LITHUANIA'S INFORMATIVE INVENTORY REPORT 2023

Air Pollutant Emissions 1990-2022

under the UNECE CLRTAP and the EU NECD

Part 1 – General information

Part 2 - Transport

Lithuanian Environmental Protection Agency

CONTENTS

Abbreviations

BC – black carbon;
CEIP – Centre on Emission Inventories and Projections;
CPST – Centre for Physical Sciences and Technology in Lithuania;
CLRTAP – Convention on long Range Transboundary Air Pollutants (ECE/EB.AIR/97);
CORINAIR – The Core Inventory of Air Emissions in Europe;
SDA – Statistics Lithuania (State Data Agency);
DSI – dry sorbent injection;
EMEP/EEA – European Monitoring and Evaluation Program / European Environmental Agency;
EMEP/EEA 2016/2019/2023 guidebook or GB2016/GB2019/GB2023- The EMEP/EEA air pollutant emission inventory guidebook, where 2016 or 2019 or 2023 is the year when guidebook was approved;
EMEP/CORINAIR - Atmospheric emission inventory guidebook, Cooperative Programme for Monitoring and Evaluation on the Long-Range Transmission of Air Pollutants in Europe, The Core Inventory of Air Emissions in Europe;
E-PRTR – European Pollutant Release and Transfer Register;
ESP – electrostatic precipitation;
FF – fabric filter;
FRD – Fire and Rescue Department under the Ministry of the Interior of the Republic of Lithuania;
GHG – Green-house Gas;
HCB – hexachlorobenzene;
IIR – Informative Inventory Report;
IPCC GPG 2000 – IPCC Good Practice Guidance and Uncertainty management in national Greenhouse Gas Inventories (2000);
IPPU - industrial processes and product use sector;
KCA – key category analysis;
EPA or LEPA – Environmental Protection Agency under the Ministry of Environmental Protection (Lithuanian Environmental Protection Agency);
MoE - Ministry of the Environmental Protection;
NECD – National Emission Ceilings directive (ES)2016/2284;
NFR – Nomenclature for Reporting;
NMVOC – non-methylated volatile organic compounds;
PAH – Polycyclic aromatic hydrocarbons;
PCB – polychlorinated biphenyl;
PCDD/PCDF – polychlorinated dibenzodioxins / polychlorinated dibenzofurans;
PM – particulate matter;
POP – persistent organic pollutants.
RC - emission reduction commitments
SNCR – selective non-catalytic reduction;
TERT - European Commission Technical Expert Review Team;
Tier 1 – A method using readily available statistical data on the intensity of processes (activity rates) and

default emission factors. These emission factors assume a linear relation between the intensity of the process and the resulting emissions. The Tier 1 default emission factors also assume an average or typical process description. This method is the simplest method, has the highest level of uncertainty and should not be used to estimate emissions from key categories;

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

TFEIP – Task Force on Emission Inventories and Projections;

TSP – total suspended particles;

UN – United Nations;

UNFCCC – United Nations Framework Convention on Climate Change;

UNECE - the United Nations Economic Commission for Europe.

Executive summary

Inventory report of air pollutants emissions in Lithuania has been prepared by Lithuanian Environment Protection Agency (EPA) and State research institute Center for Physical Sciences and Technology (CPST) according to the Reporting Guidelines (hereinafter – Reporting Guidelines) and Gothenburg Protocol and National Emissions Ceilings Directive (NECD). The Informative Inventory Report (IIR) is submitted to the UNECE Secretariat and EEA annually.

EPA is responsible for the annual preparation and submission of the Informative Inventory Report and the inventories in the NFR format to the UNECE-LRTAP Convention institutions and the European Commission. EPA also participates in meetings under the NECD and the related expert panels.

This report includes information on the emission data from 1990 to 2022 for anthropogenic emissions of NOx, NMVOC, SO2, NH3 (main pollutants); CO (other); TSP, PM10, PM2.5, BC (particulate matter); Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn (heavy metals) and PCDD/PCDF, PAHs, PCB, HCB (persistent organic pollutants), compiled according to the guidelines for estimating and reporting emissions. Emission data is reported in the Nomenclature for Reporting format as requested in the Reporting Guidelines. Detailed information about emission trends and pollutants produced in each sector can be found under appropriate sectors and subsectors.

Lithuania's IIR Submission 2024 includes detailed information about air pollutant sectors – Energy, Industrial Processes and Product Use, Agriculture, Waste, Natural emissions and Other and their subsectors. Each subsector is described with following chapters – an overview, trends in emissions, methods, emission factors, activity data, uncertainties, QA/QC and verification, recalculations, and planned improvements.

The IIR 2024 consists of 6 parts - Part 1 General information (including main information, emission trends, implementation of recommendations, **adjustments**); Part 2 – Transport (transport and non-road mobile sources); Part 3 - Energy; Part 4 - Industrial processes and product use; Part 5 - Agriculture; Part 6 - Waste.

The report shows how Lithuania complies to and follows the Guidelines for Reporting Emission Data for inventory preparation, how attempts to ensure transparency, accuracy, consistency, comparability, and completeness (TACCC) of the reporting. The submission of results was closely followed according to the template provided by the CLRTAP's Task Force on Emission Inventories and Protections (TFEIP) Secretariat.

Main differences from the last submission are:

1) Improved IIR by including more details on calculation methodologies, activity data, uncertainties, recalculations, etc.;

2) Improved methodologies, activity data and etc. in multiple categories according to 2023 TAIEX-EIR Expert mission on Air Emission inventory and assessment of the impact of policies and measures on emissions recommendations.

3) implemented recommendations, technical corrections, and revised estimates from European Commission Technical Expert Review Team (TERT) (implementation status of each observation is indicated in ANNEX 1).

4) more detailed reporting in agriculture sector, taking into account TERT recommendations.

There is a necessity for inventory improvement in the future, especially in categories, listed by the TERT on the last Review of National Air Pollutant Emission Inventory Data 2023 under Directive (EU) 2016/2284 and which weren’t implemented during 2024 submission.

Part 1 – General information

1. INTRODUCTION

The Convention on Long-range Transboundary Air Pollution (CLRTAP) was signed in Geneva in 1979 by 34 Governments and the European Community. It was the first international document addressing problems of transboundary air pollution.

In January of 1994 the Republic of Lithuania ratified the 1979 Geneva Convention on Long-Range Transboundary Air Pollution and became a party to the Convention and its protocols. One of the obligations to the Convention on LRTAP is to submit an annual pollution emission inventory. According to the Reporting Instruction of Reporting Guidelines under the CLRTAP (ECE/EB.AIR.125) time series of emissions under nomenclature for reporting (NFR) and informative inventory reports (IIR) have to be submitted every year, including recalculated emissions for the period from 1990. Projection reports, gridded data and large point sources (LPS) information have to be reported every 4 years.

The Convention entered into force in 1983 and has been extended by eight protocols, which specify financing aspects of the cooperative monitoring and evaluation programme, address groups or individual pollutants' reduction and control issues, and other issues, such as eutrophication, acidification and ground level ozone formation. The following classes of pollutants are addressed in the inventory:

- Main pollutants (SO_x, NO_x, NMVOC, NH_3);
- Particulate matter (TSP, PM_{10}, $PM_{2.5}$ and BC);
- Other (CO);
- Heavy metals (Pb, Cd, Hg, As, Cr, Cu, Ni, Se and Zn);
- Persistent organic pollutants (PCBs, Dioxins, Furans, PAHs and HCB).

The trend of national emissions of the main pollutants and PM2,5 and reduction commitments under NECD for 2020-2029 are shown in the Figure below.

The 2024 Lithuanian IIR contains information on the national inventory for 2022 including descriptions of methodologies and NFR categories, input parameters, improvement, QA/QC, recalculations, analysis and interpretation of results, assessment for TACCC and other sections as formulated in ECE.EB.AIR.125 revised guidelines. Changed parameters are applied retrospectively for previous submissions and recalculated values are changed accordingly for annual submissions.

Emission estimates are mainly based on official Lithuanian Statistics: energy, production, agricultural, transport and other statistical data, which is available on the main website https://osp.stat.gov.lt/. EMEP/EEA 2023 Guidebook is often referred to when calculating category-specific emissions.

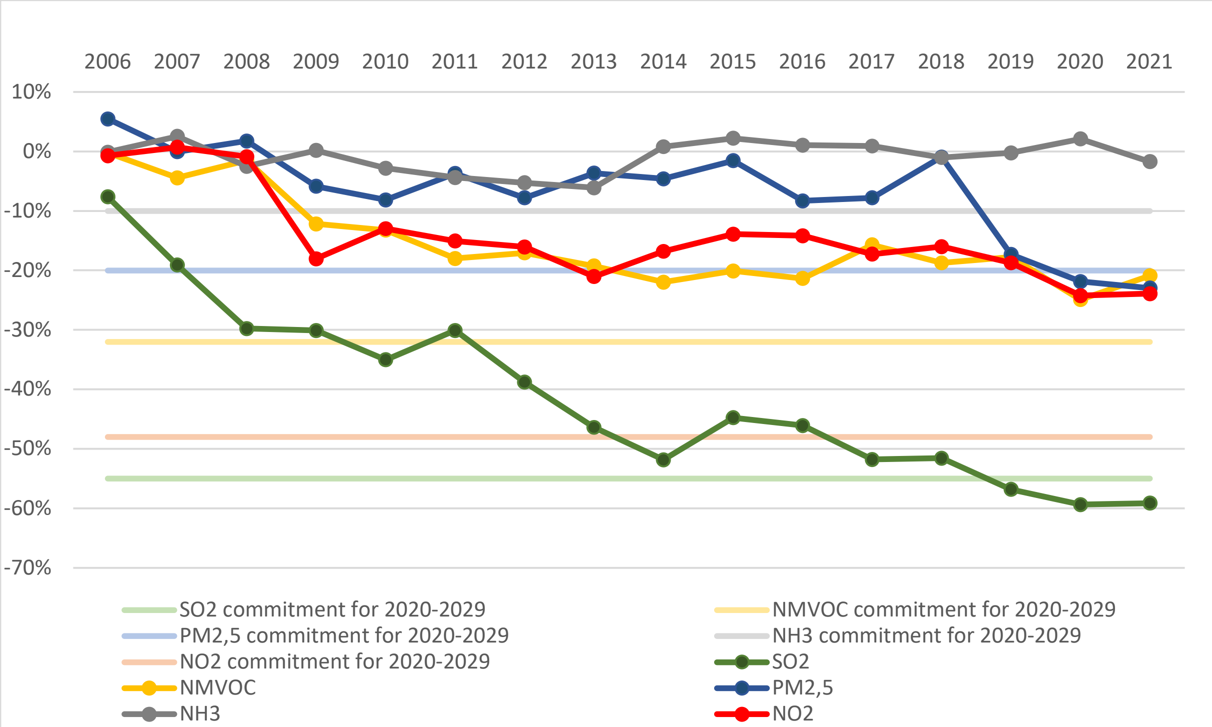


Figure 1-1. National emissions of 5 pollutants (darker shade curves) for period 2005-2022 as a percentage of base year 2005. Straight lines indicate emission reduction commitments for 2020-2029 as set out in the NECD.

1.1. Institutional Arrangements

The Lithuanian Environmental Protection Agency under the Ministry of Environment in 2011 was nominated to be responsible for the inventory communication by the Order No. D1-85. EPA have made a legal arrangement with State research institute Center for Physical Sciences and Technology (CPST) to compile about 30 percent of the inventory reports (transport sector and several categories from IPPU sector). Reports are delivered annually and is firstly estimated and compiled by experts of CPST. EPA's Ambient Air Quality Divisions specialists then recalculate, improve, check, archive and approve final inventory version. The EPA has a legal responsibility for submission of the inventory under Convention on LRTAP and NECD.

No other institutional arrangements are made.

The inventory reports documentation is archived in EPA's computers. Information and activity data which is used to compile inventory reports is saved in the EPA database and retrieved if needed.

Inventory improvements are prioritized based on the following factors:

1) Stages 1, 2 and 3 inventory reviews, which can be accessed on ceip.at website;
2) TERT reviews and recommendations.

1.2. Inventory Preparation Process

Inventory preparation at EPA is carried out with the help of experts of the Center for Physical Sciences and Technology (CPST). The activity data is mainly gathered from publicly available databases. The major and most accurate database is the Official Statistics Portal managed by the State Data Agency. The main activity data sources are available in Table 1-1.

The brief process of inventory preparation is shown in Figure 1-2.

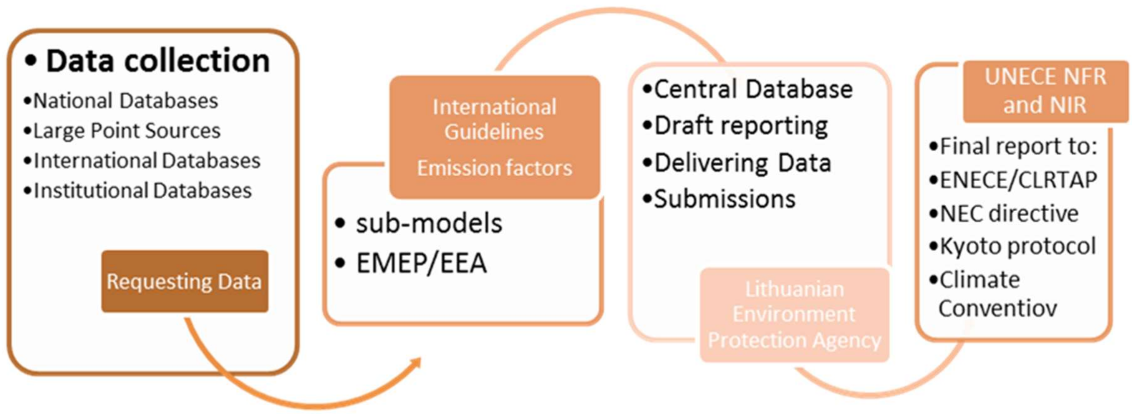


Figure 1 2. Inventory preparation process

Every year entire time series (from 1990 to the reporting year) are checked and revised, recalculations performed for changes made (error corrections, data improvement or methodology enhancement, implementation of annual inventory review recommendations). Lithuania has been reporting data regarding national total and sectoral emissions under The LRTAP convention since 2000.

The Figure 1-2 illustrates the process of inventory preparation from the first step of collecting external data to the last step, where the reporting schemes are generated for the United Nations Economic Commission for Europe/Cooperative Programme for Monitoring and Evaluation of the Longrange Transmission of Air Pollutants in Europe (UNECE/EMEP) (in the NFR format (Nomenclature For Reporting)).

1.3. Methods and Data Sources

Lithuania's air emission inventories are based on EMEP/EEA air pollutant emission inventory guidebook 2023 (EMEP/EEA 2023) with exceptions in few sectors where previous versions of EMEP emission inventory guidebooks and methodologies from 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines) are used. For the transport emission evaluation COPERT model (version v5.7.1) is used, like it is proposed for the compilation of EMEP/EEA emission inventories. Also, for evaluation of the emissions from some categories additional research was made, to compile data and investigate appropriate approach to fulfil Convention obligations.

Activity data for the compilation of the 1990-2022 inventory is obtained from State Data Agency, Eurostat, sectoral ministries and other enterprises and institutions. For major part of the NFR categories 2023 EMEP/EEA Guidebook with provided emission factors was applied. All methodologies (including specific) which were utilized are described for each NFR category. The most frequently used approach was Tier 2.

Table 1-1 describes the main activity data used for compilation of inventories and it's sources.

Table 1-1. Summary of the main activity data sources

Category	*Activity Data*	*Source*
Energy (NFR 1)		
Energy Industries (NFR 1.A.1)	Fuel Consumption	Official Statistics Portal (Statistics Lithuania (State Data Agency))
Residential, public and Commercial Machinery (NFR 1.A.4)	Fuel Consumption	Official Statistics Portal (Statistics Lithuania (State Data Agency))
Oil and Gas Exploration, Transportation, Production (NFR 1.B.2)	Fuel Production	Official Statistics Portal (Statistics Lithuania (State Data Agency))
Industrial Processes (NFR 2)		
Mineral Products (NFR 2.A)	Production Information	Official Statistics Portal (Statistics Lithuania (State Data Agency))
		Source-specific Information from Production Plants
Solvent and Other Products Use (NFR 2.D)	Solvent Consumption	European Asphalt Pavement Association Yearbook
		Official Statistics Portal (Statistics Lithuania (State Data Agency))
		GHG Inventory Report 2021
		Eurostat
		Source-specific Information from Production Plants
Agriculture (NFR 3)		
Manure Management (3.B)	Number of animals	Official Statistics Portal (Statistics Lithuania (State Data Agency))/ data recalculated to AAP
Crop Production and Agricultural Soils (3.D)	Fertilizers usage, waste usage beneficial for agriculture, crop areas, pesticide usage	International Fertilizer Industry Association Database
		Food and Agriculture Organization of the UN, Statistics Division
		Official Statistics Portal (Statistics Lithuania (State Data Agency))
		EPA Waste Registry Database
Waste (NFR 5)		
Waste Treatments (NFR 5)	Amount of Waste	GHG Inventory Report 2021
		Fire and Rescue Department under the Ministry of the Interior of the Republic of Lithuania Database

		Official Statistics Portal (Statistics Lithuania (State Data Agency))
		EPA Waste Registry Database

1.4. Key categories

Key categories for certain pollutant were identified in terms of their contribution to the total emission of that specific pollutant. The key categories were not more disintegrated as it is expressed in the NFR. Methodological approach 1 was used to identify key categories.

Level assessment was performed for 2005 and the latest year, 2022 (see Tables **Klaida! Nerastas nuorodos šaltinis.**2 and **Klaida! Nerastas nuorodos šaltinis.**-3). This was done to show contribution of categories to the total emission of specific pollutant and how distribution has changed.

Trend assessment was performed in order to find categories which trend changed significantly in any direction and that have had the most significant impact on the average trend. Declining trends could be associated with improved abatement measure in particular process or activity decrease in specific category, while increasing trend usually indicates increased activity/ production.

Table 1-2. Categories obtained from level assessment for 2005

Pollutant	Key categories (Sorted from high to low from left to right)	Total (%)
NOx	1A3biii (31.4%). 1A3bi (14.%). 1A1a (11.2%). 3Da1 (7.5%). 1A3c (7.1%). 1A1b(5.2%). 1A4bi (3.5%)	80.7
SO2	1A1b (42.9%). 1A1a (23.0%). 1B2aiv (16.5%)	82.4
NH3	3Da1 (24.7%). 3Da2a (21.0%). 3B1a (16.0%). 3B3 (11.7%). 3Da3 (7.1%)	80.5
NMVOC	1A4bi (17.2%). 1B2aiv (16.7%). 1A3bi (11.0%). 3B1a (10.2%). 2D3d (7.3%). 2H2 (6.3%). 3B1b (4.9%). 2D3a (3.6%). 3De (3.1%)	80.4
PM2.5	1A4bi (36.9%). 2A5b (10.8%). 1A1a (7.5%). 1A3biii (7.0%). 5E (6.2%). 1A4ai (4.6%). 1A1b (3.6%). 1A2gviii (3.5%)	80.3
PM10	2A5b (41.1%). 3Dc (18.0%). 1A4bi (15.5%). 1A1a (3.4%). 1A3biii (2.7%)	80.6
TSP	3Dc (23.0%). 1A4bi (22.4%). 2I (5.8%). 1A1a (5.0%). 3B3 (4.7%). 3B4gi (4.2%). 2A5a (4.0%). 1A1b (3.5%). 1A3biii (3.4%). 5E (3.0%). 1A4ai (2.7%)	81.6
BC	1A4bi (57.5%). 1A3biii (14.3%). 1A1a (7.2%). 1A3bi (5.4%)	84.4
CO	1A4bi (54.4%). 1A3bi (27.5%)	81.9
Pb	1A4bi (28.8%).1A3bvi (13.1%). 1A4ai (12.4%). 2D3i (11.6%). 1A1a (9.2%). 1A2gviii (5.0%)	80.1
Hg	2K (23.4 %). 1A4bi (15.5%). 1A4ai (14.5%). 5C1biii (10.0%). 1A1a (9.7%). 1A1b (6.5%).1B2aiv (4.0%)	83.6
Cd	1A4bi (28.6%). 1A1b (25.2%). 1A1a (14.8%). 1A4ai (11.2%). 1A2gviii (4.4%)	84.2
PCDD/PCDF	1A4bi (56.7%). 5E (24.7%)	81.4
PAH	1A4bi (85.7%)	85.7

HCB	1A4bi (51.0%). 3Df (19.2%). 1A1a (14.0%)	84.2
PCB	2K (81.0%)	81.0

Table 1-3. Categories obtained from level assessment for 2022

Pollutant	Key categories (Sorted from high to low from left to right)	Total (%)
NOx	1A3biii (28.5%). 1A3bi (14.9%). 3Da1 (14.3%). 1A1a (11.6%). 1A4bi (4.1%). 1A2f (3.5%). 1A3c (3.2%)	80.2
SO2	1B2aiv (45.9%). 1A1b (18.6%). 1A2f (12.3%). 1A1a (8.7%)	85.5
NH3	3Da1 (37.1%). 3Da2a (20.1%). 3B1a (15.5%). 3B1b (10.9%)	83.6
NMVOC	1B2aiv (16.8%). 1A4bi (14.8%). 2D3d (14.2%). 2D3a (9.8%). 3B1a (7.3%). 3B1b (6.5%). 3B4h (4.7%). 3De (3.9%). 2H2 (3.4%)	81.5
PM2.5	1A4bi (39.3%). 1A1a (8.7%). 5C1bv (5.7%). 5E (4.8%). 1A3bvi (4.6%). 1A3bi (4.6%). 5C2 (3.7%). 2A5b (3.3 %). 1A3biii (3.3%). 1A4ai (3.2%)	81.3
PM10	3Dc (32.5%). 1A4bi (18.8%). 2A5b (14.4%). 1A1a (4.5%). 1A3bvi (3.9%). 5C1bv (2.5%). 1A3bvii (2.3%). 2A5a (2.2%)	81.0
TSP	3Dc (28.1%). 1A4bi (18.2%). 2I (8.4%). 2A5a (5.2%). 1A1a (4.3%). 1A3bvi (4.3%). 3B4gi (4.3%). 1A3bvii (3.9%). 3B3 (2.7%). 5C1bv (2.4%)	81.7
BC	1A4bi (52.8%). 1A3bi (13.8%). 1A3biii (8.1%). 1A1a (8.0%)	82.7
CO	1A4bi (65.8%). 1A1a (7.0%). 1A3bi (5.5%). 1A3biii (3.7%)	82.0
Pb	1A3bvi (39.9 %). 1A4bi (14.1%). 1A1a (12.3%). 2D3i (10.1%). 5C1bv (5.9%)	82.3
Hg	5C1biii (37.0%). 1A1a (13.1%). 2K (12.8%). 1A4bi (9.3%). 5C1bv (7.0%). 1A4ai (4.2%)	83.4
Cd	1A1a (21.4%). 5C1bv (20.7%). 1A4bi (16.8%). 1A1b (13.7%). 1A4ai (6.1%). 2A3 (3.8%)	82.5
PCDD/PCDF	1A4bi (50.9%). 5E (18.5%). 1A1a (12.7%)	82.1
PAH	1A4bi (71.3%). 1A1a (8.5%). 2C3 (5.7%)	85.6
HCB	1A1a (46.0%). 1A4bi (25.5%). 3Df (14.7%)	86.2
PCB	1A4bi (41.0%). 1A4ai (28.2%). 1A2f (13.1%)	82.3

1.5. QA/QC and general uncertainty evaluation

Quality assurance and Quality control (QA/QC) activities are carried out in the inventory preparation process. QC activities mostly include general methods, such as accuracy checks on data acquisition and calculations, the use of approved standardized procedures for emission calculations, measurements, implementing of the inventory review observations, archiving information and reporting. These activities are implemented by national inventory compiler (EPA). After the implementation of QC procedures QA reviews are performed. QA actions include basic reviews of the draft report, data verification with other available information sources. The data and documentation are cross-checked by the experts not involved in the area where they do the checks. QA activities also include feedback from different inventory users and reviews made under the EC and UNFCCC.

Due to insufficient resources being available, uncertainty evaluation is carried out not to a full extent.

1.6. General Assessment of Completeness

The NFR Report is completed using following notation keys if numerical pollutant emission value is not provided:

- NO (not occurring) is used for processes that do not occur in the country;
- NE (not estimated) appears for emissions that do happen but are not estimated due to data unavailability or negligibility of emissions;
- NA (not applicable) is used for activities that do not emit specific pollutant;
- IE (included elsewhere) for pollutant emissions which are estimated but included in another category.

Table 1-4. Sources included elsewhere (IE) in 2022

NFR code	Included in NFR category
Stationary combustion in manufacturing industries and construction: Iron and steel (1A2a)	Stationary combustion in manufacturing industries and construction: Other 1A2gviii
Stationary combustion in manufacturing industries and construction: Non-ferrous metals (1A2b)	Stationary combustion in manufacturing industries and construction: Other 1A2gviii
Venting and flaring (oil, gas, combined oil and gas) (1B2c)	Fugitive emissions oil: Refining and storage (1B2aiv)
Nitric acid production (2B2)	Ammonia production (2B1)
Other product use (please specify in the IIR) (2G)	Other solvent use (2.D.3.i)
Industrial wastewater handling (5D2)	Domestic wastewater handling (5D1)
Other waste (please specify in the IIR) (5D3)	Domestic wastewater handling (5D1)

1.7. Pollutant Emission Trends

The emission estimates of air pollutants in Lithuania include emissions from following gases: sulphur dioxide (SO2), nitrogen oxides (NOx), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), ammonia (NH3), particulate matter (TSP, PM10, PM2.5), heavy metals (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn), PAHs, PCBs and PCDD/F.

The emissions trends (1990-2022) of nitrogen oxides, carbon monoxide, non-methane volatile organic compounds, ammonia and sulphur dioxide emissions are presented in Table 11-5 and Figure 1-3.

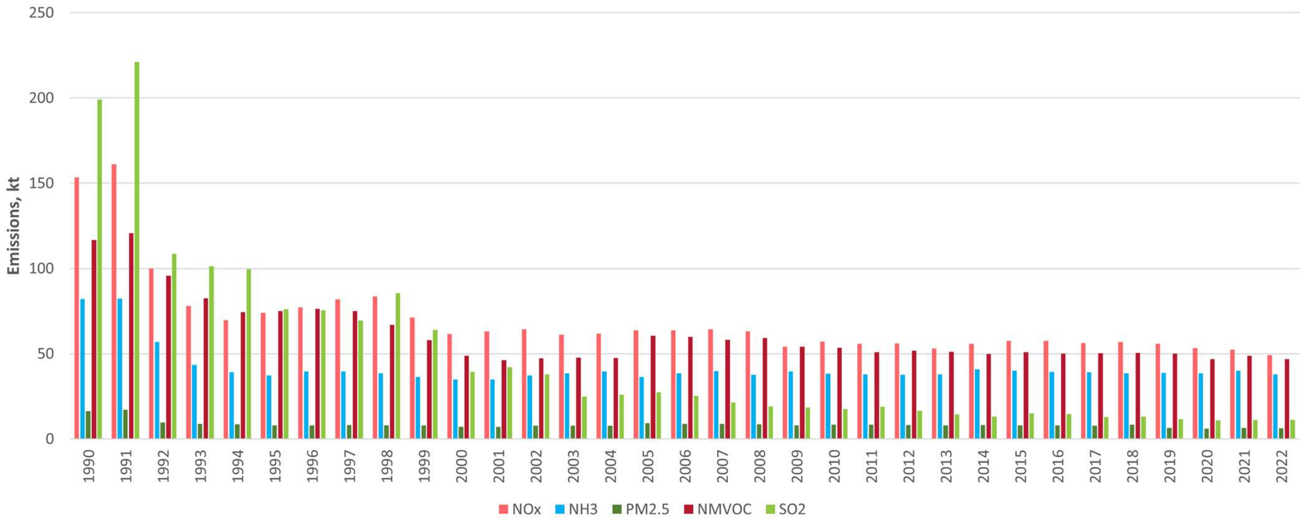


Figure 1-3. Development of emissions 1990-2022

A rapid decrease of emissions followed the decline of the country economy in the 1990 (Figure 1-3). Since 2000, the GDP has been growing continuously with economy transformation. The fluctuations of the emissions since 2005 are less visible but there is a slight decrease especially in NOx, NMVOC and SO2 emissions.

Table 1-5. 5 main pollutant emissions in the period 1990-2022, (National total, kt)

	NOx	NMVOC	SO2	NH3	PM2.5
1990	153.48	116.92	199.17	82.14	16.33
1991	161.12	120.94	221.19	82.37	17.30
1992	100.00	95.90	108.48	56.95	9.77
1993	78.02	82.84	101.27	43.49	8.97
1994	69.78	74.63	99.48	39.25	8.63
1995	73.92	75.29	75.99	37.33	8.08
1996	77.11	76.60	75.54	39.58	8.10
1997	81.78	75.38	69.52	39.55	8.17
1998	83.51	67.26	85.51	38.54	8.06
1999	71.13	58.29	63.96	36.48	8.11
2000	61.66	48.99	39.30	34.92	7.23
2001	63.10	46.42	42.15	34.88	7.22
2002	64.45	47.59	37.78	37.30	7.97
2003	61.10	48.03	24.83	38.54	7.82
2004	61.80	47.69	25.80	39.49	7.81

2005	63.59	60.59	27.43	36.44	9.34
2006	63.62	59.92	25.22	38.43	8.85
2007	64.35	58.10	21.48	39.80	8.85
2008	63.05	59.15	19.10	37.70	8.50
2009	54.06	54.05	18.46	39.66	7.89
2010	57.08	53.43	17.66	38.27	8.43
2011	55.75	50.92	18.77	37.86	8.46
2012	56.08	51.77	16.56	37.69	8.15
2013	53.07	51.16	14.37	37.76	8.03
2014	55.85	49.87	12.99	40.81	8.15
2015	57.61	50.96	14.99	39.91	7.89
2016	57.40	50.04	14.59	39.36	8.05
2017	56.27	50.25	12.95	39.11	7.83
2018	56.89	50.46	12.98	38.52	8.34
2019	55.80	50.02	11.65	38.79	6.56
2020	53.57	46.83	11.02	38.52	6.11
2021	52.63	48.83	11.05	40.06	6.40
2022	49.46	46.83	11.25	37.77	6.21

The amended Gothenburg Protocol under the UNECE established emission reduction commitments (RC) for 2020 for five pollutants: NOx, SO2, NMVOC, NH3 and PM2.5 and the same RC were agreed in NECD. The RC are expressed as a percentage reduction commitment in 2020 compared to the emission level in 2005. The definitions for what counts towards compliance is different between the Gothenburg Protocol and the NECD. For the NECD, NOx and NMVOC emissions from NFR categories 3B and 3D are excluded when determining compliance. For reporting to the UNECE, NOx emissions from NFR category 3D are excluded from the reduction commitment. Table 1-6 shows the emissions in 2005 and 2022, the achieved emission reduction in comparison with the targets under NECD.

Table 1-6. Emissions (kt) and achieved reduction under the NECD

	NOx	NMVOC	SO2	NH3	PM2.5
2005 emissions, kt	56.05	46.30	27.43	36.44	9.34
2022 emissions, kt	39.90	34.54	11.25	37.77	6.21
Reduction, % 2021/2005	**-28.8**	**-25.4**	**-59**	**+3.7**	**-33.5**
Reduction commitments 2020 vs 2005 (NECD)	**-48%**	**-32%**	**-55%**	**-10%**	**-20%**

1.8. Nitrogen Oxides (NO_x)

Total national nitrogen oxides emissions have decreased from 153.48 kt in 1990 to 49.46 kt in 2022 (Figure 1-4. National total emission trend for NOx, 1990 –).

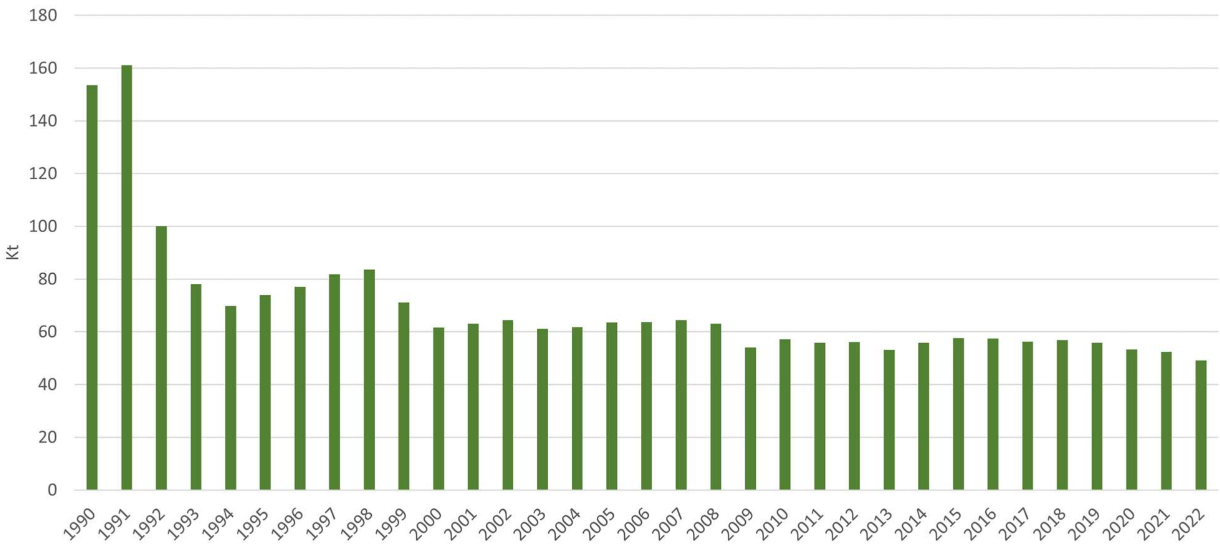


Figure 1-4. National total emission trend for NOx, 1990 – 2022

Road Transport (1.A.3) is the principal source of NOx emissions, contributing 46.2 % (and 22.75 kt) of the total in 2022 (Figure 1-4. National total emission trend for NOx, 1990 –). Energy production (including 1.A.1.a, 1.A.1.b, 1.A.1.c, 1.A.2.c, 1.A.2.d, 1.A.2.e, 1.A.2.f, 1.A.2.g.viii, 1.A.4.ai, 1.A.4.bi, 1.A.4.ci categories emissions) accounts for a decreasing percentage of the national total. The contribution of the sector in 1990 to the national total was 43.7 kt and decreased to 13.26 kt in 2022 as a result of the decrease in fuel consumption in the sector. Energy production is accounting for 26.9 % of NOx emissions in 2022. The remainder of the NOx emissions arise from combustion sources in agriculture and non-road mobile machinery categories.

