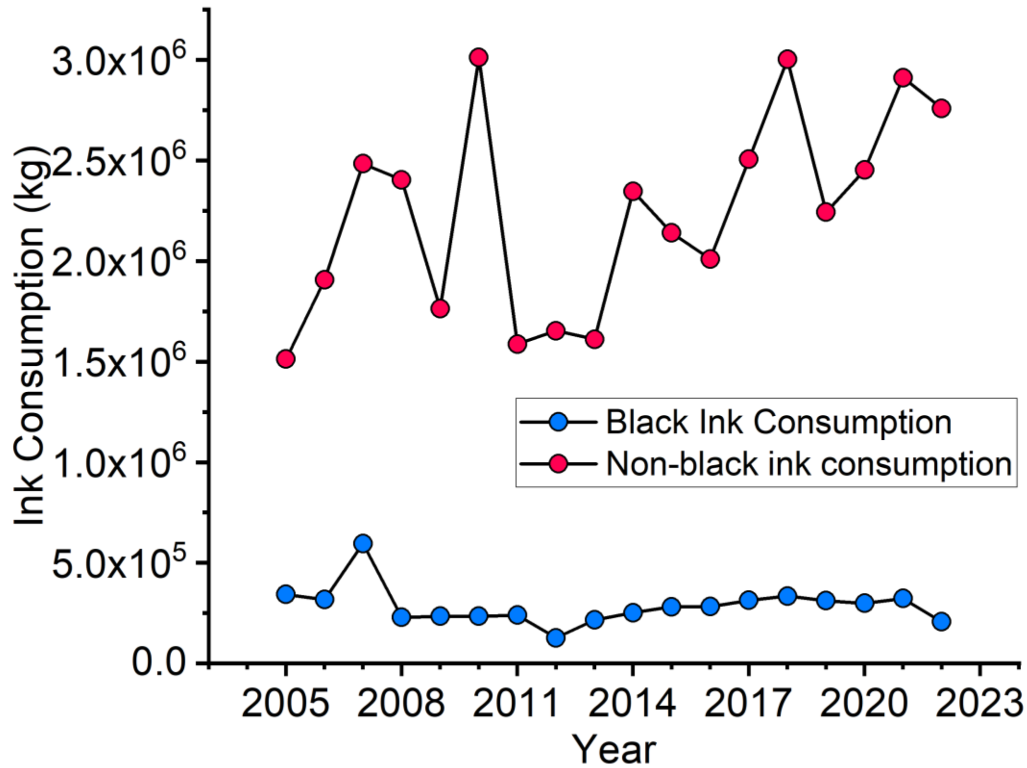

Figure 4-35. Printing ink consumption along with NMVOC release

2.8.3. Emission factors

Data on the total ink consumption for printing are taken directly from the Eurostat (Export-Import+Production). Total paint consumption was estimated by summing up local production and import, and subtracting the export.

$$AR_{Consumption} = Production - Export + Import$$

For heat offset printing, the emission factor of 730 g NMVOC/kg ink was used (EMEP/EEA, 2023, table 3-2).

$$E_{NMVOC} = AR_{Production} \cdot EF$$

Since flexography printing is further divided into small flexography printing (emission factor 900 g NMVOC/kg ink; EMEP/EEA, 2019, table 3-4) and large flexography printing (emission factor 800 g NMVOC/kg ink used; EMEP/EEA, 2019, table 3-5) categories, we have taken an average of the two emission factors (850 g NMVOC/kg ink used) and assumed that 50% of the flexography printing occurs on via small flexography, and 50% of the printing occurs via large flexography.

$$E_{NMVOC} = AR_{Production} \cdot EF_{Average}$$

In addition, we have applied 76% abatement efficiency for the industrial printing (EMEP/EEA, 2019, table 3-11), since most of the printing facilities in Lithuania are equipped with thermal incinerators, thus effectively burning the solvents evaporating during the printing process. We have assumed that implementation of thermal incinerators started from 2005 in small scale printing companies, and in 2014-2020 large scale printing companies, such as manufacturers of food packaging, finished implementing thermal incinerators with the help of European Union Structural Funds 2014-2020.

2.8.4. Recalculations

We have fixed non-black in consumption statistical error that occured in the year 2017; Additionally, we have fixed 2009 and 2010 values for black in consumption:

Original:

Year	NMVOC, Flex	NMVOC, heat offset	Total	Black ink	Non-Black
2005	0.065926289	0.268417248	0.334343537	342700	1512530
2006	0.079004834	0.321666219	0.400671053	317200	1906073
2007	0.109459821	0.445662942	0.555122762	596100	2484206
2008	0.093574479	0.380986166	0.474560645	229200	2404077
2009	0.063051975	0.256714549	0.319766524	10700	1763644
2010	0.101264618	0.412296376	0.513560993	-162400	3012085
2011	0.064938619	0.264395973	0.329334592	240000	1587436
2012	0.063267319	0.257591319	0.320858638	126600	1653804
2013	0.064955462	0.264464552	0.329420015	216500	1611410
2014	0.092360804	0.376044718	0.468405522	251900	2347223
2015	0.086057468	0.350380845	0.436438313	281830	2139911
2016	0.081469994	0.331703056	0.41317305	282344	2010301

2017	0.516327361	2.102214029	2.618541391	313639	14216316
2018	0.118579583	0.482793828	0.601373411	334317	3002628
2019	0.090787511	0.369639095	0.460426605	311594	2243255
2020	0.097782542	0.398119191	0.495901733	298880	2452816
2021	0.114944172	0.467992343	0.582936516	323192	2911449
2022	0.105396315	0.42911848	0.534514796	206672	2759283

Recalculated:

Year	NMVOC, Flex	NMVOC, heat offset	Total	Black ink	Non-Black
2005	0.065926289	0.268417248	0.334343537	342700	1512530
2006	0.079004834	0.321666219	0.400671053	317200	1906073
2007	0.109459821	0.445662942	0.555122762	596100	2484206
2008	0.093574479	0.380986166	0.474560645	229200	2404077
2009	0.071008345	0.289108712	0.360117056	234600	1763644
2010	0.11537216	0.469734886	0.585107046	234600	3012085
2011	0.064938619	0.264395973	0.329334592	240000	1587436
2012	0.063267319	0.257591319	0.320858638	126600	1653804
2013	0.064955462	0.264464552	0.329420015	216500	1611410
2014	0.092360804	0.376044718	0.468405522	251900	2347223
2015	0.086057468	0.350380845	0.436438313	281830	2139911
2016	0.081469994	0.331703056	0.41317305	282344	2010301
2017	0.100213428	0.408016483	0.508229911	313639	2506464
2018	0.118579583	0.482793828	0.601373411	334317	3002628
2019	0.090787511	0.369639095	0.460426605	311594	2243255
2020	0.097782542	0.398119191	0.495901733	298880	2452816
2021	0.114944172	0.467992343	0.582936516	323192	2911449
2022	0.105396315	0.42911848	0.534514796	206672	2759283

2.9. Other solvent and product use (NFR 2.D.3.i-2.G)

2.9.1. Overview of the sector

The sector of other solvent and product use (2D3i) covers the release of pollutants from the use of tobacco, emissions from fireworks, NMVOC emission from the usage of lubricants and adhesives, NMVOC release during dewaxing of new vehicles, evaporation of solvents during wood and furniture lacquering, as well as solvent use in glass and mineral wool enduction.

