Submission under UNECE Convention on Long Range Transboundary Air Pollution

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

Data sheet:

Romania's Informative Inventory Report 2000-2016

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1. EXECUTIVE SUMMARY

The Romania's Informative Inventory Report (IIR) 2018 contains information on the Romania's inventories for the years 2000 to 2016, including descriptions of methods, data sources, key categories analysis and trends analysis.

In this Inventory edition, it was estimated for the first time the emissions for the years 2000 to 2004. Some recalculations for period 2005-2015 have been carried out, due to updated statistics and correlations with the activity data, according with the Emission Inventory review conducted in 2017.

Emission factors applied to main pollutants emissions estimates have been updated to 2016 EMEP/EEA Guidebook.

1.1. Romania`s Reporting Obligations under the UNECE / CLRTAP Convention and National Framework for Inventory Preparation and Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC.

Romania is a Party of the Convention on Long Range Transboundary Air Pollution (CLRTAP), ratified by Law 8/1991. The CLRTAP protocols, namely Gothenburg Protocol, POPs Protocol and Heavy Metals Protocol, have been ratified by the Law 271/2003. Romania acceded to the EMEP Protocol by the Law 652/2002. Law 1/2012 and Law 263/2017 accept the adopted POPs, Gothenburg and Heavy Metals Protocols amendments.

The Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC is currently in the transposition process into national law, whose deadline is 1st of July 2018. Also, according to art. 20 provisions of the directive, Romania brought into national legislation provisions necessary to comply with Article 10(2) by 15 February 2017 regarding to the reporting obligations.

Romania prepares, maintains and reports on a yearly basis the National Emissions Inventory and the whole inventory time series, if required. Emission time series are resubmitted if any recalculation occurred due to the methodology/emission factors changes, new sources identification, updated activity data etc.

The inventory system currently used in Romania is presented in Figure 1.1.1. The National Environmental Protection Agency of Romania (N.E.P.A) is responsible for the national emissions inventory compilation.

In order to collect and compile the inventory data, institutional arrangements are made between N.E.P.A. and other administrative structures such as: National Institute for Statistics (N.I.S.), Romanian Auto Registry (R.A.R.),“Romanian Waters” National Administration (A.N.A.R).

The same institutional arrangements are also being used for reporting under the Revised NEC Directive – Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC.

1.2. Inventory compilation methodology and process

The methodology for estimating and reporting emissions is consistent with the *“EMEP/ EEA air pollutant emission inventory guidebook - 2016”* and the Ministerial Order no 3.299/2012 for the approval of the methodology for compiling and reporting of air emissions inventories.

The pollutants covered by this methodology guide are: SOx, NOx, NH_3, NMVOC, CO, BC, TSP, PM_{10}, $PM_{2.5}$, Heavy Metals, (Cd, Pb, Hg, As, Cr, Cu, Ni, Se, Zn), POPs (HCB, PCB, dioxins / furans and PAHs).

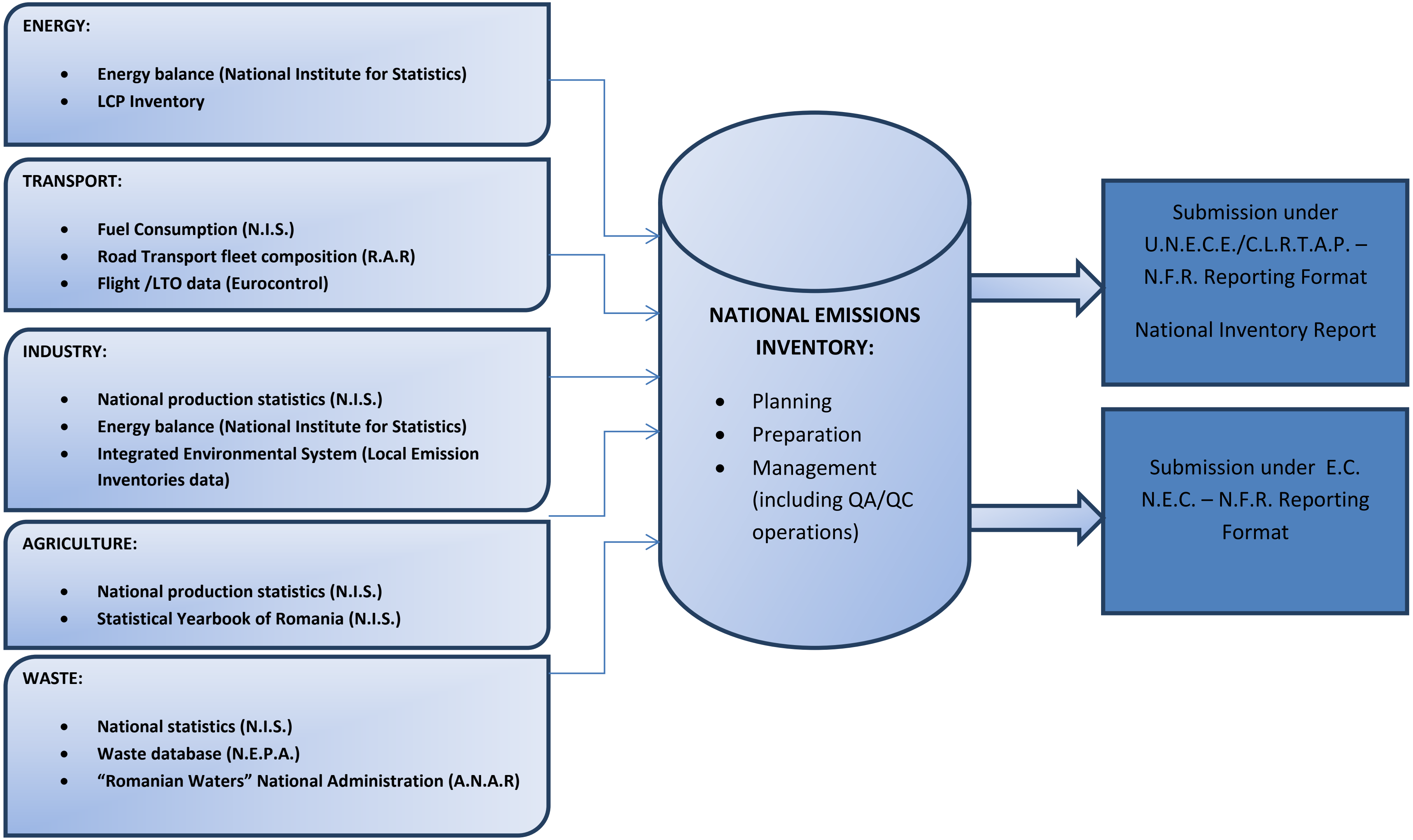
The input data were processed using the Collect-ER software. The resulting emissions from road transport sector were directly exported to the reporting formats requested by the UNECE/CRLTAP Secretariat by using COPERT’s 4 “export to NFR” option.

Inventory compilation starts with the inventory planning process. This includes allocation of human resources, prioritization of actions and improvements. For sectorial/activity improvements, the Key Category Analysis provides a starting point in order to identify the emission sources that are to be given increased importance (emissions estimation based on superior Tier, detailed data collection – activity related data from economic operators/industry etc.).

This step also includes expert allocation for different sectors and for activities required by the QA/QC procedures and data management.

The next step is inventory preparation. Input data are being collected; emission factors are being selected and all the work is documented. Afterwards, all this data is inserted in a Collect-ER database and emissions are estimated. Output data from Collect-ER is then exported to an excel file and fed to the online Integrated Environmental System application F3 – “National Emissions Inventory”, that translates it to Annex I of the CLRTAP reporting format.

Figure 1.1.1 – National Emissions Inventory Data Sources and Structure



1.3. Key Category Analysis

This chapter presents results of Romania's pollutant-specific key categories analysis.

The methodology follows the Good Practice Guidance approach to produce pollutant-specific key categories and covers both level and trend assessments. In Approach 1, key categories are identified using a predetermined cumulative emission threshold. Key categories are those which, when summed together in descending order of magnitude, cumulatively add up to 80% of the total level.

As the analysis was made for all different pollutants reported to the UNECE/CLRTAP/EU Commission and as these pollutants differ in their way of formation, most of the identified categories are key categories for one pollutant or more.