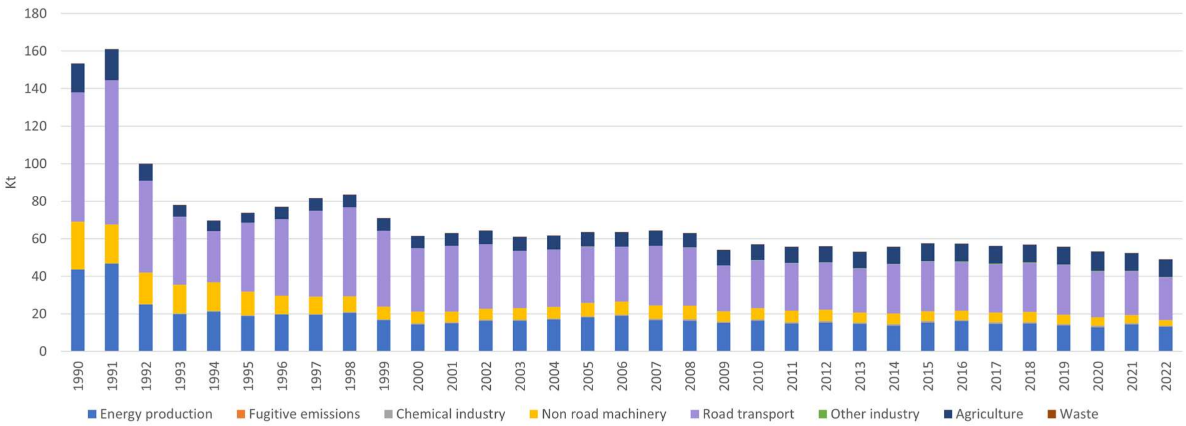


Figure 1-5. Emission trend for NOx by sectors, 1990 – 2022

Since 1990 the largest decrease of emissions has occurred in the road transport sector. It has been achieved because of fitting three-way catalysts to petrol fuelled vehicles. The decrease has been achieved also due to installation of low-NO_X burners and denitrifying units in power plants and district heating plants.

1.9. Non-Methane Volatile Organic Compounds (NMVOC)

Total national non-methane volatile organic compounds emissions have decreased from 116.92 kt in 1990 to 46.83 kt in 2022 (Figure 1-6.). The emissions of NMVOC can be divided into main groups: evaporative emissions (solvent use, fugitive emissions) and incomplete combustion. The main contributors of NMVOC in the year 2022 are Fugitive emissions (1B2aiv), Energy production (1.A.1.a, 1.A.1.b, 1.A.1.c, 1.A.2.c, 1.A.2.d, 1.A.2.e, 1.A.2.f, 1.A.2.g.viii, 1.A.4.ai, 1.A.4.bi, 1.A.4.ci) and Solvent use (2.D.3.a, 2.D.3.d, 2.D.3.e, 2.D.3.f, 2.D.3.g, 2.D.3.h, 2.D.3.i) (Figure 1-7).

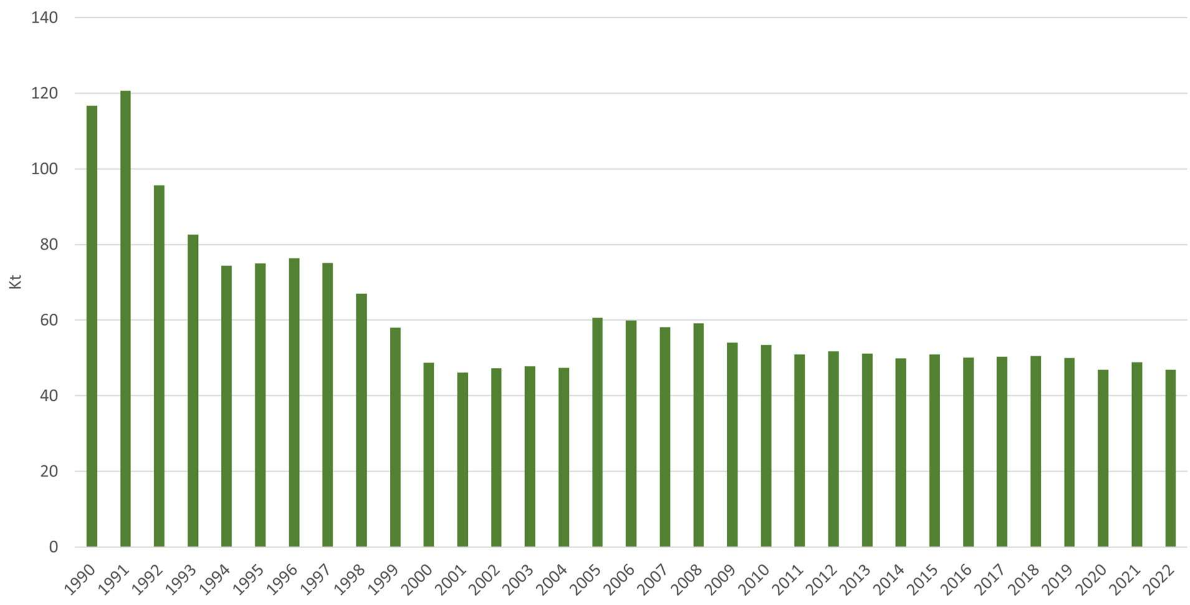


Figure 1-6. National total emission trend for NMVOC, 1990-2022

The decline in emissions since 1990 has primarily been due to reductions achieved in the road transport sector due to the introduction of vehicle catalytic converters, driven by tighter vehicle emission standards. The reductions in NMVOC emissions have been enhanced by the switching from petrol to diesel cars. Technological controls for volatile organic compounds (VOCs) in motor vehicles have been more successful than in the case of NOx, and have contributed to a significant reduction in emissions from Road Transport (1.A.3.b), responsible for 25,91 kt of NMVOC's in 1990 to 1,62 kt in 2022. (Figure).

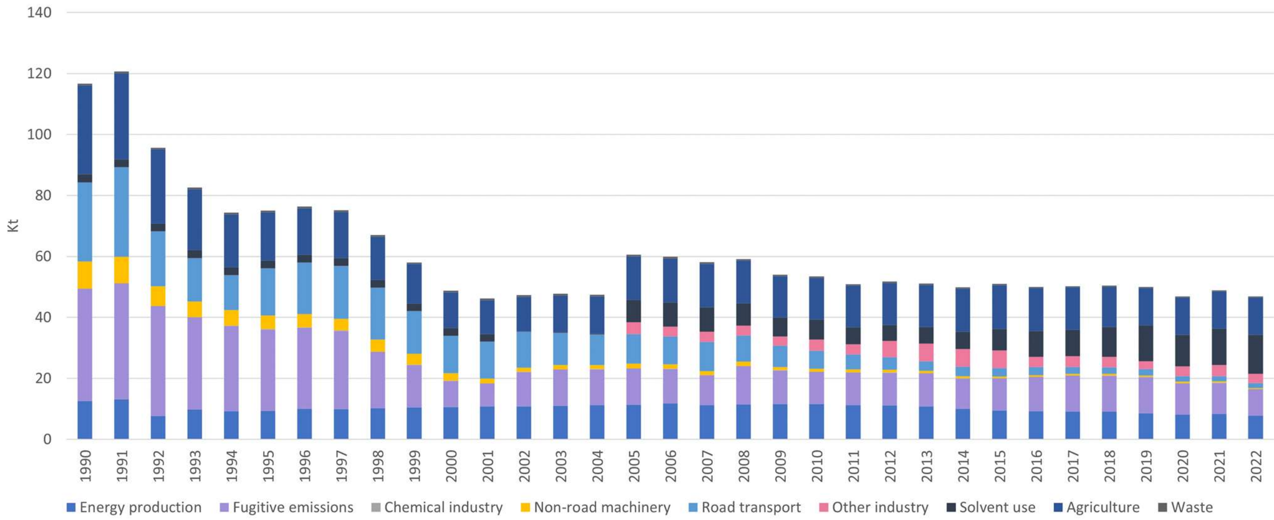


Figure 1-7. Emission trend for NMVOC by sectors, 1990-2022.

Solvent use Agriculture, Fugitive emissions and Energy production are accounting for accordingly 27, 26, 18, 17 % of national total NMVOC emissions in 2022.

1.10. Sulphur Dioxide (SO2)

The main part of the SO_2 emission originates from combustion of fossil fuels, mainly coal and oil in public power plants and district heating plants. National total sulphur dioxide emissions decreased from 199.17 kt in 1990 to 11.25 kt in 2022 (Figure). Energy production and Fugitive emissions oil: Refining /storage sectors remain the principal source of SO_2 emissions, contributing 92 % of the national total in 2021.

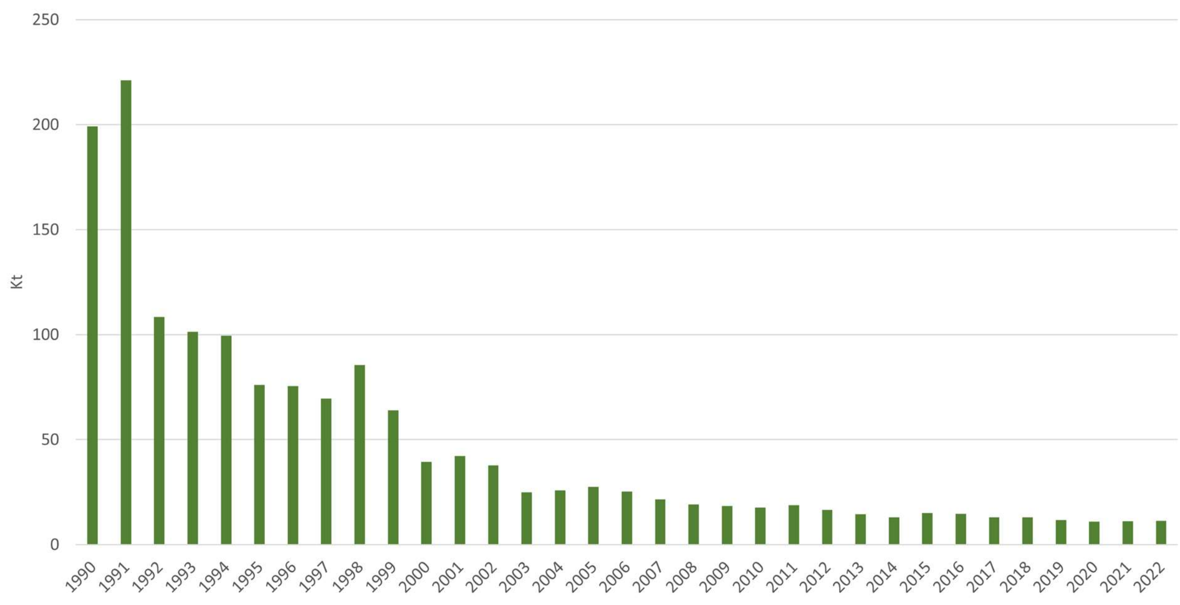


Figure 1-8. National total emission trend for SO_2, 1990-2022

Fugitive emissions oil: Refining / storage (1B2aiv) sector accounts for 52.7% of the total in 2022 and Stationary combustion in manufacturing industries and construction (1.A.2.c, 1.A.2.d, 1.A.2.e, 1.A.2.f,1.A.2.g.viii) and Residential combustion (1.A.4.bi) sectors account for the 18.7 %, Petroleum refining (1.A.1.b) – for 9.4%, Public electricity and heat production (1.A.1.a) contributes to 6.3% SO2 of national total emissions in 2022 (Figure 1-9).

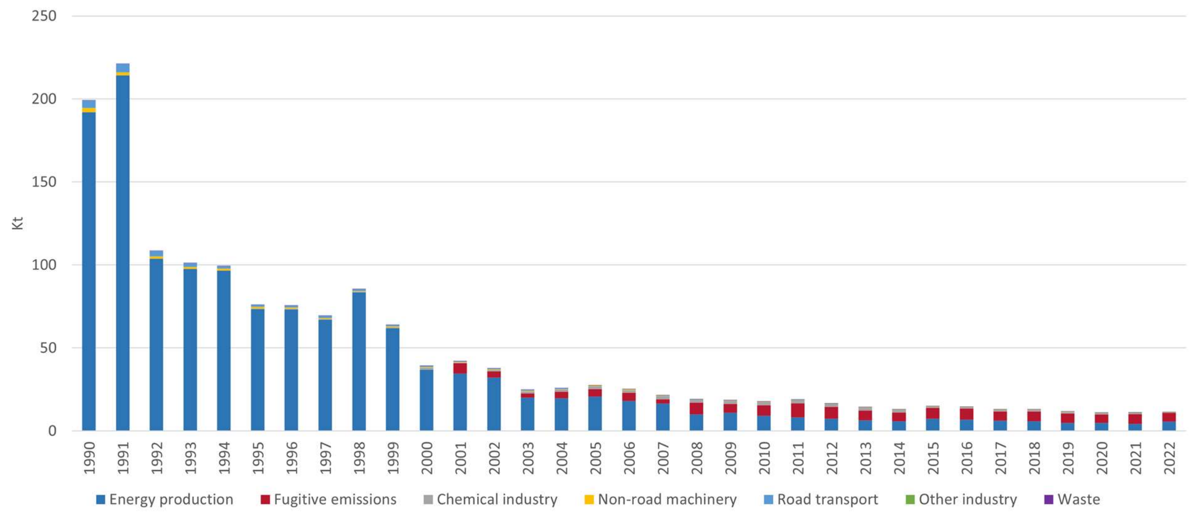


Figure 1-9. Emission trend for SO2 by sectors, 1990-2022

The large reduction of SO2 in Energy production sector is largely due to installation of desulphurisation plant, use of fuels with lower content of sulphur in public power and district heating plants, introduction of liquid fuels with lower content of sulphur and substitution of high-sulphur solid and liquid fuels to low-sulphur fuels such as natural gas. Despite the large reduction of the SO2 emissions, these plants still emit a significant part of the national total emission.

1.11. Ammonia (NH3)

The national total ammonia emissions decreased from 82.14 kt in 1990 to 37.77 kt in 2022 (Figure 1-10). This is mostly due to decreasing livestock population.

The biggest source of atmospheric emissions of NH_3 in 2022 was agricultural activities (95%) (Figure 1-11). Only a minor part of the total emission originates from Chemical industry, Energy production and Waste.

The major part of the emission from agriculture originate from livestock manure management (35.2 %) and agricultural soils (64.8 %). The largest source for manure management is losses of ammonia occurring during the handling of the manure in animal housing systems. For agricultural soils, the emissions are mainly coming from application of mineral and organic fertilisers.

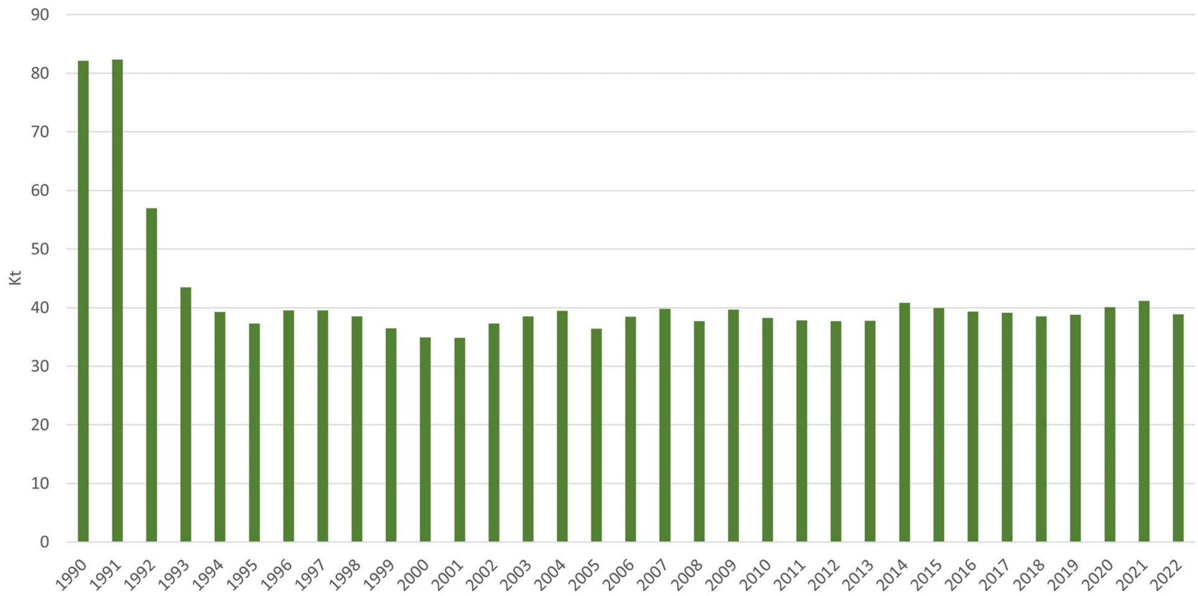


Figure 1-10. National total emission trend for NH3, 1990-2022

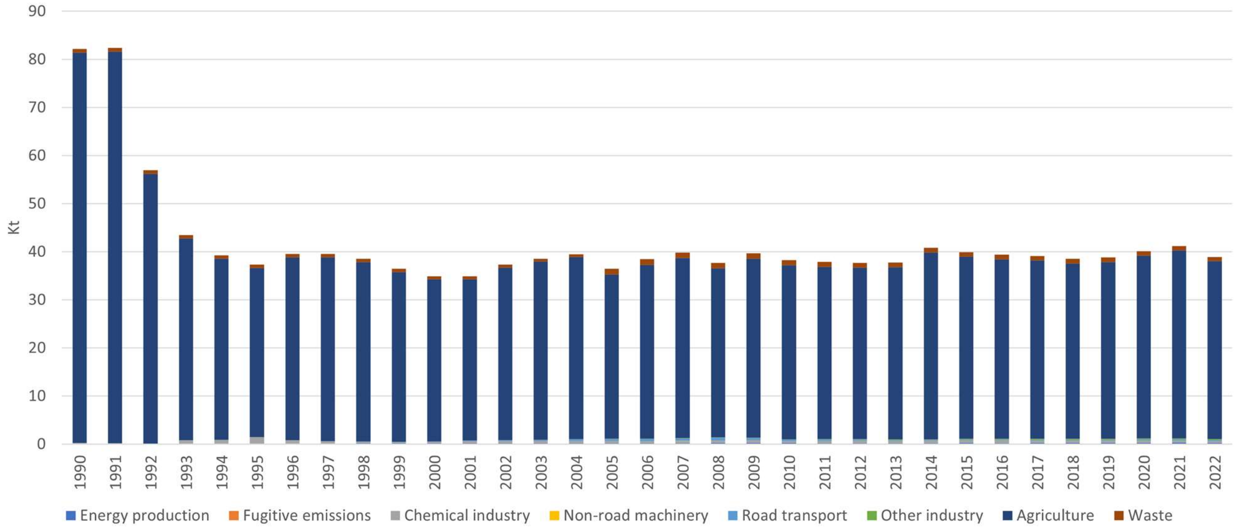


Figure 1-11. Emission trend for NH3 by sectors, 1990-2022

The emission ceilings of NECD were designed with the aim of attaining the European Community's interim environmental objectives set out in NECD. Meeting those objectives is expected to result in reduced acidification, health-and vegetation-related ground-level ozone exposure.

1.12. Particulate matter PM2.5

PM2.5 emissions have decreased from 16.33 kt in 1990 to 6.21 kt in 2022 (Figure 1-12). The largest emission source of PM2.5 are Energy production, Waste and Road transport, which contribute to 81 % of emissions (Figure 1-13). Energy sector contributes to significant PM2.5 emissions due to intensive combustion of wood, especially in Residential sector (1.A.4.bi).

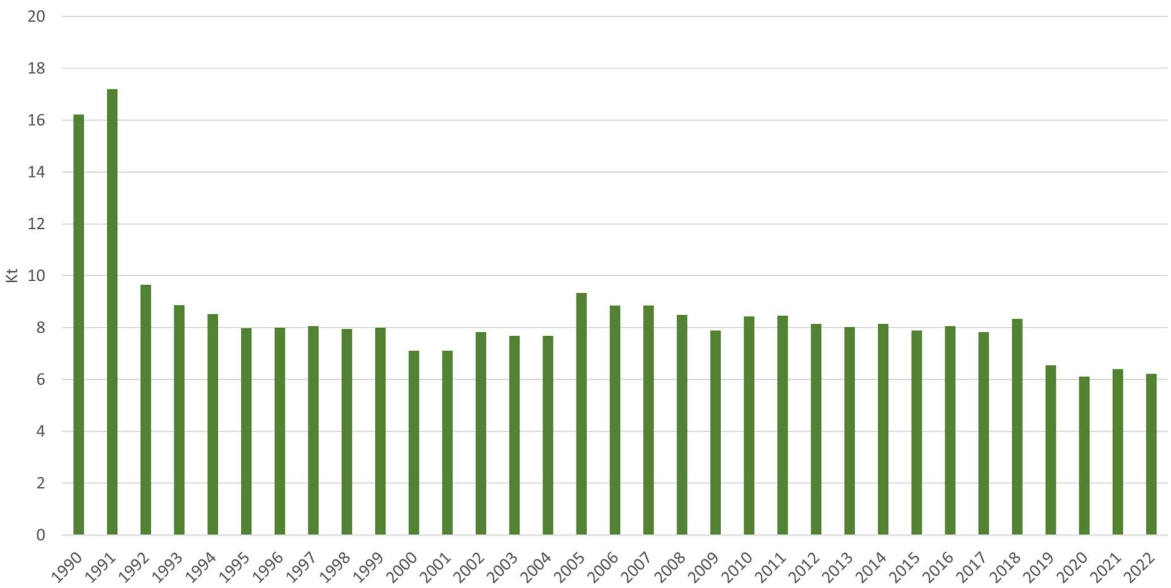


Figure 1-12. National total emission trend for PM2.5, 1990-2022

Road transport exhaust emissions account for 53 % of the transport PM2.5 emissions, while the emissions come from tyre and brake wear and road abrasion contribute to the rest of the PM2.5 emissions.

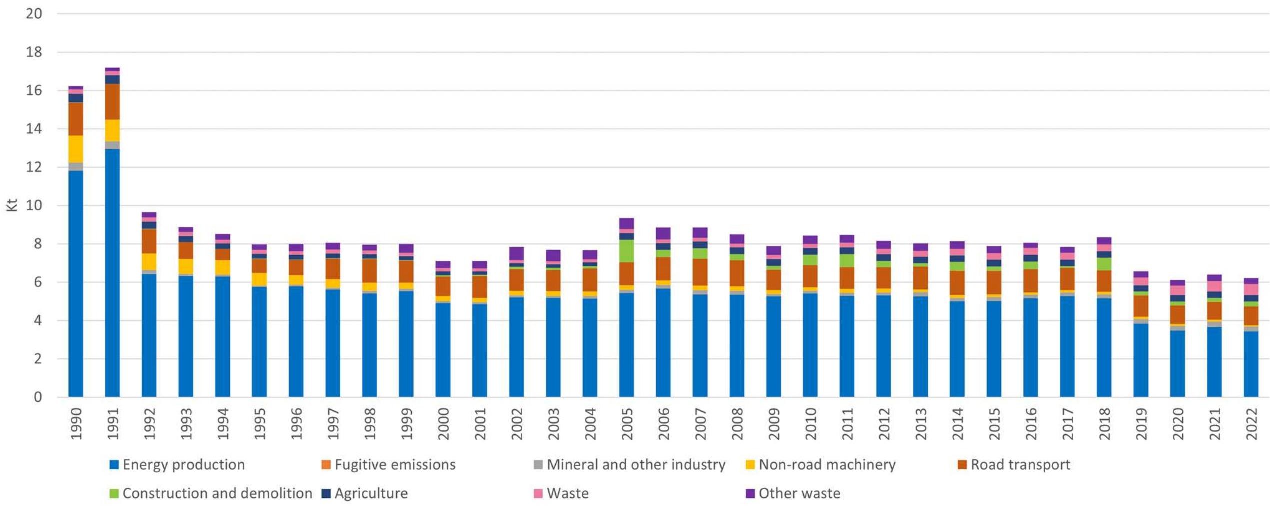


Figure 1-13. Emission trend for $PM_{2.5}$ by sectors, 1990-2022

Information on the PM2.5 condensable fraction of wood combustion in the Lithuanian households is provided in the Annex "NIIR 1990-2022 Annex PM fractions in 1A4bi.xlsx".

2. ADJUSTMENTS

The use of the flexibility set out in Article 5(3) of the Directive (EU) 2016/2284

2.1 Emission Reduction Commitments

The amended Gothenburg Protocol and the Directive (EU) 2016/2284[1] requires parties to demonstrate compliance with emission reduction commitments (ERCs) for 2020-2029 onwards using 2005 as a baseline on which ERCs are based. This is a different approach to the concept of emission ceilings for the period 2010 to 2019 as outlined in the Gothenburg Protocol and Directive 2001/81/EC. As a result, different considerations apply to the demonstration of compliance with ERCs.

According to Article 5(3) of the Directive (EU) 2016/2284, if in a given year a Member State, for which one or more ERCs laid down in Annex II are set at a more stringent level than the cost-effective reduction identified in the Thematic Strategy on Air Pollution Report No 16 (TSAP 16)[2], cannot comply with the relevant ERCs after having implemented all cost-effective measures, it shall be deemed to comply with that relevant ERC for a maximum of five years, provided that for each of those years it compensates for that non-compliance by an equivalent emission reduction of another pollutant referred to in Annex II (further 'pollutants swap').

Parties who wish to use 'pollutants swap' flexibility (Art. 5(3) of the Directive (EU) 2016/2284) to demonstrate compliance with ERCs to have substantiate the following conditions:

– the Member State cannot comply with its ERCs for a pollutant in a given year;

– the Member State must have implemented all cost-effective measures (the list of (obligatory and optional) measures to control ammonia emissions contained in Annex III, Part 2, heading A of the Directive (EU) 2016/2284);

– Art. 5(3) of the Directive (EU) 2016/2284 may be invoked by a Member State for a particular pollutant, if ERCs laid down in Annex II is more stringent than the cost-effective reduction identified in the TSAP 16.

Table 2-1. provides details of the emission values in this submission for the years 2005 and 2020-2022, the required ERCs under Directive (EU) 2016/2284 and the percentage reduction in emission levels for all five pollutants covered (NO_x, SO_2, NMVOC, NH_3 and $PM_{2.5}$). For the pollutants NO_x and NMVOC, emission

---

[1] Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L2284

[2] TSAP 16 report 'Adjusted historic emission data, projections, and optimized emission reduction targets for 2030 – A comparison with COM data 2013'. https://circabc.europa.eu/ui/group/cd69a4b9-1a68-4d6c-9c48-77c0399f225d/library/a1afa520-cb53-425c-bcad-16f73842f766/details

from the NFR sectors 3B and 3D are not included in the compliance assessment.

Table 2-1. Summary of National Emissions in 2005 and 2020-2022, the ERCs for 2020-2029 and actual emission reduction

		2005	2020	2021	2022
SO_2	kt	27,425	11,021	11,053	11,253
	ERC (%)		-55	-55	-55
	Actual reduction in emissions (%)		-59,81	-59,7	-58,97
NO_x	kt*	56,046	43,096	43,212	39,897
	ERC (%)		-48	-48	-48
	Actual reduction in emissions (%)		-23,11**	-22,9**	-28,81**
NH_3	kt	36,436	38,525	40,064	37,767
	ERC (%)		-10	-10	-10
	Actual reduction in emissions (%)		5,73**	9,96**	3,65**
	Adjusted kt by applying the flexibility referred to Art. 5(3) of the Directive (EU) 2016/2284		32,793		32,793
	Adjusted reduction in emissions (%) by applying the flexibility referred to Art. 5(3) of the Directive (EU) 2016/2284		-10		-10
NMVOC	kt*	46,297	34,557	36,586	34,536
	ERC (%)		-32	-32	-32
	Actual reduction in emissions (%)		-25,36**	-20,98**	-25,40**
$PM_{2,5}$	kt	9,337	6,113	6,398	6,211
	ERC (%)	-20	-20	-20	-20
	Actual reduction in emissions (%)		-34,53	-31,47	-33,48

* Emissions of NMVOCs and NO_x from activities falling under the NFR sectors 3B (manure management) and 3D (agricultural soils) are not accounted for the purpose of complying with ERCs.

** ERC has not been met.

The data presented in Table 2-1 shows that Lithuania is non-compliant with the ERCs for 2020-2022 for the pollutants NMVOC, NO_X and 2021 for NH_3. For NH_3, an application for the flexibility under Article 5.3 ('pollutants swap') of the Directive (EU) 2016/2284 accompanies this submission and is detailed in the following section.

2.2. 'Pollutants swap' flexibility application for NH_3

Lithuania cannot comply with its actual emission reduction commitments for NH_3 in 2020–2022 (Table 2-1). However, it shall be deemed to comply with those NH_3 ERC (-10 %) in 2020 and 2022 by applying 'pollutants swap' flexibility according to Art. 5(3) of the Directive (EU) 2016/2284.

NH_3 ERC laid down in Annex II for Lithuania are set at a more stringent level than the cost-effective reduction identified in the TSAP 16. NH_3 reduction commitment has been increased from -2 % to -10 % set in the Directive (EU) 2016/2284, therefore 'pollutants swap' flexibility could be applied to Lithuania.

Under this flexibility, NH_3 'excess' emissions (kt) are compensated by $PM_{2.5}$ emissions reduction commitment 'overachievement' (kt). The calculation is based on the exchange rates from the TSAP 15 report[3] and submitted in the template for application to flexibility under Article 5.3 of the Directive (EU) 2016/2284 ('pollutants swap') (excel format is attached to Eionet Central Data Repository[4]).

Considering, that Lithuania has exceeded its ERC threshold for NH_3 by 5,7321 kt in 2020 and by 4,9747 kt in 2022 (Table 2-2), but has reduced its emissions of $PM_{2,5}$ by (1,3568 kt in 2020 and by 1,2587 kt in 2022) more than what its ERC would have required, therefore Lithuania can use the following approach to operationalise Art. 5(3):

- exceedance of NH_3 is expressed in $PM_{2,5}$-equivalent following the exchange rates (0,194) from Table 2.2 of TSAP15;
- NH_3 excess emissions expressed in PM-equivalent (1,1120 kt in 2020; 0,9651 in 2022) is smaller than the $PM_{2,5}$ emission reduction commitment 'overachiement' (1,3568 kt in 2020; 1,2587 in 2022), therefore the flexibility can be used and Lithuania is deemed compliant for both pollutants NH_3 and $PM_{2,5}$ for the given year (here 2020, 2022).

Table 2-2. 'Pollutants swap' flexibility (Art. 5(3))

	Pollutant A emission level (kt)	**Pollutant A 'excess emissions' (kt)**	**Pollutant B emission level (kt)**	**Pollutant B emission reduction commitment 'overachiement' (kt)**	**Pollutant A excess emissions expressed in pollutant B equivalent**	**Sufficient for complying with Pollutant A ERC?**
	NH3		**PM2.5**			
2005	36,4363556		9,33670351			
2020	38,52480454	5,7321	6,11257961	1,3568	1,1120	TRUE
2021	40,06434759	7,2716	6,39825084	1,0711	1,4107	FALSE
2022	37,76739583	4,9747	6,21070123	1,2587	0,9651	TRUE

Emission Reduction Commitment Pollutant NH_3 in %	10
Max. allowed emissions NH_3 in kt	32,7927
Emission Reduction Commitment Pollutant $PM_{2.5}$ in %	20
Max. allowed emissions $PM_{2.5}$ in kt	7,4694
Exchange Rate derived for the TSAP cost effectiveness analysis	**0,194**

[3] TSAP 15 report 'A Flexibility Mechanism for Complying with National Emission Ceilings for Air Pollutants'. https://circabc.europa.eu/ui/group/cd69a4b9-1a68-4d6c-9c48-77c0399f225d/library/b0a319f3-2753-4147-b6a2-8e8e0d1f204f/details?download=true

[4] European Union (EU) obligations / National Emission reduction Commitments Directive (NECD 2016/2284/EU) / C.Flexibilies. https://cdr.eionet.europa.eu/lt/eu/nec_revised/adjustment/envzd38oa

Sectors concerned with NH_3 'excess' emissions – agricultural sector (NFR – 3B1a, 3B1b, 3B2, 3B4giii, 3B4h; 3Da1, 3Da2a); with $PM_{2.5}$ emission reduction commitment 'overachievement' – energy, industry sectors (NFR – 1A1a, 1A1b, 1A4bi, 2A5b). The magnitude of the impact upon national emission inventories is set out in the revised (version 2.0) National Emissions Inventory for 2022.

2.3. Cost-effective measures to control NH_3 emissions

Lithuania have implemented all cost-effective measures (obligatory and optional measures to control NH_3 emissions contained in Annex III, Part 2, heading A of the Directive (EU) 2016/2284):

1. Member States shall establish a national advisory code of good agricultural practice for the control of ammonia emissions:

The Code of Good Agricultural Practice[5] was developed in 2019, presented to the interested public during the agricultural exhibition 'Ką pasėsi 2019' and published on the website of the Ministry of Agriculture. The Code, based on EU legislation (water, air, climate change) and research, provides requirements and recommendations to reduce the negative impact of agriculture on water status, ambient air and climate: nitrogen management, taking into account the full nitrogen cycle, sustainable livestock farming (feeding strategies for livestock to reduce ammonia and methane emissions, livestock storage technologies, low-emission systems for manure application, storage, reduction of odour and ammonia losses), discussing the most effective measures to reduce air pollution from ammonia and other nitrogen compounds through the use of organic and mineral fertilisers.

The Rules on the design of cattle buildings, pigs, sheep farms, poultry farms, fur farming and rabbit farming[6] were updated in 2021-2022. This Rules were complemented by requirements, considering efficient, available technical, technological and environmental solutions to reduce emissions to ambient air (ammonia, hydrogen, methane, nitrous oxide, etc.) as well as odours and greenhouse gas emissions from farming activities; additionally specified requirements for manure and slurry management for all farms, except for small and very small farms for which these requirements are recommended.

It should be noted, that in 2024 it is planned to update the Rules on the technological design of manure and wastewater management structures, which will complete the overall package of updating the rules to ensure the reduction of air pollution in livestock farms, including requirements to reduce

[5] *https://zum.lrv.lt/uploads/zum/documents/files/LT_versija/Veiklos_sritys/Bendroji_zemes_ukio_politika/GZUP%20Kodeksas%20taisytas%20po%20AplinkosM-%20birzelis.pdf*

[6] Rules on the technological design of cattle buildings ŽŪ TPT 01:2009, amended by Order No 3D-428 of the Minister of Agriculture on 5 July 2021. *https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.351249/asr*;
Rules on the technological design of pigs ŽŪ TPT 02:2010, amended by Order No 3D-419 of the Minister of Agriculture on 1 July 2021. *https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.364772/asr;*
Rules on the technological design of poultry farms ŽŪ TPT 04:2012, amended by Order No 3D-764 of the Minister of Agriculture on 29 November 2021. *https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.428604/asr;*
Rules on the technological design of sheep farms ŽŪ TPT 11:2015, amended by Order No 3D-256 of the Minister of Agriculture on 13 April 2022. *https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/75c471a0f8f211e4ab99c3ab3bbb5843/asr;*
Rules on the technological design of fur farming and rabbit farming farms ŽŪ TPT 13:2016, amended by Order No 3D-580 of the Minister of Agriculture on 28 September 2022. *https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/76298800924911e68adcda1bb2f432d1/asr*

emissions to ambient air, odour emissions, manure removal, storage and use, by setting maximum levels of harmful gases (reducing ammonia, methane, nitrous oxide levels) within cattle farms, pigs and poultry houses: e.g.: reducing the pH of manure – ammonia emissions are reduced by more than 50 %; chemical and biological preparations, probiotics, organic carbon added to manure – ammonia emissions are reduced by more than 30 %; reduce the area of surfaces contaminated by manure – ammonia emissions are reduced by more than 25 %; clean removal air in biofilters – ammonia emissions are reduced by up to 80 % and other cross-cutting measures.