Information on cigarette consumption (cigarettes per inhabitant per year) from 2000 to 2021 is available from Statistics Lithuania database. Averaged 2000 – 2021 (i.e. 1092.9 cigarettes/ inhabitant/ year) value was used to estimate tobacco consumption for years before 2000. Emissions from tobacco consumption were estimated using emission factors from 2023 EMEP/EEA guidebook.

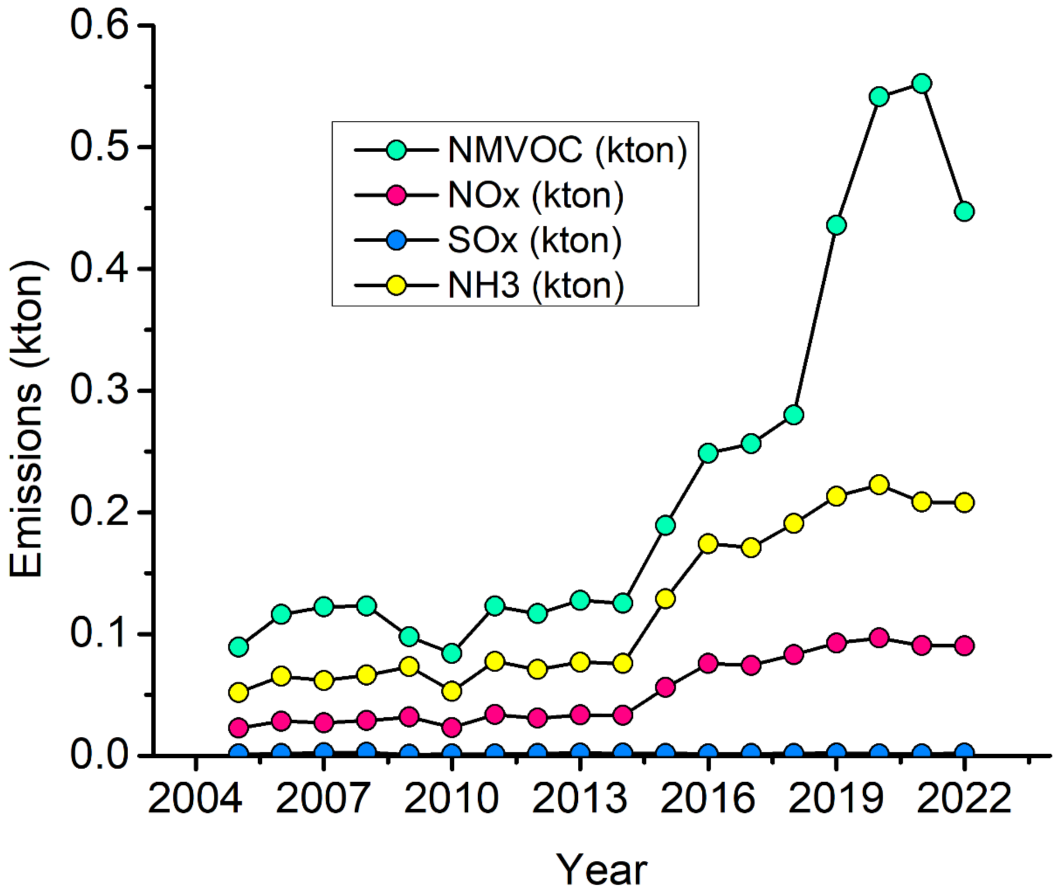

Figure 4-36. NMVOC, NH_3, NOx, SOx emissions for 2.D.3.i.

2.9.2. Activity data

All statistical data in this sector was taken directly from the Eurostat database. Briefly, such activities as wood treated with preservatives, import of new vehicles, use of adhesives, use of fireworks, consumption of tobacco (cigars, cigarettes, other), use of lubricating preparations, and consumption of hydraulic brake fluids for hydraulic transmissions. Activity data on the use of tobacco products was calculated assuming that 1 cigarette has a mass of 1 gram; for all tobacco products, the activity data was collected by summing up production and import with subtraction of export. For new vehicle dewaxing, the activity data was calculated by subtracting import from the export, as the new vehicles produced locally are not waxed. Similarly, in the case of fireworks, adhesives and lubricants, the activity data was calculated by summing up production and import with subtraction of export. For glass and mineral wool enduction, only the local mineral and glass wool production was taken into account. Similarly, for the wood treatment category, only local production of wood treated with paint and preservatives was taken into account. Such emission sources as the deicing of airports or NMVOC produced from the extraction of oil were not considered as there are no official statistics in these categories. We have assumed that NMVC emission from deicing and seed oil extraction were insignificantly small. This is justified by considering small amount and area of airports in Lithuania.

2.9.3. Emission factors

Emissions were estimated using Tier 2 approach from 2005 onward, applying relevant technology-specific emission factors for each specific product. Prior to 2005, the emissions were estimated by extrapolating data.

$$Emission = Consumption \times EF_{(\text{technlogoy}-\text{specific emission factor})}$$