The following tables present the key category analysis for:

Table 1.3.1 Key Categories for NOx (2016)

NFR CODE	CATEGORY	Latest year estimate (kt)	Level assessment (%)	Cumulative total	Rank
1A3biii	Road transport: Heavy duty vehicles and buses	49.99158490	23.73%	23.73%	1
1A1a	Public electricity and heat production	36.07191348	17.13%	40.86%	2
1A3bi	Road transport: Passenger cars	27.09477790	12.86%	53.72%	3
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	22.44993808	10.66%	64.38%	4
3Da1	Inorganic N-fertilizers (includes also urea application)	12.39519600	5.88%	70.27%	5
1A4bi	Residential: Stationary	12.29085226	5.84%	76.10%	6
1A3bii	Road transport: Light duty vehicles	11.42553310	5.42%	81.53%	7

Table 1.3.2 Key Categories for NMVOC (2016)

NFR CODE	CATEGORY	Latest year estimate (kt)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	72.42505975	28.03%	28.03%	1
2D3a	Domestic solvent use including fungicides	48.3643897	18.72%	46.74%	2
3B1a	Manure management - Dairy cattle	15.28658208	5.92%	52.66%	3

2D3g	Chemical products	10.33206343	4.00%	56.66%	4
1A3bi	Road transport: Passenger cars	10.2322	3.96%	60.62%	5
3De	Cultivated crops	7.48395048	2.90%	63.51%	6
1A3bv	Road transport: Gasoline evaporation	7.295748	2.82%	66.33%	7
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	6.858180043	2.65%	68.99%	8
3B4gi	Manure mangement - Laying hens	6.73746084	2.61%	71.60%	9
2D3f	Dry cleaning	5.893305	2.28%	73.88%	10
2H2	Food and beverages industry	5.779131555	2.24%	76.11%	11
3B1b	Manure management - Non-dairy cattle	5.331818136	2.06%	78.18%	12
1B1a	Fugitive emission from solid fuels: Coal mining and handling	4.596	1.78%	79.95%	13
2D3i	Other solvent use (please specify in the IIR)	3.92887	1.52%	81.48%	14

Table 1.3.3 Key Categories for SOx (2016)

NFR CODE	CATEGORY	Latest year estimate (kt)	Level assessment (%)	Cumulative total	Rank
1A1a	Public electricity and heat production	63.60092	59.07%	59.07%	1
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	20.91855	19.43%	78.50%	2
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	8.73801	8.12%	86.61%	3

Table 1.3.4 Key Categories for NH_3 (2016)

NFR CODE	CATEGORY	Latest year estimate (kt)	Level assessment (%)	Cumulative total	Rank
3Da2a	Animal manure applied to soils	45.66115916	27.27%	27.27%	1
3B3	Manure management - Swine	20.94368887	12.51%	39.77%	2
3B1a	Manure management - Dairy cattle	18.74592431	11.19%	50.97%	3
3Da3	Urine and dung deposited by grazing animals	16.08109413	9.60%	60.57%	4
3Da1	Inorganic N-fertilizers (includes also urea application)	15.49399500	9.25%	69.82%	5
3B4gi	Manure mangement - Laying hens	12.06127990	7.20%	77.02%	6
5D3	Other wastewater handling	9.779386	5.84%	82.90%	7

Table 1.3.5 Key Categories for $PM_{2.5}$ (2016)

NFR CODE	CATEGORY	Latest year estimate (kt)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	89.18558907	81.10%	81.10%	1

Table 1.3.6 Key Categories for PM_{10} (2016)

NFR CODE	CATEGORY	Latest year estimate (kt)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	91.55369433	65.16%	65.16%	1
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	13.57553808	9.66%	74.82%	2
2D3b	Road paving with asphalt	4.437304797	3.16%	77.98%	3
1A1a	Public electricity and heat production	4.306802131	3.07%	81.04%	4

Table 1.3.7 Key Categories for TSP (2016)

NFR CODE	CATEGORY	Latest year estimate (kt)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	96.36099621	46.65%	46.65%	1
2D3b	Road paving with asphalt	20.70742239	10.03%	56.68%	2
2B10a	Chemical industry: Other (please specify in the IIR)	18.67383	9.04%	65.72%	3
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	13.57553808	6.57%	72.29%	4
2A2	Lime production	9.55737	4.63%	76.92%	5
3B4gi	Manure mangement - Laying hens	7.75828824	3.76%	80.68%	6

Table 1.3.8 Key Categories for BC (2016)

NFR CODE	CATEGORY	Latest year estimate (kt)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	9.13040522	87.43%	87.43%	1

Table 1.3.9 Key Categories for CO (2016)

NFR CODE	CATEGORY	Latest year estimate (kt)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	502.6294297	67.72%	67.72%	1
1A3bi	Road transport: Passenger cars	92.7055858	12.49%	80.21%	2

Table 1.3.10 Key Categories for Pb (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
2C1	Iron and steel production	23.6187532	60.52%	60.52%	1
1A4bi	Residential: Stationary	3.66987086	9.40%	69.92%	2
1A1a	Public electricity and heat production	3.256954804	8.35%	78.27%	3
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	3.11098582	7.97%	86.24%	4

Table 1.3.11 Key Categories for Cd (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	1.622680055	53.22%	53.22%	1
2C1	Iron and steel production	0.396276	13.00%	66.22%	2
1A1a	Public electricity and heat production	0.389530054	12.78%	79.00%	3
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	0.172751282	5.67%	84.66%	4

Table 1.3.12 Key Categories for Hg (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
1A1a	Public electricity and heat production	0.618643418	42.81%	42.81%	1
2C1	Iron and steel production	0.2274354	15.74%	58.55%	2
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.198104978	13.71%	72.26%	3
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	0.116239255	8.04%	80.30%	4

Table 1.3.13 Key Categories for As (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
1A1a	Public electricity and heat production	3.035049769	69.13%	69.13%	1
2C1	Iron and steel production	0.953575	21.72%	90.85%	2

Table 1.3.14 Key Categories for Cr (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
2C1	Iron and steel production	5.2049966	42.70%	42.70%	1
1A4bi	Residential: Stationary	2.891168582	23.72%	66.41%	2
1A1a	Public electricity and heat production	1.946282278	15.97%	82.38%	3

Table 1.3.15 Key Categories for Cu (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
1A3bvi	Road transport: Automobile tire and brake wear	18.486	84.67%	84.67%	1

Table 1.3.16 Key Categories for Ni (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
1A1a	Public electricity and heat production	3.834545975	47.75%	47.75%	1
2C1	Iron and steel production	1.41444	17.61%	65.37%	2
1A4ai	Commercial/institutional: Stationary	1.0170276	12.67%	78.03%	3
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	0.30213682	3.76%	81.80%	4

Table 1.3.17 Key Categories for Se (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
1A1a	Public electricity and heat production	9.201130109	90.81%	90.81%	1

Table 1.3.18 Key Categories for Zn (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	64.28780312	54.20%	54.20%	1
2C1	Iron and steel production	13.346106	11.25%	65.45%	2
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	8.691833339	7.33%	72.77%	3
1A3bvi	Road transport: Automobile tyre and brake wear	6.81	5.74%	78.51%	4
1A3bi	Road transport: Passenger cars	5.282154589	4.45%	82.97%	5

Table 1.3.19 Key Categories for PCDD/F (2016)

NFR CODE	CATEGORY	Latest year estimate (g I-TEQ)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	97.7654059	63.11%	63.11%	1
2C1	Iron and steel production	32.016564	20.67%	83.77%	2

Table 1.3.20 Key Categories for Total PAHs (2016)

NFR CODE	CATEGORY	Latest year estimate (t)	Level assessment (%)	Cumulative total	Rank
1A4bi	Residential: Stationary	44.08581485	65.53%	65.53%	1
3F	Field burning of agricultural residues	8.732321668	12.98%	78.51%	2
2C1	Iron and steel production	6.40476	9.52%	88.03%	3

Table 1.3.21 Key Categories for HCB (2016)

NFR CODE	CATEGORY	Latest year estimate (kg)	Level assessment (%)	Cumulative total	Rank
1A1a	Public electricity and heat production	1.40672141	61.18%	61.18%	1
1A4bi	Residential: Stationary	0.624199023	27.15%	88.33%	2

Table 1.3.22 Key Categories for PCB (2016)

NFR CODE	CATEGORY	Latest year estimate (kg)	Level assessment (%)	Cumulative total	Rank
2C1	Iron and steel production	13.5308	69.88%	69.88%	1
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	3.9463766	20.38%	90.26%	2

Table 1.3.23 Key Categories by activity/pollutant – Main pollutants (2016)

Category		Main Pollutants								
		NOx	NMVOC	SOx	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
1A1a	Public electricity and heat production	17.13%		59.07%			3.07%			
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel			19.43%						
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	10.66%	2.65%	8.12%						
1A3bi	Road transport: Passenger cars	12.86%	3.96%							12.49%
1A3bii	Road transport: Light duty vehicles	5.42%								
1A3biii	Road transport: Heavy duty vehicles and buses	23.73%								
1A3bv	Road transport: Gasoline evaporation		2.82%							
1A4bi	Residential: Stationary	5.84%	28.03%			81.10%	65.16%	46.65%	87.43%	67.72%
1B1a	Fugitive emission from solid fuels: Coal mining and handling		1.78%							
2A2	Lime production							4.63%		
2B10a	Chemical industry: Other (please specify in the IIR)							9.04%		
2D3a	Domestic solvent use including fungicides		18.72%							
2D3b	Road paving with asphalt						3.16%	10.03%		
2D3f	Dry cleaning		2.28%							
2D3g	Chemical products		4.00%							
2D3i	Other solvent use (please specify in the IIR)		1.52%							
2H2	Food and beverages industry		2.24%							
3B1a	Manure management - Dairy cattle		5.92%		11.19%					
3B1b	Manure management - Non-dairy cattle		2.06%							
3B3	Manure management - Swine				12.51%					
3B4gi	Manure management - Laying hens		2.61%		7.20%			3.76%		
3Da1	Inorganic N-fertilizers (includes also urea application)	5.88%			9.25%					
3Da2a	Animal manure applied to soils				27.27%					
3Da3	Urine and dung deposited by grazing animals				9.60%					
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products						9.66%	6.57%		
3De	Cultivated crops		2.90%							
5D3	Other wastewater handling				5.84%					

Table 1.3.24 Key Categories by activity/ pollutant – Heavy Metals (2016)

Category		Heavy Metals								
		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
1A1a	**Public electricity and heat production**	8.35%	12.78%	42.81%	69.13%	15.97%		47.75%	90.81%	
1A2a	**Stationary combustion in manufacturing industries and construction: Iron and steel**	7.97%		13.71%				3.76%		
1A2gviii	**Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)**		5.67%	8.04%						7.33%
1A3bi	**Road transport: Passenger cars**									4.45%
1A3bvi	**Road transport: Automobile tyre and brake wear**						84.67%			5.74%
1A4ai	**Commercial/institutional: Stationary**							12.67%		
1A4bi	**Residential: Stationary**	9.40%	53.22%			23.72%				54.20%
2C1	**Iron and steel production**	60.52%	13.00%	15.74%	21.72%	42.70%		17.61%		11.25%

Table 1.3.25 Key Categories by activity/pollutant – POPs (2016)

Category		POPs			
		PCDD/F	Total PAHs	HCB	PCBs
1A1a	**Public electricity and heat production**			61.18%	
1A2a	**Stationary combustion in manufacturing industries and construction: Iron and steel**				20.38%
1A4bi	**Residential: Stationary**	63.11%	65.53%	27.15%	
2C1	**Iron and steel production**	20.67%	9.52%		69.88%
3F	**Field burning of agricultural residues**		12.98%		

1.4. Quality Assurance and Quality Control (QA/QC)

The first draft of the inventory is usually produced first month after the end of the given year depending primarily on the availability of required activity data. During the following several weeks, experts carry out extensive checks, based on trends variation and other activities in order to complete missing data / correct errors in the inventory. Various meetings with data providers are also undertaken, as to clarify important variations in activity data.