2. Member States may establish a national nitrogen budget:

According to the provisions of the Directive (EU) 2016/2284, the national nitrogen balance is not obligatory. However, long-term surveys to monitor the agrochemical properties of soil have been carried out continuously (three-year programmes) since 2007 by order the Ministry of Agriculture. Mineral nitrogen monitoring in the country's soils is carried out annually (in autumn and spring) by the Agricultural Chemical Research Laboratory of the Lithuanian Centre of Agricultural and Forest Sciences. Long-term results of mineral nitrogen monitoring studies make it possible to estimate the remaining reserves of readily available nitrogen after the summer season and to predict how much they may remain in the spring for regenerative vegetation. Soil samples have been taken from more than 200 sites across Lithuania. Mineral nitrogen and mineral sulphur content shall be determined in spring and autumn and information shall be made publicly available in order to optimise nitrogen and sulphur fertilisation of plants in the current year. To that end, 1600 studies on mineral nitrogen and 800 mineral sulphur were carried out on sites in various regions of Lithuania. Every year, in 5-6 municipalities, studies of pH, mobile phosphorus and mobile potassium were carried out on an area of 40 thousand ha in soil (humus (organic carbon) since 2019). The data is uploaded to the dataset on agrochemical soil properties DirvAgroch_DB10LT and published on www.geoportal.lt. Based on survey data on the agrochemical characteristics of the country's utilised agricultural soils and their regional variations, farmers can plan spring and autumn fertilisations on the country's farmland according to their needs.

3. Member States shall prohibit the use of ammonium carbonate fertilisers and may reduce ammonia emissions from inorganic fertilisers:

The Law on fertilising products[7] prohibits the placing and placing on the market of ammonium carbonate fertilisers in the Republic of Lithuania. According to Article 9(1) of the Law on fertilising products, only fertilising products included in the Identification list of fertilising products and / or European Community fertilisers listed in Annex I to Regulation (EC) No 2003/2003 may be used. Ammonium carbonate fertilisers is not included in the Identification list of fertilising products.

In order to achieve a balanced use of organic and mineral fertilisers:

- a unified methodology for the establishment of fertilisation plans has been developed to optimise plant nutrition and prevent overfertilisation of soils and nutrient leaching into water bodies, which is publicly available and published on the websites of the Ministries of Agriculture and the Environment[8];

---

[7] *https://www.e-tar.lt/portal/lt/legalAct/23f242301d4c11e9875cdc20105dd260*

[8]*https://zum.lrv.lt/uploads/zum/documents/files/LT_versija/Veiklos_sritys/Kooperacija/Vieninga%20tr%C4%99%C5%A1imo%20plan%C5%B3%20sudarymo%20metodika%20LAMMC.pdf;*

- according to the prepared methodology for the establishment of fertilisation plans, from 2022 an additional functional component of fertilization planning is being created in the information system for receiving applications (PPIS), which will be completed by 2024 July. This component will allow agricultural operators, taking into account the agrochemical properties of the soil and the nutrients present in the soil, pre-sown, crops cultivated, planned yields, to draw up an objective fertilisation plan, which will calculate optimal fertilisation rates for the active substances (nitrogen, phosphorus, potassium and fertiliser volumes required by 1 ha of crop). The above-mentioned fertilisation plan measures encourage farmers to use mineral fertilisers more efficiently while reducing the use of mineral fertilisers while maintaining optimal production rates;

- the Description of the requirements for the use of fertilizing products was amended in 2023 in order to change the regulation of the use of inorganic (nitrogen) fertilizers[9]. This Description provides the requirement to fill a register on the use of fertilising products ('the logbook') in the PPIS came into force on 1 September 2023. The electronic logbook contributes to more efficient data availability and transparency, while at the same time encourages farmers to objectively assess the real need for mineral fertilisers in plant production. It is mandatory enter data on mineral (inorganic), organic fertilizers, exception of inorganic secondary plant nutrients (calcium, magnesium, sodium, sulphur), and micronutrient fertilizers in the logbook. The logbook must be kept by agricultural operators applying an area equal to or greater than 10 ha and fertilising animal and wood fuel ash to 0.01 ha or more. In addition, the Description provides maximum rates per hectare for nitrogen (N), phosphorus (P_2O_5) and potassium (K_2O) from 1 June 2023. The total nitrogen (N) input into the soil, including manure and slurry, shall not exceed 210 kg, phosphorus (P_2O_5) 90 kg and potassium (K_2O) 240 kg per hectare per calendar year. Agricultural operators participating in the support measures 'Agri-environment-climate' and 'Natura 2000' and 'Water Framework Directive payments' in 2023 in the activity 'Natura 2000 support on agricultural land' under the Lithuanian Rural Development Programme 2014-2020, as well as in some eco-schemes beneficial for the climate, the environment and animal welfare of Lithuania's 2023-2027 Strategic Plan for Agriculture and Rural Development, are also required to fill in the PPIS logbook. This requirement shall apply from the first hectare;

- as part of the incentive measures to reduce the use of mineral fertilisers, the measure 'Agri-environment and climate' of the Lithuanian Rural Development Programme 2014-2020 was implemented in 2022, which prohibits the use of organic and/or mineral fertilisers on the entire holding (excluding grazing of livestock) and the annual nitrogen input (from manure, slurry and grazing of livestock) may not exceed 170 kg per hectare. In total, around 28.9 million EUR was allocated to this measure in 2022. The Ministry of Agriculture, through financial incentives, encouraged farmers to participate in the relevant

---

https://am.lrv.lt/uploads/am/documents/files/Tr%C4%99%C5%A1imo%20metodikos_Galutin%C4%97%20ataskaita%20_2021%2007%2020%20-%20Copy.pdf.

[9] The Description of requirements for the use of fertilising products amended by Order No 3D-203 of the Minister of Agriculture on 3 April 2023, and by Order No 3D-540 of the Minister of Agriculture on 10 August 2023.

https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/10c9ed11d25711ed9b3c9397e1236c2a?jfwid=-1b9a01a5u;
https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/b69dcd2037b411eeb4b9a076396dcf81?jfwid=-1b9a01a5u

activities, which increased year-on-year over the period 2018-2022 and are presented in the table (according to data from the PI Agricultural Data Centre).

Agri-environment-climate activities	2018	2019	2020	2021	2022
Extensive grassland management with grazing, ha	15371,06	17962,3	17938,1	19702,5	26136,8
Production of catch crops on arable land, ha	16463,5	22652	28225,7	35522,6	39442,4
Specific grassland management, ha	2244,02	2213,47	2166,07	2269,72	1956,24
Extensive wetland management, ha	8858,92	6147,26	7646,77	8376,96	8120,34
Conservation of habitats in natural and semi-natural meadows in endangered wooden populations, ha	2766,18	3006,78	3045,88	3287,65	3480,16
Conservation of habitats of endangered wooden reeds in wetlands, ha	108,5	109	125,5	146,78	185,06
Strips or fields of melliferous crops on arable land, ha	122,83	127,86	133,46	146,74	135,04
Perennial grass strips or fields on arable land, ha	67,69	120,42	182,01	203,47	221,5
Protection of water bodies against pollution and soil erosion on arable land, ha	5,64	5,47	7,36	22,36	19,05
Maintenance of ditch slopes, ha	4377,77	2926,18	865,3	689,36	633,14
Improvement of the status of "risk" water bodies, ha	3554,43	4574,43	6219,11	7154,16	7526,72
Stubble fields during winter, ha	36115,1	31540,4	34111,5	40570,3	42366,5

- the non-arable cultivation of agricultural crops also contributes to reducing the use of mineral fertilisers and reducing ammonia emissions from used nitrogen fertilisers. Less fuel is used for soil preparation, soil absorption properties are improved, mineral fertilizers are used more precisely and efficiently when working the land on non-arable cultivation. According to preliminary estimates, with the application of non-arable cultivation, around 20 % of the total mineral fertiliser required for plant production is introduced at the time of direct sowing, thus avoiding the release of NH_3. By providing financial incentives, the Ministry of Agriculture encouraged farmers to use non-arable technologies, the volumes of which are shown in the table over the period 2019-2023 (according to data from the PI Agricultural Data Centre (ADC).

	2019	2020	2021	2022	2023
Area cultivated by non-arable technology, declared to the ADC, ha	180 100	245 000	445 000	474 912	1 221 754
Area cultivated by non-arable technology compared to arable land under agricultural land[10], %	6,00	8,23	14,89	15,82	40,69

[10]National Land Service under the Ministry of the Environment, Statistics. https://www.nzt.lt/go.php/lit/Lietuvos-respublikos-zemes-fondas

- it is important that plants nutrient balance ensures good crop yields and preserves soil productivity in ecological production farms, where fertilizers are used very limited. The use of mineral fertilisers containing basic nutrients from plants – nitrogen, phosphorus, potassium (NPK) – is prohibited in ecological production farming, and fertilisers or soil conditioners suitable for use in ecological production are published on the website of the Plant Service. Financial support for new entrants to ecological farming plays a key role in expanding and promoting ecological farming. Between 2014 and 2022, the RDP measure 'Ecological farming' was envisaged to support ecological farms, supporting two activities: 'Support for the transition to organic farming' for applicants entering ecological farming or declaring new areas and 'Support for ecological farming' for applicants declaring ecological certified areas for years other than the first year. According to the PI Agricultural Data Centre, in 2022 it was declared around 259251.23 ha under the RDP measure 'Ecological farming', representing an increase of 11134.04 ha compared to 2021. According to the National Paying Agency's data, it was allocated 318.6 million EUR to ecological farming (together with conversion to ecological farming and ongoing commitments) for the 2014-2020 financial period and it was paid 282.9 million EUR.

Measure	2018	2019	2020	2021	2022
Ecological farming, ha	201523,62	200895,26	188486,34	248117,19	259251,23

4. Member States may reduce ammonia emissions from livestock manure:

The requirements for the proper storage and use of manure are set out in the Environmental requirements for manure and slurry management[11]. The review of the requirements for manure and slurry storage and management shall be carried out on an ongoing basis by adjusting the environmental requirements for manure and slurry management related to the storage and management of manure and slurry, except for their storage and management in small and very small farms:

(a) only spreading manures and slurries in line with the foreseeable nutrient requirement of the receiving crop or grassland with respect to nitrogen and phosphorous:

Since 2005, there is an applicable requirement that the amount of nitrogen applied to the soil (from manure, slurry and grazing) per calendar year cannot exceed 170 kg per hectare[12]. In addition, nitrogen (N), phosphorus (P_2O_5) and potassium (K_2O) maximum rates per hectare are set in the Description of the requirements for the use of fertilising products (into force since 1 June 2023).

(b) not spreading manures and slurries when the receiving land is water saturated, flooded, frozen or snow covered:

The provision[13] that manure and slurry shall not be spreading if the land is saturated, flooded, frozen or snow covered has been in force since 2005.

[11] https://www.e-tar.lt/portal/lt/legalAct/TAR.AE113D1C5ECF/asr

[12] The Description of environmental requirements for manure and slurry management approved by Order No D1-367/3D-342 of the Minister of the Environment and the Minister of Agriculture on 14 July 2005.

[13] https://www.e-tar.lt/portal/lt/legalAct/TAR.AE113D1C5ECF/asr

(c) applying slurries spread to grassland using a trailing hose, trailing shoe or through shallow or deep injection:

Special equipment used for spreading manure and slurry must be technically sound and safe (the provision has been valid since 2013). From 1 April 2014, only broadcast spreader, trailing hose, trailing shoe or through shallow / deep injection into the soil technologies must be used[14] when fertilizing fields with liquid manure and slurry. From 1 January 2025 onwards[15], the broadcast spreader technique for slurry and liquid manure application are prohibited for persons who fertilizes 50 ha or more of agricultural land (excluding cases when slurry has been treated with odours and anti-pollution measures (acidification, probiotics, etc.).

(d) incorporating manures and slurries spread to arable land within the soil within 4 hours of spreading:

Incorporating solid and liquid manures to arable land within 24 hours of spreading are binding from 2012; for slurry from 2021. From 1 January 2024 onwards[16], persons fertilizing 30 ha or more of agricultural land, are required to ensure incorporation of manure and slurry into the soil as soon as possible but no later than 4 hours of spreading on arable land (excluding cases when conditions are not favourable for a faster incorporation, e.g. when human and machinery resources are not economically available, – could be incorporated up to 12 hours; where treated manure or slurry is used for fertilization – could be incorporated up to 24 hours); persons fertilizing up to 30 ha or more of agricultural land, are required to ensure incorporation of manure and slurry into the soil as soon as possible but no later than 4 hours of spreading on arable land.

(e) covering stores for solid manure:

In 2005[17], it was set that solid manure accumulated in open storage must be covered with straw, peat, or film. From 2021[18], solid manure must be stored in storage or barns, as well as in solid manure coils near the barns, in accordance with the requirements laid down in point 8 of the Description of environmental requirements for manure and slurry management. Solid manure storage, stacks in urbanised areas must be covered (flexible, watertight coatings, a layer of peat or straw of at least 10 cm thick, etc.). It is not necessary to cover solid manure treated with science-based measures to reduce ammonia emissions and unpleasant odours (separation, probiotics, etc.). There is an obligation to cover solid manure stored in the fields that will be fertilized (with flexible, water non-conductive coatings or not thinner than 10 cm thick peat, earth, crushed and (or) a layer of whole straw, sawdust; barns must be

[14] Order No D1-1006/3D-922 of the Minister of the Environment and the Minister of Agriculture on 31 December 2013.

[15] Order No D1-445/3D-494 of the Minister of the Environment and the Minister of Agriculture on 30 July 2021.

[16] Order No D1-755/3D-844 of the Minister of the Environment and the Minister of Agriculture on 9 December 2020.

[17] Order No D1-367/3D-342 of the Minister of the Environment and the Minister of Agriculture on 14 July 2005.

[18] Order No D1-445/3D-494 of the Minister of the Environment and the Minister of Agriculture of 30 July 2021.

installed to ensure that slurry from they would not flow into the environment and ammonia emissions and odours would be avoided)[19].

(f) ensuring farms have sufficient manure storage capacity to spread manure only during periods that are suitable for crop growth:

In 2020[20], it was set that manure, slurry stores and stacks of solid manure at the farm must be of such capacity as to accommodate manure and / or slurry produced over a period of at least 6 months, including slurry (liquids) from manure stored in manure, manure loading areas, milking sites, feed preparation sites. Where manure and / or slurry is stored in the barn, used for compost and biogas production, or transferred to another person for processing, the capacity or area of manure pits, thick manure stockpiles by the barn and / or slurry stores may be correspondingly smaller. The capacity of manure, slurry pool, solid manure stack shall be calculated in accordance with the relevant rules for the technological design of buildings and the recommendations of the Code of Good Agricultural Practice.

In 2021[21], the prohibited periods of land application of manure and/or slurry were adjusted (the application of manure and slurry is prohibited from 15 November to 20 March, 15 June to 1 August); and the mandatory requirements for the installation of solid manure stacks in the fields (site selection, strata formed on the soil, surrounded by dyke; covered manure stored for a maximum period of 6 months, etc) have also entered into force on 15 November 2021.

(g) reducing emissions from animal housing, by using ammonia emissions reduced systems; and reducing emissions from manure, by using low protein feeding strategies:

The proposals for possible measures to reduce emissions from animal housing through ammonia-reducing systems and emissions through feeding strategies with a low protein content are discussed above (Code of Good Agricultural Practice and Rules on the design of cattle buildings, pigs, sheep farms, poultry farms, fur farming and rabbit farming).

In addition, for the sustainable use of manure and slurry, biogas production using manure makes it possible to avoid the release of NH_3 from manure. Manure is considered one of the most important raw materials in biomethane production. According to 2022 data, animal manure is used as raw material in 13 biogas plants (out of 16 using agricultural raw materials).

In 2020 it was allocated 8 million EUR (the Climate Change Program) for the construction of new biogas production, the construction of biogas with biomethane production plants, the development of biomethane gas production plants, the installation of biogas treatment plants in the vicinity of existing or under construction of biogas plants; 4 projects were implemented. In 2021 it was allocated 15 million EUR for the expansion of biomethane production; 8 projects were implemented.

In 2017 it was allocated 1.6 million EUR (the Lithuanian Rural Development Programme 2014-2020) for biomethane production (1 project); in 2020 – 6.22 million EUR.

____

[19] Para 14 of the Description of environmental requirements for manure and slurry management. https://www.e-tar.lt/portal/lt/legalAct/TAR.AE113D1C5ECF/asr

[20] Order D1-755/3D-844 of the Minister of the Environment and the Minister of Agriculture on 9 December 2020.

[21] Order No D1-445/3D-494 of the Minister of the Environment and the Minister of Agriculture on 30 July 2021.

Part 2 – Transport

3. TRANSPORT (NFR 1.A.3)

Since 1990, the Government of Lithuania has adopted a number of important decisions on the reduction of transport pollution, i.e. national programs like “Transport and the Protection of Environment”, “Measures for the Implementation of the National Transport Development Programme”, and other programs aimed at reducing the negative impact of transport on the environment and on people’s health. Due to a difficult economic situation, the implementation of these programs is slower than expected.
Please note that emissions from mobile sources are calculated based on **fuel sold** in Lithuania, thus national total emissions include, the main document, analyzing transport impact on the environment is the State Program “Transport and Environmental
Protection”. It includes the activities to be followed:

On motor road transport:

- national distribution of traffic flows.
- perfection of means for selection and training of drivers.
- trolley-bus network development in Vilnius and Kaunas.
- optimization of fuel prices.
- construction of new biotransport routes.

On railway transport:

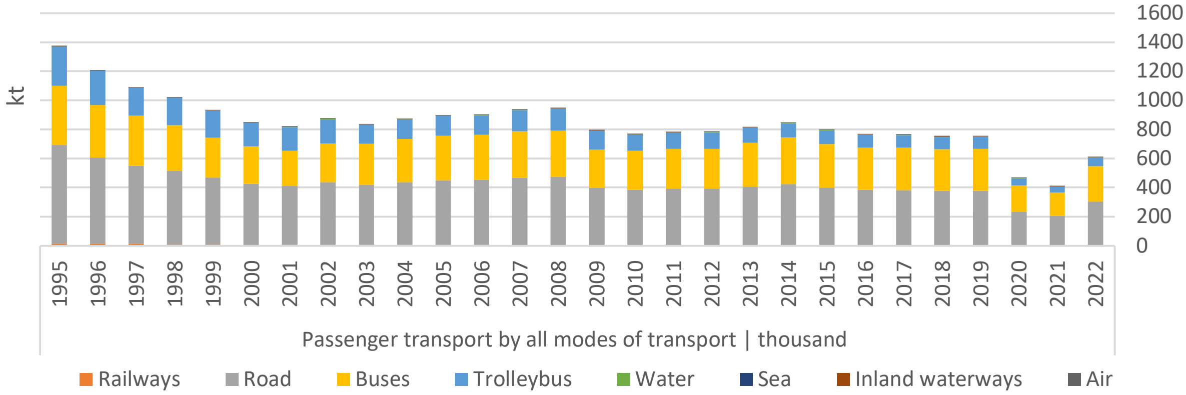
- electrification of Lithuanian railways.
- pipeline transport development for oil products transportation.

On Sea transport:

- power supply from the municipal power network to the ships in the port.

On the Entire Means of Transport:

- the formation of the fleet of various means of transport, taking into account the existing ecological requirements. development and implementation of national ecological standards. The main Passenger transport modes is by Road transport and Busses.



Estimation of emissions in 1.A.3 *Transport* are carried out for each fuel in sub-categories are listed below:

- *Civil and International Aviation* 1.A.3.a
- *Road Transportation* 1.A.3.b
- *Railways* 1.A.3.c
- *Navigation* 1.A.3.d
- *Other Transportation* 1.A.3.e

3.1. Civil aviation (Domestic LTO NFR 1A3ai(i)) and international aviation LTO (NFR 1A3aii(i))

Source category description

This category includes activities related to air traffic within or in the surroundings of airports (landing and take-off cycles (LTO)). Civil aviation includes emissions both from domestic and international aviation LTO cycles. These categories are not key categories. This category does not include military aviation, which is reported under 1A5b sector.
Emissions from the aviation sector are split into different aircraft activities, and allocations are made according to the requirements for reporting:
1.A.3.a.i (i) International aviation LTO (civil);
1.A.3.a.ii (i) Domestic aviation LTO (civil);
1.A.3.a.i (ii) International aviation cruise (civil);
1.A.3.a.ii (ii) Domestic aviation cruise (civil).
Emissions from the cruise phase are reported as a memo item and are not included in national totals. International traffic includes all flights whose origin or final destination is a foreign airport. In Lithuania there are four international airports:

- Vilnius International Airport
- Kaunas Airport
- Palanga International Airport
- Šiauliai International Airport

Aviation emissions reflect the level of overall aviation activity. All the changes in the time series are mostly borne from changes in fuel consumption and the number of landing and take-off operations.

Methodological issues

Lithuania reports its air pollutants emissions according to the requirements of the CLRTAP as well as greenhouse gas according to the requirements of the UNFCCC. The nomenclature for both reportings is (almost) the same (NFR), but there are differences concerning the system boundaries. Emissions from civil aviation are accounted for differently under the CLRTAP and the UNFCCC: Only emissions from domestic flights are accounted for in the GHG inventory, while emissions from international flights are reported as memo items. For the reporting under the CLRTAP, landing and takeoff (LTO) emissions of domestic and international flights are accounted for, while emissions of international and domestic cruise flights are reported under memo items only.

Differences between reporting under CLRTAP and UNFCCC concerning the accounting to the national total			**CLRTAP / NFR-Templates**			**UNFCCC/CRTables**	
			National total	National total for compliance	Memo item	National total	Bunker 1D
Aviation 1.A.3.a	Civil/Domestic aviation	Landing and Take-off (LTO)	Yes	Yes	No	Yes	No
		Cruise	No	No	Yes	Yes	No
	International aviation	Landing and Take-off (LTO)	Yes	No	No	No	Yes
		Cruise	No	No	Yes	No	Yes

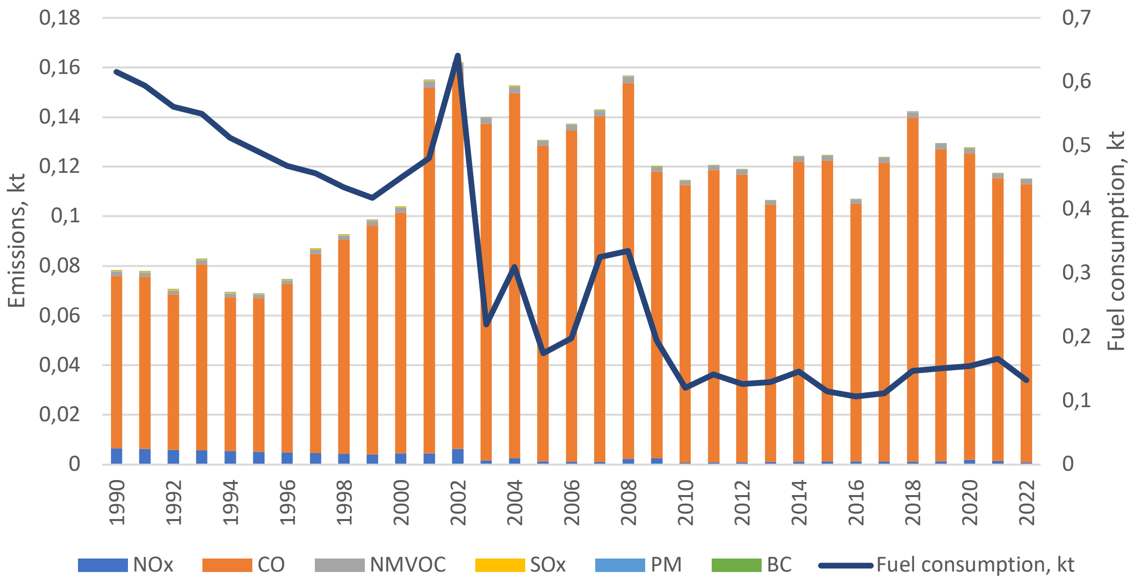


Figure 3-1. Pollutant emissions and fuel consumption in sector 1.A.3.a.ii (i) Domestic aviation LTO (civil)

Table 3-1. Emissions from A.3.a.ii (i) Domestic aviation LTO (civil)

	NOx, kt	CO, kt	NMVOC, kt	Sox, kt	PMs, kt	BC, kt	Fuel, kt
1990	0.0065	0.0695	0.0018	0.0005	0.00006	0.00002	0.62

1995	0.0051	0.0618	0.0015	0.0004	0.00004	0.00002	0.49
2000	0.0044	0.0970	0.0020	0.0004	0.00004	0.00004	0.45
2005	0.0012	0.1272	0.0021	0.0002	0.00001	0.00005	0.17
2010	0.0008	0.1118	0.0018	0.0001	0.00000	0.00004	0.12
2011	0.0009	0.1177	0.0019	0.0001	0.00001	0.00005	0.14
2012	0.0009	0.1160	0.0019	0.0001	0.00001	0.00005	0.13
2013	0.0009	0.1037	0.0017	0.0001	0.00001	0.00004	0.13
2014	0.0011	0.1209	0.0020	0.0001	0.00001	0.00005	0.15
2015	0.0012	0.1212	0.0020	0.0001	0.00001	0.00005	0.11
2016	0.0012	0.1039	0.0017	0.0001	0.00001	0.00004	0.11
2017	0.0012	0.1204	0.0020	0.0002	0.00001	0.00005	0.11
2018	0.0010	0.1387	0.0023	0.0002	0.00001	0.00005	0.15
2019	0.0012	0.1259	0.0021	0.0002	0.00001	0.00005	0.15
2020	0.0018	0.1235	0.0020	0.0002	0.00002	0.00005	0.15
2021	0.0013	0.1141	0.0019	0.0002	0.00001	0.00004	0.17
2022	0.0008	0.1122	0.0018	0.0001	0.00001	0.00004	0.13
Change in 2005-2022, %	**-32%**	**-12%**	**-12%**	**-25%**	**-14%**	**-12%**	**-28%**
Change in 1990-2022, %	**-88%**	**61%**	**3%**	**-76%**	**-89%**	**77%**	**-88%**

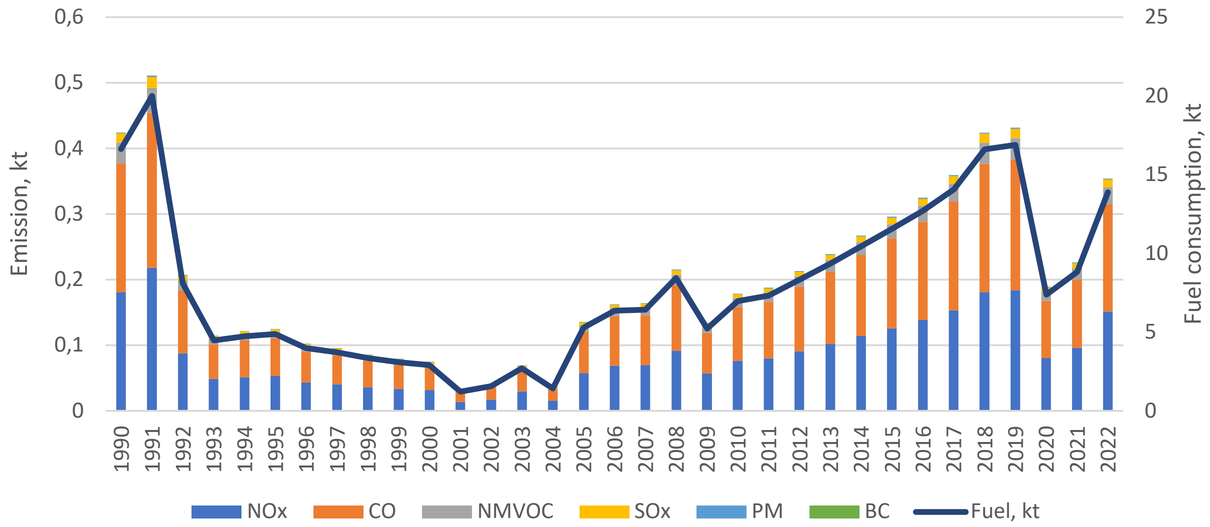


Figure 3-2 Pollutant emissions in sector 1.A.3.a.i (ii) International aviation LTO (civil)

Table 3-2 Emissions from A.3.a.ii (ii) International aviation LTO (civil)

	NOx	CO	NMVOC	SOx	PM	BC	Fuel, kt
1990	0.1811	0.1961	0.0316	0.0140	0.0015	0.0002	16.618
1995	0.0532	0.0576	0.0093	0.0041	0.0004	0.0001	4.881

2000	0.0319	0.0345	0.0056	0.0025	0.0003	0.0000	2.924
2005	0.0577	0.0624	0.0101	0.0044	0.0005	0.0001	5.291
2010	0.0761	0.0824	0.0133	0.0059	0.0006	0.0001	6.979
2011	0.0798	0.0864	0.0139	0.0062	0.0007	0.0001	7.325
2012	0.0908	0.0983	0.0158	0.0070	0.0007	0.0001	8.331
2013	0.1019	0.1103	0.0178	0.0078	0.0008	0.0001	9.345
2014	0.1140	0.1234	0.0199	0.0088	0.0009	0.0001	10.456
2015	0.1261	0.1365	0.0220	0.0097	0.0010	0.0002	11.566
2016	0.1384	0.1499	0.0241	0.0107	0.0011	0.0002	12.701
2017	0.1533	0.1659	0.0267	0.0118	0.0013	0.0002	14.063
2018	0.1809	0.1958	0.0315	0.0139	0.0015	0.0002	16.596
2019	0.1841	0.1993	0.0321	0.0142	0.0015	0.0002	16.889
2020	0.0806	0.0873	0.0141	0.0062	0.0007	0.0001	7.396
2021	0.0963	0.1042	0.0168	0.0074	0.0008	0.0001	8.833
2022	0.1511	0.1636	0.0263	0.0116	0.0012	0.0002	13.865
Change in 1990-2022, %	**-17%**	**-17%**	**-17%**	**-17%**	**-17%**	**-17%**	**-17%**
Change in 1990-2022, %	**162%**	**162%**	**162%**	**162%**	**162%**	**162%**	**162%**
Change in 2021-2022, %	**57%**	**57%**	**57%**	**57%**	**57%**	**57%**	**57%**

Emission factors

EMEP/EEA 2023 Tier 1 and Tier 2 approaches have been applied. Tier 1 methodology for emission estimation in aviation, both for aviation gasoline and jet kerosene was used for time series 1990-2004. Tier 2 approach with split in LTO and cruise cycles has been applied for jet kerosene emission calculation for time period 2006-2022. Emissions from 2006 were calculated using EUROCONTROL based on Tier 2 for jet kerosene fuel. The real share of national and international emissions for the period 2005-2022 was taken from the EUROCONTROL database directly; for 1990-2004 period an average for 2006-2021 was applied to calculate IEF. According to EUROCONTROL practically all PM emitted by modern aircrafts have an aerodynamic diameter of less than 0.1 microns. Hence, the TSP and PM10 values are provided equal to PM2.5.

Table 3-3 Emission factors used in the calculation of emissions from Civil aviation (kg/t fuel)

	NOx	**CO**	**NMVOC**	**SO_2**	**$TSP=PM_{2.5}=PM_{10}$**	**BC-f**
DOMESTIC						
LTO Aviation petrol	4*	1200*	0.1*	1.0*	0.2*	0.15*
Jet kerosene	11.1	11.4	1.4	0.8	0.1	0.48

Cruise						
Jet kerosene	13.6	5.3	0.5	0.84	0.15	0.15
INTERNATIONAL						
LTO	10.9	11.8	1.9	0.84	0.09	0.15
Cruise	12.8**	1.1	0.5	1.0	0.2	0.15

*EMEP/EEA Guidebook 2019

**Latvian NIR 2021

Net calorific values (NCVs) used to convert fuel consumption in natural units into energy units are provided in the Table 3-4.

Table 3-4. Specific net calorific values (conversion factors)

Type of fuel	Tonne	Tonne of oil equivalent (toe)	TJ/tonne
Gasoline type jet fuel	1.0	1.070	0.04479
Kerosene type jet fuel	1.0	1.031	0.04316

Activity data

The data about fuel consumption for domestic and international civil aviation is derived from the Statistics Lithuania by request. Aviation gasoline is more common as fuel for private aircraft, while the jet fuel used in aircraft, airlines, military aircraft and other large aircraft.

<u>LTO/Cruise</u>

The amounts of domestic fuels use for LTO in years 1990 – 2004 were calculated based on extrapolation data on fuel share of jet kerosene used for international aviation in Lithuania (calculated based in EUROCONTROL database): it was assumed that 24% of the fuel use is used for domestic LTO part of flight and 13% for International LTO. Cruise fuel usage is estimated as the difference between the total fuel use from aviation fuel sale statistics for domestic use and the total calculated LTO fuel use.

For the time series 2005-2022 EUROCONTROL data on the number of flights, fuel consumption and share of domestic and international flights LTO/Cruise) were used. The emissions of NOx, SOx, PMs and CO were taken from EUROCONTROL file for LTO and Cruise separately.

EUROCONTROL data used Tier 3 methodology applying the Advanced Emissions Model (AEM). Following data were taken from the EUROCONTROL data published in 2022 into national inventory:

- fuel consumption of aviation gasoline for domestic flights (LTO and cruise);
- fuel consumption of aviation gasoline for international flights (LTO and cruise);
- fuel consumption of jet kerosene for domestic flights (LTO and cruise);
- fuel consumption of jet kerosene for international flights (LTO and cruise);
- pollutants for all subcategories.

Uncertainties and time-series consistency

Uncertainty in activity data 2005-2022 of fuel consumption is ±2%. For the 1990-2004 period uncertainty in activity data of fuel consumption is ±20%.

Source-specific QA/QC and verification

Assessment of trends were performed by a sectorial expert.

Source-specific planned improvements

No improvement planned.