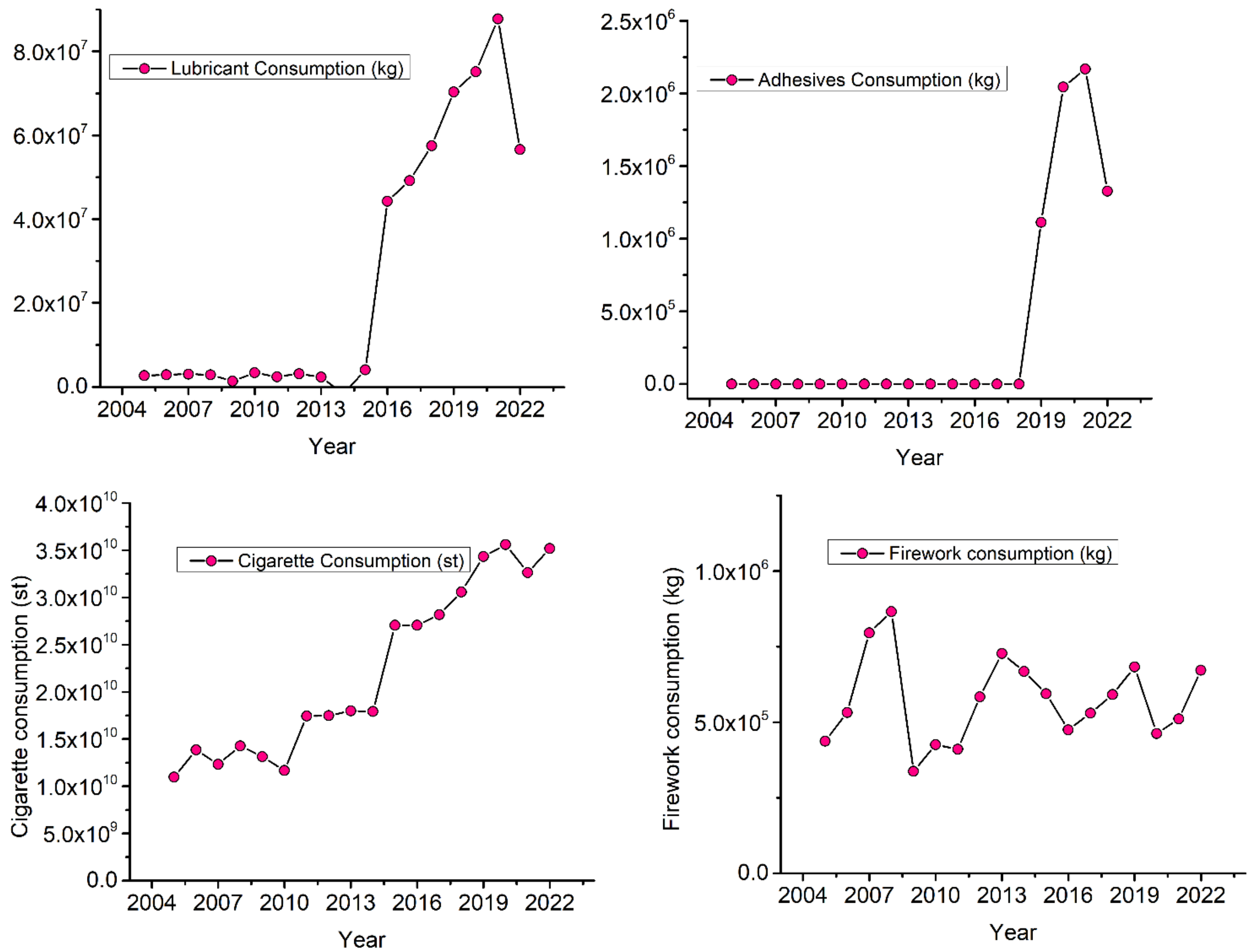

Figure 4-37. Consumption of products for sector 2.D.3.i

The following emission factors were used: for glass wool enduction 250 g NMVOC/t glass wool produced (EMEP/EEA Guidebook 2023, 2.D.3.i-2.G, table 3-2), 1000 g NMVOC/vehicle dewaxed (EMEP/EEA Guidebook 2023, 2.D.3.i-2.G, table 3-9), 522 g NMVOC/kg of adhesives consumed (EMEP/EEA Guidebook 2019, 2.D.3.i-2.G, table 3-11), 3020 SO2 g/t of fireworks used (EMEP/EEA Guidebook 2023, 2.D.3.i-2.G, table 3-14) along with all the relevant emission factors for heavy metals, particulate matter from the firework usage (EMEP/EEA Guidebook 2023, 2.D.3.i-2.G, table 3-14), 4.84 kg NMVOC/Mg tobacco consumed (EMEP/EEA Guidebook 2023, 2.D.3.i-2.G, table 3-15) along with all relevant pollutant emission factors for heavy metals, particulate matter, and main pollutants for tobacco (EMEP/EEA Guidebook 2023, 2.D.3.i-2.G, table 3-15).

2.10. Food and beverages industry (NFR 2.H.2)

2.10.1. Overview of the sector

The sector of food and beverages industry (2.H.2) covers the release of NMVOCs from the production of fermented beverages (such as beer, wine), sugar production, meat, fish and bread preparing, margarine and cooking oil usage, as well the release of PM_{10} from handling of agricultural goods (soya, wheat).

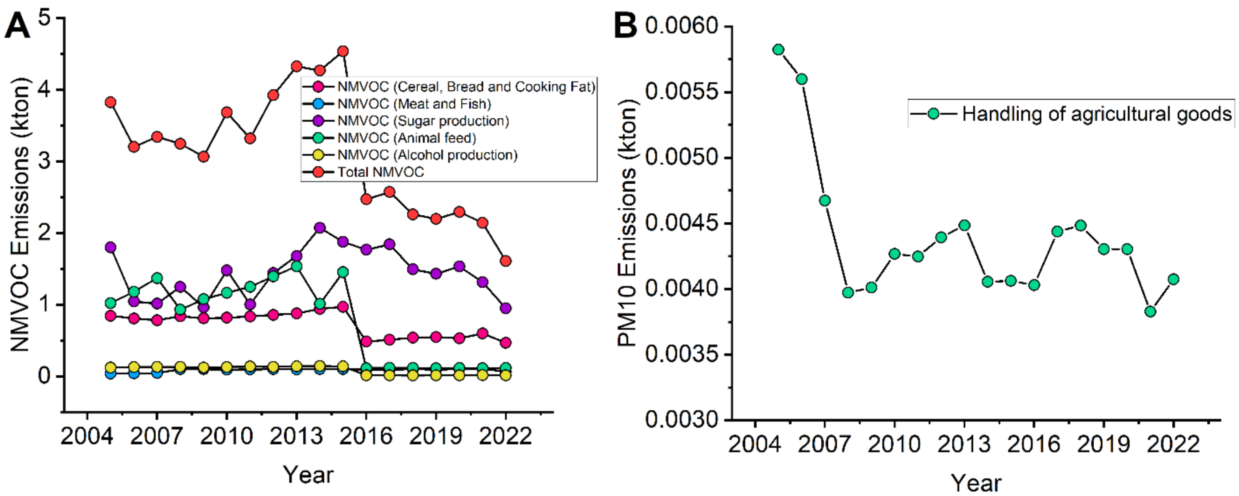

Figure 4-38. NMVOC (A) and PM10 (B) emissions from relevant 2.H.2 categories.

2.10.2. Activity data

All statistical data in this sector was taken directly from the Eurostat database. For NMVOC calculations total consumption of meat, fish, poultry, and cooking far usage were taken into account (Production+Import-Export). Local production values for animal feed, sugar, bread, biscuits, as well as coffee roasting, and production of beer, wine and other fermented beverages (ciders, vermouth, distilled spirits) were also taken into account. For PM10 calculations handling of agricultural goods (cereal grains and wheat) was taken into account. Overall, production or consumption of more than 200 different products was taken into account.