Estimated emissions are compared to ones from previous years by sector and activities (time series), and outliers are scrutinized in more detail. After the checking stage is completed, the final inventory is prepared together with the draft version of the accompanying reports.

After this step, the inventory is uploaded on EEA/EIONET database in the requested NFR format and a notification is sent to CLRTAP Secretariat/European Comission and CEIP.

The QA/QC plan aims to improve transparency, consistency, comparability, completeness and confidence of the national emissions inventories. It establishes the procedures to be applied in the process of emission inventorying at all stages from data collection to national emission inventory compilation.

The national air emissions inventory system includes:

- Data collection at:
  - Local level – from economic operators and local public institutions;
  - National level – main statistical data from national public institutions (such as the N.I.S. or the R.A.R.);
- Compilation of the local emission inventories (by the Local Environmental Protection Agencies-L.E.P.A.). Local emission inventories provide source specific data for the National inventory and for the air modeling maps;
- Compilation of the national emission inventory (by N.E.P.A.) according to the latest version of the EMEP/EEA Guidebook and to the UNECE/CLRTAP Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/125);

The quality control (QC) procedures refer to:

- Primary Data validation (applied by L.E.P.A). It means the verification routines for validation of activity data provided by the operators through the 'I.E.S-Integrated Environmental System;
- Quality control of emissions inventories (applied at L.E.P.A or N.E.P.A level, for the local or national inventories).

These procedures include the verification methods of the emission inventory compilation such as:

- Checking the quality of data used for compilation of the national inventory (checking if audited, qualitative rating of data);
- Checking the correctness of assumptions, mainly for key categories (emission factors, calculations);
- Checking the proper allocation of NFR;
- Identification of ‘outliers’, verification of plausibility and applying corrections if necessary;
- Checking if data collected bottom-up are comparable with those reported in national statistics;
- Checking if the emission inventory data is consistent and correlated with data reported under different other reporting obligations;
- Checking the plausibility and completeness of the time series;
- Checking the consistency and documentation in case of recalculations;
- Checking the application of improvements or corrections required by reviews or methodology changes;
- Checking the application of archiving procedures.

In addition, quality assurance activities may be conducted by external experts in order to verify and review the quality of emission inventories.

The quality control procedures are being developed by N.E.P.A in cooperation with L.E.P.As.

An internal discussion forum has been set for a better communication between all N.E.P.A and L.E.P.As data providers and contributors to emissions inventory compilation. Discussions are structured on NFR categories/data collection questionnaires and the results of discussions, questions and the adequate solutions are further analyzed, summarized and included in the quality control procedures.

RepDab Report (available at www.ceip.at) is also generated as an additional QA/QC activity.

2. EMISSION TRENDS by YEAR

2.1.Emission trends for Main Pollutants

Table 2.1.1 Total Emission trends (kt) for Main Pollutants, Particulate Matter, CO and BC

Year/Pollutant	NOx	NMVOC	SOx	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
2000	262.52843	281.24293	492.53284	168.21637	94.19891	116.52304	202.86234	9.88227	684.77528
2001	270.85888	264.26714	515.07551	164.38319	74.43879	97.43268	178.48303	7.98590	593.08278
2002	276.66482	263.82330	509.39105	171.69585	77.10885	99.29886	180.13049	8.28449	613.23966
2003	287.78785	282.10608	588.78707	174.41835	91.72906	116.29647	219.94637	9.79783	703.14555
2004	293.96928	290.03950	551.70194	188.11604	104.25907	131.72722	241.27480	11.29558	786.69892
2005	317.50889	328.71726	604.85189	205.70108	123.10646	157.42888	290.45194	10.70142	960.26520
2006	313.65521	332.87360	648.70920	204.59860	118.22609	153.03655	263.12448	10.28383	898.21289
2007	294.53588	322.26404	518.48290	200.63042	117.72676	156.72314	284.19689	10.27497	845.95159
2008	291.56570	333.85381	525.30894	197.62349	138.64350	173.47070	311.27218	12.38477	948.62398
2009	247.67820	294.67700	446.74726	190.56763	131.54129	164.66349	265.73079	11.94682	872.64677
2010	233.80907	288.22909	354.09435	174.54267	132.42427	166.16165	280.68274	12.33401	868.14072
2011	243.95534	279.85305	324.34979	172.73367	122.39492	156.79294	276.26423	11.26223	791.97301
2012	240.66508	285.18717	259.91162	171.73783	124.63972	158.61831	264.93057	11.61936	813.51257
2013	223.74841	270.58078	227.38346	172.15545	115.85409	148.26178	241.65954	10.85072	761.99451
2014	217.36682	265.93868	183.37763	168.64360	115.15254	148.26456	244.74735	10.74807	765.98762
2015	213.92513	259.71483	157.26505	171.44030	110.25140	142.34060	221.10176	10.38248	744.05822
2016	210.62919	258.41586	107.66931	157.60495	109.97411	140.51304	206.54784	10.44253	742.26127

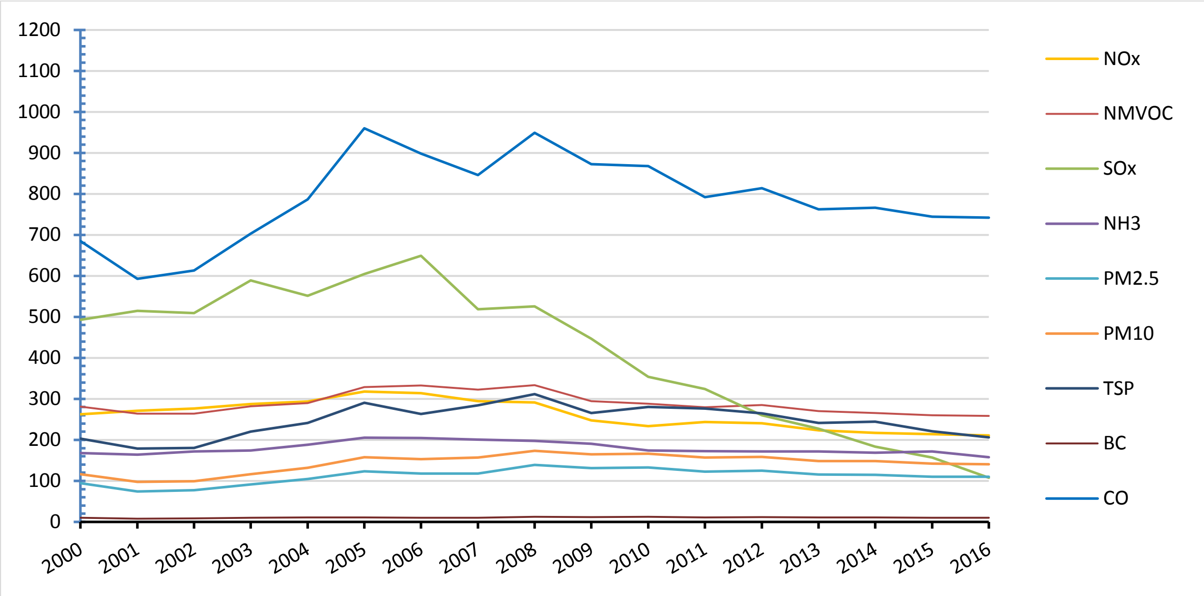


Figure 2.1.1. Total Emission trends (kt) for Main Pollutants, Particulate Matter and CO

Compared to 2000, 2016 SO_X emissions decreased by almost 78.1%. This was mainly due to the use of low-sulphur fuels and also the regulatory binding on maximal fuel content in transport diesel/gas oil. Also, many LCPs installed desulphurization equipment in order to achieve compliance with the EU legislation.

NOx emissions decreased by almost 19.8% in 2016, compared cu 2000 emission data, mainly because of NOx catalyst reduction in road vehicles and low-NOx burners used in industrial / power plants.

By 2016 NMVOC and NH_3 decreased also with 8.1% and 0.44% respectively, compared to 2000 emission data.

There is a general increasing trend of emissions prior to year 2007 followed by a decreasing trend of emissions until 2016. The trend reflects several issues: the economic growth in Romania before the world financial and economic crisis that triggered the decrease of industrial production, the decrease of energy production in fossil fuels power plants and the implementation of emission reduction technologies. Additionally: the biomass consumption in residential small combustion, which is key source for most of pollutants, increased slightly until 2010, followed by slight decrease until 2016; the agriculture sector contributed with increased emissions for the main pollutants for the 2004-2006 period, especially for NH3, according to livestock production; NMVOC emissions in the period 2000-2005 increased due to increasing disposal of solid waste on land.