Recalculations

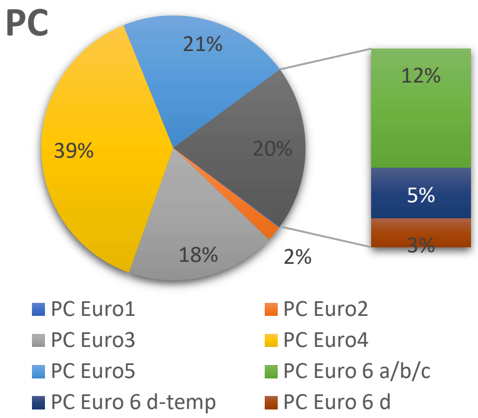
No recalculations were done.

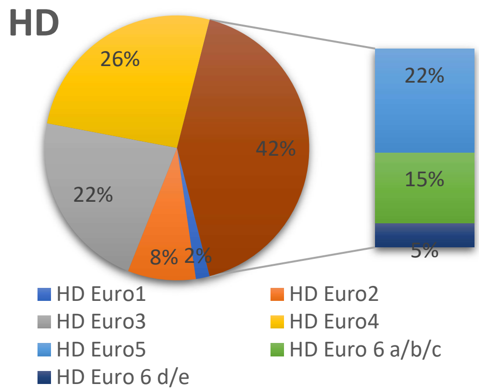
3.2. Road transport (NFR 1.A.3.b)

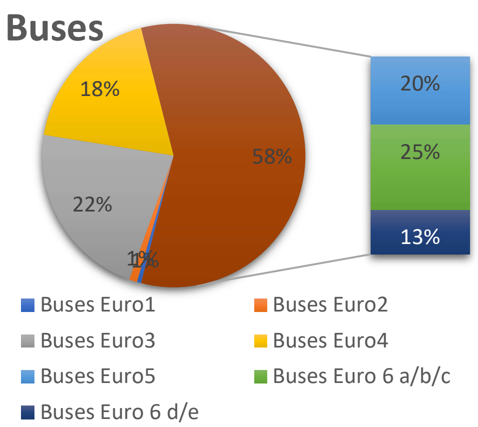
Source category description

Lithuania has a fairly well-developed road network provided with a dense road (1.291 km/km²) network (2022). At the end of 2022, the length of roads amounted to 21,203 thousand kilometers; the length of E-roads amounted to 1,742 kilometers, of which motorways – 400 km (Statistics Lithuania, 2022).

Road transportation is the most important emission source in the Transport sector. This sector includes all types of vehicles on roads (passenger cars (PC), light duty vehicles (LD), heavy duty trucks and buses (HD), motorcycles and mopeds (2-wheels)). The source category does not cover farm and forest tractors driving occasionally on the roads because they are included in other sectors as off-roads.







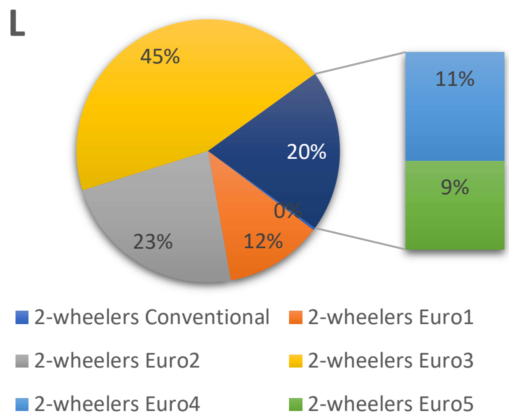


Figure 3-3. Road vehicles by standard, 2022

Activity data for mobile sources are based on official energy balance of the Lithuania prepared by the Statistics Lithuania (2022). The parameters necessary for distribution of sold fuels are transport mode, fuel type, weight of vehicle and equipment with more or less effective catalytic system. The appropriate distribution is necessary for assigning of the relevant emission factor. Sector 1A3b Road Transportation is split into five subsectors:

- 1.A.3.b i Passenger Cars
- A.3.b ii Light Duty Vehicles
- 1.A.3.b iii Heavy Duty Vehicles
- 1.A.3.b iv Mopeds & Motorcycles
- 1.A.3.b v Gasoline Evaporation
- 1.A.3.b vi Automobile tire and brake wear
- 1.A.3.b vii Automobile road abrasion

Calculations of emissions from road transport (NFR sector 1A3b) are based on:

- statistical fuel consumption data from Energy balance
- traffic intensity, estimated by Institute of Transport
- road transport fleet data, taken from Registry of Transport (State Enterprise "Regitra"). Emission factors and fuel consumption factors for NOx, NMVOC, CO, TSP and NH_3 emission estimations were calculated using COPERT v5.7.1 – Sep 2023 model. Road transport was differentiated into the passenger cars, light duty vehicles, heavy duty vehicles, buses and motorcycles categories.

Table 3-5. Trend of emissions in Road transport

	NOx	NMVOC	SOx	NH3	PM2.5	PM10	TSP	BC	CO
1990	68.909	25.911	4.650	0.028	1.705	1.983	2.337	0.701	204.840
1991	76.940	29.344	5.141	0.032	1.858	2.161	2.550	0.763	246.688
1992	48.833	18.048	3.391	0.020	1.272	1.467	1.716	0.530	140.091
1993	36.266	14.209	2.428	0.015	0.882	1.028	1.213	0.361	105.610
1994	27.301	11.504	1.740	0.012	0.591	0.700	0.840	0.235	84.750
1995	36.814	15.546	1.111	0.016	0.720	0.867	1.057	0.276	109.958
1996	40.668	16.884	1.226	0.021	0.796	0.958	1.166	0.306	117.709
1997	45.831	17.402	1.476	0.026	1.072	1.254	1.487	0.437	117.628
1998	47.426	17.030	1.115	0.040	1.245	1.438	1.684	0.524	110.191
1999	40.553	13.972	0.960	0.049	1.152	1.329	1.554	0.492	84.321
2000	33.747	12.220	0.802	0.076	1.011	1.171	1.376	0.437	68.577
2001	35.227	12.135	0.731	0.117	1.149	1.323	1.547	0.507	68.006

2002	34.426	11.779	0.735	0.156	1.147	1.329	1.562	0.508	66.930
2003	30.633	10.633	0.623	0.218	1.105	1.290	1.530	0.498	61.201
2004	30.552	10.076	0.538	0.351	1.202	1.409	1.676	0.556	57.851
2005	29.953	9.732	0.102	0.385	1.203	1.424	1.709	0.562	56.409
2006	29.249	9.187	0.108	0.431	1.223	1.463	1.773	0.585	55.837
2007	31.826	9.483	0.128	0.519	1.414	1.703	2.078	0.695	58.580
2008	31.047	8.579	0.129	0.533	1.367	1.657	2.033	0.677	54.624
2009	24.383	6.994	0.021	0.425	1.080	1.319	1.630	0.535	44.909
2010	25.506	5.873	0.022	0.322	1.150	1.396	1.714	0.589	37.565
2011	25.320	4.839	0.022	0.268	1.133	1.379	1.697	0.585	32.102
2012	25.169	4.091	0.022	0.224	1.119	1.367	1.686	0.587	27.814
2013	23.464	3.196	0.022	0.160	1.195	1.427	1.726	0.678	21.175
2014	26.415	3.145	0.025	0.144	1.265	1.527	1.865	0.712	20.182
2015	26.581	2.715	0.027	0.140	1.240	1.520	1.882	0.703	18.221
2016	26.082	2.608	0.030	0.141	1.218	1.516	1.903	0.692	17.004
2017	25.819	2.227	0.031	0.139	1.154	1.468	1.878	0.635	14.853
2018	26.121	2.177	0.034	0.147	1.125	1.463	1.902	0.594	15.042
2019	26.480	2.075	0.035	0.153	1.112	1.466	1.925	0.571	14.088
2020	24.406	1.804	0.036	0.202	0.959	1.291	1.724	0.477	12.679
2021	23.439	1.692	0.036	0.194	0.931	1.264	1.697	0.455	11.815
2022	22.748	1.624	0.036	0.210	0.976	1.385	1.860	0.478	10.641
Change in 1990-2022, %	**-67%**	**-94%**	**-99%**	**650%**	**-43%**	**-30%**	**-20%**	**-32%**	**-95%**
Change in 2005-2022,%	**-24%**	**-83%**	**-65%**	**-45%**	**-19%**	**-3%**	**9%**	**-15%**	**-81%**

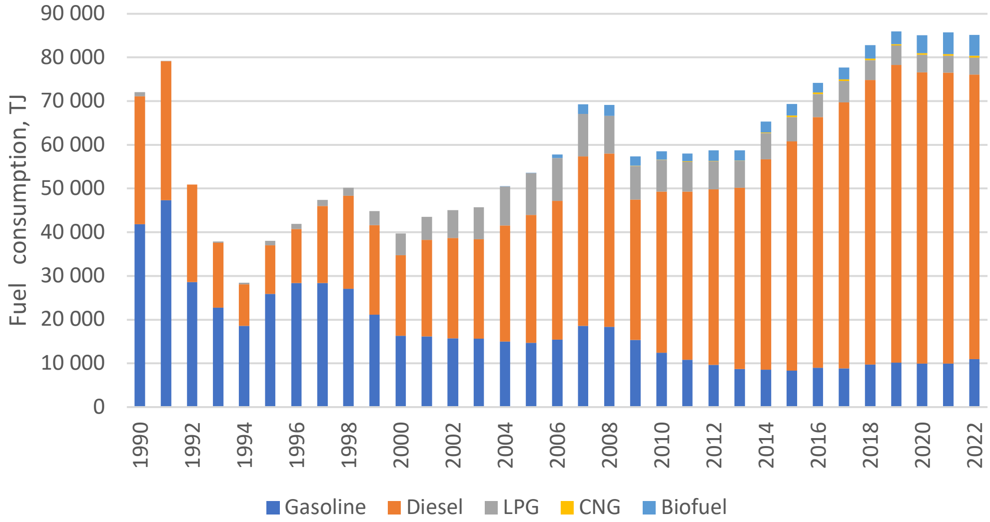


Figure 3-4. Fuel consumption in road transport in 1990-2022, TJ

Diesel and petrol fuels are mainly used in transport sector with a slow and steady increase in electromobiles. According to “Regitra” there were 2496 registered electro cars in 2022.

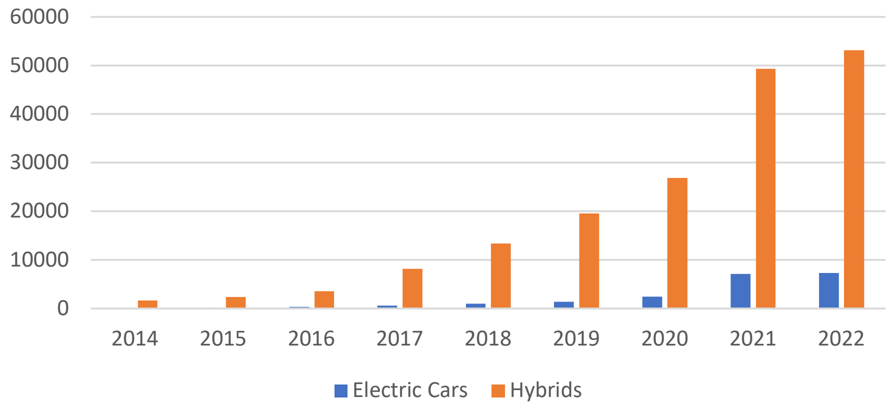


Figure 3-3. Share of electromobiles

There is a marked switch from petrol engines to diesel. The number of petrol engines (all vehicles) has decreased and as a result petrol fuel consumption has dropped between 1990 and 2020, while the number of diesel engines increased significantly from ~14 to 1067 thousand for the same period.

Passenger cars represent the most fuel-consuming vehicle category, followed by heavy-duty vehicles, light duty vehicles and 2-wheelers, are in decreasing order.

Many factors had influence on changes of energy consumption: deep economic slump in 1991-1994, fast economic growth over the period 2000-2008, dramatic reduction of economic activities in all branches of the national economy, a significant increase of energy prices, an increase of energy efficiency and other reasons. During the period 2000-2008 the energy consumption was increasing by 3.8% per annum. During this period the average growth rate of GDP was 8.1% per annum (Statistics Lithuania, Statistical Yearbook of Lithuania, 2008). The impact of global economic recession was dramatic in Lithuania. The global economic crisis had an effect on Lithuanian GDP already in 2008, but GDP growth rate in 2008 was still positive (2.6%). In 2009, GDP decreased by 14.8%. Since 2010 Lithuania's GDP has grown slightly by 1.6% in 2010, 6.0% in 2011 and 3.8% in 2012. During 2013–2014, GDP growth rates slightly slowdown and accounted 3.5% per annum. In 2015, GDP growth rate reduced by two times (to 1.8%), Increased by 6.2% import volume of goods and services and by 0.4% reduced export volume were the key drivers of slacken rate of GDP growth. 1.A.3.b.iv is highly variable as vehicle registration is highly variable due to re-registration.

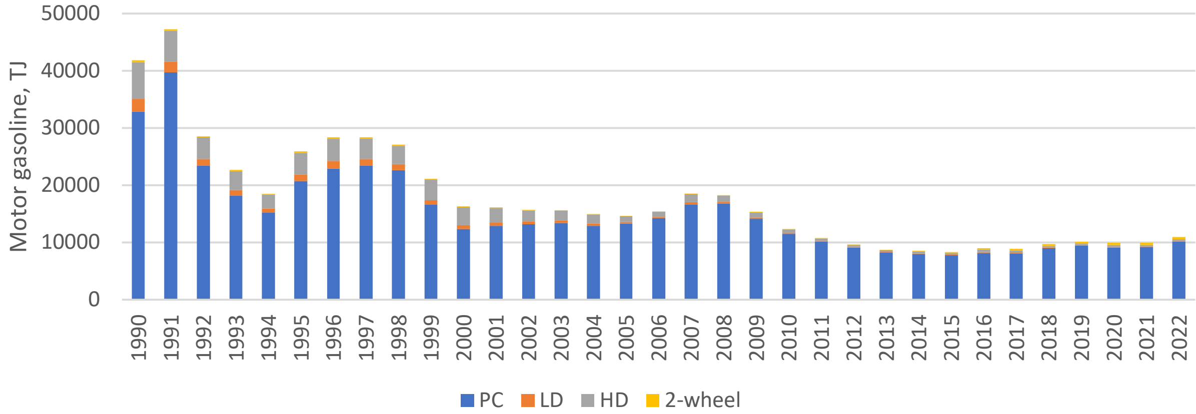


Figure 3-4. Gasoline fuel consumption per vehicle type for road transport 1990-2022

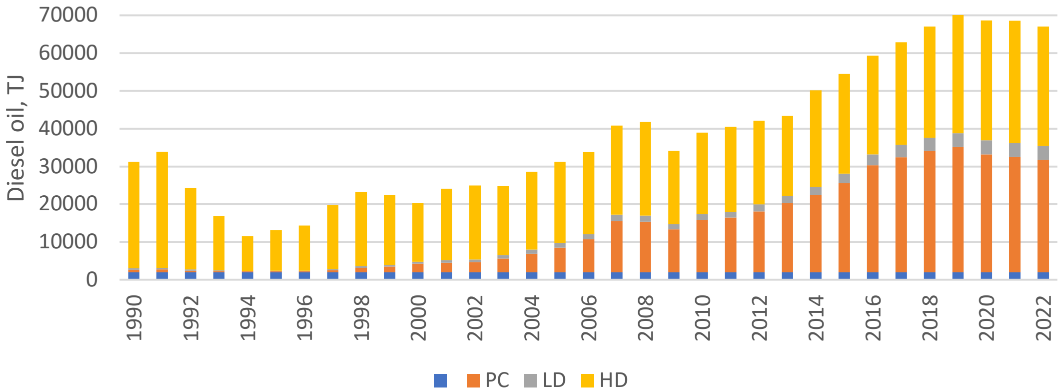


Figure 3-5 Diesel oil consumption per vehicle type for road transport 1990-2022

In 2022, fuel consumption shares for diesel heavy-duty vehicles, diesel passenger cars, gasoline passenger cars, diesel light-duty vehicles and LPG vehicles were 40%, 37%, 13%, 5%, 5%, respectively.

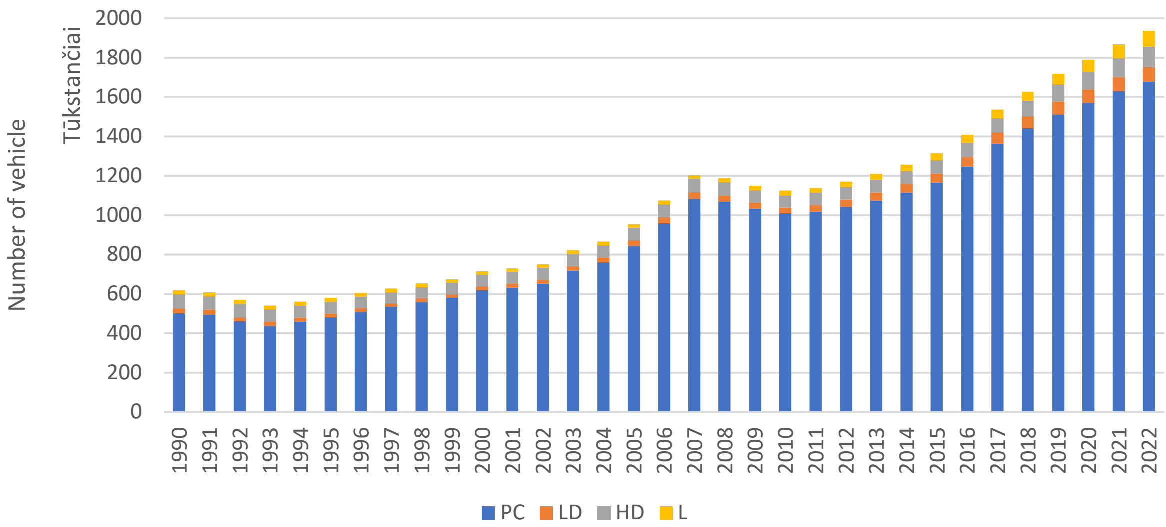


Figure 3-6. Number of vehicles in Lithuania, 1990-2022

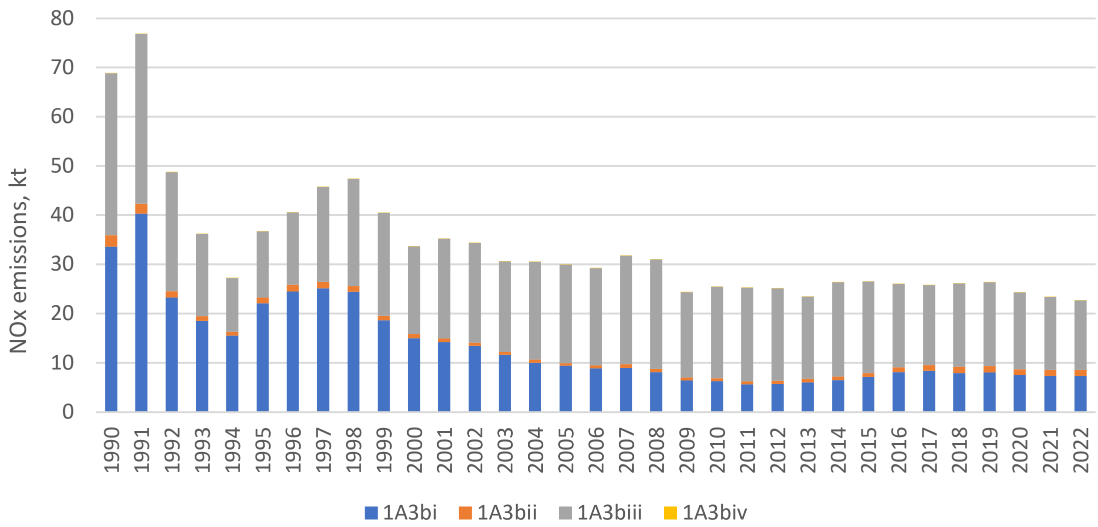


Figure 3-7. Development of NOx emissions in Road transport sector 1990-2022

Development of NOx emissions in Road transport sector is presented. Passenger cars NOx emissions contribution to Road transport has decreased by 76 % since 1990. During the whole period 1990-2022 HD vehicles contribute the biggest part to NOx emissions in Road transport sector.

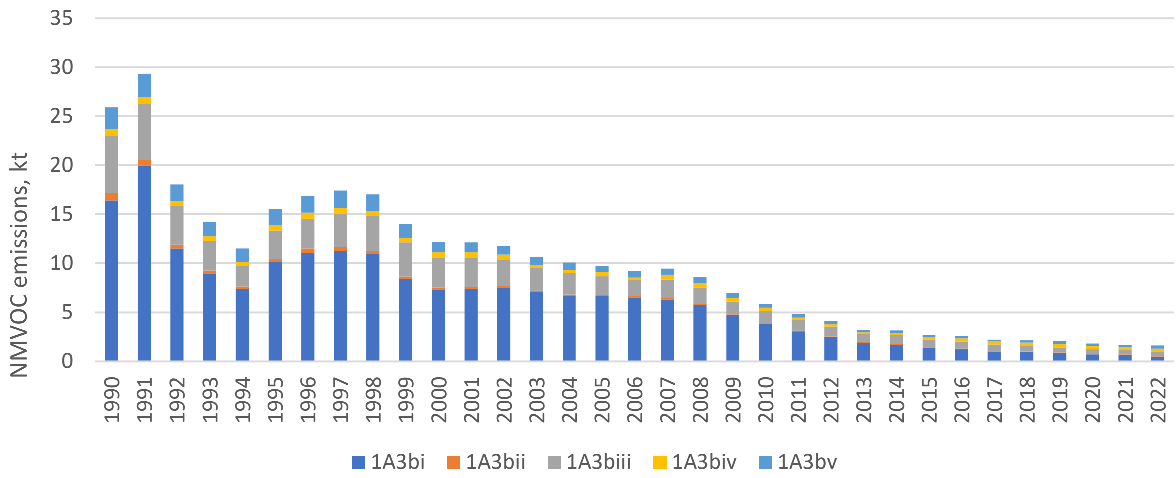


Figure 3-8. Development of NMVOC emissions in Road transport sector, 1990-2022

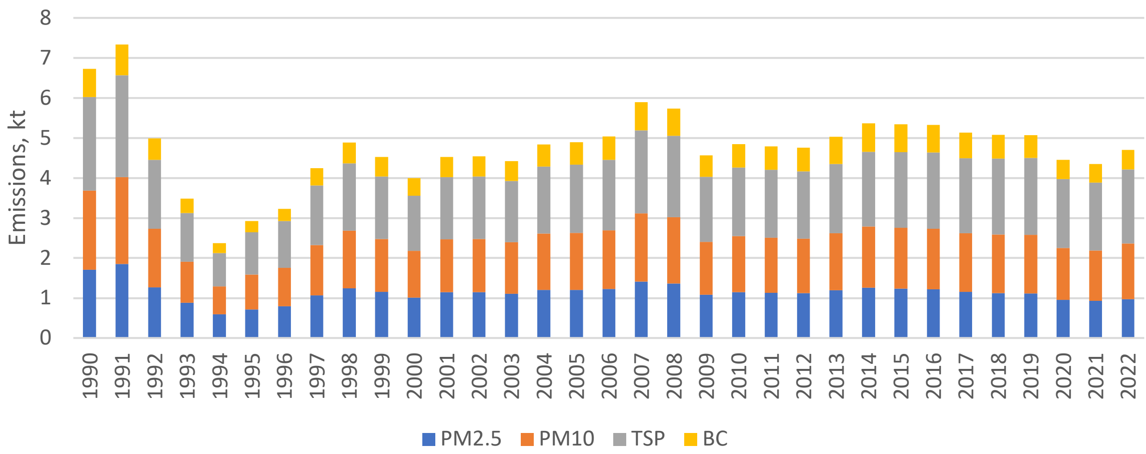


Figure 3-9. Development of PMs emissions in Road transport sector, 1990-2022

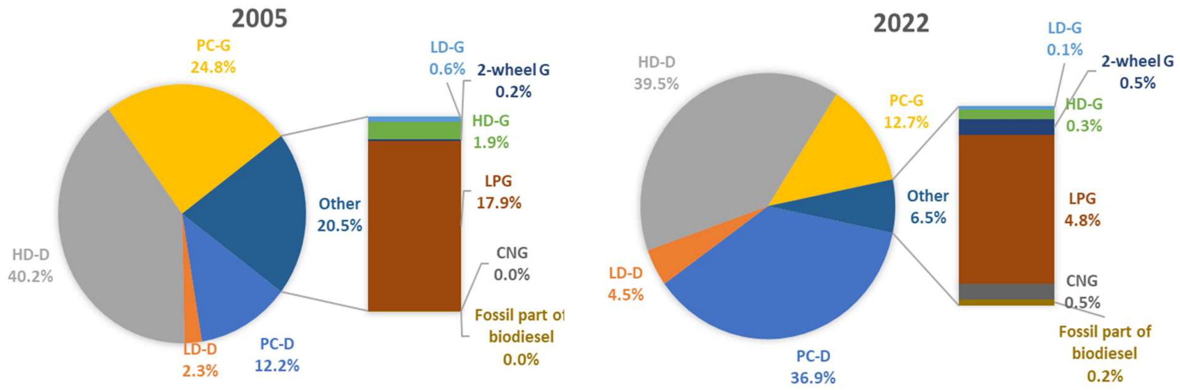


Figure 3-10. Fuel consumption share per vehicle type and fuel type for road transport in 2005 and 2022

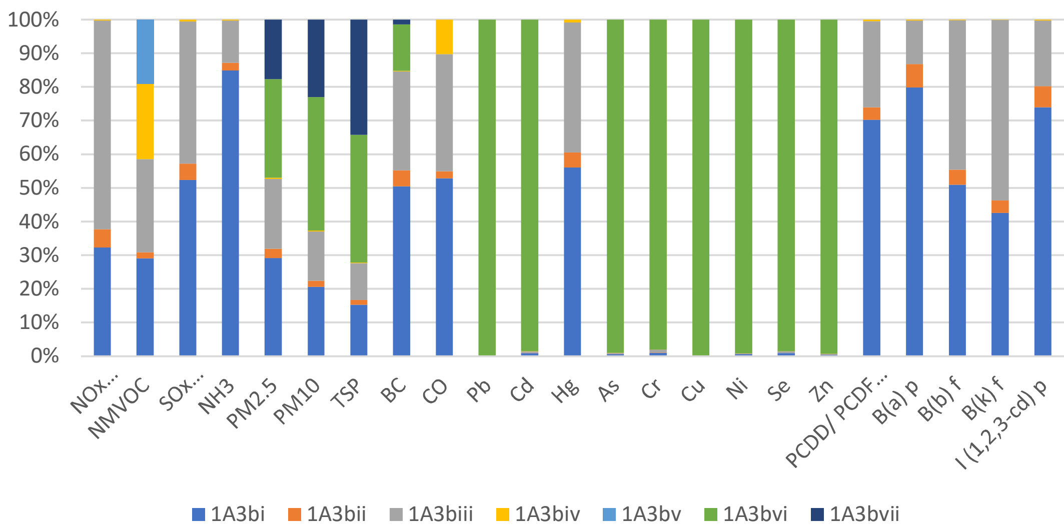


Figure 3-11. Distribution of emissions in Transport sector by subsectors in 2022, %

Passenger cars takes up the biggest part of Transport sector emissions for most of the pollutants followed by Heavy Duty vehicles. Automobile tyre and break wear contributes the biggest part (99.7 %) of Pb, Cd and As emissions.

Methodological issues

In the Tier *3* method emissions are calculated using a combination of firm technical data and activity data. The activity data of road transport was split and filled in for a range of parameters including:

- Fuel consumed, quality of each fuel type;
- Emission controls fitted to vehicle in the fleet;
- Operating characteristics (e.g. average speed per vehicle type and per road)

- Types of roads;
- Maintenance;
- Fleet age distribution;
- Distance driven (mean trip distance);
- Climate

The model calculates vehicle mileages, fuel consumption, exhaust gas emissions, evaporative emissions of the road traffic. The balances use the vehicle stock and functions of the km driven per vehicle and year to assess the total traffic volume of each vehicle category. The production year of vehicles in this category has been taken into account by introducing different classes. which either reflects legislative steps ('ECE', 'Euro') applicable to vehicles registered in each Member State. The technology mix in each particular year depends on the vehicle category and the activity dataset considered. Lubricant use in two-stroke engines amounts only to 0.72-1.44 TJ, consequently emissions do not exceed threshold of significance (10 kt), therefore emissions from lubricant use are considered as insignificant.

For the period between 1990 and 2006, it was necessary to estimate the figures with the aid of numerous assumptions. The total emissions were calculated by summing emissions from different sources, namely the thermally stabilized engine operation (hot) and the warming-up phase (cold start) (EEA 2000; MEET, 1999). For Tier *3* approaches cold start emissions were estimated:

$$E_{COLD;i,j} = \beta_{i,k} \times N_k \times M_k \times E_{HOT;i,k} \times (e_{COLD} / e_{HOT}\big|_{i,k} - 1) \quad (1)$$

Where:

$E_{COLD;i.k}$ - *cold start emissions of pollutant i(for the reference year), produced by vehicle technology k,*

$\beta_{i.k}$ - *fraction of mileage driven with a cold engine or the catalyst operated below the light-off temperature for pollutant i and vehicle [veh] technology k,*

N_k - *number of vehicles of technology k in circulation,*

M_k - *total mileage per vehicle [km veh^{-1}] in vehicle technology k,*

e_{COLD}/e_{HOT} - *cold/hot emission quotient for pollutant i and vehicle of k technology,*

$$E_{total} = E_{cold} + E_{hot} \quad (2)$$

where:

E_{TOTAL} - *total emissions (g) of compound for the spatial and temporal resolution of the application,*

E_{HOT} - *emissions (g) during stabilized (hot) engine operation,*

E_{COLD} - *emissions (g) during transient thermal engine operation (cold start).*

The *β*-parameter depends upon ambient temperature t_a (for practical reasons the average monthly temperature was used). Since information on average trip length is not available for all vehicle classes. simplifications have been introduced for some vehicle categories. According to the available statistical

data (André *et al*. 1998), a European value of 12.4 km has been established for the l_{trip} value and used in estimations in Lithuania.
Due to the fact that concentrations of some pollutants during the warming-up period are many times higher than during hot operation. In this respect, a distinction is made between urban, rural and highway driving modes. Cold-start emissions are attributed mainly to urban driving (and secondarily to rural driving), as it is expected that a limited number of trips start at highway conditions. Therefore, as far as driving conditions are concerned, total emissions were calculated by means of the equation:

$$E_{Total} = E_{Urban} + E_{Rural} + E_{Highw} \quad (3)$$

where:

E_{URBAN}, E_{RURAL} and $E_{HIGHWAY}$ - the total emissions (g) of any pollutant for the respective driving situations.

Fuel was distributed to transport categories, types, ecology standards and driving modes according to data taken from State Enterprise Transport and Road Research Institute under the Ministry of Transport and Communications of the Republic of Lithuania.
Emissions was estimated from the fuel consumed (represented by fuel sold) and the distance travelled by the vehicles. The first approach (fuel sold) was applied.

Emission factor assumes full oxidation of the fuel. Emission equation for air pollutants for Tier *3* is:

$$Emission = \sum_{a,b,c,d} \left[Distance_{a,b,c,d} \cdot EF_{a,b,c,d} \right] + \sum_{a,b,c,d} C_{a,b,c,d} \ . \quad (5)$$

where:

Emission - emission of air pollutants;
$EF_{a,b,c,d}$ - emission factor, kg/km;
$Distance_{a,b,c,d}$ - distance travelled during thermally stabilized engine operation phase, km;
$C_{a,b,c,d}$ - emission during (g) during transient thermal engine operation (cold start), kg;
b – vehicle type;
c – emission control technology;
d – driving situation (urban, rural, highway).

The annual mileage driven by the stock of vehicle per year is an important parameter in emission calculation as it affects both the total emissions calculated but also the relative contributions of the vehicle types considered. Calculations demand annual mileage per vehicle technology and the number of vehicles was supplied by the Lithuanian Road Administration and study funded by the European Commission – DG Environment and executed in collaboration with KTI, Renault, E3M-Lab/NTUA, Oekopol, and EnviCon. The source for these data is various European measurement programmes. Fuel consumption was calculated on the basis of appropriate assumptions for annual mileage of the different vehicle categories can be balanced with available fuel statistics (Ntziachristos et al. 2008). In general, the COPERT COPERT v5.7.1 – Sep 2023 data are transformed into trip-speed dependent fuel consumption and emission factors for all vehicle categories and layers. The calculated fuel consumption in COPERT COPERT v5.7.1 – Sep 2023 must

equal the statistical fuel sale totals according to the UNFCCC and UNECE emissions reporting format. The statistical fuel sales for road transport are derived from the Statistics Lithuania.
For example, if a country has bulk fuel sold but does not have fuel use by vehicle type, they may allocate total fuel consumption across vehicle types based on the consumption patterns of their fleet (TRB's National Cooperative Highway Research Program (NCHRP) project report. Greenhouse Gas Emission Inventory Methodologies for State Transportation Departments). By applying a trial-and-error approach, it was possible to reach acceptable estimates of mileage. For each group, the emissions were estimated by combining vehicle type and annual mileage with hot emission factors, cold/hot ratios and evaporation factors.
Fuel was distributed to transport categories, types, ecology standards and driving modes according to mileage data taken from Institute of Transport and transport fleet data taken from Transport Registry.
Lubricant use in two-stroke engines amounts only to 0.72-1.44 TJ, consequently emissions do not exceed threshold of significance (10 kt), therefore emissions from lubricant use are considered as insignificant.

Lead (Pb) and other heavy metals emissions

Emissions of lead are estimated by assuming that 75 % of lead contained in the fuel is emitted into air. Then the equation is:

$$E_{Pb,j}^{CALC} = 0.75 \cdot k_{Pb,m} \cdot FC_{jm}^{CALC} . \qquad (2)$$

Where, $k_{Pb,m}$ – weight related lead content of gasoline (type m) in [kg/kg fuel]. The emission factor for lead is given in Table 2-6.

Table 2-6. Emission factor for lead, g/l

Fuel	1990	2003	2006	2010
Leaded Gasoline	0.15	-	-	-
Unleaded Gasoline	0.013	0.005	0.003	0.0001

With regard to the emission of other heavy metal species, emission factors provided correspond both to fuel content and engine wear. Therefore, it is considered that the total quantity is emitted to the atmosphere (no losses in the engine). Heavy metal emissions depend on metal content in fuel. Therefore, emissions were calculated according to consumed fuel. LPG doesn't contain heavy metal; therefore, there are no heavy metals emissions from road transport using LPG.

Table 3-7. Heavy metal emission factors for all vehicle categories in [mg/kg fuel]

Category	Cadmium	Copper	Chromium	Nickel	Selenium	Zinc
Road transport	0.01	1.7	0.05	0.07	0.01	1

Gasoline evaporation (NFR 1.A.3.b.v)

Gasoline evaporation emissions are estimated according to mileage of separate road transport categories consuming gasoline and number of vehicles consuming gasoline. Mileage of road transport categories was estimated according to statistical fuel consumption data and mileage data estimated by Institute of Transport.