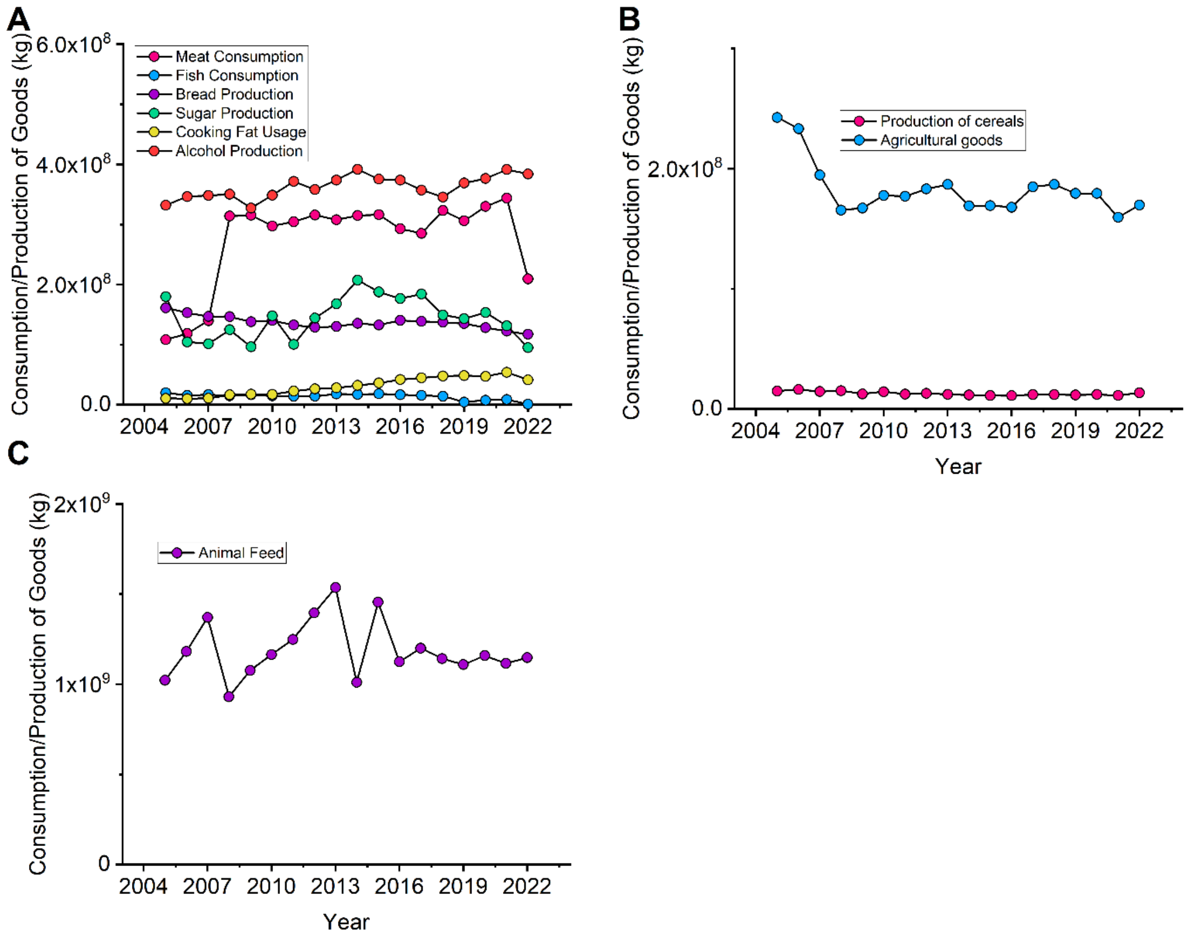

Figure 4-39. Consumption/manufacture of goods.

2.10.3. Emission factors

Emissions were estimated using Tier 2 approach from 2005 onward, applying relevant emission factors for each specific product or technology. Emissions prior to 2005 were not estimated. For NMVOC calculations, the following emission factors were applied: 0.3 g NMVOC/kg meat consumed (EMEP/EEA Guidebook 2023, table 3.19), 0.3 g NMVOC/kg fish consumed (EMEP/EEA Guidebook 2023, table 3.19), 4.5 g NMVOC/kg bread produced (EMEP/EEA Guidebook 2023, table 3.13), 1 g NMVOC/kg cereal produced (EMEP/EEA Guidebook 2023, table 3.18), 10 g NMVOC/kg sugar produced (EMEP/EEA Guidebook 2023, table 3.20), 10 g NMVOC/kg fats used (EMEP/EEA Guidebook 2023, table 3.21), 1 g NMVOC/kg animal feed produced (EMEP/EEA Guidebook 2023, table 3.22), 0.55 g NMVOC/kg coffee roasted (EMEP/EEA Guidebook 2023, table 3.23), 0.35 g NMVOC/l beer produced (EMEP/EEA Guidebook 2023, table 3.27), 0.8 g NMVOC/l red wine produced (EMEP/EEA Guidebook 2023, table 3.25), 0.4 g NMVOC/l other fermented beverages produced (EMEP/EEA Guidebook 2023, table 3.32). In the case of handling agricultural goods, emission factor of 0.024 g NMVOC/kg agricultural goods handled was applied (EMEP/EEA Guidebook 2023, table 3.10).

$$E_{NMVOC} = AR_{Production} \cdot EF$$

In addition, from 2016 onwards, 90% abatement efficiency was applied to NMVOC emissions from the production of animal feed, spirits, bread, and cereal. We have assumed that the European Parliament Directive 2010/75/ES was fully implemented by 2016 in the industry, and thus large industrial manufacturers of bread, cereal, animal feed and spirits are required to have abatement equipment, such as NMVOC adsorption filters or thermal incinerators.

2.11. Other Industrial Processes (NFR 2.H.3)

2.11.1. Overview of the sector

The sector of other industrial processes (2.H.3) covers the release of NMVOCs, NOx, TSP, SO_2, NH_3 and CO from the major manufacturer of furniture (IKEA) and from the major manufacturer of acetate textile fibers (DP Acetate). Both facilities directly measure and report their pollutant emissions to the government of Lithuania. In the case of furniture manufacturing, the NMVOCs, NOx, TSP, SO_2, NH_3 and CO are released from the wood preservation, furniture cutting and coating. From the manufacture of acetate fibers, only the NMVOCs are released during polymerization process.