2.2.Emission trends for Heavy Metals

Table 2.2.1 Total Emission trends (t) for Pb, Cd, Hg, As, Cr, Cu, Ni, Se and Zn

Year/Pollutant	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
2000	48.916	3.225	1.799	5.710	14.791	4.823	30.699	11.818	100.465
2001	50.017	2.916	1.842	5.965	14.761	4.348	37.626	11.638	91.109
2002	56.172	2.957	1.916	6.247	16.749	4.639	30.215	11.726	95.717
2003	60.720	3.455	2.164	6.938	17.935	5.048	28.723	13.802	109.738
2004	62.857	3.665	2.098	6.715	18.531	5.570	25.155	13.128	113.765
2005	67.237	3.763	2.234	6.753	19.237	18.814	25.703	13.168	132.921
2006	66.542	3.768	2.309	7.143	18.912	19.083	21.464	14.687	128.851
2007	64.695	3.731	2.209	7.050	18.939	19.055	17.105	14.871	128.609
2008	56.982	3.899	2.164	6.729	17.114	21.005	15.215	15.222	138.441
2009	36.404	3.318	1.661	5.273	12.217	20.196	13.507	12.714	124.675
2010	43.058	3.471	1.727	5.099	12.679	19.291	12.159	12.355	128.238
2011	43.064	3.358	1.837	5.710	12.420	19.749	13.280	14.488	118.840
2012	39.537	3.291	1.612	4.766	11.655	20.780	11.384	11.841	121.738
2013	36.720	3.021	1.426	4.260	11.489	20.102	8.555	10.069	115.729
2014	37.419	3.010	1.438	4.270	11.514	20.312	8.754	10.203	116.567
2015	40.052	2.977	1.487	4.473	12.206	20.555	8.458	10.435	116.281
2016	39.026	3.049	1.445	4.390	12.190	21.832	8.030	10.132	118.622

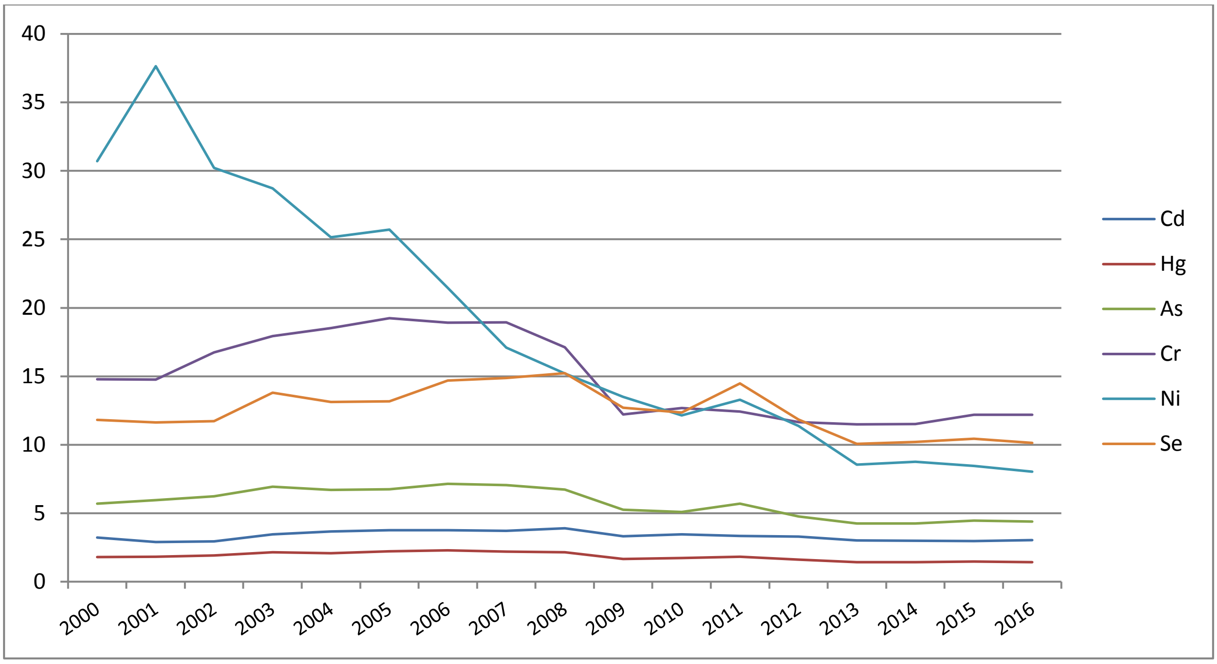


Figure 2.2.1.a Total Emission trends (t) for Cd, Hg, As, Cr, Ni and Se

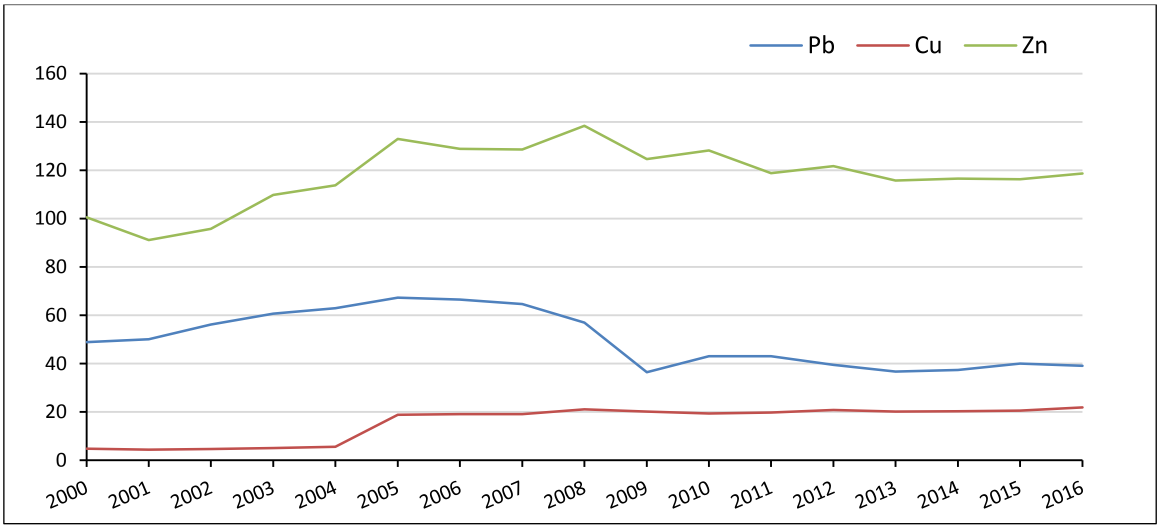


Figure 2.2.1.b Total Emission trends (t) for Pb, Cu and Zn

The most important decreases in 2016, compared to 2000 emission data, were recorded for Ni (73.8%), Pb (20.2%) and Hg (19.6%). All other heavy metals emissions followed a decreasing trend up to 2013. In 2014-2015, emissions slightly increased, due to rising activity data in the sectors NFR 1.A.1.a Public electricity, NFR 1.A.2.a Stationary combustion in manufacturing industries and construction: Iron and steel, NFR 1.A.2.f Stationary combustion in manufacturing industries and construction: Non-metallic minerals and NFR 2.C.1 Iron and steel production.

2.3.Emission trends for POPs

Table 2.3.1 Total Emission trends for PCDD/F (g I-TEQ), total PAHs (t), HCB and PCBs (kg)

Year/Pollutant	PCDD/ PCDF (g I-TEG)	total PAHs (t)	HCB (kg)	PCBs (Kg)
2000	143.516	78.310	2.302	27.777
2001	122.133	58.445	2.220	29.025
2002	131.285	63.816	2.300	33.791
2003	149.489	74.884	2.711	36.642
2004	166.900	74.392	2.690	36.854
2005	181.668	77.363	2.767	38.457
2006	246.328	74.816	3.377	37.642
2007	173.091	84.035	2.994	35.767
2008	185.479	81.737	3.156	30.201
2009	155.225	72.859	2.773	17.380
2010	178.390	73.247	2.763	20.870
2011	184.996	68.188	3.082	20.078
2012	191.689	76.683	2.749	18.460
2013	167.462	67.045	2.386	17.498
2014	154.150	68.159	2.294	17.995
2015	155.704	69.288	2.323	20.230
2016	154.925	67.271	2.299	19.363

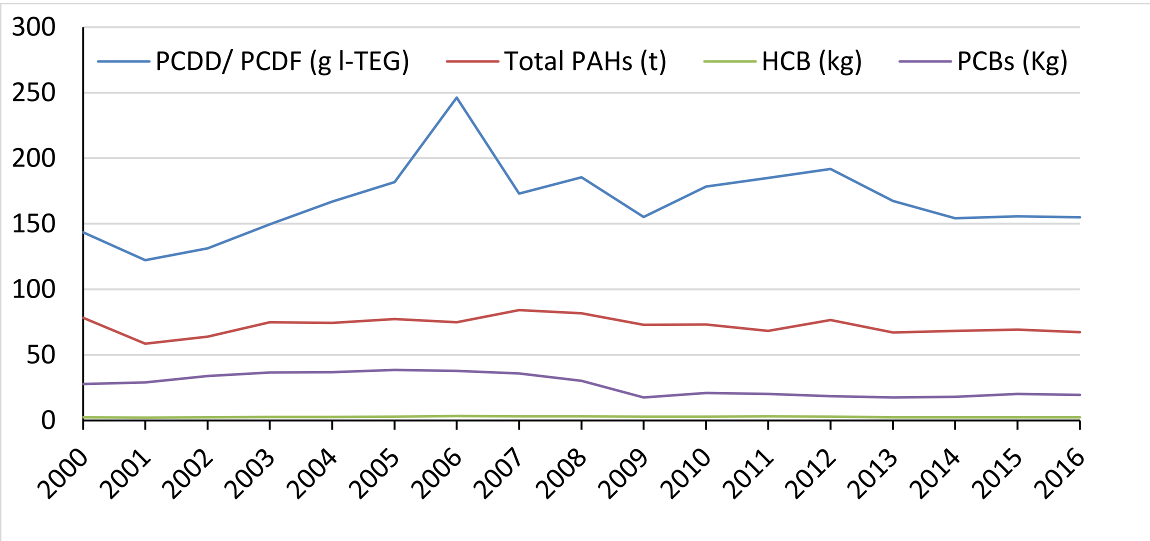


Figure 2.3.1 Total Emission trends for Dioxines (g I-TEQ), total PAHs (t), HCB and PCBs (kg)

Compared to 2000, total PAHs emissions in 2016 showed a decrease of 14.1% and PCBs a decrease of almost 30.3%, mainly due to activity decrease in the iron and steel industry.