Table 3-8. NMVOC emission factors for gasoline evaporation

	NMVOC emission factors	Units
Passenger cars		
Diurnal and hot soak emissions in summer	3642.00	g/vehicle
Diurnal and hot soak emissions in winter	4807.00	g/vehicle
Running losses in summer	0.022	g/km
Running losses in winter	0.006	g/km
Light duty vehicle		
Diurnal and hot soak emissions in summer	3642.00	g/vehicle
Diurnal and hot soak emissions in winter	4807.00	g/vehicle
Running losses in summer	0.022	g/km
Running losses in winter	0.006	g/km
Motorcycles		
Diurnal and hot soak emissions in summer	1457.00	g/vehicle
Diurnal and hot soak emissions in winter	1923.00	g/vehicle
Running losses in summer	0.009	g/km
Running losses in winter	0.002	g/km

Tyre, brake wear and road abrasion emissions (NFR 1.A.3.vi)

Tyre, brake wear and road abrasion emissions are estimated according to mileage of separate road transport categories. Mileage of road transport categories was estimated according to statistical fuel consumption data, fuel consumption factors calculated by COPERT COPERT v5.7.1 – Sep 2023 and mileage data estimated by Institute of Transport. The resulting mileage data (**Klaida! Nerastas nuorodos šaltinis.**) is used as activity rates for estimating tyre, brake wear and road abrasion emissions.

Table 3-9. Road transport mileage by categories, [km]

Category	Mileage, km
Passenger cars	7 502 454 100
Light duty vehicle	1 566 991 000
Heavy duty vehicle	1 887 711 951
Buses	752 344 000

Motorcycles	5 632 879
Mopeds	10 176 919

TSP, PM_{10} and heavy metal emission factors for tyre, brake wear and road abrasion were taken from COPERT COPERT v5.7.1 – Sep 2023 and reported in **Klaida! Nerastas nuorodos šaltinis.**1. $PM_{2.5}$ and PM_{10} emission factors were taken from EMEP/EEA 2019 and reported in **Klaida! Nerastas nuorodos šaltinis.**-**Klaida! Nerastas nuorodos šaltinis.**3-13.

Table 3-10. TSP emission factors for tyre. brake wear and road abrasion

Transport category	**Emission factor (g/km)**		
	Tyre wear	**Brake wear**	**Road abrasion**
Motorcycles	0.0028	0.0037	0.0030
Passenger cars	0.0064	0.0073	0.0075
Light duty vehicles	0.0101	0.0115	0.0075
Heavy duty vehicles and buses	0.0270	0.0320	0.0380

Table 3-11. PM_{10} emission factors for tyre, brake wear and road abrasion

Transport category	**Emission factor (g/km)**		
	Tyre wear	**Brake wear**	**Road abrasion**
Motorcycles	0.0028	0.0020	0.0030
Passenger cars	0.0064	0.0033	0.0075
Light duty vehicles	0.0101	0.0052	0.0075
Heavy duty vehicles and buses	0.0270	0.0130	0.0380

Table 3-12. PM2.5 emission factors for tyre, brake wear and road abrasion

Transport category	**Emission factor (g/km)**		
	Tyre wear	**Brake wear**	**Road abrasion**
Motorcycles	0.0001	0.0003	0.0016
Passenger cars	0.0003	0.0022	0.0042
Light duty vehicles	0.0003	0.0022	0.0042
Heavy duty vehicles and buses	0.0020	0.0071	0.0209

Table 3-13. Heavy metal fraction of tyre, brake wear and road abrasion TSP emission

Heavy metal	**Tyre wear [mg/kg TSP]**	**Brake wear [mg/kg TSP]**	**Road abrasion [mg/kg TSP]**
As	0.8	10.0	0
Cd	2.6	13.2	1
Cr	12.4	669	40
Cu	174	51112	12
Ni	33.6	463	20
Pb	107	3126	15
Zn	7434	8676	35

Uncertainties and time-series consistency

Expert judgement suggests that the uncertainty of the activity data is approximately ±5%. The primary source of uncertainty is the activity data rather than emission factors.

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.

Source-specific recalculations

No source specific recalculations.

Source-specific planned improvements

No source-specific improvements.

3.3. Railways (NFR 1.A.3.c)

Source category description

In 2022, the operational length of railways amounted to 1,919.2 km. The length of electrified lines remained unchanged (152.4 km). Emissions from producing electricity used in electric trains are not included in this category, but in category 1.A.1. Lithuanian Railways (lithuanian: "Lietuvos Geležinkeliai") is the national, state-owned railway company of Lithuania. Lithuanian's trains operate frequent services across the whole of Lithuania. In 2022, goods transport by rail amounted to 30.9 million tonnes. National goods transport by rail amounted to 13.8 million tonnes. LTG Cargo, the freight transportation company of the state-owned Lietuvos Geležinkelių (LTG) group, has stopped the movement of all wagons to Belarus and Russia, as well as their transit through these countries in 2022 March.

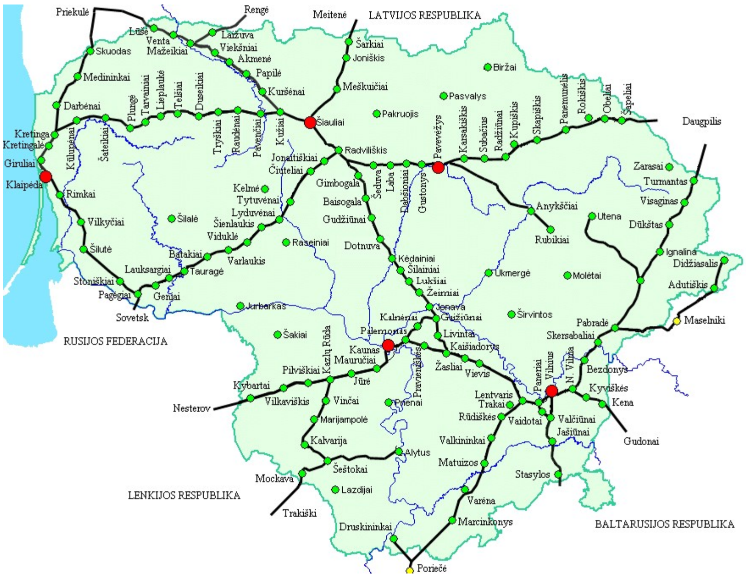


Figure 3-12. Map of Lithuanian railways

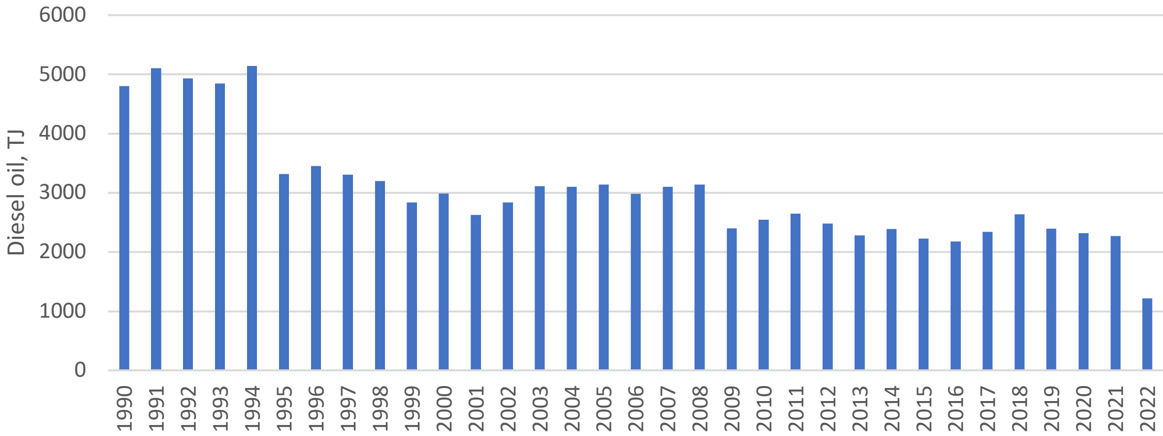


Figure 3-13. Fuel consumption in Railway 1.A.3.c sector

Trend in emissions (kt) is provided in Table 2-14 below.

Table 3-14. Trend (%) of 1.A.3c emissions (kt)

	NOx (as NO2)	NMVOC	SOx (as SO2)	NH3	PM2.5	PM10	TSP	BC	CO
1990	5.88	0.52	0.04	0.00	0.15	0.16	0.17	0.00	1.20
1991	6.24	0.55	0.05	0.00	0.16	0.17	0.18	0.00	1.27
1992	6.03	0.54	0.05	0.00	0.16	0.17	0.17	0.00	1.23
1993	5.93	0.53	0.05	0.00	0.16	0.16	0.17	0.00	1.21
1994	6.29	0.56	0.05	0.00	0.16	0.17	0.18	0.00	1.29
1995	4.06	0.36	0.03	0.00	0.11	0.11	0.12	0.00	0.83

1996	4.22	0.37	0.03	0.00	0.11	0.12	0.12	0.00	0.86
1997	4.07	0.36	0.03	0.00	0.11	0.11	0.12	0.00	0.83
1998	3.95	0.35	0.03	0.00	0.10	0.11	0.11	0.00	0.81
1999	3.50	0.31	0.03	0.00	0.09	0.10	0.10	0.00	0.71
2000	3.66	0.32	0.02	0.00	0.10	0.10	0.11	0.00	0.75
2001	3.22	0.29	0.02	0.00	0.08	0.09	0.09	0.00	0.66
2002	3.47	0.31	0.02	0.00	0.09	0.10	0.10	0.00	0.71
2003	3.81	0.34	0.02	0.00	0.10	0.10	0.11	0.00	0.78
2004	3.79	0.34	0.02	0.00	0.10	0.10	0.11	0.00	0.77
2005	3.84	0.34	0.00	0.00	0.10	0.11	0.11	0.00	0.78
2006	3.66	0.32	0.00	0.00	0.10	0.10	0.11	0.00	0.75
2007	3.77	0.33	0.00	0.00	0.10	0.10	0.11	0.00	0.77
2008	3.81	0.34	0.00	0.00	0.10	0.10	0.11	0.00	0.78
2009	2.92	0.26	0.00	0.00	0.08	0.08	0.08	0.00	0.60
2010	3.09	0.27	0.00	0.00	0.08	0.08	0.09	0.00	0.63
2011	3.22	0.29	0.00	0.00	0.08	0.09	0.09	0.00	0.66
2012	3.03	0.27	0.00	0.00	0.08	0.08	0.09	0.00	0.62
2013	2.79	0.25	0.00	0.00	0.07	0.08	0.08	0.00	0.57
2014	2.92	0.26	0.00	0.00	0.08	0.08	0.08	0.00	0.60
2015	2.74	0.24	0.00	0.00	0.07	0.08	0.08	0.00	0.56
2016	2.65	0.24	0.00	0.00	0.07	0.07	0.08	0.00	0.54
2017	2.85	0.25	0.00	0.00	0.07	0.08	0.08	0.00	0.58
2018	3.21	0.28	0.00	0.00	0.08	0.09	0.09	0.00	0.66
2019	2.91	0.26	0.00	0.00	0.08	0.08	0.08	0.00	0.59
2020	2.82	0.25	0.00	0.00	0.07	0.08	0.08	0.00	0.58
2021	2.76	0.24	0.00	0.00	0.07	0.08	0.08	0.00	0.56
2022	1.61	0.13	0.00	0.00	0.03	0.05	0.05	0.00	0.45
Change, % 1990/2022	**-73%**	**-76%**	**-99%**	**-46.31%**	**-80%**	**-80%**	**-80%**	**-62%**	**-62%**
Change, % 2005/2022	**-65%**	**-63%**	**-92%**	**-64%**	**-64%**	**-64%**	**-64%**	**-64%**	**-64%**

Methodological issues

The Tier 2 approach is based on apportioning the total fuel used by railways to that used by different generic locomotive technology types as the measure of activity. It assumes that the fuel can be apportion for example using statistics on the number of locomotives, categorized by type, and their average usage, e.g. from locomotive maintenance records.
For this approach the algorithm used is:

$$E_i = \sum_m \sum_j (FC_{j,m} \times EF_{i,j,m})$$

Where *Ei* - mass of emissions of pollutant *i* during inventory period; *FC* - fuel consumption; *EFi* - average emissions of pollutant *i* per unit of fuel used.

EFi,j,m - emission factor of pollutant *I* for each unit of fuel type *m* used by category *j* (kg/tonnes)

m – fuel type (diesel, gas oil)

j - locomotive category (shunting, rail car, line haul).

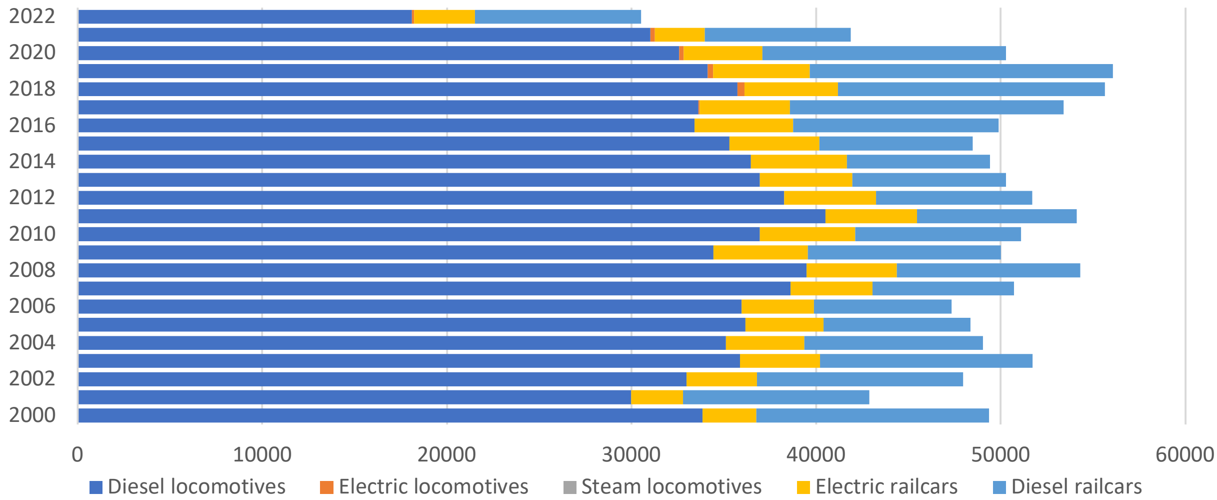


Figure 3-14. Trains technology, thous. km, 2000-2022

Emissions were estimated using fuel statistics from Statistics Lithuania. Tier 2 emission factors were taken from 2016 EMEP/EEA Guidebook 1.A.3.c category. While several EFs based on sulphur content in the fuel were used: for the 1990-2000 period 400 g Sulphur/Mg of fuel consumed, 2000-2005 – 300 g/Mg, 2005-2009 – 40 g/Mg and 8 g/Mg for every year from 2009. The following Guidebook-provided equation was used to estimate SOx emissions:

$$Emission_{SOx} = 2 \times Fuel\ consumed\ (Gg)_{Diesel} \times Sulphur\ content\ (Gg\ of\ S\ per\ Gg\ of\ diesel)$$

Fuel consumption in the railways transport decreased 75% from 1990 to 2022, similar drop change occurred in the amounts of emissions, 2005/2022 emissions. SOx emissions decreased by 99.0% and 92% from 1990 to 2022 and from 2005 to 2022, respectively.

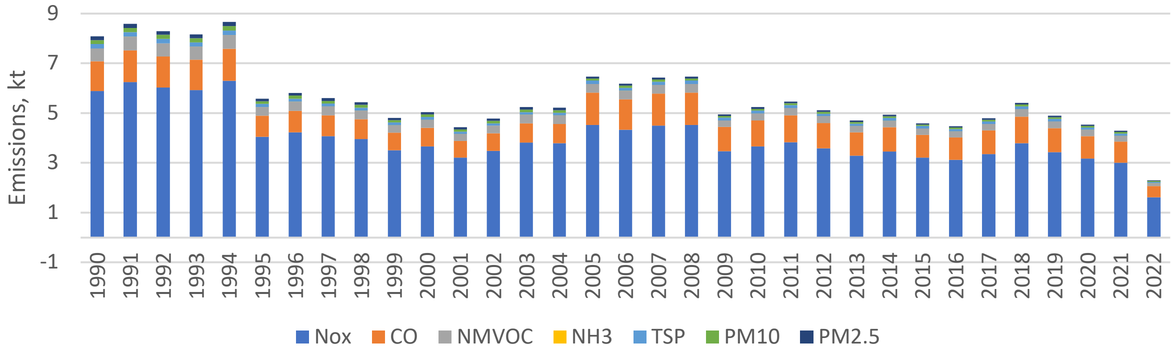


Figure 3-15. Pollutant emissions in sector 1.A.3.c

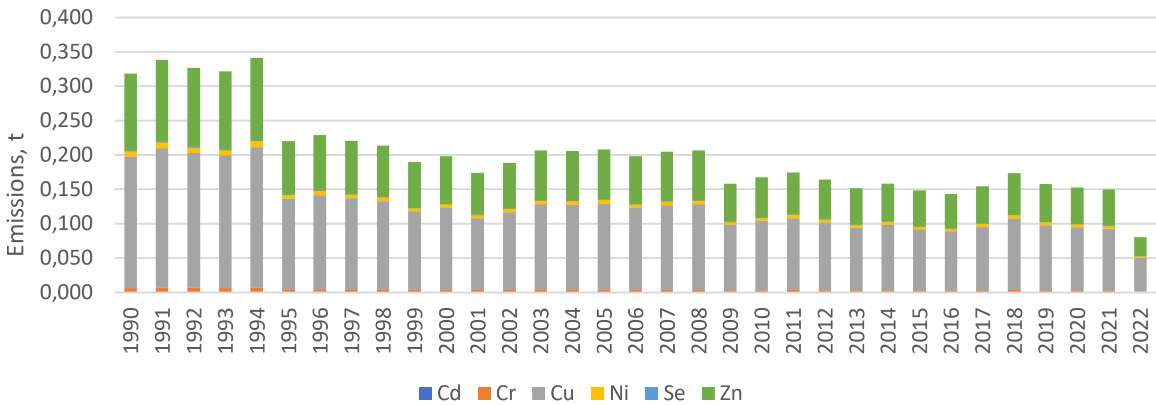


Figure 3-16. Heavy metals emissions in sector 1.A.3.c

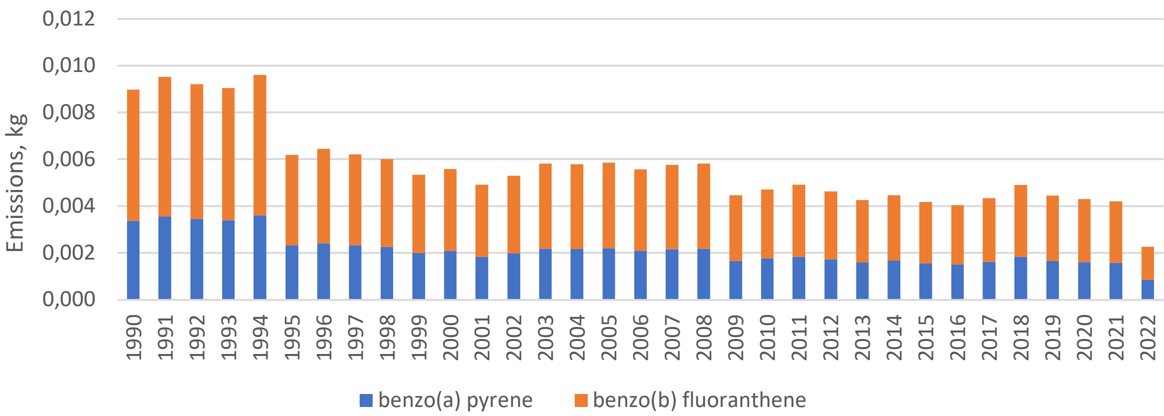


Figure 3-17. PAHs emissions in sector 1.A.3.c

B(k)f & Indeno (1,2,3-cd) pyrene and dioxins emission factor values are not available for railway emissions. It is therefore recommended to use values corresponding to old technology heavy duty vehicles from the Exhaust Emissions from Road Transport chapter (1.A.3.b.iii), BC fraction of PM (f-BC): 0.53.

Uncertainties and time-series consistency

The uncertainty in activity data is 2%. The EF in table above provide ranges indicating the uncertainties associated with diesel fuel. In the absence of specific information, the percentage relationship between the upper and lower limiting values and the central estimate may be used to derive default uncertainty ranges associated with emission factors for additives.

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.

Source-specific planned improvements

No source-specific improvements.

Source-specific recalculations

No recalculations were done.

3.4. National navigation (shipping) (NFR 1.A.3.d)

Source category description

There are 921 km of inland waterways of national importance of the Republic of Lithuania, 464 km of them are being operated. In 1997 the Republic of Lithuania signed European Agreement on Main Inland Waterways of International Importance (AGN agreement), according to which inland waterways of the

River Nemunas and the Curonian Lagoon from Kaunas to Klaipeda are inland waterway of international importance E41 (the length – 291.2 km).

Figure 2-18 Operated inland waterways of national importance of the republic of Lithuania

All navigation period along the E41way there has to be maintained indicators as it is defined by waterways network main standards and parameters description TRANS / SC.3 / 144 of the United Nations Economic Commission. For the E41 waterway section from Klaipėda to Jurbarkas there are set these measurements: length of vessel – 100 m, beam – 10 m, depth of the waterway – 1,5 m (draught not more than 1.3 m); for the section from Jurbarkas to Kaunas: length of vessel – 100m, beam – 10m, depth of waterway – 1,2m (draught not more than 1,00m). Trends of emissions (kt) is provided in Table 3-15 below.

Table 3-15. Trend (%) of 1.A.3.d emissions (kt)

	NOX	NMLOJ	Sox	NH3	PM2.5	PM10	TSP	BC	CO
1990	0.190	0.0139	0.028	3.470-6	0.007	0.007	0.007	0.002	0.0367
1995	0.038	0.003	0.005	0.000	0.001	0.001	0.001	0.000	0.007
2000	0.110	0.008	0.014	0.000	0.004	0.004	0.004	0.001	0.021
2005	0.206	0.015	0.027	0.000	0.008	0.008	0.008	0.002	0.040
2006	0.234	0.017	0.012	0.000	0.009	0.009	0.009	0.003	0.045
2007	0.219	0.016	0.011	0.000	0.008	0.009	0.009	0.002	0.042
2008	0.232	0.017	0.006	0.000	0.008	0.009	0.009	0.003	0.045
2009	0.202	0.015	0.005	0.000	0.007	0.008	0.008	0.002	0.039
2010	0.243	0.018	0.006	0.000	0.009	0.009	0.009	0.003	0.047
2011	0.201	0.015	0.005	0.000	0.007	0.008	0.008	0.002	0.039
2012	0.184	0.013	0.005	0.000	0.007	0.007	0.007	0.002	0.035
2013	0.176	0.013	0.005	0.000	0.006	0.007	0.007	0.002	0.034
2014	0.178	0.013	0.005	0.000	0.007	0.007	0.007	0.002	0.034
2015	0.168	0.012	0.004	0.000	0.006	0.007	0.007	0.002	0.032
2016	0.162	0.012	0.004	0.000	0.006	0.006	0.006	0.002	0.031
2017	0.208	0.015	0.005	0.000	0.008	0.008	0.008	0.002	0.040

2018	0.181	0.013	0.005	0.000	0.007	0.007	0.007	0.002	0.035
2019	0.198	0.014	0.005	0.000	0.007	0.008	0.008	0.002	0.038
2020	0.142	0.010	0.004	0.000	0.005	0.006	0.006	0.002	0.027
2021	0.151	0.011	0.004	0.000	0.006	0.006	0.006	0.002	0.029
2022	0.118	0.009	0.003	0.000	0.004	0.005	0.005	0.001	0.023
1990/2022	**-37.87%**	**-37.87%**	**-87.57%**	**-37.87%**	**-37.87%**	**-37.87%**	**-37.87%**	**-37.87%**	**-37.87%**
2005/2022	**-42.61%**	**-42.61%**	**-88.52%**	**-42.61%**	**-42.61%**	**-42.61%**	**-42.61%**	**-42.61%**	**-42.61%**
2021/2022	**-21.89%**	**-21.89%**	**-21.89%**	**-21.89%**	**-21.89%**	**-21.89%**	**-21.89%**	**-21.89%**	**-21.89%**

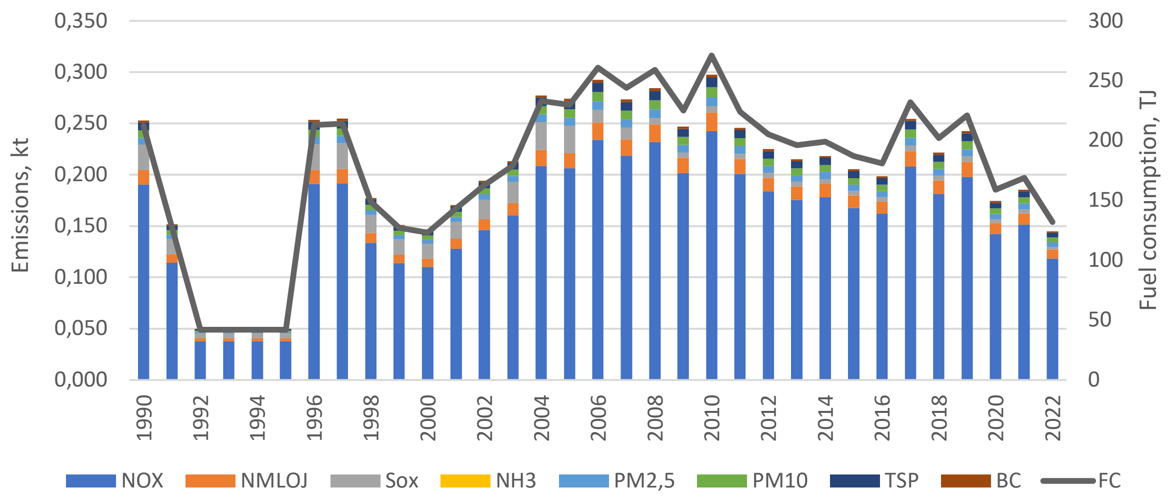


Figure 3-21. Pollutant emissions and fuel consumption in sector 1.A.3.d.ii

As seen in Figure fuel consumption decreased by 34 % between 2005 and 2022. This decrease is obviously due to the impact of the decreased fuel consumption in inland waterways.

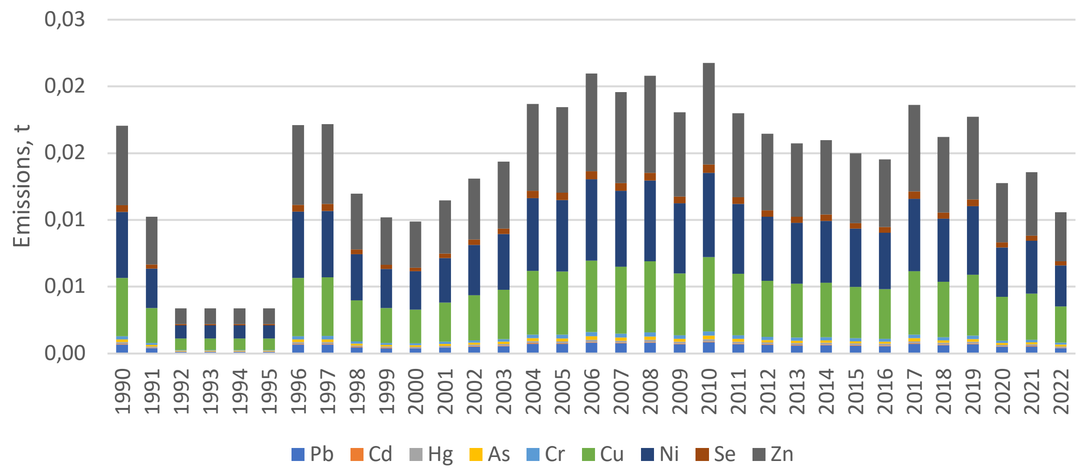


Figure 3-19. Heavy metal emissions in sector 1.A.3.d.ii

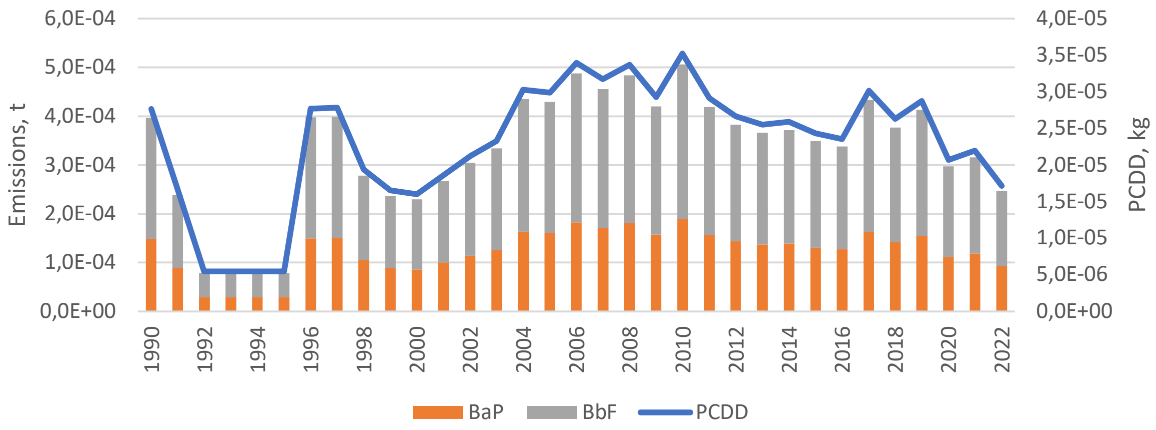


Figure 3-20. PAHs emissions in sector 1.A.3.d.ii

Methodological issues

Emissions were calculated according to EEA emission guidebook 2013 methodology Tier 1 approach.

A simple methodology for estimating emissions is based on total fuel consumption data. which have to be multiplied by appropriate emission factors. Therefore, the equation to be applied in this case is:

$$E_i = FC \times EF_i$$

were E_i - mass of emissions of pollutant *i* during inventory period; *FC* - fuel consumption; EF_i - average emissions of pollutant *i* per unit of fuel used.

Uncertainties and time-series consistency

Entec (2002) provides estimates of uncertainties for emission factors as indicated in the Table below.

Table 3-16 Estimated uncertainties given as percentage related to the emission factor parameter

	At sea	**Maneuvering**	**In port**
NOx	±20%	±40%	±30%
SOx	±10%	±30%	±20%
NMVOC	±25%	±50%	±40%
PM	±25%	±50%	±40%
Fuel Consumption	±10%	±30%	±20%

The uncertainty in activity data is 2%. The EF in table above provide ranges indicating the uncertainties associated with gasoil fuel. In the absence of specific information, the percentage relationship between the upper and lower limiting values and the central estimate may be used to derive default uncertainty ranges associated with emission factors for additives.

Source-specific planned improvements

No source-specific improvements.

Source-specific recalculations

No recalculations were done in this submission.

3.5. Pipelines (NFR 1.A.3.e)

Source category description

In Lithuania, natural gas is transported via gas transmission and distribution systems. Statistics Lithuania started collecting data on consumption of natural gas used for gas transportation in pipeline compressor stations from 2001.

JSC "Lietuvos Dujos" is the operator of Lithuania's natural gas transmission system in charge of the safe operation, maintenance and development of the system. The transmission system is comprised of gas transmission pipelines, gas compressor stations, gas metering and distribution stations (**Klaida! Nerastas nuorodos šaltinis.**).

Table 3-2 Lithuanian natural gas transmission system

Gas transmission pipelines	Gas distribution stations	Gas metering stations	Gas compressor stations
1.9 thous. km	65 stations	3 stations	2 stations

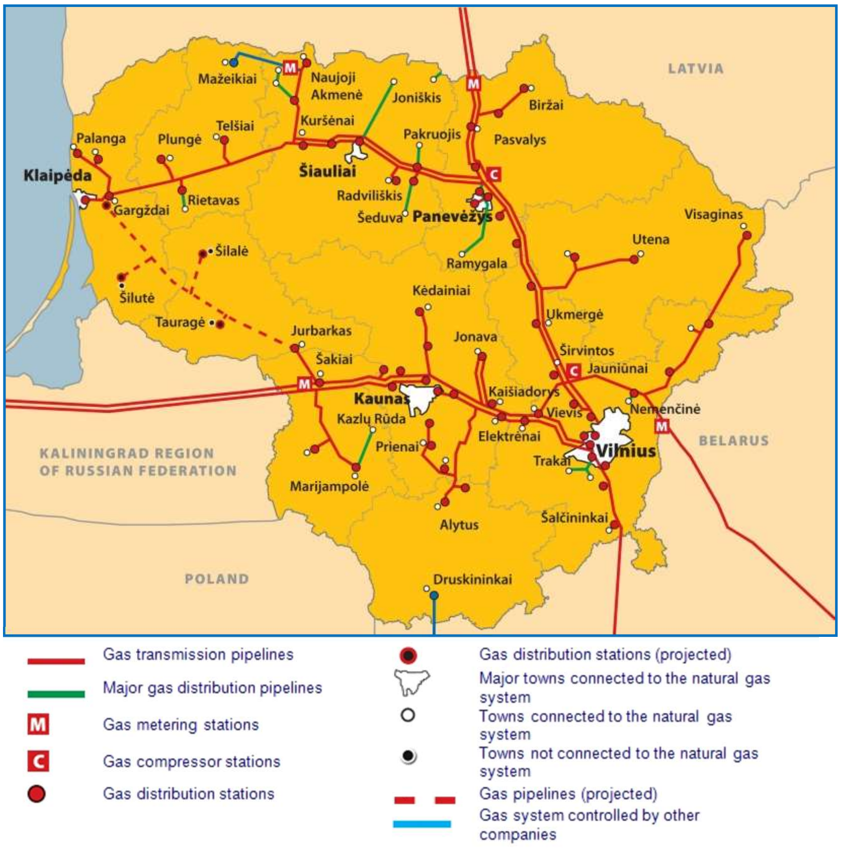


Figure 3-21. Gas distribution network in Lithuania

Transport via pipelines includes transport of gases via pipelines.