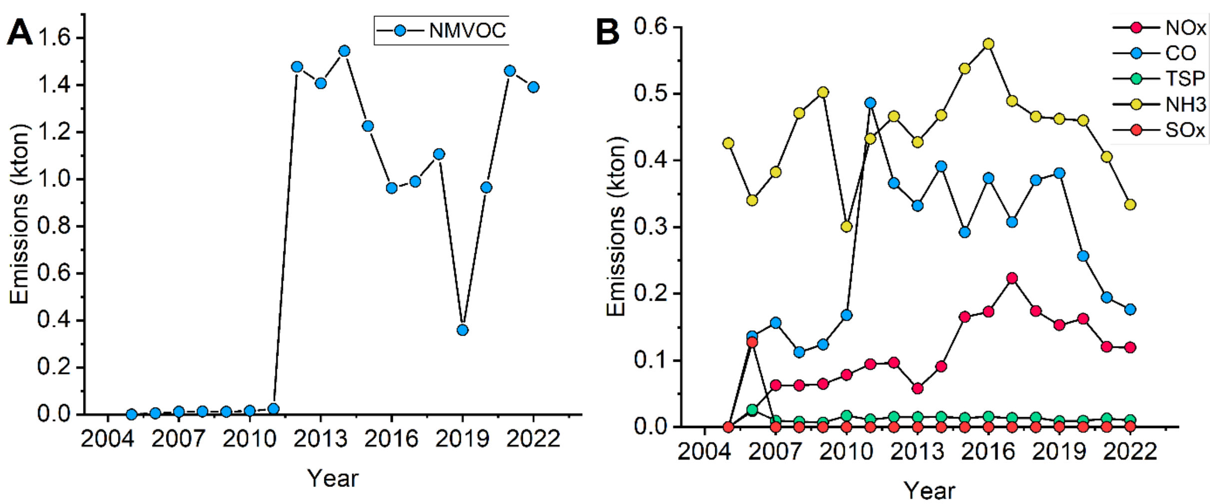

Figure 4-40. NMVOC (A) and other pollutant (B) emissions from 2.H.3.

2.11.2. Emission factors

Tier 3 approach was used in pollutant estimations as both IKEA and DP Acetate directly measure and report their emissions from the facility.

2.11.3. Recalculations

We have corrected errorous statisticals reports that were mixed with the IKEA pollutant emission reports and now we provide correct IKEA pollutant emissions, along with original and 2.H.3. recalcualted values:

Original:

	NMVOC (kton)	NH3 (kton)	CO (kton)	NOx (kton)	SO2 (kton)	TSP (kton)
2005	0.013263	0.016333	0.03526	0.021228	0.005546	0.065343
2006	0.012379	0.010465	0.025893	0.013864	0.006155	0.057607
2007	0.008733	0.013048	0.029801	0.009461	0.006052	0.042333
2008	0.006397	0.007268	0.032157	0.034564	0.002906	0.022365
2009	0.003908	0.004998	0.017814	0.018413	0.001929	0.013117
2010	0.007125	0.009513	0.039728	0.027888	0.003592	0.038023
2011	0.007143	0.025084	0.068334	0.04436	0.007713	0.086345
2012	1.466308	0.028433	0.077128	0.050077	0.008696	0.097636
2013	1.391202	0.031204	0.084396	0.054795	0.009575	0.107291
2014	1.527226	0.027336	0.074473	0.048246	0.008394	0.094705
2015	1.217932	0.026144	0.070891	0.04604	0.008	0.090701
2016	0.94843823	0.02995	0.083541	0.055201	0.007308	0.060699
2017	0.98990303	0.034259	0.09458	0.062592	0.008291	0.068652
2018	0.98880103	0.0351	0.0982129	0.064733	0.008556	0.0716089
2019	0.11840203	0.03196	0.087757	0.05824	0.007717	0.0636909
2020	0.66607973	0.0341843	0.0935404	0.0616464	0.0081345	0.0679624
2021	1.21890943	0.0285835	0.0485373	0.0291672	0.0002737	0.0392776

Original IKEA:

	NMVOC (kton)	NH3 (kton)	CO (kton)	NOx (kton)	SO2 (kton)	TSP (kton)
2005	0.013263	0.016333	0.03526	0.021228	0.005546	0.065343
2006	0.012379	0.010465	0.025893	0.013864	0.006155	0.057607
2007	0.008733	0.013048	0.029801	0.009461	0.006052	0.042333
2008	0.006397	0.007268	0.032157	0.034564	0.002906	0.022365
2009	0.003908	0.004998	0.017814	0.018413	0.001929	0.013117
2010	0.007125	0.009513	0.039728	0.027888	0.003592	0.038023

2011	0.007143	0.025084	0.068334	0.04436	0.007713	0.086345
2012	0.008052	0.028433	0.077128	0.050077	0.008696	0.097251
2013	0.008836	0.031204	0.084396	0.054795	0.009575	0.106811
2014	0.007757	0.027336	0.074473	0.048246	0.008394	0.093877
2015	0.00741	0.026144	0.070891	0.04604	0.008	0.089849
2016	0.01332703	0.02995	0.083541	0.055201	0.007308	0.060523
2017	0.01509003	0.034259	0.09458	0.062592	0.008291	0.068652
2018	0.01559403	0.0351	0.0982129	0.064733	0.008556	0.0709199
2019	0.01404303	0.03196	0.087757	0.05824	0.007717	0.0635769
2020	0.01482173	0.0341843	0.0935404	0.0616464	0.0081345	0.0671414
2021	0.00701743	0.0285835	0.0485373	0.0291672	0.0002737	0.0384026

Recalculated Sector:

	NMVOC (kton)	NH3 (kton)	CO (kton)	NOx (kton)	SO2 (kton)	TSP (kton)
2005	0	0	0	0	0	0
2006	0.005012	0	0.136144	0.023963	0.127323	0.026144
2007	0.011042	0	0.156339	0.062595	0	0.009574
2008	0.012397	0	0.112375	0.062534	0	0.008169
2009	0.011025	0	0.123904	0.064754	0	0.00672
2010	0.015067	0	0.168045	0.078207	0	0.016894
2011	0.02361	0	0.486201	0.094377	0	0.011354
2012	1.477561	0	0.365895	0.096596	0	0.015096
2013	1.407681	0	0.332166	0.057821	0	0.014858
2014	1.54481	0	0.391123	0.090988	0	0.0153
2015	1.22534	0	0.292187	0.165183	0	0.013562
2016	0.9618142	0	0.373437	0.173059	0	0.01555
2017	0.990027	0	0.307577	0.223267	0	0.013362
2018	1.105695	0	0.370422	0.174231	0	0.014137
2019	0.3583749	0	0.381046	0.152931	0.000432	0.008766
2020	0.965128	0	0.256476	0.162604	0.000282	0.009575
2021	1.459969	0	0.194449	0.120391	0.00038	0.012676

Recalculated IKEA:

	NMVOC (kton)	NH3 (kton)	CO (kton)	NOx (kton)	SO2 (kton)	TSP (kton)
2005	0	0	0	0	0	0
2006	0.005012	0	0.136144	0.023963	0.127323	0.026144
2007	0.011042	0	0.156339	0.062595	0	0.009574
2008	0.012397	0	0.112375	0.062534	0	0.008169
2009	0.011025	0	0.123904	0.064754	0	0.00672
2010	0.015067	0	0.168045	0.078207	0	0.016894
2011	0.02361	0	0.486201	0.094377	0	0.011354

2012	0.019305	0	0.365895	0.096596	0	0.014711
2013	0.025315	0	0.332166	0.057821	0	0.014378
2014	0.025341	0	0.391123	0.090988	0	0.014472
2015	0.014818	0	0.292187	0.165183	0	0.01271
2016	0.026703	0	0.373437	0.173059	0	0.015374
2017	0.015214	0	0.307577	0.223267	0	0.013362
2018	0.132488	0	0.370422	0.174231	0	0.013448
2019	0.2540159	0	0.381046	0.152931	0.000432	0.008652
2020	0.31387	0	0.256476	0.162604	0.000282	0.008754
2021	0.248077	0	0.194449	0.120391	0.00038	0.011801

2.12. Consumption of POPs and heavy metals (e. g. electrical and scientific equipment (NFR 2.K)

2.12.1. Overview of the sector

In most cases, emissions from this sector are considered to be insignificant as they account for less than 1% of total national emissions. However, for some POPs, the use of electrical equipment may be an important source of emissions. In Lithuania, PCB emissions from electrical equipment constitute the biggest part of all PCB emissions.