3. NFR 1 – SECTOR ENERGY

The "ENERGY" sector represents the main source of emissions in Romania. This includes fuel combustion in energy industry (NFR 1.A.1) and in manufacturing industry (NFR 1.A.2), transport (NFR 1.A.3), small combustion, including off-road mobile machinery (NFR 1.A.4) and fugitive emissions from fuels (NFR 1.B.1 and NFR 1.B.2).

3.1 Stationary Fuel Combustion

This chapter considers emissions originating from stationary fuel combustion activities (NFR 1.A.1, NFR 1.A.2 and NFR 1.A.4). The related sources of non road mobile machineries NFR 1.A.4.aii, NFR 1.A.4.bii, NFR 1.A.4.cii and NFR 1.A.5.b are also included in this chapter.

Following the Emission Inventory review in 2017, all categories were recalculated and extended back to the year 2000, based on the following criteria: to answer as much as possible the specific requests of the review, to use updated statistics, to use operators measured emissions and corresponding fuel consumption, where available, to assure the consistency with all relevant categories from the energy statistics, and to update the emission factors to those included in the 2016 EMEP/EEA Guidebook.

Table 3.1.1 gives a summary of activity data sources for stationary combustion categories (including the related non-road mobile machineries). The table is relevant for assessing the completion of NFR categories on stationary and non-road.

Most of data for years 2000 to 2015 were taken from the EUROSTAT energy balances, (annual data nrg_110a), for relevant activities, as detailed in Table 3.1.2

Table 3.1.1 Reference of activity data for NFR categories 1.A.1, 1.A.2, 1.A.4 and 1.A.5.

NFR	Activity data source
1.A.1.a Public Electricity and Heat Production	(1) LCP operators; (2) Energy statistics*: Main activity producer plants, (Electricity/CHP/Heat only), Own use in electricity, CHP and heat plants, Autoproducers* • 2000-2015: EUROSTAT complete energy balances, annual data (nrg_110a) • 2016 – national energy balance (National institute of Statistics)
1.A.1.b Petroleum refining	• 2000-2012: EUROSTAT complete energy balances, annual data (nrg_110a*) Consumption of the energy branch/Petroleum refineries* • 2013-2015 – national reports from refineries operators • 2016 – refineries operators online reporting to the National Environmental Integrated System;
1A1c Manufacture of Solid fuels and Other Energy Industries	• 2000-2015: EUROSTAT complete energy balances, annual data (nrg_110a): *Consumption of the energy branch/ Consumption in Oil and gas extraction, Consumption in Coal Mines, Consumption in Coke Ovens, Consumption in Non-specified (Energy)* • 2016 : National Institute of Statistics (Eurostat questionnaires)

1.A.2.a Iron and Steel	• 2000-2015: EUROSTAT complete energy balances, annual data (nrg_110a): *Final energy consumption/Industry/Iron & steel industry;* • 2016: national energy balance (National institute of Statistics).
1.A.2.b Non-ferrous Metals	IE – included at 1.A.2.g.viii
1.A.2.c Chemicals	IE – included at 1.A.2.g.viii
1.A.2.d Pulp, Paper and Print	IE – included at 1.A.2.g.viii
1.A.2.e Food Processing, Beverages and Tobacco	IE – included at 1.A.2.g.viii
1.A.2.f Non-metallic Minerals	IE – included at 1.A.2.g.viii
1.A.2.g Other Stationary Combustion	• 2000-2015: EUROSTAT complete energy balances, annual data (nrg_110a): *Final energy consumption/Industry (all) minus amount considered at 1A2a(Iron & steel industry)* • 2016: national energy balance (National institute of Statistics).
1.A.4.a.i Commercial/ Institutional: stationary	• 2000-2015: EUROSTAT complete energy balances, annual data (nrg_110a): *Final energy consumption/Other Sectors /Services + Non-specified* • 2016: national energy balance (National institute of Statistics).
1.A.4.a.ii Commercial/ institutional: Mobile	IE – included at 1A4ai
1.A.4.b.i Residential: stationary	• 2000-2015: EUROSTAT complete energy balances, annual data (nrg_110a): *Final energy consumption/Other Sectors /Residential* • 2016: national energy balance (National institute of Statistics).
1.A.4.b.ii Residential: Household and gardening (mobile)	IE – included at 1A4bi
1.A.4.c.i Agriculture/ Forestry/Fishing, Stationary	• 2000-2015: EUROSTAT complete energy balances, annual data (nrg_110a): *Final energy consumption/Other Sectors / Agriculture / Forestry. From oil category, only the fuel oil was allocated to this category (other liquid fuels were used at 1.A.4.c.ii);* It includes also the National fishing (1A4ciii). • 2016: national energy balance (National institute of Statistics).
1.A.4.c.ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	• 2000-2015: EUROSTAT complete energy balances, annual data (nrg_110a): *Final energy consumption/Other Sectors / Agriculture / Forestry : Motor Gasoline and Gas/Diesel Oil.* • 2016: national energy balance (National institute of Statistics)
1.A.5.a Other Stationary (including Military)	IE – included at 1.A.4.ai
1.A.5.b Other, Mobile (including military, land based and recreational boats)	IE – included at 1.A.4.ai

Fuels in the energy balances were aggregated to categories liquid, solid, gas and biomass according to relevance for Tier 1 application of emission factors, as in the following table:

Table 3.1.2 Aggregation of fuels on fuel types

Tier 1 Fuel type	**Associated fuel types**
Hard coal /solid	Coking coal, other bituminous coal, sub-bituminous coal, coke, manufactured 'patent' fuel
Brown coal / solid	Lignite, oil shale, manufactured 'patent' fuel, peat
Gaseous fuels	Natural gas, natural gas liquids, liquefied petroleum gas, refinery gas,gas works gas, coke oven gas, blast furnace gas
Heavy fuel oil / Liquid fuels	Residual fuel oil, refinery feedstock, petroleum coke, orimulsion, bitumen
Light oil / Liquid fuels	Gas oil, kerosene, naphtha, shale oil
Biomass	Wood, charcoal, vegetable (agricultural) waste

(source: Table 3-1 Tier 1 fuel classifications, 2016 EMEP/EEA Guidebook)

Details on calculations and trends are given in the following sections.

3.2 NFR 1.A.1.a Public electricity and heat production

Activities in this category cover combustion processes from production of electric power and thermal energy in public power and district heating plants, including the own fuel consumption.

NFR 1.A.1.a is key source category for SOx, NOx and $PM_{2.5}$ pollutants.

Following the Emission Inventory review in 2017, the 1.A.1.a category was recalculated, in order to take into account the fuel consumption in all power and heat plants (including the ones under 50 MW) as well as the fuel consumption for own use in electricity, CHP and heat plants (review ref: RO-1A1a-2017-0001).

The calculation was done as following:

2000-2004: Tier 1 emission factors (2016 EMEP/EEA Guidebook, NFR 1.A.1.a, Tables 3.3, 3.4, 35. and 3.7) were applied to activity data taken from EUROSTAT energy balances, categories *Main activity producer plants (Electricity/CHP/Heat only)* and *Own use in electricity, CHP and heat plants,* including *Autoproducers*. For this timeseries, there are no more specific data available from operators. Note that, based on information from the N.I.S, the autoproducers are reported in national statistics not separate, but included in Electricity/CHP/Heat only categories, therefore, the consumption for Autoproducers was allocated to NFR 1.A.1.a, to assure consistency between data sources (Eurostat energy balances and national energy balances).

2005-2016: the fuel consumption and the measured emissions of TSP, NOx and SOx reported by the LCPs operators were considered as first approach. The fuel consumption in LCP was compared with the values provided by Eurostat energy balances (and domestic energy balance for 2016), at categories *Main activity producer plants (electricity/CHP/Heat only)* and *Own use in electricity, CHP and heat plants*, including *Autoproducers*. The difference between fuel data from energy balances and consumption in LCP were considered for Tier 1 estimation of TSP, NOx and SO_x emissions. These emissions were summed up with the measured TSP, NOx and SO_x emissions from LCPs, to report on NFR 1.A.1.a.

The emissions estimates for CO, NMVOC, Heavy Metals and POPs pollutants were calculated entirely with Tier1 emission factors applied on fuel consumption in energy balances, for the mentioned categories.

The emissions of PM_{10}, $PM_{2.5}$ and BC pollutants were estimated with Tier 1 methodology for the years 2000 to 2004, where no more specific information was available.