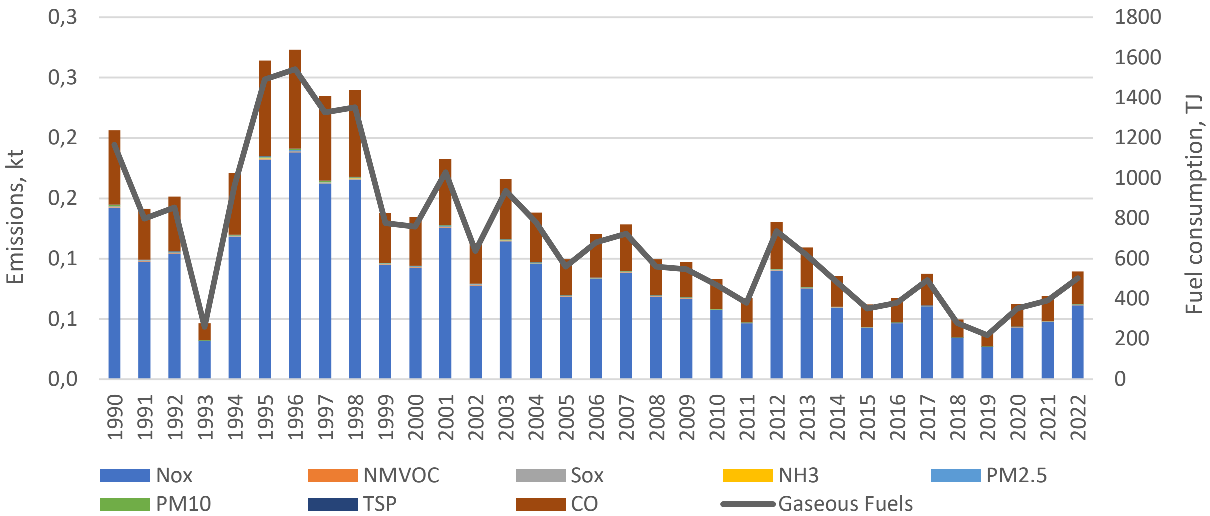


Figure 3-22. Pollutant emissions and fuel consumption in sector 1.A.3.e.i

Methodological issues

Statistics Lithuania has started collecting data on consumption of natural gas used for gas transportation in pipeline compressor stations from 2001. For the period prior to 2001 data on use of natural gas for transmission are not available.

The surrogate method to estimate unavailable data during 1990-2000 was used since the extrapolation approaches should not be done to long periods and inconsistent trend. To evaluate more accurate relationships the regression analysis was developed by relating emissions to more than one statistical parameter. The relationship between gas pipeline emissions and surrogate data was developed on the basis of underlying activity data during multiple years. $PM_{2.5}$ and PM_{10} emissions were calculated as $TSP=PM_{10}=PM_{2.5}$.

Uncertainties and time-series consistency

The uncertainty in activity data (fuel use) is 5%.

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.

Source-specific planned improvements

No source-specific improvements.

Source-specific recalculations

No recalculations were done.

3.6. NON-ROAD MOBILE SOURCES (1.A.4.aii-cii(iii), 1.A.5.b)

Source category description

This chapter covers several mobile sources. More specifically, the types of equipment covered in this chapter are included in the following NFR categories:

- Commercial and institutional mobile machinery (NFR 1.A.4.a.ii);
- Mobile combustion used in residential areas: household and gardening mobile machinery (NFR 1.A.4.b ii);
- Off-road vehicles and other machinery used in agriculture/forestry mobile machinery (excluding fishing) (NFR 1.A.4.c ii);
- Fishing (NFR 1.A.4.c iii);
- Mobile combustion in manufacturing industries and construction (NFR 1.A.2.g vii);
- Other mobile including military mobile machinery (NFR 1.A.5.b);

All these mobile sources are aggregated in one chapter because each of these sectors have minor importance into total emissions.

Methodological issues

This sector covers a mixture of equipment which is distributed across a wide range of sectors, typically land based, and is commonly referred to collectively as “Non-Road Mobile Machinery” (NRMM). Despite this diversity there is the common theme that all the equipment covered uses reciprocating engines, fueled with liquid hydrocarbon-based fuels. They comprise both diesel- (compression ignition), petrol- and LPG- (spark ignition) engine machinery. The diesel engines range from large diesel engines >200 kW (installed in cranes, graders/scrapers, bulldozers, etc.) to small diesel engines, around 5 kW, fitted to household and gardening equipment (e.g. lawn and garden tractors, leaf blowers, etc.).

Data on fuel consumption by off-road vehicles and machinery in industry, construction, agriculture, fishery, forestry and residential zones are not collected separately and provided in statistical reports but included in overall fuel consumption by separate sectors (industry, construction, agriculture, fishery, commercial and public services). Consumption of motor gasoline and diesel oil in these sectors as shown in energy balances provided by the Statistics Lithuania actually should be assigned to consumption by off-road machinery. Therefore, consumption of motor gasoline and diesel oil can be separated from other fuels and emissions caused by off-road vehicles can be calculated from these data. Off-road machinery engine on diesel oil provide better fuel efficiency, excellent oxidation resistance, higher engine reliability. In this reason dieselization from about 1999 occurred.

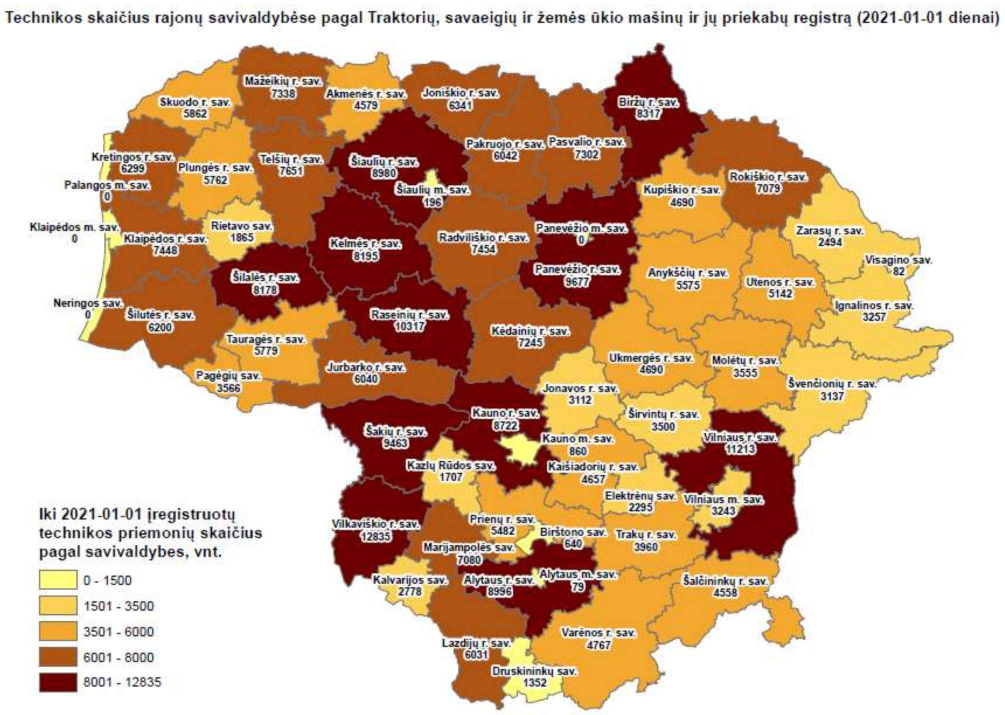
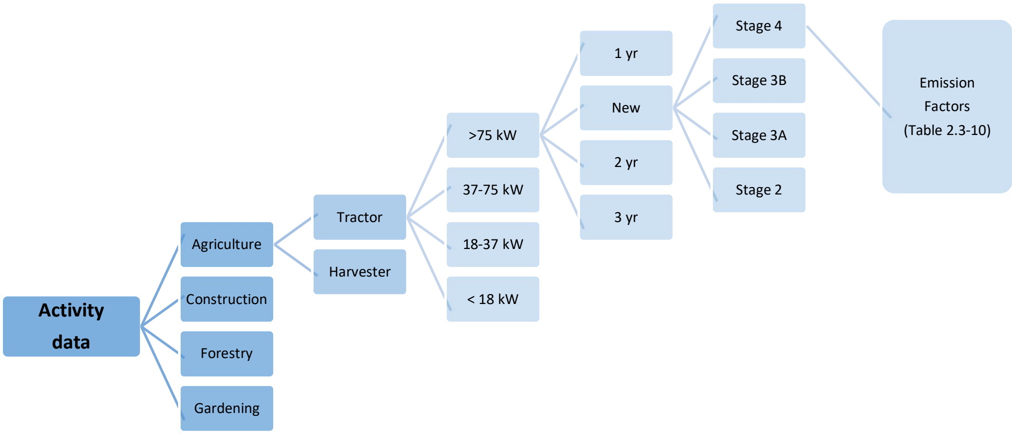


Figure 3-23. Number of off-road vehicles in 2020 (State Enterprise Agricultural Information and Rural Business Center)

The vehicles were distributed by age and engine type.



EFs were applied provided for Tier 2 in EMEP/EEA Emission Guidebook (2019).

Table 3-8. Tier 2 EF for off-road machinery (diesel) 1.A.4.a ii

Technology										
Pollutant	**Units**	**< 1981**	**1981-1990**	**1991-Stage I**	**Stage I**	**Stage II**	**Stage IIIA**	**Stage IIIB**	**Stage IV**	**Stage V**
BC	g/toes fuel	3414	2369	2001	800	825	758	78	78	56
CH_4	g/tons fuel	199	171	144	42	39	36	15	13	23
CO	g/tons fuel	20690	18890	16258	6639	7135	6826	6445	6019	7352
CO_2	kg/tons fuel	3160	3160	3160	3160	3160	3160	3160	3160	3160
N_2O	g/tons fuel	121	128	135	137	136	136	137	137	136
NH_3	g/tons fuel	7	7	8	8	8	8	8	8	8
NMVOC	g/tons fuel	8077	6962	5851	1725	1587	1470	625	536	930
NOx	g/tons fuel	26552	33942	43552	31077	22101	15653	11933	1570	7663
PM_{10}	g/tons fuel	6207	4308	3642	1005	1034	950	98	98	116

$PM_{2.5}$	g/tons fuel	6207	4308	3642	1005	1034	950	98	98	116
TSP	g/tons fuel	6207	4308	3642	1005	1034	950	98	98	116

Table 3-19. Tier 2 EF for off-road machinery (Diesel oil) 1.A.c ii

Technology										
Pollutant	**Units**	**< 1981**	**1981-1990**	**1991-Stage I**	**Stage I**	**Stage II**	**Stage IIIA**	**Stage IIIB**	**Stage IV**	**Stage V**
BC	g/tons fuel	3221	2221	1074	727	483	416	74	73	9
CH_4	g/tons fuel	191	158	110	38	29	29	29	13	13
CO	g/tons fuel	19804	17566	14147	6463	6104	6035	6087	6024	6077
CO_2	*kg/tons fuel*	*3160*	*3160*	*3160*	*3160*	*3160*	*3160*	*3160*	*3160*	*3160*
N_2O	g/tons fuel	122	129	137	138	138	139	139	139	139
NH_3	g/tons fuel	7	7	8	8	8	8	8	8	8
NMVOC	g/tons fuel	7760	6439	4493	1544	1181	1173	544	530	526
NOx	g/tons fuel	29901	37383	49002	30799	20612	12921	9318	1587	1861
PM_{10}	g/tons fuel	5861	5861	5861	5861	5861	5861	5861	5861	5861
$PM_{2.5}$	g/tons fuel	5861	5861	5861	5861	5861	5861	5861	5861	5861
TSP	g/tons fuel	5861	5861	5861	5861	5861	5861	5861	5861	5861

Table 3-20. Tier 2 EF for off-road machinery 1.A.4.a ii, 1.A.4.b ii, 1.A.4.c ii (Gasoline: two-stroke)

Technology										
Pollutant	**Units**	**< 1981**	**1981-1990**	**1991-Stage I**	**Stage I**	**Stage II**	**Stage IIIA**	**Stage IIIB**	**Stage IV**	**Stage V**
BC	g/tons fuel	352	239	193	184	215	215	215	215	214
CH_4	g/tons fuel	22483	19462	17284	16979	8517	8517	8517	8517	8539
CO	g/tons fuel	754523	699494	621083	620519	695237	695237	695237	695237	694870

CO_2	kg/tons fuel	3197	3197	3197	3197	3197	3197	3197	3197	3197
N_2O	g/tons fuel	12	16	16	18	20	20	20	20	20
NH_3	g/tons fuel	2	3	3	4	4	4	4	4	4
NMVOC	g/tons fuel	298703	258562	229630	225579	113157	113157	113157	113157	111450
NOx	g/tons fuel	1050	1682	1852	3445	2495	2495	2495	2495	2490
PM10	g/tons fuel	7037	4786	3869	3683	4299	4299	4299	4299	4278
PM2.5	g/tons fuel	7037	4786	3869	3683	4299	4299	4299	4299	4278
TSP	g/tons fuel	7037	4786	3869	3683	4299	4299	4299	4299	4278

Table 3-21. Tier 2 EF for off-road machinery 1.A.4.a ii, 1.A.4.b ii, 1.A.4.c ii (gasoline: four-stroke)

Technology										
Pollutant	**Units**	**< 1981**	**1981-1990**	**1991-Stage I**	**Stage I**	**Stage II**	**Stage IIIA**	**Stage IIIB**	**Stage IV**	**Stage V**
BC	g/tons fuel	7	7	8	8	8	8	8	8	8
CH_4	g/tons fuel	710	910	672	650	568	568	568	568	468
CO	g/tons fuel	1214855	836966	768445	774457	804157	804157	804157	804157	778282
CO_2	kg/tons fuel	3197	3197	3197	3197	3197	3197	3197	3197	3197
N_2O	g/tons fuel	56	55	59	59	60	60	60	60	59
NH_3	g/tons fuel	4	4	4	4	4	4	4	4	4
NMVOC	g/tons fuel	20182	25852	19082	18469	16126	16126	16126	16126	13293
NOx	g/tons fuel	2429	5743	7129	7088	6676	6676	6676	6676	5354
PM_{10}	g/tons fuel	148	147	157	159	159	159	159	159	159
$PM_{2.5}$	g/tons fuel	148	147	157	159	159	159	159	159	159
TSP	g/tons fuel	148	147	157	159	159	159	159	159	159

Table 3-22. Tier 2 HM and POP EFs for off-road machinery 1.A.4.a ii, 1.A.4.b ii, 1.A.4.c ii

		Diesel	**Gasoline**
Pollutant	**Units**	**Emission factor**	
Cadmium	mg/kg fuel	0.010	0.010
Copper	mg/ kg fuel	1.70	1.70
Chromium	mg/ kg fuel	0.050	0.050
Nickel	mg/ kg fuel	0.07	0.07
Selenium	mg/ kg fuel	0.01	0.01
Zinc	mg/ kg fuel	1.00	1.00
Benz(a)anthracene	µg/kg fuel	80	75
Benzo(b)fluoranthene	µg/kg fuel	50	40
Dibenzo(a,h)anthracene	µg/kg fuel	10	10
Benzo(a)pyrene	µg/kg fuel	30	40
Chrysene	µg/kg fuel	200	150
Fluoranthene	µg/kg fuel	450	450
Phenanthene	µg/kg fuel	2500	1200

BC: For agriculture, forestry, industry and gasoline/LPG machinery, the following BC fractions of PM (f-BC) are used: 0.57, 0.65, 0.62 and 0.05.

SO2: The emissions of SO2 are estimated by assuming that all Sulphur in the fuel is transformed completely into SO2 using the formula:

$$E_{SO2} = 2\ \Sigma k_{S,l}\, b_{j,l}$$

where

$k_{S,l}$ = weight related Sulphur content of fuel of type [kg/kg],

$b_{j,l}$ = total annual consumption of fuel of type *l* in [kg] by source category *j*.

Table 3-23. Sulphur content of fuel (by weight)

NFR	**Fuel**	**1990**	**2000**	**2001**	**2003**	**2004**	**2005**	**2006**	**2009**	**2010 -**
1A2gvii	Gasoline	0.10 %	0.10 %	0.05 %	0.015 %	0.013 %	0.005 %	0.002 %	0.002 %	0.002 %
1A4aii 1A4bii	Diesel	0.50 %	0.50 %	0.05 %	0.035 %	0.030 %	0.005 %	0.004 %	0.002 %	0.002 %
1A4ciii 1A4cii	Light fuel oil	0.50 %	0.20 %	0.20 %	0.20%	0.20%	0.20%	0.20%	0.20%	0.10%

Table 3-24. Sulphur content and SO_2 EFs used in Off-road sector

	199	**199**	**199**	**199**	**199**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**201**	**201**	**201**	**201**	**201**	**201**
Diesel													0.2								0.1
Gasoline	0.015										0.02			0.01							0.0005

Notes:
Gasoline, diesel oil – EU legislation

Lead: Pb emissions are estimated according to the calculation that 75% of lead contained in gasoline is emitted into the air. Equation:

$$E_{Pb} = 0.75 \times k \times FC$$

where
E_{Pb} – Pb emissions;
k – weight-related lead content of gasoline (kg/kg);
FC – fuel consumption.

Table 3-25. Lead content in gasoline (g/l)

Fuel	**Leaded gasoline**	**Unleaded gasoline**
1990	0.15	0.013
2003	-	0.005
2006	-	0.003
2010	-	0.0001

Data need be used to split the total fuel consumption into engine technology layers for each following year starting from 2013 inventory year as Country specific data available only from 2013.

Table 3-26. Average year specific fuel consumption (%) per engine age and inventory year for diesel-fueled non-road machinery in 1.A.4.a.ii and 1.A.2.g ii

	2013	**2014**	**2015**	**2016**	**2017-2022**
<1981	0	0	0	0	0
1981-1990	0	0	0	0	0
1991-Stage I	5	4	3	3	3
Stage I	0	0	0	0	0
Stage II	29	18	7	4	3
Stage IIIA	58	62	66	60	52
Stage IIIB	8	16	24	25	27
Stage IV	0	0	1	8	15
Stage V	0	0	0	0	0

Table 3-27. Average year specific fuel consumption (%) per engine age and inventory year for diesel-fueled non-road machinery in 1.A.4.c.ii

	2013	**2014**	**2015**	**2016**	**2017-2022**
<1981	0	0	0	0	0
1981-1990	0	0	0	0	0
1991-Stage I	42	36	31	26	22

Stage I	9	10	10	10	9
Stage II	18	18	18	19	19
Stage IIIA	24	24	24	24	24
Stage IIIB	7	12	14	14	14
Stage IV	0	0	4	10	16
Stage V	0	0	0	0	0

Table 3-28. Average year specific fuel consumption (%) per engine age and inventory year for diesel-fueled non-road machinery in 1.A.2.g.vii

	2013	2014	2015	2016	2017-2022
<1981	0	0	0	0	0
1981-1990	0	0	0	0	0
1991-Stage I	5	4	3	3	3
Stage I	0	0	0	0	0
Stage II	29	18	7	4	3
Stage IIIA	58	62	66	60	52
Stage IIIB	8	16	24	25	27
Stage IV	0	0	1	8	15
Stage V	0	0	0	0	0

Table 3-29. Average year specific fuel consumption (%) per engine age and inventory year for 2-stroke motor gasoline-fueled non-road machinery in 1.A.4.a.ii, 1.A.4.b.ii and 1.A.4.c.ii

	2013	2014	2015	2016	2017-2022
1981-1990	0	0	0	0	0
1991-Stage I	10	0	0	0	0
Stage I	27	27	18	8	0
Stage II	63	73	82	92	100
Stage V	0	0	0	0	0

Table 3-30. Average year specific fuel consumption (%) per engine age and inventory year for 4-stroke motor gasoline-fueled non-road machinery in 1.A.4.a.ii, 1.A.4.b.ii and 1.A.4.c.ii

	2013	2014	2015	2016	2017-2022
1981-1990	0	0	0	0	0
1991-Stage I	25	17	8	0	0
Stage I	23	22	18	18	9
Stage II	52	61	74	82	91
Stage V	0	0	0	0	0

Emissions 1.A.4.a.ii

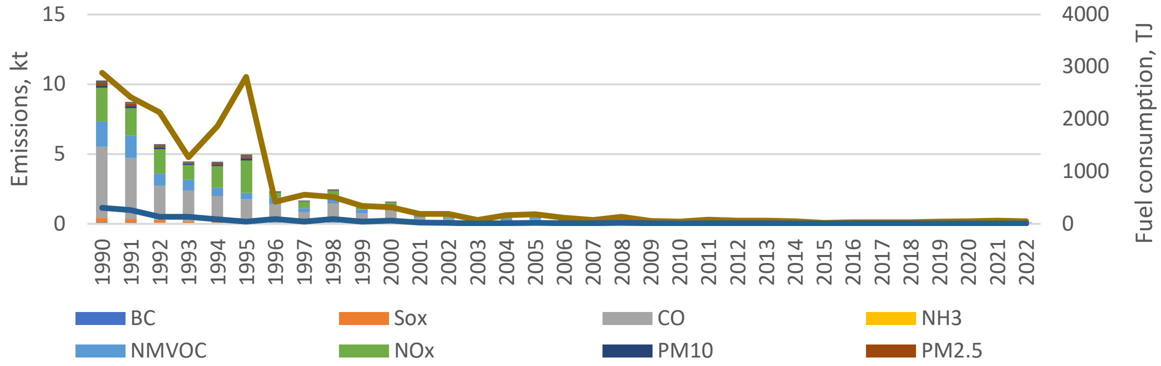


Figure 0-24 Pollutant emissions and fuel consumption in sector 1.A.4.a.ii

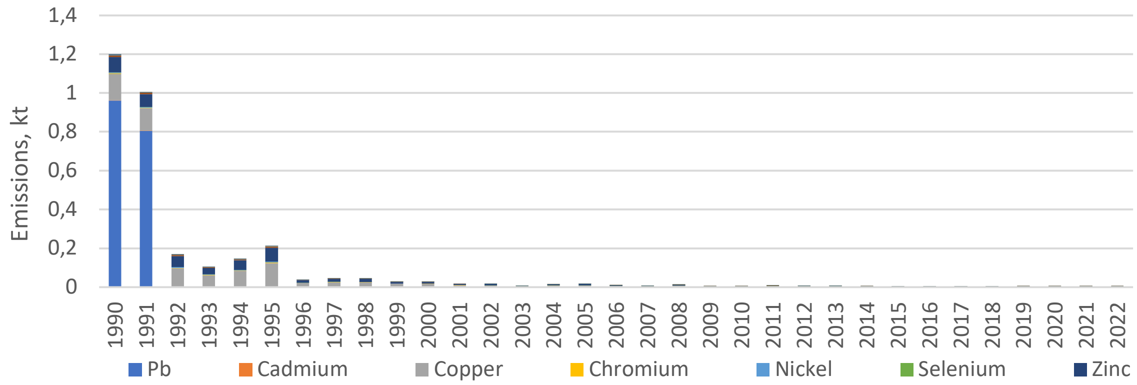


Figure 0-25 Heavy metal and PAHs emissions in sector 1.A.4.a.ii

Table 3-31. Trends of emissions 1.A.4.a ii (kt), %

	BC	CO	NH3	NMVOC	NOx	PM10	PM2.5	TSP
1990	0.096	5.126	0.001	1.835	2.390	0.179	0.170	0.179
1995	0.095	1.380	0.001	0.465	2.303	0.152	0.143	0.152
2000	0.014	0.904	0.000	0.326	0.265	0.022	0.021	0.022
2005	0.007	0.318	0.000	0.114	0.154	0.011	0.011	0.011
2010	0.002	0.110	0.000	0.040	0.033	0.003	0.003	0.003
2011	0.003	0.162	0.000	0.058	0.065	0.005	0.005	0.005
2012	0.003	0.172	0.000	0.062	0.052	0.004	0.004	0.004
2013	0.001	0.163	0.000	0.038	0.024	0.002	0.002	0.002
2014	0.001	0.115	0.000	0.024	0.018	0.001	0.001	0.001
2015	0.000	0.096	0.000	0.018	0.006	0.001	0.001	0.001
2016	0.000	0.067	0.000	0.012	0.010	0.001	0.001	0.001

2017	0.000	0.084	0.000	0.013	0.011	0.001	0.001	0.001
2018	0.000	0.084	0.000	0.013	0.011	0.001	0.001	0.001
2019	0.001	0.134	0.000	0.021	0.007	0.001	0.001	0.001
2020	0.000	0.071	0.000	0.011	0.007	0.001	0.001	0.001
2021	0.000	0.073	0.000	0.011	0.009	0.001	0.001	0.001
2022	0.000	0.055	0.000	0.008	0.007	0.000	0.000	0.000
2005-2022, %	**-96.30**	**-82.81**	**-74.54**	**-92.64**	**-95.40**	**-96.45**	**-96.25**	**-96.45**
1990-2022, %	**-99.73**	**-98.93**	**-98.36**	**-99.54**	**-99.70**	**-99.77**	**-99.76**	**-99.77**

Emissions 1.A.4.b.ii

Activity data for 1990-1995 were taken from fuel balance of Statistics Lithuania; from 1996 (40 TJ of diesel oil) were taken from IIASA TSAP 16 Underlying assumptions - GAINS details.xlsx database. Tier 1 EFs were taken from GB2023 off-road machinery chapter.

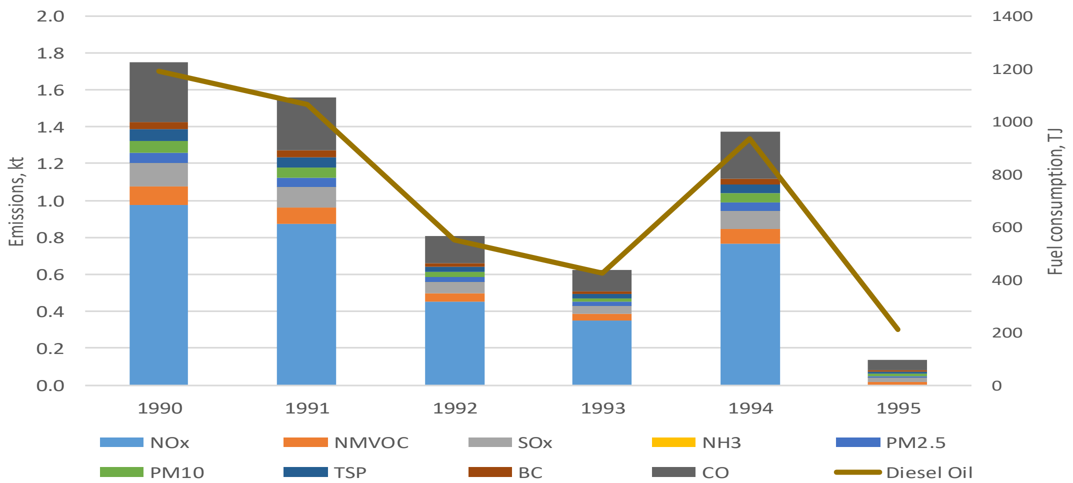


Figure 3-26. Polutant emissions in sector 1.A.4.b.ii

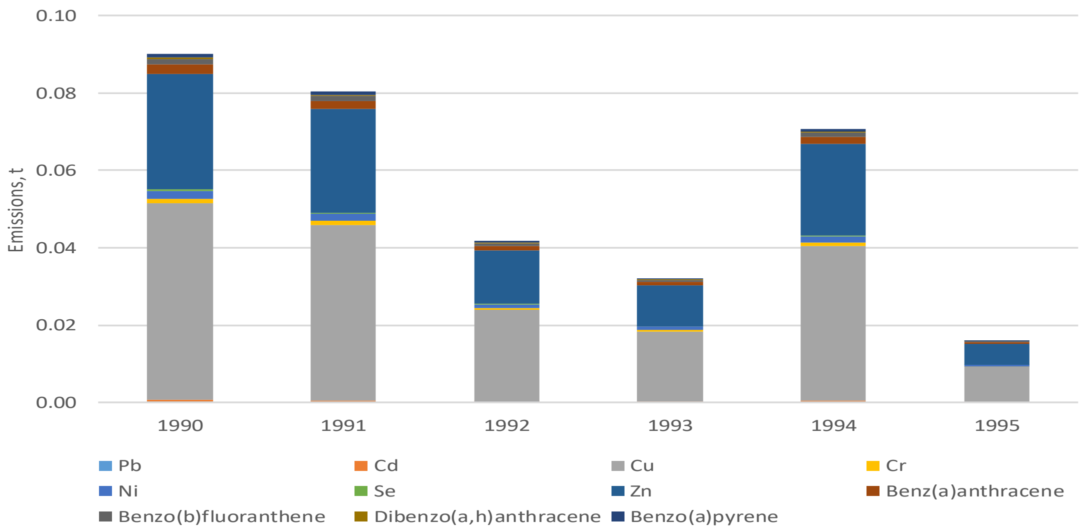


Figure 3-27. Heavy metal and PAHs emissions in sector 1.A.4.b.ii

Emissions 1.A.4.c.ii

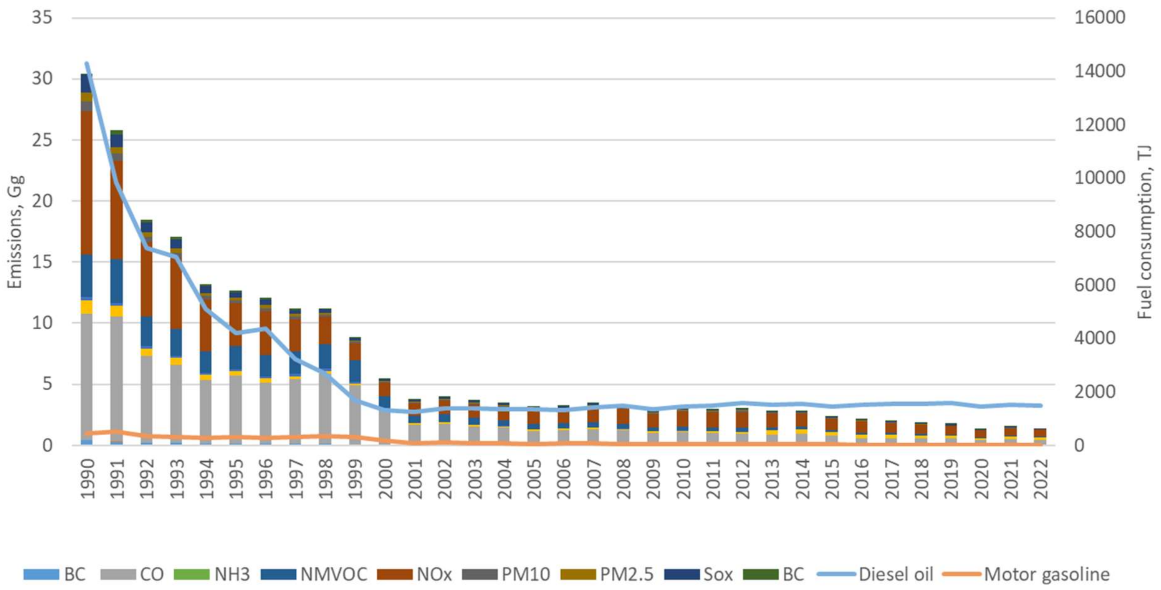


Figure 3-28. Pollutant emissions and fuel consumption in sector 1.A.4.c.ii

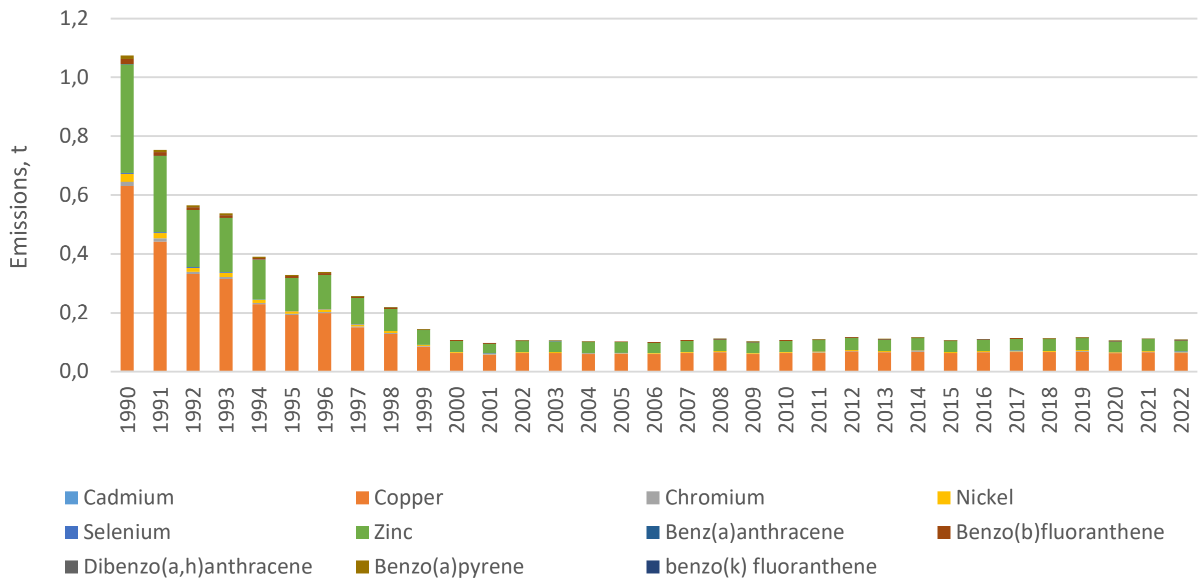


Figure 3-29. Heavy metal and PAHs emissions in sector 1.A.4.c.ii

Emissions 1.A.4.c.iii

Currently, the main inland water areas used for fishing in Lithuania are the Curonian Lagoon, the Kaunas Lagoon reservoir, major rivers and lakes. Inland fishing quotas are set in inland water bodies, the rules for allocation of quotas (approved by the Ministry of Agriculture in May 2005) D1-267 of 30 May 2005) establishes the rules for the allocation of quotas to users of fish resources (hereinafter referred to as users). The majority of air pollutants emissions from both fishing vessels and aquaculture farms motorised watercraft.

Methodological issues

Data on fuel consumption by fishing vehicles provided by the Statistics Lithuania. Diesel oil consumed in Fisheries sector was assumed as consumed by fishing ships and presented in 1.A.4.c.iii sector. Differences between the NIR data and the IEA data occurs due to rounding of number and conversion of units. LT data on fuel consumption provided to Eurostat and IEA in natural measurement units coincides. Within country published data is provided in thousand tonnes to decimal point and converted to tentative fuel with the use of a certain conversion coefficient. Statistics Lithuania provides fuel consumption to Eurostat and IEA in measurement units (thousands tons) rounding digits to whole numbers. Eurostat uses conversion coefficients provided by Statistics Lithuania, but IEA uses average values of the coefficients. EF used is applied provided by EMEP/EEA Guidebook 2023.