Currently, in 2022, only one company in Lithuania still uses electrical equipment which produces PCB. As there is no information on the PCB amount in the liquid of the electric equipment still in use, assumption was made that PCB is equal to 0.05% of the liquid mass.

According to the requirements of the Rules on PCB/PCT Management, adopted on 26 September 2003 by Order No 473 of the Minister of Environment (as amended in 2004), holders of equipment containing PCBs shall compile inventory of equipment where PCB content exceeds 5 dm^3 and equipment containing PCBs from 0.05% to 0.005% by fluid weight. The Rules on PCB/PCT Management are aimed at implementing the PCB Directive – Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT). The updated inventory reports are submitted to the Regional Environmental Protection Departments annually.

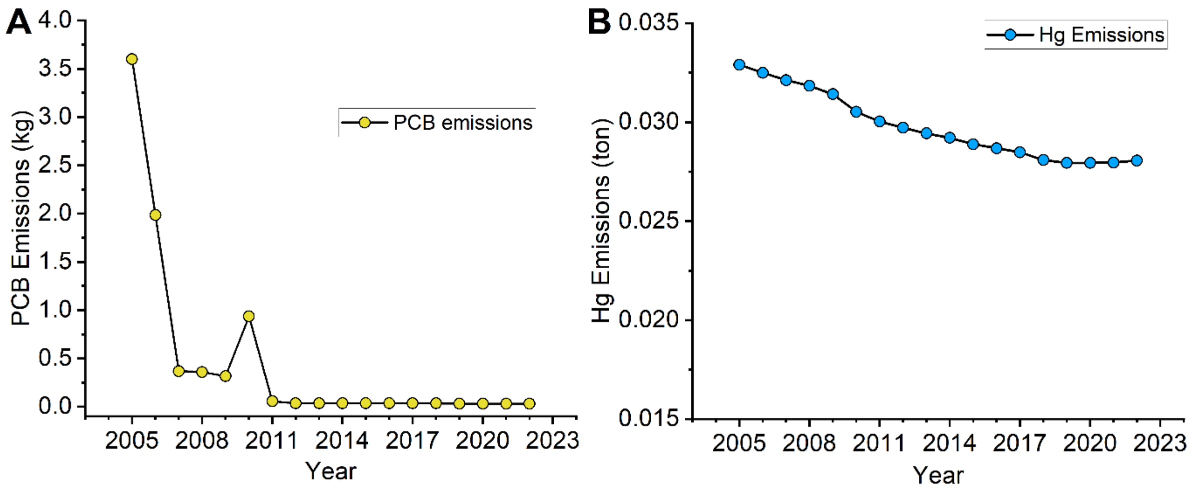

Figure 4-41. PCB emissions (A) and Hg emissions (B) from 2.K sector in 2005-2022.

According to the Rules on PCB/PCT Management. PCB-containing equipment was to be decontaminated and/or disposed by the end of 2010 at the latest. The major part of the equipment inventoried before the end of 2010 in Lithuania has been disposed by this deadline. It should be noted that not all companies holding PCB–containing equipment managed to comply with this deadline. The Regional Environmental Departments are observing such companies concerning their situation, actions and plans for disposal/decontamination of PCB equipment no longer permitted. However, transformers the fluids in which contain between 0.05% and 0.005% of PCBs by weight are to be either decontaminated or disposed of at the end of their useful lives.

2.12.2. Activity data

Data on electrical equipment containing liquids with PCBs was provided by the specialists of waste licensing division in Lithuanian EPA. No information on the amount of liquid containing PCBs was available for year 2006. Thus, average of 2005 and 2007 was taken. Mercury emissions were estimated using Tier 1 approach by considering the total population of Lithuania.