For the years 2005 to 2016, the measured TSP in LCP were used as a basis for adjustment of Tier 1 estimation of PM_{10}, $PM_{2.5}$ and BC. This adjustment was made due to the fact that it was a too high discrepancy between the measured TSP and the Tier 1 estimation. (measured values higher than estimated ones). Therefore, for the years when measured TSP values were available (2005-2016), the Tier 1 emissions of PM_{10}, $PM_{2.5}$ and BC were adjusted based on the emission factors ratio (PM10/TSP, PM2.5/TSP) in Tier 1 emission factor tables (2016 EMEP/EEA Guidebook, NFR 1.A.1.a, Tables 3.3, 3.4, 3.5 and 3.7). There are no measured values for years before 2005, which results in discrepancies between 2004 and 2005 values of TSP, PM and BC. The planned improvement foresees the harmonization of the whole timeseries trend by reanalyzing the measured TSP values and eventually extrapolation of equivalent emission factors for PM and BC for the whole timeseries based on available TSP measurements.

Table 3.2.1. Emission Trends (kt) for NFR 1.A.1.a. for NOx, SOx, Particulate Matter, Black Carbon and CO

Year/Pollutant (kt)	NOx	SOx	$PM_{2.5}$	PM_{10}	TSP	BC	CO
2000	87.407	427.705	2.653	4.244	5.975	0.105	11.567
2001	88.885	442.864	3.046	4.780	6.761	0.129	10.849
2002	86.145	437.999	2.889	4.539	6.280	0.110	10.666
2003	98.511	508.790	2.556	4.313	6.112	0.093	11.836
2004	90.020	473.535	2.273	3.861	5.383	0.073	10.769
2005	98.043	515.414	15.734	23.787	30.438	0.304	9.768
2006	101.241	561.540	14.937	23.276	29.815	0.298	9.231
2007	86.382	444.295	12.820	19.977	25.588	0.256	9.674
2008	85.321	452.357	13.253	20.652	26.453	0.265	9.691
2009	66.371	397.729	11.849	18.464	23.650	0.237	9.130
2010	56.515	300.646	8.670	13.510	17.305	0.173	7.697
2011	60.119	274.242	10.127	15.781	20.214	0.202	7.815
2012	54.473	213.356	7.622	12.067	15.710	0.151	6.903
2013	48.765	185.982	5.616	8.751	11.209	0.112	7.012
2014	44.261	140.475	4.565	7.114	9.112	0.091	6.902
2015	42.186	109.766	3.440	5.335	6.853	0.070	7.460

2016	36.072	63.601	2.764	4.307	5.517	0.055	7.575

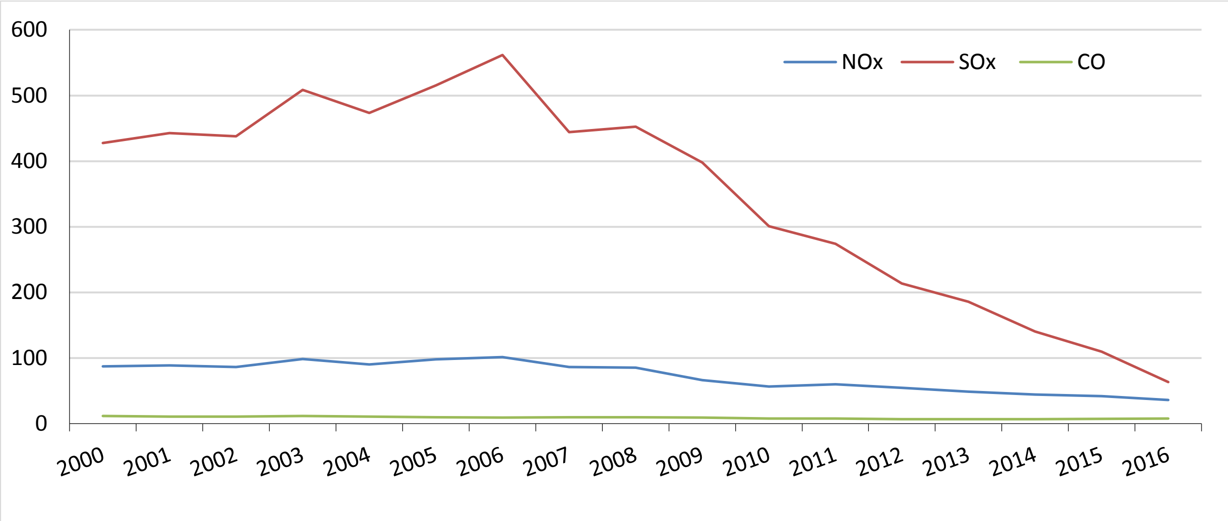


Figure 3.2.1.a Emission Trends (kt) for NFR 1.A.1.a. for NOx, SOx and CO

Compared to 2000 emission data, the most important emission decreases in this sector were recorded for NOx (almost 58.73%) and SOx (almost 85%), due to implementation of emission reduction program in LCP installations.

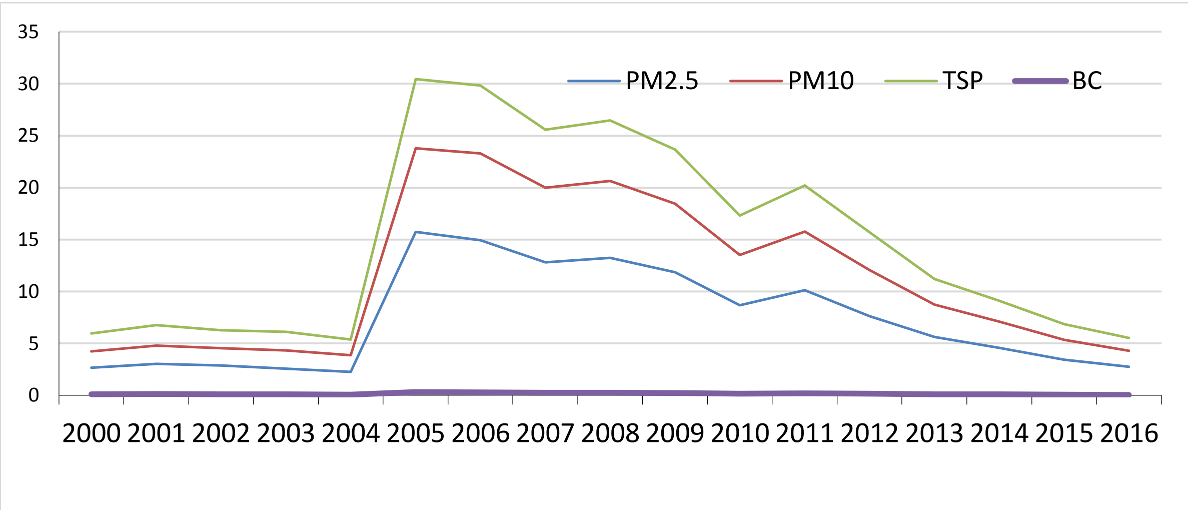


Figure 3.2.1.b. Emission Trends (kt) for NFR 1.A.1.a. for TSP, PM_{10}, $PM_{2.5}$ and BC

As outlined above, the TSP, PM and BC trends will be subject of future analyse, to enable the consistency in the timeseries.

Table 3.2.2. Total Emission Trends (t) for NFR 1.A.1.a. for Heavy Metals

Year/Pollutant	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
2000	3.853	0.515	0.719	3.657	2.316	0.689	23.156	10.540	9.425
2001	3.981	0.547	0.729	3.772	2.390	0.811	29.461	10.669	11.519
2002	3.999	0.527	0.741	3.768	2.397	0.720	21.634	10.890	9.420
2003	4.571	0.593	0.865	4.348	2.755	0.671	20.519	12.850	8.765
2004	4.294	0.542	0.818	4.070	2.585	0.565	13.913	12.193	6.773
2005	4.287	0.543	0.821	4.085	2.589	0.517	13.899	12.315	6.364
2006	4.776	0.594	0.917	4.545	2.885	0.514	11.521	13.855	5.888
2007	4.718	0.576	0.921	4.511	2.859	0.391	6.772	13.975	4.048
2008	4.978	0.598	0.945	4.654	2.982	0.598	6.336	14.166	5.719
2009	4.445	0.535	0.817	4.066	2.631	0.749	8.310	12.024	7.396
2010	3.937	0.479	0.767	3.756	2.383	0.333	5.224	11.634	3.366
2011	4.649	0.564	0.902	4.431	2.814	0.389	5.773	13.747	3.867
2012	3.765	0.457	0.730	3.582	2.276	0.333	4.822	11.080	3.311
2013	3.233	0.390	0.622	3.050	1.945	0.340	4.097	9.349	3.296
2014	3.278	0.393	0.621	3.054	1.960	0.415	4.061	9.263	3.926
2015	3.335	0.399	0.632	3.105	1.992	0.426	3.981	9.408	4.002
2016	3.257	0.390	0.619	3.035	1.946	0.411	3.835	9.201	3.861