Table 3-32. Trend (%) of 1.A.3.c.iii emissions (kt)

	NOX	NMLOJ	Sox	NH3	PM2,5	PM10	TSP	BC	CO
1990	5.2E-04	3.8E-05	6.8E-05	9.5E-09	1.9E-05	2.0E-05	2.0E-05	5.9E-06	1.0E-04
1995	1.7E-04	1.2E-05	2.2E-05	3.0E-09	6.0E-06	6.5E-06	6.5E-06	1.9E-06	3.2E-05
2000	4.0E-04	2.9E-05	5.2E-05	7.2E-09	1.4E-05	1.5E-05	1.5E-05	4.5E-06	7.6E-05
2005	5.4E-04	3.9E-05	7.0E-05	9.8E-09	2.0E-05	2.1E-05	2.1E-05	6.1E-06	1.0E-04
2010	1.9E-04	1.4E-05	5.0E-06	3.5E-09	7.0E-06	7.5E-06	7.5E-06	2.2E-06	3.7E-05
2015	3.5E-04	2.5E-05	9.0E-06	6.3E-09	1.3E-05	1.4E-05	1.4E-05	3.9E-06	6.7E-05
2016	3.8E-04	2.8E-05	1.0E-05	7.0E-09	1.4E-05	1.5E-05	1.5E-05	4.3E-06	7.4E-05
2017	3.8E-04	2.8E-05	1.0E-05	7.0E-09	1.4E-05	1.5E-05	1.5E-05	4.3E-06	7.4E-05
2018	3.8E-04	2.8E-05	1.0E-05	7.0E-09	1.4E-05	1.5E-05	1.5E-05	4.3E-06	7.4E-05
2019	2.3E-04	1.7E-05	6.0E-06	4.2E-09	8.4E-06	9.0E-06	9.0E-06	2.6E-06	4.4E-05
2020	2.7E-04	2.0E-05	7.0E-06	4.9E-09	9.8E-06	1.1E-05	1.1E-05	3.0E-06	5.2E-05
2021	2.7E-04	2.0E-05	7.0E-06	4.9E-09	9.8E-06	1.1E-05	1.1E-05	3.0E-06	5.2E-05
2022	2.30E-04	1.68E-05	6.00E-06	4.20E-09	8.40E-06	9.00E-06	9.00E-06	2.60E-06	4.44E-05
1990/2022	**-55.56%**	**-55.56%**	**-91.11%**	**-55.56%**	**-55.56%**	**-55.56%**	**-55.56%**	**-55.56%**	**-55.56%**
2005/2022	**-57.14%**	**-57.14%**	**-91.43%**	**-57.14%**	**-57.14%**	**-57.14%**	**-57.14%**	**-57.14%**	**-57.14%**
2021/2022	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**

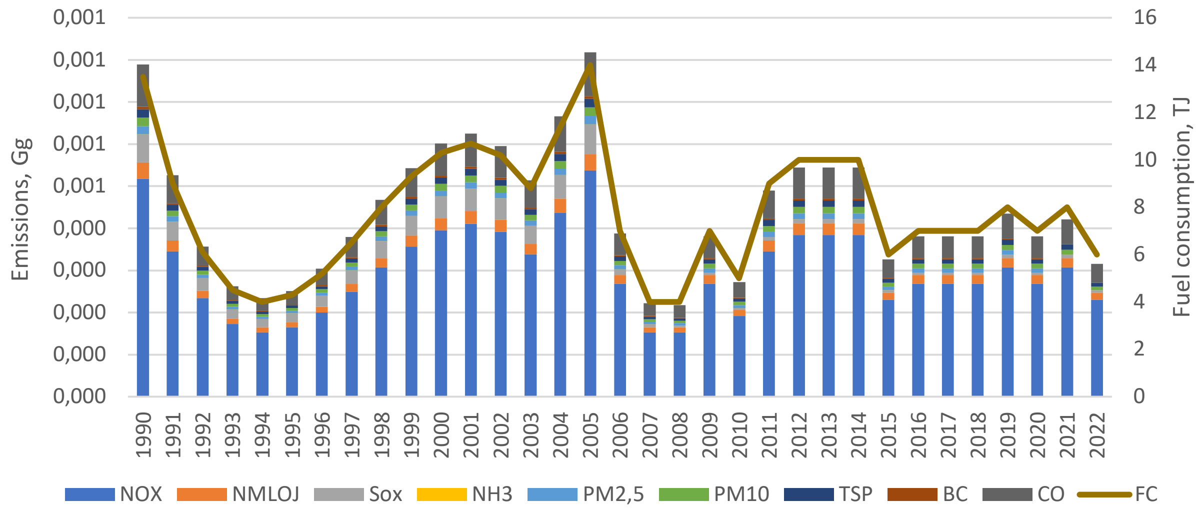


Figure 3-30. Pollutant emissions in sector 1.A.4.c.iii

Table 3-33. Trend (%) of 1.A.3.c.iii HM emissions (kt)

	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
1990	1.76E-06	1.35E-07	4.05E-07	5.40E-07	6.75E-07	1.19E-05	1.35E-05	1.35E-06	1.62E-05
1995	5.59E-07	4.30E-08	1.29E-07	1.72E-07	2.15E-07	3.78E-06	4.30E-06	4.30E-07	5.16E-06
2000	1.34E-06	1.03E-07	3.09E-07	4.12E-07	5.15E-07	9.06E-06	1.03E-05	1.03E-06	1.24E-05

2005	1.82E-06	1.40E-07	4.20E-07	5.60E-07	7.00E-07	1.23E-05	1.40E-05	1.40E-06	1.68E-05
2010	6.50E-07	5.00E-08	1.50E-07	2.00E-07	2.50E-07	4.40E-06	5.00E-06	5.00E-07	6.00E-06
2011	1.17E-06	9.00E-08	2.70E-07	3.60E-07	4.50E-07	7.92E-06	9.00E-06	9.00E-07	1.08E-05
2012	1.30E-06	1.00E-07	3.00E-07	4.00E-07	5.00E-07	8.80E-06	1.00E-05	1.00E-06	1.20E-05
2013	1.30E-06	1.00E-07	3.00E-07	4.00E-07	5.00E-07	8.80E-06	1.00E-05	1.00E-06	1.20E-05
2014	1.30E-06	1.00E-07	3.00E-07	4.00E-07	5.00E-07	8.80E-06	1.00E-05	1.00E-06	1.20E-05
2015	7.80E-07	6.00E-08	1.80E-07	2.40E-07	3.00E-07	5.28E-06	6.00E-06	6.00E-07	7.20E-06
2016	9.10E-07	7.00E-08	2.10E-07	2.80E-07	3.50E-07	6.16E-06	7.00E-06	7.00E-07	8.40E-06
2017	9.10E-07	7.00E-08	2.10E-07	2.80E-07	3.50E-07	6.16E-06	7.00E-06	7.00E-07	8.40E-06
2018	9.10E-07	7.00E-08	2.10E-07	2.80E-07	3.50E-07	6.16E-06	7.00E-06	7.00E-07	8.40E-06
2019	1.04E-06	8.00E-08	2.40E-07	3.20E-07	4.00E-07	7.04E-06	8.00E-06	8.00E-07	9.60E-06
2020	9.10E-07	7.00E-08	2.10E-07	2.80E-07	3.50E-07	6.16E-06	7.00E-06	7.00E-07	8.40E-06
2021	1.04E-06	8.00E-08	2.40E-07	3.20E-07	4.00E-07	7.04E-06	8.00E-06	8.00E-07	9.60E-06
2022	7.80E-07	6.00E-08	1.80E-07	2.40E-07	3.00E-07	5.28E-06	6.00E-06	6.00E-07	7.20E-06
1990/2022	**-55.56%**	**-55.56%**	**-55.56%**	**-55.56%**	**-55.56%**	**-55.56%**	**-55.56%**	**-55.56%**	**-55.56%**
2005/2022	**-57.14%**	**-57.14%**	**-57.14%**	**-57.14%**	**-57.14%**	**-57.14%**	**-57.14%**	**-57.14%**	**-57.14%**
2021/2022	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**	**-28.57%**

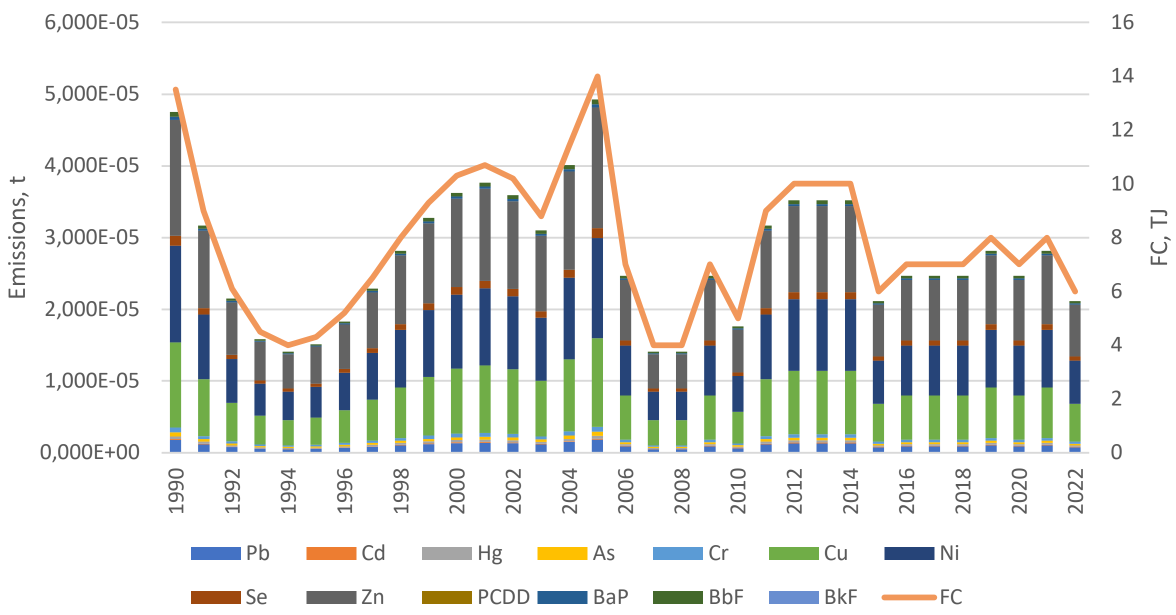


Figure 3-31. Heavy metal and PAHs emissions in sector 1.A.4.c.iii

Uncertainties and time-series consistency

Uncertainty in activity data 2005-2022 of fuel consumption is ±2%. For the 1990-2004 period uncertainty in activity data of fuel consumption is ±20%.

Source-specific QA/QC and verification

Assessment of trends were performed by a sectorial expert.

Source-specific planned improvements

No improvement planned.

Recalculations

No recalculations were done.

Emissions 1.A.5.b

Source category description

Military activity is defined here as those activities using fuel purchased by or supplied to the military authorities of the country. No statistical data are available for fuel consumption for military mobile sources up to 2000. Data for 1990-2000 was extrapolated. Statistical reports are based on information provided by the fuel suppliers.

Emission factors

Emission factors were derived from Guidebook, 2023.

Activity data

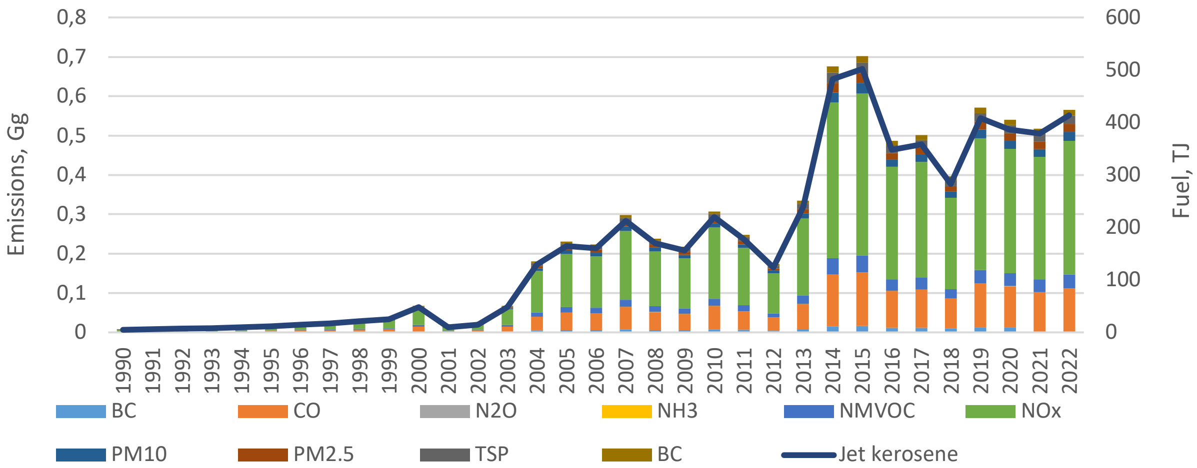


Figure 3-32. Pollutant emissions and fuel consumption in sector 1.A.5.b

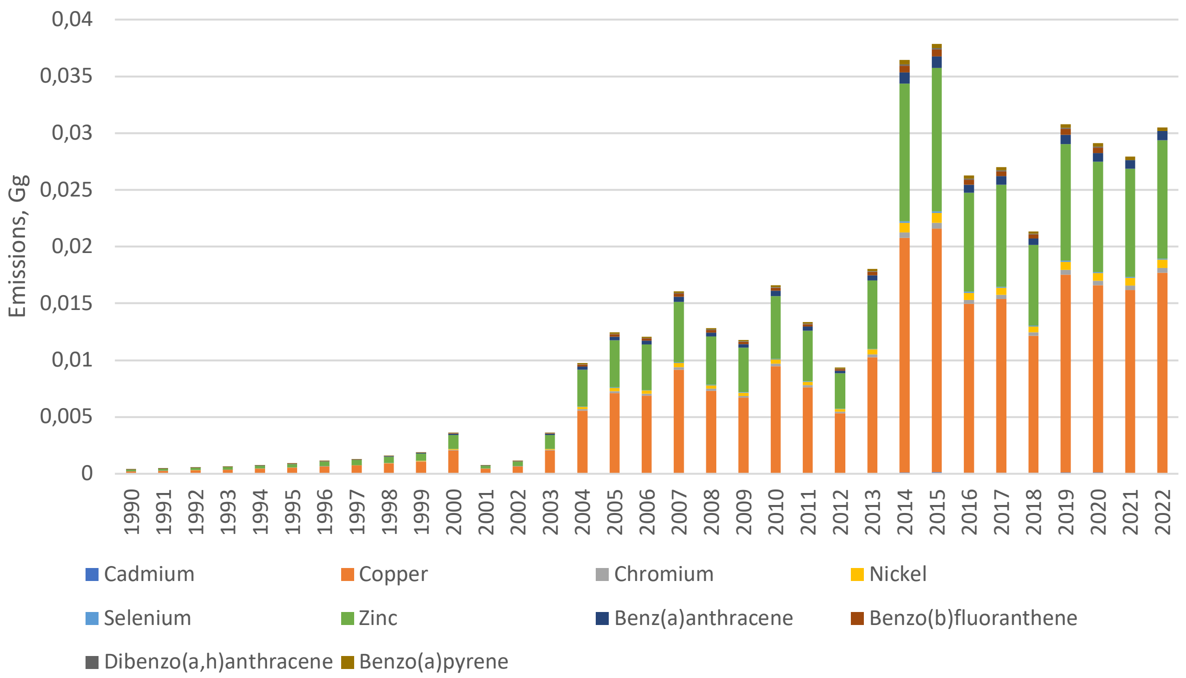


Figure 3-33. Heavy metals and PAHs emissions in sector 1.A.5.b

Uncertainties and time-series consistency

Uncertainty in activity data 2005-2022 of fuel consumption is ±2%. For the 1990-2004 period uncertainty in activity data of fuel consumption is ±20%.

Source-specific QA/QC and verification

Assessment of trends were performed by a sectorial expert.

Source-specific planned improvements

No improvement planned.

Recalculations

No recalculations were done.

ANNEX 1. Implementation of NECD 2023 Review Recommendations

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-2D3a-2023-0001	Yes	2D3a Domestic solvent use including fungicides, NMVOC, 2005-2021	NA	TC	No	Implemented
Recommendation For category 2D3a Domestic solvent use including fungicides, NMVOC and years 2005-2021, the TERT notes that in response to a question raised during the review Lithuania explained that they had recalculated emissions using a Tier 2 approach for this category in the 2023 submission, but that they lacked activity data for some activities (e.g. cosmetics, pharmaceutical products, aerosol sprays, household DIY products). Therefore NMVOC emissions from these activities are not fully included in the inventory. Lithuania did not provide a revised estimate. The TERT decided to calculate a technical correction for the years 2005 and 2019-2021, which was accepted by Lithuania. The estimates demonstrate that the issue is above the threshold of significance. **The TERT recommends that Lithuania include the revised emission calculation in the 2024 submission.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-3B-2023-0002	No	3B Manure management, NMVOC, 1990-2021	NA	TC	No	Not implemented
Recommendation For category 3B1a Dairy cattle, 3B1b Non-dairy cattle and 3B4h Other animals (fur animals), NMVOC for all years, the TERT noted that a Tier 1 method is used for these key categories, which is not good practice. In response to a question raised during the review, Lithuania explained that inventory team is currently prioritising improvements elsewhere in the inventory and policy development areas, so were not able to provide a revised estimate. The TERT decided to calculate a technical correction for the years 2005, 2019, 2020 and 2021 for these categories based on a Tier 2 methodology. A technical correction was also calculated for category 3D Crop production and agricultural soils, because this is also impacted by the shift from Tier 1 to Tier 2 methodology. The technical corrections were accepted by Lithuania. The estimates demonstrate that the issue is above the threshold of significance. **The TERT recommends that Lithuania include a revised emission calculation in the 2024 submission.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2022 (2)	LT-3B-2022-0001	No	3B Manure management, NH_3, 1990-2021	TC	RE	No	Partly implemented

Assessment of the implementation of the initial recommendation

For category 3B Manure management, NH_3 for all years, the TERT noted that there were under-estimates of emissions that exceeded the threshold of significance. During the 2022 NECD inventory review, a Technical Correction (TC) was issued by the TERT, which was agreed with by Lithuania. In the 2023 submission a revised estimate was not submitted, and the N-flow tool file submitted as an Annex to the 2023 submission contained errors and significant inconsistency with the parameters used in the GHG inventory and the previously issued TC. In particular, the fraction of manure deposited in housing and yards which is stored was set to 50% for all animals, whereas the GHG inventory data suggested that 100% of manure is either stored or sent to biogas. Also the fraction of manure stored and sent to biogas added up to more than 100% for swine, which is not possible. In response to a question raised during the review, Lithuania submitted a revised N-flow tool spreadsheet, which corrected the errors mentioned above. They also provided further rationale for the country-specific parameter values used in their estimate, namely the values of 0.15 and 0.1 for fraction of time spent on yards for dairy and non-dairy cattle, stating that this is the expert judgement of Lithuanian animal science estimate. The TERT agreed with the revised estimate submitted by Lithuania. The TERT notes that in future submissions for Dairy cattle and Non-dairy cattle the housing period and Xhouse_slurry parameter could in future submissions be adjusted to ensure that the fraction of manure managed in different systems matches the values used in the GHG inventory across the time series (a working file LT-3Da3-2022-0001 and LT-3-2022-0001 worked example_v2.xlsx is attached). Lithuania's revised estimate considered this for 2021 but not for earlier years. However, the TERT notes that this does not greatly affect emissions. The TERT notes that this revised estimate is linked to issue LT-3Da3-2022-0001 because the revisions to the N-flow tool affect emissions from both 3B and 3D.

The TERT recommends that Lithuania include the revised estimate in the 2024 submission, and the housing period and Xhouse_slurry parameters for cattle to ensure that the proportion of manure deposited on pasture and managed in liquid and solid systems matches the values used in the GHG inventory.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2022 (2)	LT-3Da3-2022-0001	No	3Da3 Urine and dung deposited by grazing animals, NH_3, 1990-2021	TC	RE	No	Partly implemented

Assessment of the implementation of the initial recommendation

For category 3Da2a Animal manure applied to soils and 3Da3 Urine and dung deposited by grazing animals, NH_3 for all years, the TERT notes that there were under-estimates of emissions that exceeded the threshold of significance. During the 2022 NECD inventory review, a Technical Correction (TC) was issued by the TERT, which was agreed with by Lithuania. In the 2023 submission a revised estimate was not submitted, and the N-flow tool file submitted as an Annex to the 2023 submission contained errors and significant inconsistency with the parameters used in the GHG inventory and the previously issued TC. In particular, the fraction of manure deposited in housing and yards which is stored was set to 50% for all animals, whereas the GHG inventory data suggested that 100% of manure is either stored or sent to biogas. Also the fraction of manure stored and sent to biogas added up to more than 100% for swine, which is not possible. In response to a question raised during the review, Lithuania submitted a revised N-flow tool spreadsheet, which corrected the errors mentioned above. They also provided further rationale for the country-specific parameter values used in their estimate, namely the values of 0.15 and 0.1 for fraction of time spent on yards for dairy and non-dairy cattle, stating that this is the expert judgement of Lithuanian animal science estimate. The TERT agreed with the revised estimate submitted by Lithuania. The TERT notes that in future submissions for Dairy cattle and Non-dairy cattle the housing period and Xhouse_slurry parameter could in future submissions be adjusted to ensure that the fraction of manure managed in different systems matches the values used in the GHG inventory across the time series (a working file LT-3Da3-2022-0001 and

LT-3-2022-0001 worked example_v2.xlsx is attached illustrating how this can be done). Lithuania's revised estimate considered this for 2021 but not for earlier years. However, the TERT notes that this does not greatly affect emissions. The TERT notes that this revised estimate is linked to issue LT-3-2022-0001 because the revisions to the N-flow tool affect emissions from both 3B and 3D. **The TERT recommends that Lithuania include the revised estimate in the 2024 submission, and the housing period and Xhouse_slurry parameters for cattle to ensure that the proportion of manure deposited on pasture and managed in liquid and solid systems matches the values used in the GHG inventory across the time series.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2021 (3)	LT-1B2aiv-2021-0001	Yes	1B2aiv Fugitive emissions oil: Refining / storage, NMVOC, 2005-2021	No	UPTC	No	Implemented
Assessment of the implementation of the initial recommendation For 1B2aiv Fugitive emissions oil: Refining and storage, NMVOC, 2005-2021, the TERT notes that the methodology used to estimate emissions is unclear and may be an over-estimate as the operator applied an old methodology without abatement measures. This was raised during the 2021 and 2022 NECD inventory review. In response to a question during the 2022 review, Lithuania explained that the high emissions are due to the operator applying an old methodology when estimating the emissions which does not take into account abatement measures. In response to a question raised during the 2023 NECD inventory review, Lithuania stated that the methodology had been improved with a campaign of direct measurement of NMVOC leakage by the refinery operator which means that the effectiveness of abatement measures can be assessed and taken into account in the emissions calculations. However, Lithuania explained that further work is needed and that the refinery operator plans to implement the methods mentioned in the BAT Reference Document for the Refining of Mineral Oil and Gas for estimating diffuse emissions of NMVOC. The TERT note that this issue relates to an over-estimate of emissions with an impact on total emissions that is above the threshold of significance. During the review, Lithuania provided some updated data, but not a revised estimate. It is currently not possible for the TERT to provide a numerical emission estimate with an adequate level of certainty as the TERT has no activity data available. Therefore, this is flagged as an unquantified potential technical correction, and will be assessed as a high priority item in future reviews. **The TERT strongly recommends that Lithuania obtain data from the refinery operator that accurately takes into account the levels of abatement for determining emission estimates, and include updated emission estimates in the 2024 submission, as well as including a transparent and detailed description of the methodology and recalculations in the IIR.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2020 (4)	LT-0A-2020-0001	No	0A National total - National total for the entire territory - Based on fuel sold/fuel used, SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, BaP, PAHs, PCBs, HCB, Pb, PCDD/F, PM_{10}, CO, BC, 1990-2021	No	No	No	Not implemented

<table>
<tr><td colspan="7">Assessment of the implementation of the initial recommendation

The TERT noted that there is a lack of transparency regarding the IIR (section 1.6 Uncertainty). The methods used for the assessment of the uncertainty are only very briefly described. This was raised during the 2020, 2021 and 2022 NECD inventory reviews. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Lithuania provided some very high level uncertainty estimates for dedicated sectors.

The TERT recommends that Lithuania carry out the uncertainty evaluation in line with the ‘Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution’, which clearly state that: ‘Parties shall quantify uncertainties in their emission estimates using the most appropriate methodologies available, taking into account guidance provided in the 2019 EMEP/EEA Guidebook. Uncertainties should be described in the IIR.'</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-0A-2023-0003</td><td>No</td><td>0A National total - National total for the entire territory - Based on fuel sold/fuel used, SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, PM_{10}, 1990-2021</td><td>NA</td><td>No</td><td>No</td><td>Partly implemented</td></tr>
<tr><td colspan="7">Recommendation

The TERT notes that there is a lack of transparency regarding recalculations, uncertainty assessment and overall detail in the IIR. There is also a lack of transparency regarding the Lithuanian inventory framework, in particular record keeping of past inventories. In response to a question raised during the review, Lithuania explained that due to resourcing issue they are not able to carry out an uncertainty assessment or provide in the IIR a detailed and transparent description of the AD and EFs used (including the Tier), assumptions and methodologies for all sectors. Lithuania further stated that they do not document changes in calculations nor keep previous versions of activity data in xls. Lithuania is planning to enhance the documenting of changes in calculation files and its description in the IIR.

The TERT recommends that Lithuania improve the overall Lithuanian NECD inventory framework, most importantly setting up a structure that retains previous years' inventory calculations with all associated AD and EFs (including the Tier), assumptions and methodologies used. The TERT recommends that Lithuania provide detailed and transparent information of AD and EFs (including the Tier), assumptions and methodologies used for all sectors, pollutants and years in the 2024 IIR.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-0A-2023-0004</td><td>No</td><td>0A National total - National total for the entire territory - Based on fuel sold/fuel used, SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, PM_{10}, 1990-2021</td><td>NA</td><td>No</td><td>No</td><td>Implemented</td></tr>
</table>

Recommendation For all pollutants, categories, fuels and year(s), the TERT notes that there is a lack of transparency regarding the results of the key categories analysis (KCA). This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Lithuania explained that a key category analysis had not been included in the 2023 IIR due to insufficient resources being available at the time. Lithuania provided the 2023 KCA results during the review week. **The TERT recommends that Lithuania include the results of the KCA in the 2024 IIR ahead of the 2024 NECD inventory review and provide detailed information as to how these key categorise where determined in the 2024 submission (i.e. in line the methodology described in 2019 EMEP/EEA Guidebook, Part A, chapter 2).**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-1A2f-2023-0001	Yes	1A2f Stationary combustion in manufacturing industries and construction: Non-metallic minerals, SO_2, 2005	NA	No	No	Implemented
Recommendation For 1A2f Stationary combustion in manufacturing industries and construction: Non-metallic minerals, pollutant SO_2 and year 2005, the TERT notes that there is a lack of transparency regarding the recalculation. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Lithuania provided the data and explained that they considered the plant reported data to be an under-estimate and moved to use the 2019 EMEP/EEA Guidebook Tier 2 emission factor. **The TERT recommends that Lithuania include a transparent methodology description in the next submission.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-1A3ai(ii)-2023-0002	No	1A3ai(ii) International aviation cruise (civil) - Memo Item, PM_{10}, 1990-2021	NA	No	No	Implemented
Recommendation For categories 1A3ai(ii) International aviation cruise (civil), 1A3aii(ii) Domestic aviation cruise (civil), liquid fuels, PM_{10} and all years, the TERT notes that PM_{10} emissions are not reported in the NFR tables (notation key 'NE' is used), while $PM_{2.5}$ time series contains values. Although emissions of memo items are not included in the national total, these should be reported so as to improve the completeness of the inventory and comparability among countries. It is noted that this issue applies to the whole aviation sector, i.e. domestic and international, LTO and cruise. In response to a question raised during the review, Lithuania answered that according to EUROCONTROL practically all PM emitted by modern aircrafts have an aerodynamic diameter of less than 0.1 microns. Hence, in the 2024 submission, the PM_{10} values will be provided equal to $PM_{2.5}$. **The TERT accepts this plan and recommends that this is documented transparently in next year's submission.**							

<table>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-1A3aii(i)-2023-0001</td><td>No</td><td>1A3aii(i) Domestic aviation LTO (civil), $PM_{2.5}$, PM_{10}, 1990-2021</td><td>NA</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">Recommendation

For 1A3aii(i) Domestic aviation LTO (civil), liquid fuels, all years, the TERT notes that PM_{10} emissions are not reported in the NFR tables (notation key ‘NE’ is used), while $PM_{2.5}$ time series contains values. This issue applies to the whole aviation sector, i.e. domestic and international, LTO and cruise. In response to a question raised during the review, Lithuania answered that according to EUROCONTROL, practically all PM emitted by modern aircrafts have an aerodynamic diameter of less than 0.1 microns. Hence, in the next 2024 submission, the PM_{10} values will be provided equal to $PM_{2.5}$. The TERT accepts this plan and notes that the contribution of $PM_{2.5}$ from the aviation sector (LTO) to national total is 0.0112%, i.e., below the threshold of significance.
The TERT recommends that Lithuania implement this planned improvement in time for their next submission.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2021 (3)</td><td>LT-1A3aii(i)-2021-0001</td><td>No</td><td>1A3aii(i) Domestic aviation LTO (civil), SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, BaP, PAHs, PCBs, HCB, Cd, Hg, Pb, PCDD/F, PM_{10}, CO, BC, TSP, 1990-2021</td><td>No</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">Assessment of the implementation of the initial recommendation

For 1A3aii(i) Domestic aviation LTO (civil), pollutants NO_X, NMVOC, SO_X, $PM_{2.5}$, PM_{10}, all years, the TERT had raised an observation during the 2022 review regarding possible inconsistencies in activity data and emission calculations and lack of detailed description in the IIR (follow-up from LT-1A3aii(i)-2021-0001). The recommendation was that Lithuania should revise the whole time series of activity data and emissions of 1A3aii(i) and improve the description in the IIR. Studying the 2023 IIR, the TERT found that Lithuania is planning to implement this recommendation during the next 2024 reporting cycle (p.75, Annex 1. Implementation of NECD 2022 Review Recommendations). However, in the relevant chapter for aviation (pp.23-28, section 2.1), the TERT found that the description of this sector has been updated and improved, including recalculations which seem to address (i.e. implement) the recommendation made during the 2022 review. In addition, the TERT checked the NFR tables and confirmed the existence of recalculations. Due to the contradictory information in the IIR (p.75 vs. pp.23-28), the TERT raised a question to clarify if this issue has been implemented, or if there are still points (i.e., pollutants, emission factors, methodologies, etc.) that need to be improved. Lithuania answered that it did recalculations for the whole time series using EUROCONTROL data and updated the description in the IIR. For the next 2024 submission, the only planned improvement is the reporting of PM_{10} (=$PM_{2.5}$) values, which are currently ‘NE’ (not estimated).
The TERT recommends that Lithuania: i) clearly state in the next 2024 submission of the IIR which of the previous years’ recommendations have been addressed and how, and ii) report PM_{10} emissions which are currently 'NE' in the next IIR.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
</table>

<table>
<tr><td>2023 (1)</td><td>LT-1A3b-2023-0001</td><td>No</td><td>1A3b Road transport, NO_X, NMVOC, $PM_{2.5}$, PM_{10}, CO, TSP, 1990-2021</td><td>NA</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">Recommendation

For 1A3b Road transport: all subcategories, all relevant pollutants and all years, the TERT notes that Lithuania has used COPERT version 5 for emission calculations, but it is not clear from the IIR exactly which subversion of COPERT 5 has been used. In response to a question raised during the review, Lithuania clarified that it was COPERT version 5.6.1 (Sep. 2022). The TERT confirms that this was the most recent available version at the time of preparing the inventory for the 2023 review and expects that Lithuania will continue using the most updated version for the 2024 submission (currently, version 5.6.5, Apr. 2023, https://www.emisia.com/utilities/copert/versions/).

The TERT recommends that Lithuania clarify exact subversion of COPERT used for emission calculations in the next IIR.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-1A3di(i)-2023-0003</td><td>No</td><td>1A3di(i) International maritime navigation - Memo Item, PM_{10}, 1990-2021</td><td>NA</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">Recommendation

For 1A3di(i) International maritime navigation - Memo Item, PM_{10}, all years, the TERT notes that this pollutant is not reported, while values for $PM_{2.5}$ have been reported. The TERT acknowledges that this is a memo item not included in national total, but emissions from this sector should be reported in order to improve the completeness of the inventory and comparability among countries and the 2019 EMEP/EEA Guidebook contains relevant emission factors. In response to a question raised during the review, Lithuania answered that PM_{10} from 1A3di(i) would be estimated in the 2024 submission.