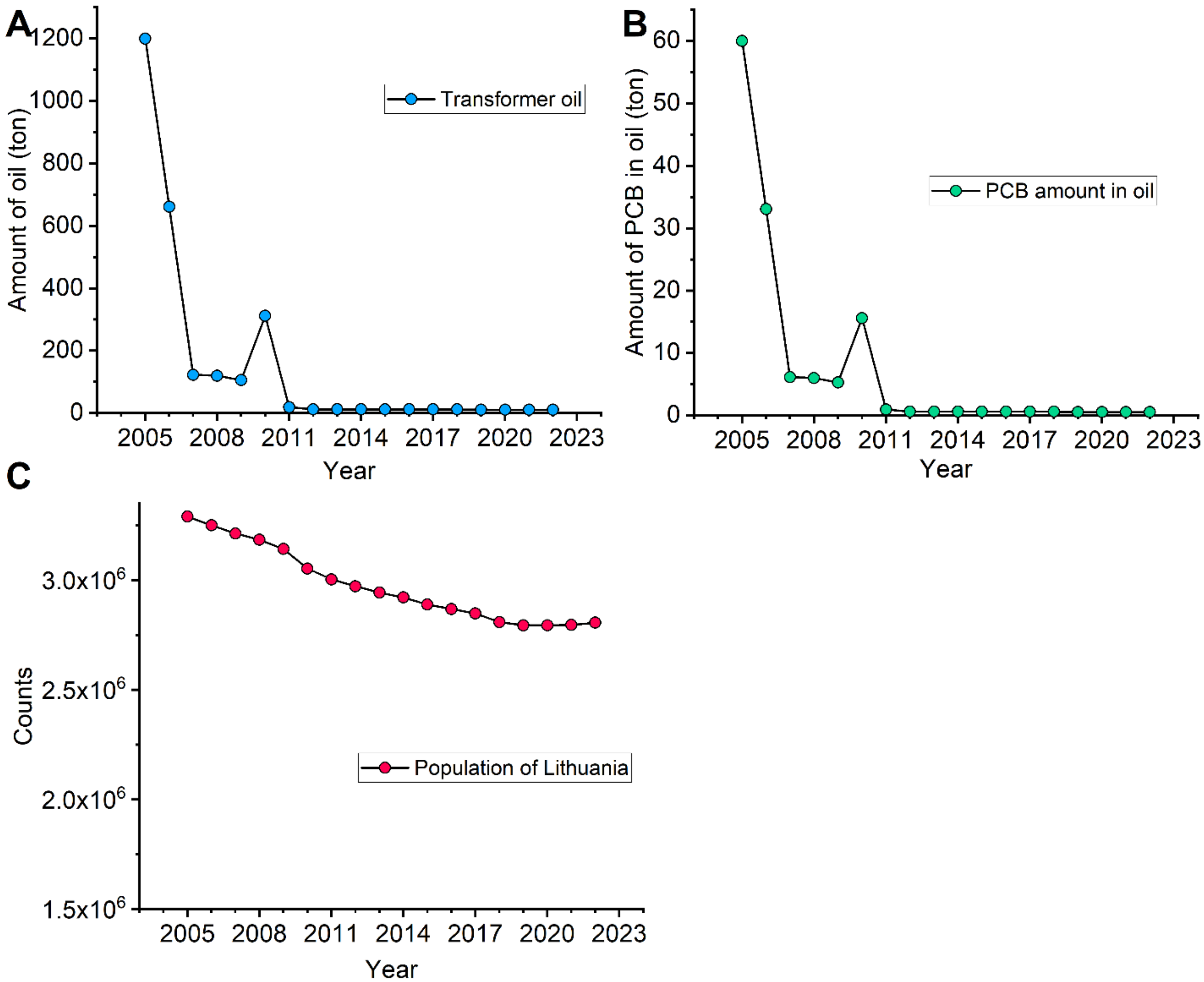

Figure 4-39. Amount of transformer oil (A), PCB amount of in oil (B) and population of Lithuania (C).

2.12.3. Emission factors

For the estimation of Hg emissions, emission factor of 0.01 g Hg/capita was used. For PCBs, we used emission factor of 0.06 kg PCBs/kg of PCB in electrical equipment. The amount of pollutants released were calculated by multiplying activity data with emission relevant factors.

$$E_{Pollutant} = AR_{production} \times EF_{pollutant}$$

2.13. Wood processing (NFR 2.I)

2.13.1. Overview of the sector

Emissions form this sector occurs from production of wood products: sawnwood, veneer sheets, plywood, particle board and fibre board. Occuring emissions are TSP.

2.13.2. Methodological issues

Statistical data on wood production for the latest reporting year, is not made available in time for the reporting deadline. Therefore, the three latest reported years are the same. Activity data for the latest reporting year in this year's submission, will be updated with the correct statistical data in next year's submission.

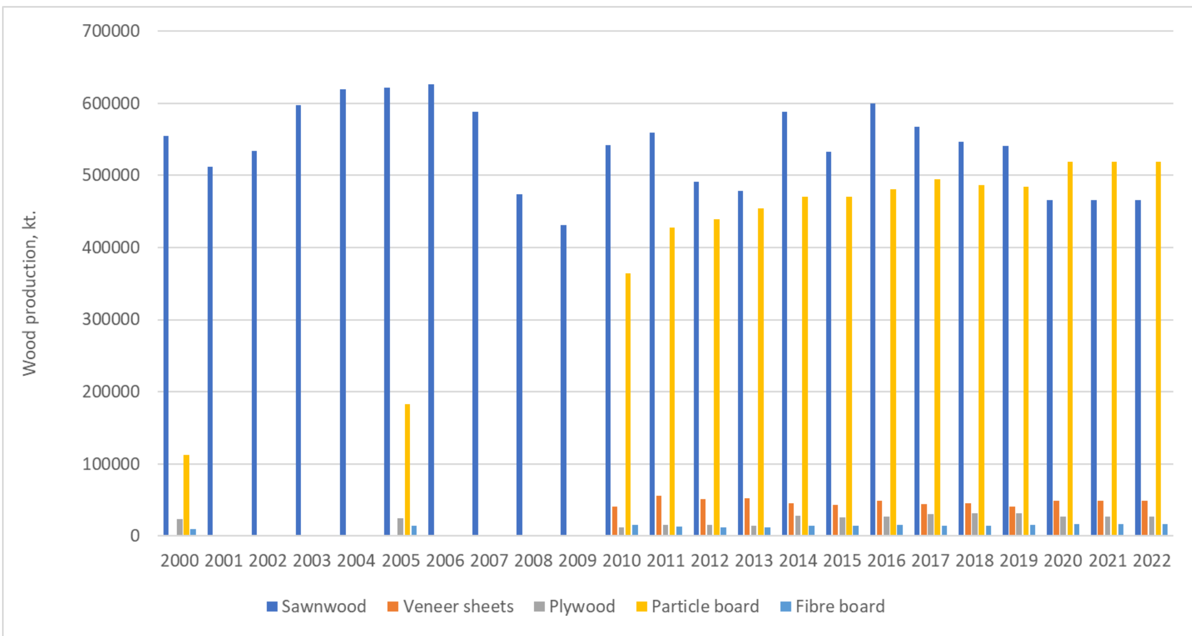

Figure 4-40 . Production of wood industry in the period 2000-2022.

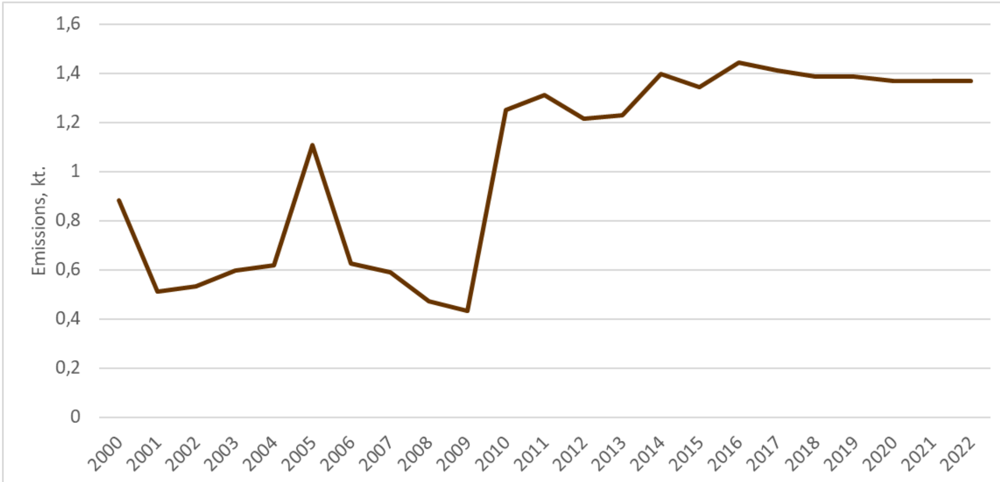

Figure 4-41. TSP emissions in Sector 2I. Wood processing in the period 2000-2022.