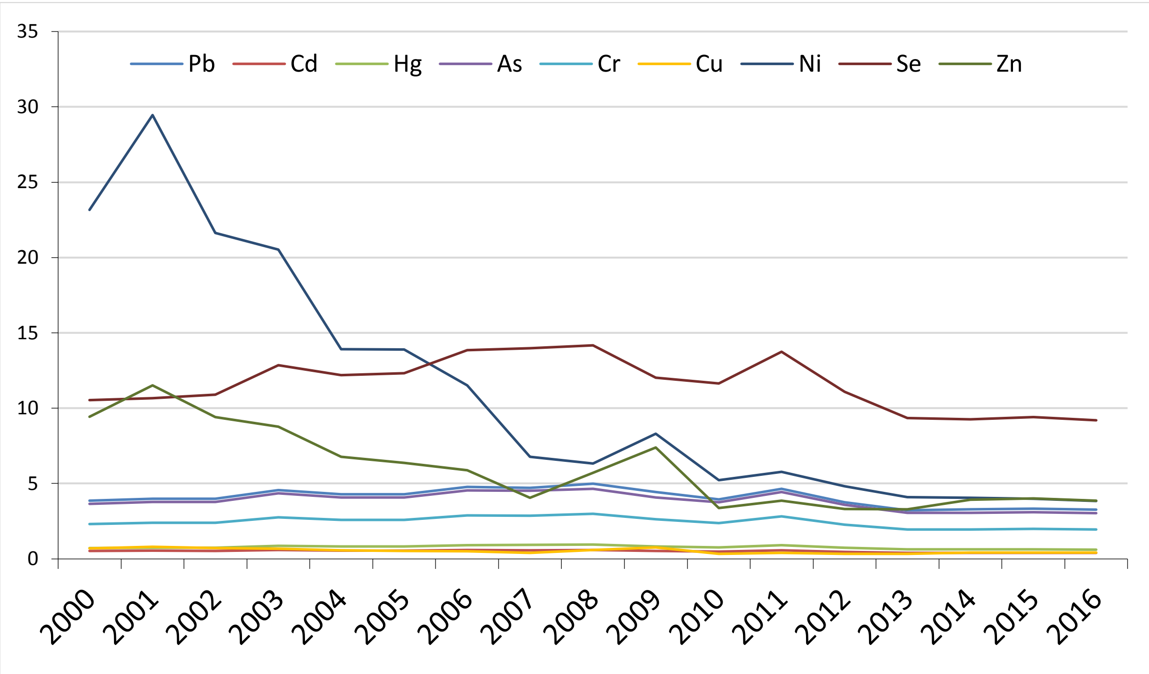


Figure 3.2.2. Total Emission Trends (t) for NFR 1.A.1.a. for Heavy Metals

The highest heavy metals emissions decreases, compared to 2000 emission data, were for Ni (83%), Zn (59%), Cu (40%) and Cd (24.4%). In 2014-2016, emissions of heavy metals in this sector are steady or slightly increased.

Table 3.2.3 Fuel consumption trends (TJ) by fuel type, for NFR 1.A.1.a.

Year/Fuel type	Liquid fuels	Solid fuels	Gaseous fuels	Biomass
2000	81981	230389	210910	1100
2001	106668	232146	183694	611
2002	75559	238396	182287	3800
2003	69678	282280	211471	899
2004	44173	268800	192325	2923
2005	44143	271586	171542	272
2006	33450	306288	152164	707
2007	14763	309835	172911	819
2008	12329	313911	149806	545
2009	21506	265718	126108	550
2010	10622	257997	133604	901
2011	10973	304930	125309	1217
2012	9467	245703	114465	1754
2013	7945	207248	120611	4281
2014	7671	205244	109766	7991
2015	7210	208475	122413	8477
2016	6829	183339	127381	8106

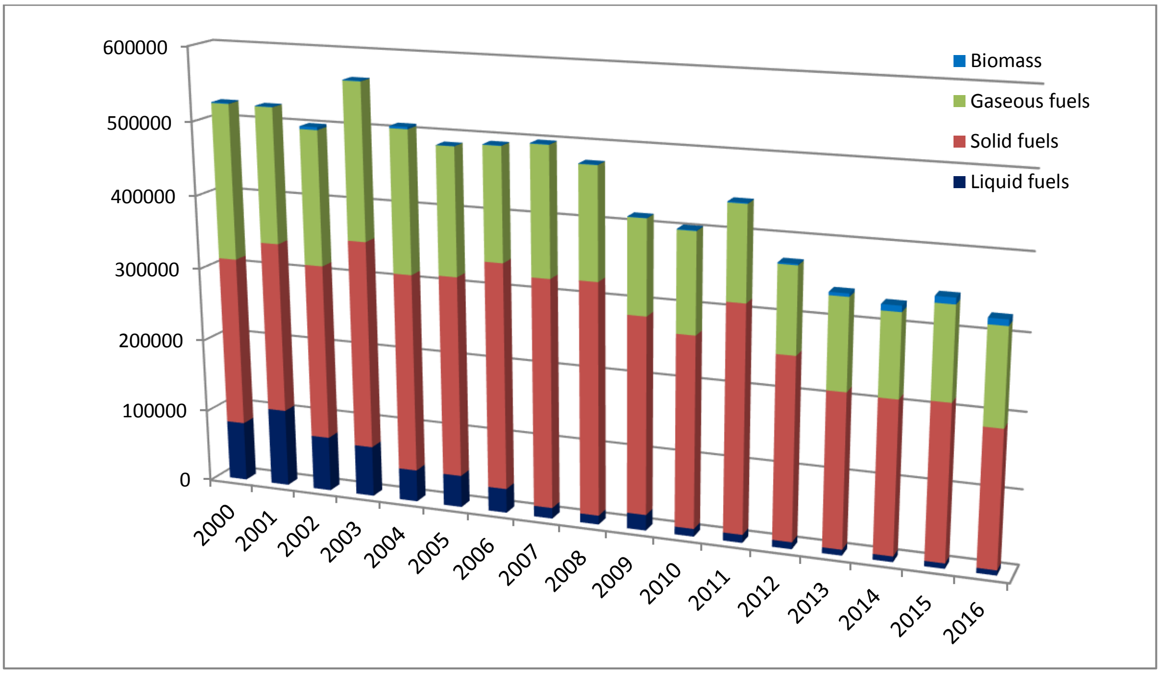


Figure 3.2.3 Fuel consumption trends, by fuel type, for NFR 1.A.1.a.

The general decrease in emissions are consistent with the decrease of fuel consumption and technology improvement in power plants. In the last 4 years, the fuel consumption in the energy sector as well as emissions levels were pretty steady. On the other hand, variations in emission trends (high/low annual values) are due to different ratios of solid/liquid/gasesous fuels along the timeseries, which contribute with different emission factors (or measured emissions) for each pollutant.

3.3 NFR 1.A.1.b Petroleum refining

The NFR category 1.A.1.b covers emissions released from combustion processes within a refinery. The time series previously reported was recalculated, due to the fact that the activity data reported in CLRTAP/NECD inventories were not consistent with corresponding data in the energy statistics.

NFR 1.A.1.b is not a key source for any pollutant.

The timeseries 2000-2004 were calculated and the time series 2005-2012 were recalculated by applying Tier 1 emission factors (2016 EMEP/EEA Guidebook 1.A.1.a, Tables 3.3, 3.4, 3.5 and 3.7) to activity data from EUROSTAT (complete energy balances, annual data - nrg_110a), category *Consumption of the energy branch/Petroleum refineries*. Emissions and fuel consumptions for 2013-2015 were taken from reports delivered by refineries operators. 2016 data, emissions and fuel consumption, were provided by refineries operators via the I.E.S and are considered as the most reliable in the dataseries. Data for 2013-2015 show inconsistencies which need further detailed assessment. The reasons of inconsistencies could be:

a. applying Tier 1 for years when improved technology was already installed;

b. underestimated values for years 2013-2015 (not all plants covered by the estimation).

The planned improvement foresees the harmonization of the data trend over the whole time series for 2019 submission, in order to remove the inconsistencies in the data trend and to take into consideration the information on technology improvement, which took place in the last 10 years in refineries.

Tables and charts below show the emissions trend and fuel consumption timeseries for the category NFR 1.A.1.b.

Table 3.3.1. Emission Trends (kt) for NFR 1.A.1.b. for NOx, NMVOC, SOx, $PM_{2.5}$, PM_{10}, TSP

Year/Pollutant (kt)	NOx	NMVOC	SOx	$PM_{2.5}$	PM_{10}	TSP
2000	5.953	0.153	5.789	0.198	0.249	0.332
2001	6.202	0.134	13.278	0.220	0.297	0.405
2002	5.922	0.161	3.213	0.150	0.182	0.236
2003	5.136	0.137	3.719	0.133	0.164	0.213
2004	5.045	0.133	3.915	0.156	0.193	0.256
2005	5.398	0.140	4.922	0.176	0.221	0.293

2006	5.191	0.128	6.555	0.205	0.261	0.353
2007	4.709	0.126	3.182	0.158	0.195	0.259
2008	4.637	0.126	2.738	0.117	0.142	0.184
2009	3.803	0.102	2.360	0.109	0.133	0.174
2010	4.195	0.109	3.600	0.172	0.214	0.288
2011	3.750	0.096	3.562	0.166	0.208	0.281
2012	3.361	0.088	2.751	0.133	0.165	0.222
2013	0.373	0.005	0.206	0.002	0.002	0.047
2014	0.559	0.006	0.395	0.002	0.002	0.075
2015	0.452	0.004	0.387	0.002	0.002	0.028
2016	0.575	0.047	0.155	0.020	0.023	0.027