The TERT recommends that the estimation of PM_{10} for 1A3di(i) International maritime navigation - Memo Item is included in the next submission.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-1A3di(i)-2023-0004</td><td>No</td><td>1A3di(i) International maritime navigation - Memo Item, $PM_{2.5}$, 2014</td><td>NA</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">Recommendation

For 1A3di(i) International maritime navigation - Memo Item, $PM_{2.5}$, year 2014, the TERT notes that zero emissions were reported, which is unexpected when comparing to adjacent years, i.e., the emission time series presents a strange and sudden drop to zero for this year. In addition, activity data is unexpectedly zero in year 2017. In response to a question raised during the review, Lithuania answered that all activity data and pollutants for 1990-2022 for this memo item would be checked and corrected if necessary in the next submission. The TERT acknowledges that this is a memo item not included in national total. Nevertheless, any inconsistencies and possible errors in activity data and emissions from this sector should be corrected in order to improve the accuracy of the values, completeness of the inventory and time series consistency.</td><td></td></tr>
</table>

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
The TERT recommends that Lithuania implement the corrections for 1A3di(i) International maritime navigation - Memo Item in the next submission.							
2017 (7)	LT-1A4bii-2017-0001	No	1A4bii Residential: Household and gardening (mobile), SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, BaP, PAHs, PCBs, HCB, Cd, Hg, Pb, PM_{10}, CO, 1990-2021	No	No	No	Implemented
Assessment of the implementation of the initial recommendation For 1A4bii Residential: Household and gardening (mobile), all pollutants, all years, the TERT had raised a transparency issue during the 2022 review regarding lack of detailed description in the IIR (follow-up from LT-1A4bii-2017-0001). The recommendation was that Lithuania should update the IIR with the clarifications provided in response to a question raised during the review, so as to properly describe the methodology followed for emission calculations, activity data, assumptions and parameters used. Studying the 2023 IIR, the TERT found in the Transport chapter (p. 63) a reference to the Energy chapter where limited information is provided, i.e., "for mobile combustion in households activity data (40 TJ) proposed by IIASA GAINS model was used" (p. 28). The TERT would expect more details to be provided based on the recommendation of the 2022 review. . **The TERT reiterates the recommendation that Lithuania improve the description in the IIR and provide it together with other mobile sources.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2017 (7)	LT-1A4ciii-2017-0001	No	1A4ciii Agriculture/Forestry/Fishing: National fishing, NH_3, 1990-2021	No	No	No	Implemented
Assessment of the implementation of the initial recommendation For 1A4ciii Agriculture/Forestry/Fishing: National fishing, NH_3 for all years, the TERT raised a transparency issue during the 2022 review regarding lack of detailed description in the IIR (follow-up from LT-1A4ciii-2017-0001). The recommendation was that Lithuania should improve the IIR by providing methodological and activity data information related to 1A4ciii Agriculture/Forestry/Fishing: National fishing. Studying the 2023 IIR, the TERT found no relevant additional information. Furthermore, it is stated that this issue "will be implemented during the next reporting cycle" (p.78, Annex 1. Implementation of NECD 2022 Review Recommendations). **The TERT reiterates the recommendation that Lithuania improve the description in the IIR.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2022 (2)	LT-1A4ciii-2022-0001	No	1A4ciii Agriculture/Forestry/Fishing:	No	No	No	Implemented

<table>
<tr><td></td><td></td><td></td><td>National fishing, PM_{10}, $PM_{2.5}$, 1990-2021</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Assessment of the implementation of the initial recommendation

For 1A4ciii Agriculture/Forestry/Fishing: National fishing, $PM_{2.5}$, PM_{10}, all years, the TERT raised an observation during the 2022 review regarding higher $PM_{2.5}$ than PM_{10} emissions (LT-1A4ciii-2022-0001). The recommendation was that Lithuania should include in the next submission the corrected values that had been provided in response to a question raised during the review. Studying the 2023 IIR, the TERT found that Lithuania is planning to implement this recommendation during the next 2024 reporting cycle (p.79, Annex 1. Implementation of NECD 2022 Review Recommendations). However, looking at the NFR tables, the TERT found that the ratio of $PM_{10}/PM_{2.5}$ is higher than 1 (i.e., 1.0714 in 2021), which seems to address (i.e., implement) the recommendation made during the 2022 review. Due to the contradictory information in the IIR (p79) and NFR tables, the TERT raised a question to clarify this issue, i.e., whether the recommendation has been implemented or further improvements need to be done. Lithuania answered that the recommendation had been completely implemented and no further improvements were planned.
The TERT recommends that Lithuania clearly state in the next 2024 submission of IIR which of the previous years' recommendations have been addressed and how.</td><td></td></tr>
<tr><td>Review year of initial recommendation (number of years it has been recommended)</td><td>Observation</td><td>Key Category</td><td>NFR, Pollutant(s), Year(s)</td><td>RE, TC in 2022</td><td>RE, TC, or UPTC in 2023</td><td>Tier 1 used for Key Category</td><td>Implementation status</td></tr>
<tr><td>2023 (1)</td><td>LT-1A5a-2023-0001</td><td>No</td><td>1A5a Other stationary (including military), NO_X, NMVOC, SO_2, NH_3, $PM_{2.5}$, PM_{10}, 1990-2021</td><td>NA</td><td>No</td><td>No</td><td>Not implemented</td></tr>
<tr><td colspan="7">Recommendation

For 1A5a Other stationary (including military), all pollutants, all years, the TERT notes that the notation key 'NE' (not estimated) is used. In response to a question raised during the review, Lithuania stated that they would try to get activity data from military institutions for the next submission. The TERT notes that as 1A5a typically only contains emissions from stationary military activity, which is often smaller than emissions from mobile military activity, the issue is likely to be below the threshold of significance for a technical correction.

The TERT recommends that Lithuania collect activity data from military institutions for their stationary emissions for the next submission to report emissions for 1A5a Other stationary (including military). The TERT notes that emissions could be reported with notation key 'IE' (included elsewhere) if there are issues of confidentiality, with emissions included in other stationary categories such as 1A4ai Commercial/institutional: Stationary.</td><td></td></tr>
<tr><td>Review year of initial recommendation (number of years it has been recommended)</td><td>Observation</td><td>Key Category</td><td>NFR, Pollutant(s), Year(s)</td><td>RE, TC in 2022</td><td>RE, TC, or UPTC in 2023</td><td>Tier 1 used for Key Category</td><td>Implementation status</td></tr>
<tr><td>2022 (2)</td><td>LT-2-2022-0001</td><td>No</td><td>2A5a Quarrying and mining of minerals other than coal, $PM_{2.5}$, PM_{10}, 1990-2021</td><td>No</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">Assessment of the implementation of the initial recommendation

For category 2A5a Quarrying and mining of minerals other than coal, $PM_{2.5}$ and PM_{10} and all years, the TERT notes that there is a lack of transparency regarding the parameters and EFs of the methodology used to estimate emissions. In particular, Lithuania applied a Tier 2 method from the previous</td><td></td></tr>
</table>

<table>
<tr><td colspan="7">version of the EMEP/EEA Guidebook (i.e. 2016 EMEP/EEA Guidebook) to estimate $PM_{2.5}$ and PM_{10} emissions. This method differentiates EFs between technologies and practices that result in low/medium and medium/high emission levels. The distinction between low/medium and medium/high emission levels depends on the level of maintenance of equipment, the abatement applied and age of plants. No information about the characterization of emission levels was included in the IIR. In response to a question raised during the review, Lithuania clarified that all limestone extracted in the country during 1998-2021 is assumed to yield medium to high emission levels. As for the quarrying and mining of dolomite, gravel, sand, and peat, it is assumed that most companies have implemented air pollution abatement measures, therefore classifying these extracted minerals in Lithuania during the same period as low to medium emission levels. Lithuania reported in the IIR that the potential application of the 2019 EMEP/EEA Guidebook Tier 2 method would be deliberated with experts during a TAIEX-EIR Expert Mission on Air Emission Inventory and assessment of the impact of policies and measures on emissions in 2023.

The TERT recommends that Lithuania strengthen the rationale behind the assumptions made for the current estimation of $PM_{2.5}$ and PM_{10} emissions, especially concerning the characterization of quarries and mines as low, medium, or high emission levels. Furthermore, the TERT recommends that Lithuania explore ways to apply a Tier 2 method from the 2019 EMEP/EEA Guidebook to estimate emissions and report in the subsequent IIR about its progress.</td><td></td></tr>
<tr><td>Review year of initial recommendation (number of years it has been recommended)</td><td>Observation</td><td>Key Category</td><td>NFR, Pollutant(s), Year(s)</td><td>RE, TC in 2022</td><td>RE, TC, or UPTC in 2023</td><td>Tier 1 used for Key Category</td><td>Implementation status</td></tr>
<tr><td>2022 (2)</td><td>LT-2A5c-2021-0001</td><td>No</td><td>2A5c Storage, handling and transport of mineral products, $PM_{2.5}$, PM_{10}, 1990-2013</td><td>RE</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">**Assessment of the implementation of the initial recommendation**

For category 2A5c Storage, handling and transport of mineral products, pollutants $PM_{2.5}$ and PM_{10} and 1990-2013, the TERT notes that the emissions were reported as 'NE' (Not Estimated), despite the fact that a revised estimate was submitted during the 2022 NECD inventory review that covered the year 2005. In response to a question raised during the review, Lithuania clarified that activity data for 2005 is unavailable. Given that such data is accessible from 2014 onwards, emissions have been reported for the period of 2014 to 2021. The TERT notes that the issue is below the threshold of significance for a technical correction for the period (mandatory: 2005, non-mandatory:1990-2004 and 2006-2013).

The TERT recommends that Lithuania explore ways to estimate $PM_{2.5}$ and PM_{10} for the years 1990-2013. To estimate emissions for the missing years, Lithuania can apply a method from the chapter “Time series consistency” from the 2019 EMEP/EEA Guidebook, such as the surrogate method, which relates emissions to underlying drivers or other indicative data (e.g. port statistics, etc).</td><td></td></tr>
<tr><td>Review year of initial recommendation (number of years it has been recommended)</td><td>Observation</td><td>Key Category</td><td>NFR, Pollutant(s), Year(s)</td><td>RE, TC in 2022</td><td>RE, TC, or UPTC in 2023</td><td>Tier 1 used for Key Category</td><td>Implementation status</td></tr>
<tr><td>2022 (2)</td><td>LT-2B2-2022-0001</td><td>No</td><td>2B2 Nitric acid production, NO_X, 1990-2021</td><td>No</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">**Assessment of the implementation of the initial recommendation**

For category 2B2 Nitric acid Production, NO_X , all years, the TERT notes that there is a lack of transparency regarding whether the associated emissions with nitric acid production were included in the national inventory. In particular, in the NFR table, the NO_X and the other pollutant emissions associated with the 2B2 category were reported as 'NO' (Not Occurring). No further information was reported in the IIR. This does not relate to an over- or under-</td><td></td></tr>
</table>

estimate of emissions. This issue was also raised during the 2022 NECD inventory review. In response to a review question, Lithuania clarified that nitric acid is produced in the country at a single facility, which primarily manufactures ammonia and generates nitric acid as a by-product. The emission data from the plant does not segregate emissions from nitric acid production and ammonia production, given they are monitored by the same devices. The TERT recognizes Lithuania's challenges in distinguishing emissions between ammonia and nitric acid production due to the combined facility emission data reported by the single plant operator.

The TERT recommends that Lithuania record NO_X emissions associated with the 2B2 Nitric acid production category as 'IE' (Included Elsewhere), and include transparent information in the next IIR detailing under which category the respective emissions are reported, the estimation methodology used, and the reasons that complicate the segregation of emissions from ammonia and nitric acid production.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-2D-2023-0001	No	2D Non energy products from fuels and solvent uses, SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, PM_{10}, 1990-2020	NA	No	No	Implemented

Recommendation

For category 2D solvent uses, pollutants SO_2, NO_X, NH_3, NMVOC, $PM_{2.5}$, PM_{10} and years 1990-2020, the TERT notes that there is a lack of transparency regarding recalculations of pollutant emissions and that no explanations for the recalculations have been provided in the IIR. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Lithuania provided an explanation for recalculations of pollutant emission in this source category.

The TERT recommends that Lithuania always provide a justification for recalculations in the IIR as it is a mandatory requirement according to paragraph 38 of the "Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution" in order to improve the transparency of the information and facilitate national and international reviews.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2022 (2)	LT-2D3b-2022-0001	No	2D3b Road paving with asphalt, NMVOC, $PM_{2.5}$, PM_{10}, 1990-2021	No	No	No	Implemented

Assessment of the implementation of the initial recommendation

For category 2D3b, NMVOC, PM_{10} and $PM_{2.5}$ in all years, the TERT notes that there is an under-estimate of emissions due to the use of bitumen as the activity data (AD) instead of asphalt to estimate emissions by applying the Tier 1 method from the 2019 EMEP/EEA Guidebook. Asphalt is the final product of asphalt plants, which is composed of around 5% bitumen and other materials (mainly aggregates). Therefore, the AD used to estimate emissions corresponds only to around 5% of the asphalt used for road paving. Thus, the reported emissions need to be multiplied by 1/5%. The TERT notes that the issue is below the threshold of significance for a technical correction.

The TERT recommends that Lithuania estimate the NMVOC, PM_{10} and $PM_{2.5}$ emissions by using asphalt as AD instead of bitumen (asphalt = bitumen * 1/5%) in the next submission.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2017 (7)	LT-2D3e-2017-0001	No	2D3e Degreasing, NMVOC, 1990-2020	No	No	No	Implemented
Assessment of the implementation of the initial recommendation For category 2D3e Degreasing, NMVOC, years 1990-2020, the TERT notes that there is a lack of transparency regarding the discrepancy between the described methodology in the IIR and the activity data and NMVOC emission estimates reported in the NFR tables. This does not relate to an over- or under-estimate of emissions. This was raised during the 2017, 2018, 2019, 2020, 2021 and 2022 NECD inventory review. In response to a question raised during the review, Lithuania explained that it was difficult to estimate how the different degreasing methods have evolved in Lithuania, but an expert judgement had been provided how different degreasing process types are stratified. For the next submission, Lithuania is going to implement the updated methodology and emission will be recalculated using 0.71 g/kg EF. Lithuania also confirmed that the wrong dimension of AD in kt instead of tonnes had been reported in the NFR tables. **The TERT recommends that Lithuania report in the NFR tables, in correct units, the whole amount of used solvent in this category and not only the amount of used Dichloromethane. Furthermore, the TERT notes that the description of the used methodology for estimating emission has to be in line with the activity data, emission factors and calculated emissions and recommends that Lithuania correct the mentioned issues in the NFR tables and in the IIR for the 2024 submission.**							

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-2D3h-2023-0001	No	2D3h Printing, NMVOC, 2017	NA	No	No	Implemented
Recommendation For category 2D3h Printing, NMVOC in 2017, the TERT notes that there is a lack of transparency regarding time series inconsistency as there is a big jump (a factor of 6) in ink consumption and NMVOC emission estimate for 2017 compared to 2016 and 2018. The TERT also noted that there is no explanation given for that time series inconsistency in the Lithuanian IIR 2023. This is related to a possible over-estimate of emissions. In response to a question raised during the review, Lithuania explained that there might be an error in the national statistics data on the amount of imported printing inks (excl. black) for 2017. Lithuania also explained that they had sent a request to the Lithuanian Statistics Department to further investigate this error and clarify whether this value is accurate. **The TERT recommends that Lithuania include an explanation for that time series inconsistency in the IIR or correct the possible error in the NFR tables and IIR in the 2024 submission. For future reference, if during the calculation of emission estimates and/or QA/QC procedures Lithuania will identify a time series inconsistency, then the TERT recommends to “smooth” that inconsistency by interpolating activity data to get a consistent time series until the reasons for that possible error has been investigated and, if necessary, corrections have been implemented in the inventory. On the other hand, if Lithuania prefers to report inconsistent time series, an explanation for that inconsistency must be included in the IIR with an improvement plan on how and when that inconsistency will be corrected.**							

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-3-2023-0001	No	3 Agriculture, NH_3, 1990-2021	NA	No	No	Partly implemented

Recommendation

For 3 Agriculture, NH_3 and all years, the TERT noted that there is a lack of transparency in the IIR regarding the assumptions made on NH_3 mitigation measures implemented. This expands the recommendation made during the 2022 review LT-3B3-2022-0001 (which focused only on swine) to other categories. The TERT notes that for categories 3B1a Dairy cattle, 3B1b Non-dairy cattle and 3B3 swine the IIR includes information on the quantity of NH_3 emissions subtracted from the measures in the 2019 NAPCP. However, no information is provided in the IIR on the assumed penetration rates of mitigation measures over time, the assumed abatement efficiency (effect on the emission factor), and for cattle no information on the measures actually implemented. In response to a question raised during the review, Lithuania explained that the corresponding measures in the 2019 NAPCP were: a) review of requirements on Manure and slurry storage and handling, b) review and update of technical and technological solutions on design of farm animals storage areas, and c) setting of general rules for operation of storage areas of Farms animals. The producers of the 2019 NAPCP estimated the effects of these measures by expert judgement as equal to 1 per cent. The TERT notes that this issue may result in an over- or under-estimate of emissions, but due to the very small estimated impact of measures, the issue is below the threshold of significance for a potential technical correction.

The TERT recommends that in the next IIR submission i) Lithuania include additional explanation and source of the assumptions made on the impact of ammonia abatement measures (for example explicitly providing data on estimated penetration rates of measures over time and the assumed abatement efficiency of the different measures), and ii) where no actual data on penetration of measures of abatement efficiency are currently collected, Lithuania organise suitable data collection and document this improvement in the IIR.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-3-2023-0002	No	3 Agriculture, NO_X, NH_3, NMVOC, $PM_{2.5}$, 1990-2021	NA	No	No	Partly implemented

Recommendation

For 3 Agriculture, pollutants NO_X, NH_3, NMVOC, $PM_{2.5}$ and all years, the TERT noted a lack of transparency in the IIR regarding the documentation of recalculations. No information on recalculations made between the 2022 and 2023 submission is included in the agriculture chapter of the IIR, which is not in line with good practice as described in Annex II to the 2014 Guidelines for reporting emission data under the Convention (ECE/EB.AIR/125). In response to a question raised during the review, Lithuania confirmed that it currently does not document changes in calculations nor keep previous versions of activity data in xls, but that Lithuania is planning to enhance the documentation of changes in calculation files and their description in the IIR. The TERT notes that this is particularly important in cases where recalculations relate to a key category or a shift in methodological Tier.

The TERT recommends that in the next IIR submission Lithuania include a section in the IIR documenting recalculations, including a clear description of the rationale for the recalculations and a quantitative assessment of the impact for each pollutant and source category affected.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status

<table>
<tr><td>2023 (1)</td><td>LT-3B-2023-0001</td><td>No</td><td>3B Manure management, NO_X, $PM_{2.5}$, 1990-2021</td><td>NA</td><td>No</td><td>No</td><td>Partly implemented</td></tr>
<tr><td colspan="7">Recommendation

For 3B Manure management, $PM_{2.5}$ and NO_X, for all years, the TERT notes that there is a lack of transparency in the IIR regarding the recalculations made for several livestock subcategories. There may have been erroneous zero values in the 2022 NFR submission for the years 2000-2004, 2006-2010, and 2015. In the 2022 NECD review, fluctuating emissions trends were highlighted by the TERT for $PM_{2.5}$ and in one case NO_X, and recommendations were made to add an explanation to the IIR for these trends. Looking at the recalculations between the 2022 and 2023 submissions, the unusual fluctuations are no longer present in the 2023 submission and the TERT considers it likely that the zero values reported in the 2022 NFR submission were errors, given that emissions trends for livestock numbers and other pollutants did not show the same pattern. In the 2023 submission, the TERT does not consider the trends in livestock population to be unusual. In response to a question raised during the review, Lithuania confirmed that the zero values in the 2022 NFR submission had been indeed errors, which were corrected in the 2023 submission. The TERT notes that this issue does not relate to an over- or under-estimate of emissions.

The TERT recommends that in the next IIR submission Lithuania include a section in the IIR documenting the reason for all significant recalculations, including the results from error corrections.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-3B1a-2023-0001</td><td>Yes</td><td>3B1a Manure management - Dairy cattle, NMVOC, 2000-2020</td><td>NA</td><td>No</td><td>No</td><td>Not implemented</td></tr>
<tr><td colspan="7">Recommendation

For category 3B1a Dairy cattle for the pollutant NMVOC and years 2000-2020, the TERT noted a lack of transparency in the IIR regarding the documentation of recalculations made between the 2022 and 2023 submission. The TERT notes that this is a key category. For example, in 2020, NMVOC emissions were recalculated upwards by 21.2% (2.94 kt in the 2022 submission and 3.56kt in the 2023 submission). No information on the reason for this recalculation is provided in the IIR. In response to a question raised during the review, Lithuania confirmed that it currently does not document changes in calculations nor keep previous versions of activity data in spreadsheets, but that Lithuania is planning to enhance the documentation of changes in calculation files and their description in the IIR. The TERT notes that this recommendation links to the more general recommendation LT-3-2023-0002.

The TERT recommends that in the next IIR submission Lithuania include a section in the IIR documenting recalculations, including a clear description of the rationale for the recalculations and a quantitative assessment of the impact for each pollutant and source category affected.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-3B1b-2023-0001</td><td>Yes</td><td>3B1b Manure management - Non-dairy cattle, NMVOC, 2000-2020</td><td>NA</td><td>No</td><td>No</td><td>Not implemented</td></tr>
<tr><td colspan="7">Recommendation</td><td></td></tr>
</table>

For category 3B1b Non-dairy cattle for the pollutant NMVOC and years 2000-2020, the TERT noted a lack of transparency in the IIR regarding the documentation of recalculations made between the 2022 and 2023 submission. The TERT notes that this is a key category. For example, NMVOC emissions for the year 2020 were recalculated upwards by 19.8% (2.07kt in the 2022 submission and 2.48kt in the 2023 submission). No information on the reason for this recalculation is provided in the IIR. In response to a question raised during the review, Lithuania confirmed that it currently does not document changes in calculations nor keep previous versions of activity data in spreadsheet form, but that Lithuania is planning to enhance the documentation of changes in calculation files and their description in the IIR. The TERT notes that this recommendation links to the more general recommendation LT-3-2023-0002. **The TERT recommends that in the next IIR submission Lithuania include a section in the IIR documenting recalculations, including a clear description of the rationale for the recalculations and a quantitative assessment of the impact for each pollutant and source category affected.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2022 (2)	LT-3B3-2022-0001	No	3B3 Manure management - Swine, NH_3, 2020	No	No	No	Partly implemented
Assessment of the implementation of the initial recommendation For 3B3 Manure management – Swine, NH_3 and the year 2020, the TERT notes that there is a lack of transparency in the IIR regarding the assumptions made on NH_3 mitigation measures implemented. This issue was raised during the 2022 review, and it was recommended that Lithuania provide more explanation of the methods used to estimate emissions, including how abatement measures are accounted for. In the 2023 IIR submission, the TERT notes that some additional text has been added to the IIR showing the adjustment made to emissions to account for NH_3 abatement measures at large swine farms (as well as for dairy and non-dairy cattle) taken from the 2019 NAPCP. However, there is no rationale provided in terms of assumptions on which measures are involved (for cattle), uptake rates or abatement efficiency of the measures. This specific issue for swine relates to a wider issue LT-3-2023-0001 regarding documentation of NH_3 mitigation measures from all agricultural sources. In response to a question raised during the review for issue LT-3-2023-0001, Lithuania explained that the corresponding measures in the 2019 NAPCP were: a) review of requirements on Manure and slurry storage and handling, b) review and update of technical and technological solutions on design of Farm animals storage areas, and c) setting of general rules for operation of storage areas of farm animals. The producers of the 2019 NAPCP estimated the effects of these measures by expert judgement as equal to 1 per cent. **The TERT recommends that in the next IIR submission Lithuania i) include additional explanation and source of the assumptions made on the impact of ammonia abatement measures (for example explicitly providing data on estimated penetration rates of measures over time and the assumed abatement efficiency of the different measures), and ii) where no actual data on penetration of measures of abatement efficiency are currently collected, Lithuania organise suitable data collection and document this improvement in the IIR.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2022 (2)	LT-3De-2022-0001	Yes	3De Cultivated crops, NMVOC, 2005-2021	No	No	No	Not implemented
Assessment of the implementation of the initial recommendation For 3De Cultivated crops, NMVOC and years 2005-2021, the TERT noted that there is a lack of transparency in the IIR regarding the methodological tier							

<table>
<tr><td colspan="7">used to estimate emissions. This issue is also related to LT-3De-2023-0001. The TERT notes that the recommendation made in the previous review to include a detailed explanation of the methods used and the reasons for recalculations in the next submission has not been implemented. The TERT further notes that on page 27 of the agriculture chapter of the IIR the text still refers to using the Tier 1 default EF (2019 EMEP/EEA Guidebook, table 3.1) for all crops of 0.86 kg/ha, whereas the implied emission factor for 3De in the 2023 submission varies between 0.61 and 0.71 kg/ha over the time series. This suggests that the methodological description has not been updated in the latest IIR. In response to a question raised during the review for this issue and for LT-3De-2023-0001, Lithuania confirmed that a Tier 2 method has been used for the 2023 submission. The TERT notes that this issue does not relate to an over- or under-estimate of emissions.

The TERT recommends that in the next IIR submission Lithuania update the methodology description to describe the Tier 2 method implemented, including details of crop yield per type, country-specific parameters and assumptions made when applying parameters presented in Table 3.3 of the 2019 EMEP/EEA Guidebook (chapter 3D).</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-3De-2023-0001</td><td>Yes</td><td>3De Cultivated crops, NMVOC, 2005-2021</td><td>NA</td><td>No</td><td>No</td><td>Not implemented</td></tr>
<tr><td colspan="7">Recommendation

For 3De Cultivated crops, NMVOC and years 2005-2021, the TERT notes that significant recalculations have been applied (e.g. -19.7%; from 2.26kt to 1.81kt in 2020 for NMVOC) in the 2023 submission compared to the 2022 submission. In response to a question during the 2022 review (LT-3De-2022-0001), Lithuania stated that emissions from this category were recalculated from the 2021 submission by moving to a Tier 2 method. However, the IEF for NMVOC in the 2022 submission was 0.75 kg/ha for all years. This is lower than the default Tier 1 EF, but if a Tier 2 method had been applied in 2022 the TERT would expect the IEF to vary over time due to shifts in the area of different crop types varies (as evident from the table on p. 27 of the IIR). In the 2023 submission the IEF varies over time between 0.61 and 0.71 kg/ha. In response to a question raised during the review, Lithuania confirmed that a Tier 2 method has been used for the 2023 submission, but the method used in the 2022 submission cannot be confirmed, because Lithuania does not document changes in calculations nor keep previous versions of activity data in xls. Lithuania is planning to enhance the documenting of changes in calculation files and its description in the IIR. This issue relates to a connected recommendation (LT-3De-2022-0001) focusing on documentation of methodology in the IIR for this emissions category. The TERT notes that that this issue does not relate to an over- or under-estimate of emissions.

The TERT recommends that in the next IIR submission Lithuania include a section in the IIR documenting the reason for all significant recalculations.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2022 (2)</td><td>LT-5A-2022-0001</td><td>No</td><td>5A Biological treatment of waste - Solid waste disposal on land, $PM_{2.5}$, PM_{10}, 1990-2021</td><td>No</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">Assessment of the implementation of the initial recommendation

For 5A Solid waste disposal on land, $PM_{2.5}$ and PM_{10}, all years, the TERT notes that there is a lack of transparency regarding the Activity Data (AD) used to estimate emissions. Indeed, the AD (waste statistics) required for the estimation of PM emissions needs to include the amounts of mineral waste handled (construction and demolition waste and other mineral waste). However, the information provided in the IIR, section on solid waste disposal,</td><td></td></tr>
</table>

does not provide detailed information on what activity data has been used, and thus it is possible that the calculated PM emissions are under-estimated. This was raised during the 2022 NECD review. The TERT notes that the issue is below the threshold of significance. In response to a question during the 2022 NECD review, Lithuania informed that the amount of mineral waste for the years 2005 and 2019 had already been evaluated, and that this was also planned for the whole 2005-2021 period to include this waste type in the calculation of PM emissions. In response to a question during the review, Lithuania responded that This problem will be solved in the next submission. **The TERT reiterates the recommendation that Lithuania report on what waste types are currently covered and include AD on mineral waste in its inventory for particulate matter (e.g. by using Eurostat data on the amount of mineral waste generated) in the next submission.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-5B1-2023-0001	No	5B1 Biological treatment of waste - Composting, NH_3, 1990-2021	NA	No	No	Implemented
Recommendation For 5B1 Biological treatment of waste - Composting, NH_3, all years, the TERT notes that there is a lack of transparency regarding activity data, i.e. amounts of waste composted, and emission factor applied. In the NFR tables 'NO' is reported as activity data, and in the IIR, section 1.2, pages 4-5, no information on the methodology, including on AD and EF used is provided. In response to a question raised during the review, Lithuania explained that the activity data from the UNFCCC GHG inventory is used and the default EF from the 2019 EMEP/EEA Guidebook is applied. However, the activity data taken from the UNFCCC GHG inventory (CRF) refers to dry matter (as required by the CRF template) while the default EF (0.24 kg/t) of the 2019 EMEP/EEA Guidebook requires the wet weight mass. The TERT notes that the issue is below the threshold of significance for a technical correction. **The TERT recommends that Lithuania use the amounts of composted waste in wet weight, as included in Table 7-36, page 470 of the NIR 2023, for calculation instead of the waste amounts of the CRF (stated as dry matter), and report on the recalculations in the next submission.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-5B2-2023-0002	No	5B2 Biological treatment of waste - Anaerobic digestion at biogas facilities, NH_3, 1990-2021	NA	No	No	Not implemented
Recommendation For 5B2 Biological treatment of waste - Anaerobic digestion at biogas facilities, NH_3, all years, the TERT notes that there is a lack of transparency in the IIR, Part 6 - Waste, section 1.3, regarding the methodology applied. In response to a question raised during the review, Lithuania provided data which transparently showed the methodological approach and confirmed that the issue did not relate to changes in emissions above the threshold of significance. Thus, it was not necessary to process the new data as a revised estimate. **The TERT recommends that Lithuania include this data in the next submission and transparently report on these recalculations as well as the underlying methodology in the IIR 2024.**							

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2022 (2)	LT-5C1bii-2022-0001	No	5C1bii Hazardous waste incineration, $PM_{2.5}$, PM_{10}, 1990-2021	No	No	No	Implemented

Assessment of the implementation of the initial recommendation

For 5C1bii Hazardous waste incineration, $PM_{2.5}$ and PM_{10} for all years, the TERT notes that there is a lack of transparency in the IIR, section 1.4 of Part 6 Waste, regarding the methodology applied and trend of historical years prior 2016. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Lithuania explained that incinerated amounts, as recorded in the database of the Lithuanian EPA, and the default Tier 1 emission factors were used for the calculation. Lithuania explained that emissions from waste incineration had fluctuated quite strongly in historical years until 2005, which was due to the number of small amounts of waste incinerated in various production facilities in this time period, which incinerated waste on random basis.

The TERT recommends that Lithuania include a clear explanation of the data sources and trend in the next submission 2024.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2022 (2)	LT-5-2022-0001	No	5C1bv Cremation, SO_2, NO_X, NMVOC, $PM_{2.5}$, PM_{10}, 1990-2021	No	No	No	Implemented

Assessment of the implementation of the initial recommendation

For 5C1bv Cremation, SO_2, NO_X, NMVOC $PM_{2.5}$ and PM_{10} emissions for all reported years, the TERT notes that there is a lack of transparency regarding the methodology applied and recalculations submitted in 2023. During the 2022 NECD inventory review, the TERT raised a question on the application of the Tier 1 EFs referred to in the IIR (Part 6, Table 1-1, page 8). Lithuania responded that the EFs from Table 3-1 of the 2019 EMEP/EEA Guidebook on source category 5C1bv Cremation would be used for next reporting round, i.e. for the 2023 submission. The TERT notes that the 2023 IIR (Part 6 - Waste, page 11) states that no source-specific recalculations were carried out. However, the 2023 NFR tables(v3.0) for the calendar years 2019 and 2020 show recalculated data in the order of +23% (2019) and +80% (2020) that were apparently attributable to revisions of activity data. In response to a question raised by the TERT, Lithuania responded that they would contact the AD provider on the revised data, and that they plan to address the issue in the 2024 submission.

The TERT reiterates the recommendation that Lithuania apply the Tier 1 emission factors of Table 3-1 on Cremation of the 2019 EMEP/EEA Guidebook and elaborate on recalculations in its next submission.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-5C2-2023-0002	Yes	5C2 Open burning of waste, $PM_{2.5}$, 1990-2021	NA	No	Yes	Implemented

Recommendation

<table>
<tr><td colspan="7">For 5C2 Open burning of waste, $PM_{2.5}$, all years, the TERT notes that Lithuania is applying a Tier 1 methodology although $PM_{2.5}$ from 5C2 is identified as a key category for the years 2020 and 2021. Moreover, the TERT notes that there is no information in the IIR indicating whether the burning of forest residues is prohibited by law. In response to a question raised during the review, Lithuania indicated that the legal order no. 269 does not regulate a burning of forest residues but that the national circumstances make open burning of forest residue unlikely (small part of forest residues are gathered and used for energy recovery in the heating plants. The biggest part of these residues remains in the forests). The TERT notes that the issue is expected to be below the threshold of significance for a technical correction.

The TERT recommends that Lithuania apply a Tier 2 estimate in the next submission, elaborating carefully on national circumstances having an impact on activity data, especially regarding forest residues and provide publication/documentation supporting that there is no open burning of forest residues.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-5C2-2023-0001</td><td>Yes</td><td>5C2 Open burning of waste, $PM_{2.5}$, 2019-2020</td><td>NA</td><td>No</td><td>No</td><td>Partly implemented</td></tr>
<tr><td colspan="7">Recommendation

For 5C2 Open burning of waste, $PM_{2.5}$, 2019 and 2020, the TERT notes that significant recalculations have been reported (e.g. +10.6%; from 0.21 kt to 0.23 kt in 2020 for $PM_{2.5}$) without providing an explanation in the IIR 2023, section 1.5. In response to a question raised during the review, Lithuania informed the TERT that no changes in calculations were documented or previous versions of activity data kept in xls.

The TERT recommends that Lithuania improve its QAQC accordingly and start to document any changes made and recalculations submitted.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-5D1-2023-0001</td><td>No</td><td>5D1 Domestic wastewater handling, NH_3, 1990-2021</td><td>NA</td><td>No</td><td>No</td><td>Implemented</td></tr>
<tr><td colspan="7">Recommendation

For 5D1 Domestic wastewater handling, NH_3, all years, the TERT notes that the NFR tables include the notation key 'NA' and that NH_3 emissions from latrines are reported under 5D3.

The TERT recommends that Lithuania report emissions from that source under NFR category 5D1 Domestic wastewater handling in its next submission to be in line with the 2019 EMEP/EEA Guidebook. The TERT also recommends that Lithuania improve transparency of reporting in its next submission and include more detailed information on the AD used for calculation by referring the total numbers on the population as well as connection rates over the whole time series in the next IIR 2024.</td><td></td></tr>
<tr><th>Review year of initial recommendation (number of years it has been recommended)</th><th>Observation</th><th>Key Category</th><th>NFR, Pollutant(s), Year(s)</th><th>RE, TC in 2022</th><th>RE, TC, or UPTC in 2023</th><th>Tier 1 used for Key Category</th><th>Implementation status</th></tr>
<tr><td>2023 (1)</td><td>LT-5E-2023-0001</td><td>Yes</td><td>5E Other waste, $PM_{2.5}$, PM_{10}, TSP, 1990-2021</td><td>NA</td><td>No</td><td>No</td><td>Partly implemented</td></tr>
</table>

Recommendation For 5E Other waste, $PM_{2.5}$ and PM_{10}, TSP, for all years, the TERT notes that there is a lack of transparency regarding recalculations carried out in the 2023 submission. Recalculations can be observed for the whole time series, but no information on recalculations is provided in the IIR, section 1.7. In response to a question raised during the review, Lithuania explained that changes in the calculation spreadsheets are currently not documented, but that they would start to do so while preparing 2024 submission. **The TERT recommends that Lithuania improve its QAQC and start to document and report on any changes in future submissions.**							
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2022	RE, TC, or UPTC in 2023	Tier 1 used for Key Category	Implementation status
2023 (1)	LT-5E-2023-0002	Yes	5E Other waste, $PM_{2.5}$, PM_{10}, TSP, 2019-2021	NA	No	No	Implemented
Recommendation For 5E Other Waste, $PM_{2.5}$, PM_{10} and TSP, 2019-2021, the TERT notes that there is a lack of transparency/consistency regarding activity data. The numbers of fires as presented in Table 4-13, page 15, in the IIR 2023, Part 6 - Waste, do not correspond to the numbers of fires as included in the NFR of the 2023 submission. In response to a question raised during the review, Lithuania provided an Excel file showing the actual numbers of fires used for calculation (refer to 'T-5E-2023-0001'). The TERT notes that the numbers included in the Excel correspond to the numbers in the NFR Tables submitted 2023, and thus the mistake seems to be in the IIR Table. This does not relate to an over- or under-estimate of emissions. **The TERT recommends that Lithuania correct the table of the number of fires accordingly in its next submission.**							