Activity data for wood processing were retrieved from national forest agency. Emission factors were taken from 2023 Guidebook, Tier 1 methodology was used.

$$E_{Pollutant} = AR_{production} \times EF_{pollutant}$$

Where:

$E_{pollutant}$ – the emission of the specified pollutant

$AR_{production}$ – the annual wood production

$EF_{pollutant}$ – the emission factor for this pollutant

2.13.3. Source-specific QA/QC verification

All quality procedures according to the Lithuanian QA/QC plan have been implemented during the work with this submission.

2.13.4. Source-specific recalculations

No source specific recalculations.

2.13.5. Source-specific planned improvements

No source specific planned improvements .

2.14. Use of pesticides (NFR 3.D.f)

2.14.1. Overview of the sector

The sector of the use of pesticides (3.D.f) covers the usage of insecticides, fungicides, plant growth regulators, rodenticides, and herbicides for the agricultural purposes and their HCB emissions. The 2001 Stockholm Convention on Persistent Organic Pollutants (POPs) and Protocol to the Convention on LRTAP banned production and consumption of 11 specific POPs. In addition, there are multiple Directives concerning maximum levels of pesticide residues in fruits and vegetables (Directive 76/895/EEC), cereal products (86/362/EEC), food of animal origin (86/363/EEC), plant origin products (90/642/EEC), placing of plant products on the market (91/414/EEC), biocidal products in the market (98/8/EEC) and, maximum levels of pesticides in the animal food and feed (EC regulation No. 396/2005).

According to the latest study, most of the pesticides used in 2014 were herbicides (43%), fungicides (29%), plant growth regulators (26%) and insecticides (2%). [1] In the herbicide category, glyphosate (20.6%) and MCPA (16.8%) were the most common constituents in commercial herbicides. In the case of fungicide, the major constituent was tebuconazole (25.6%). In the case of insecticides, the major constituent was thiacloprid (45.5%), and only 5 active substances are being used in the plant growth regulators with major substance being chlormequat (84.3%).

90-95% of sugar beetroot, sweetcorn, rapes and cereal species are processed with pesticides, and in the case of other agricultural goods, only a smaller percentage of the harvest was treated with pesticides: potatoes (62%), vegetables (26%), and fruit and berries (23%). On average 1.08 kg of active ingredients were used for one hectare of agricultural land, with most of the active pesticides being used for berries and fruits (3.09 kg/ha) and least for the sweetcorn (0.38 kg/ha).

[1] https://osp.stat.gov.lt/informaciniai-pranesimai?articleId=3975263

Information on the amount of different pesticides used (i.e. insecticides, fungicides, herbicides, etc.) for the 1992-2014 period can be gathered from the Statistics Division of the Food and Agriculture Organization of UN (FAOSTAT). No national data on total or plant-specific pesticide consumption is available. In 2014 conducted study, we have shown that only HCB emissions occur from the use of pesticides (3.D.f).

2.14.2. Methodological issues

In 2014 we have conducted a study 2014 conducted study, where we proved that only HCB emissions occur from the use of pesticides (3.D.f). Pesticides which contain minor amounts of HCB as impurity were addressed. Only two chemicals, chlorothalonil and clopyralid, were identified to produce HCB emissions in small amounts. HCB emissions were estimated by using Yang (2006) emission factors (EMEP/EEA guidebook, 2023, 3.D.f, 3., table 3). For chlorothalonil and clopyralid the emission factors were 10 g/Mg and 2.5 g/Mg of pesticides used, respectively. The total amounts of chlorothalonil and clopyralid were obtained from statistical studies, and are equal to 5190.07 and 1359.65 kg, respectively.

Furthermore, no annual statistics in Lithuania are collected on the use of pesticides. Thus, HCB emissions from pesticide usage in 1990 were calculated based on reported HCB emissions by other countries. The average ratio of HCB emitted per agricultural land (kg of HCB per 1000 ha) was applied for agricultural area (3389 thousand ha) in Lithuania in 1992 (no data on agricultural land in 1990 is available at FAOSTAT database), and reported for 1990 on assumption that HCB emissions from this sub-sector were similar for years 1990 and 1992.

Country	Agricultural Land, 1000 ha (1990)	Reported HCB emissions from NFR 3.D.f (1990)	Ratio, kg/1000 ha
Denmark	2788	18.280	6.56E-03
Finland	2393	1.207	5.04E-04
Italy	16840	23.486	1.39E-03
Germany	18032	21.830	1.21E-03
United Kingdom	18203	116.326	6.39E-03
		Average	3.21E-03

Figure 4-42 Agricultural land (FEOSTAT Database), with reported HCB emissions and ratios by the country.

2.14.3. Activity data

As no statistics are collected on the use of pesticides, the agricultural land area was used for the HCB emission calculations. The statistics on the agricultural land area were taken from the National Lithuania Statistics database.

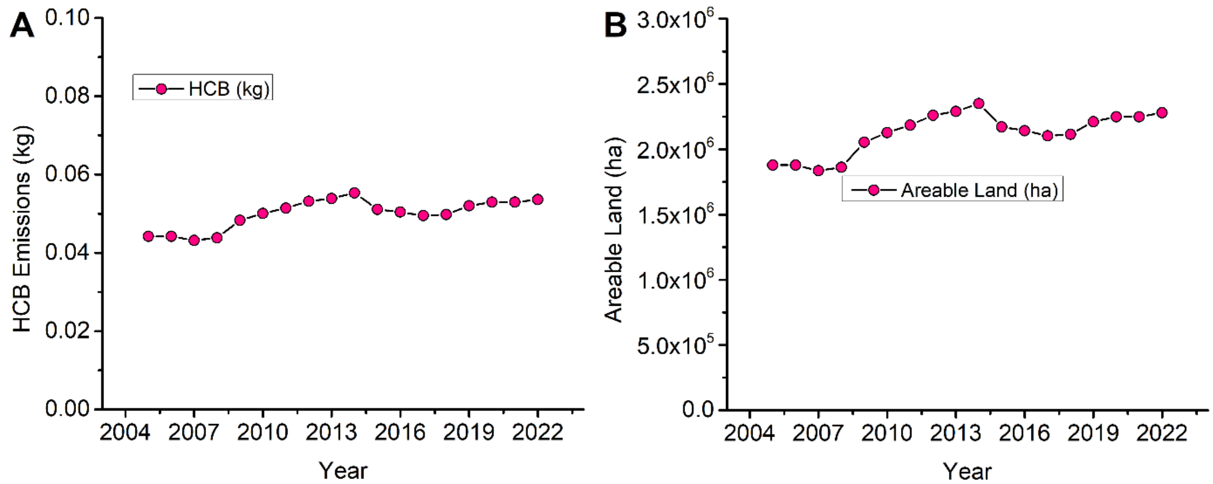

Figure 4-43 Agricultural land area along with HCB emissions (kg).