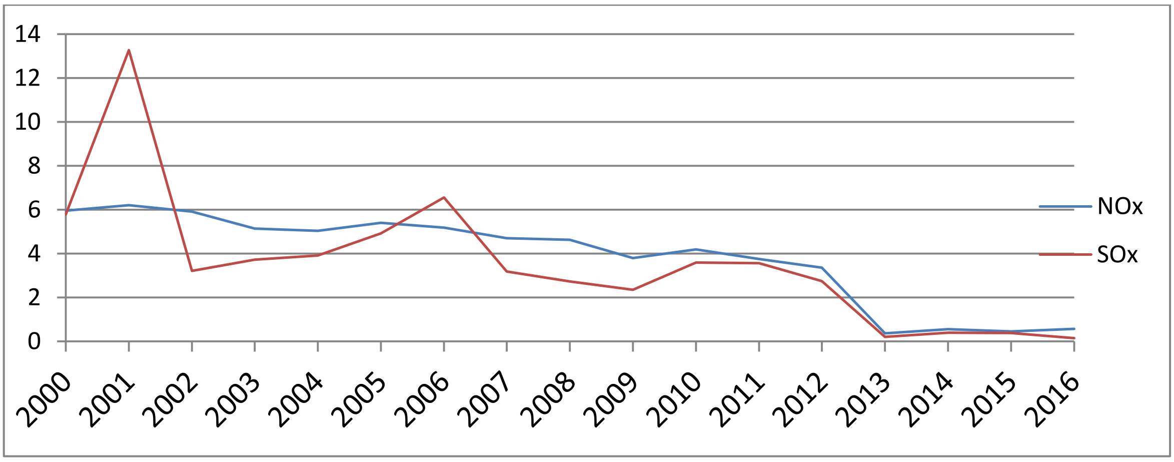


Figure 3.3.1.a. Emission Trends (kt) for NFR 1.A.1.b. for NOx, SOx

Main pollutant emissions recorded a peak in 2001 following the activity data trend and decreased heavily afterwards. Important emissions reductions were recorded for all main pollutants for the 2000-2016 time period: 90.3% for NOx, 69.5% for NMVOC, 97.3% for SOx and 90% for $PM_{2.5}$.

Figure 3.3.1.b. Emission Trends (kt) for NFR 1.A.1.b. for NMVOC, $PM_{2.5}$, PM_{10} and TSP

Table 3.3.2. Fuel consumption trends (TJ), by fuel type, for NFR 1.A.1.b

Year/Fuel type (Tj)	Liquid fuels	Gaseous fuels
2000	7709	51355
2001	8640	41045
2002	5080	57305
2003	4520	48065
2004	5880	45670
2005	6798	47257
2006	8489	40909
2007	6227	42834
2008	3924	44552
2009	3936	35788
2010	7253	35563
2011	7178	30683
2012	5542	28924
2013	0.989	2195
2014	0	1058
2005	0	1783
2016	355	22761

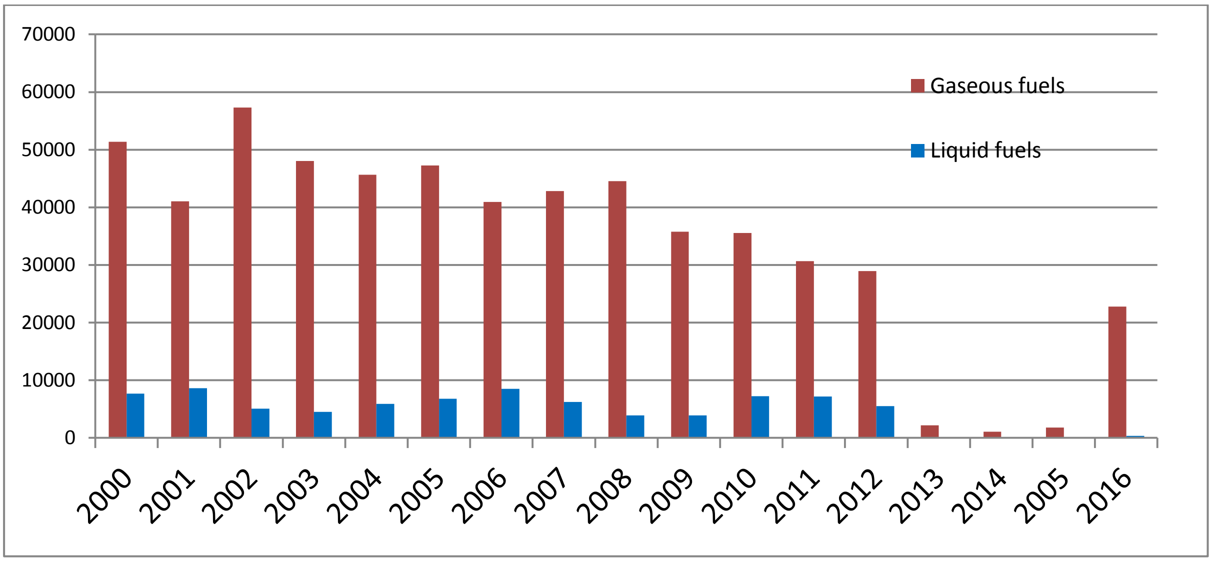


Figure 3.3.2. Fuel consumption [TJ] trends, by fuel type, for NFR 1.A.1.b

Gaseous fuels in Petroleum Refining recorded a 52% decrease. Liquid fuels decreased from 7709 TJ in 2000 down to 355 TJ in 2016. Variations in activity data are directly related to variations in petroleum market request.

3.4 NFR 1.A.1.c Manufacture of solid fuels and other energy industries

This category includes emissions from fuel combustion in the following industries: Oil and gas extraction, Coal Mines, Coke Ovens and other non-specified fuel consumtion in energy industries. The 2000-2015 emissions were estimated by applying Tier 1 emission factors (2016 EMEP/EEA Guidebook, small combustion) to activity data from EUROSTAT (complete energy balances, annual data - nrg_110a), categories *Consumption of the energy branch/ Consumption in Oil and gas extraction, Consumption in Coal Mines, Consumption in Coke Ovens, Consumption in Non-specified (Energy).* 2016 data were provided by the N.I.S via Eurostat questionnaires.

NFR 1.A.1.c is not a key source for any pollutant.

Tables and charts below show the emissions trend and fuel consumption timeseries for the category NFR 1.A.1.c.

Table 3.4.1. Emission Trends (kt) for NFR 1.A.1.c. for NOx, NMVOC, SOx CO and PM

Year/Pollutant (kt)	NOx	NMVOC	SOx	CO	$PM_{2.5}$	PM_{10}	TSP
2000	5.708	1.020	1.635	2.614	0.296	0.324	0.329
2001	6.214	1.184	1.685	2.866	0.310	0.338	0.344
2002	8.992	1.429	2.235	3.515	0.431	0.473	0.477
2003	8.853	2.040	9.771	11.739	1.370	1.488	1.558
2004	9.844	1.489	4.443	5.661	0.733	0.802	0.822
2005	9.339	1.301	2.252	3.301	0.443	0.488	0.490
2006	5.929	0.877	1.320	2.068	0.265	0.292	0.292
2007	5.962	0.671	1.523	1.946	0.300	0.332	0.332
2008	6.262	0.758	1.653	2.175	0.319	0.353	0.354
2009	3.401	0.524	0.789	1.250	0.156	0.172	0.173
2010	4.060	0.603	0.892	1.408	0.180	0.198	0.198
2011	3.515	0.525	0.773	1.224	0.155	0.171	0.171
2012	3.211	0.506	0.673	1.127	0.137	0.151	0.151
2013	3.239	0.519	0.622	1.095	0.130	0.143	0.143
2014	3.937	0.596	0.806	1.326	0.166	0.183	0.183
2015	2.565	0.387	0.530	0.866	0.109	0.120	0.120
2016	1.875	0.426	0.222	0.693	0.053	0.057	0.057

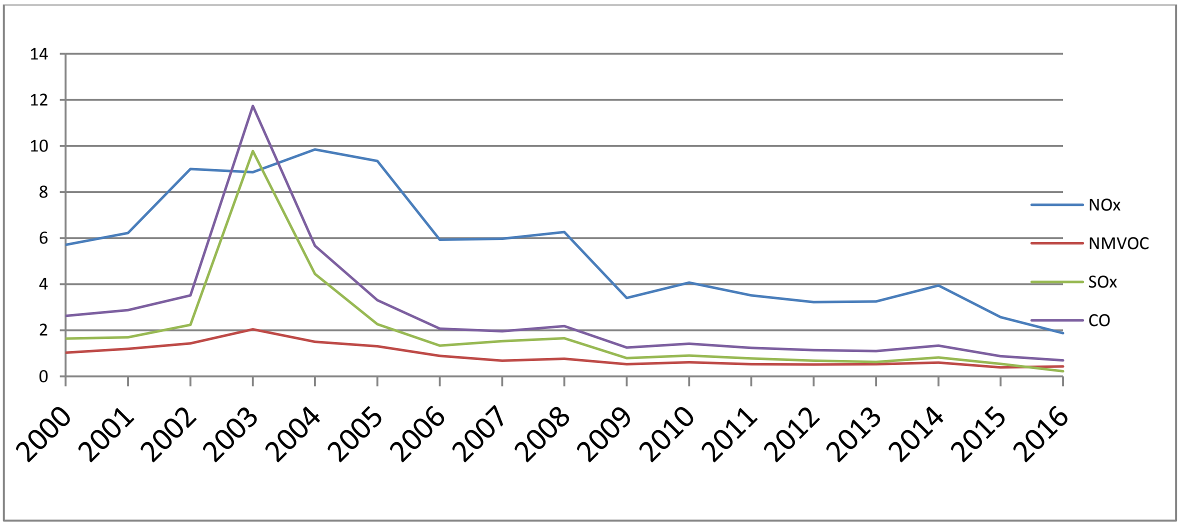


Figure 3.4.1a Emission Trends (kt) of NOx, NMVOC, SOx and CO for NFR 1.A.1.c.

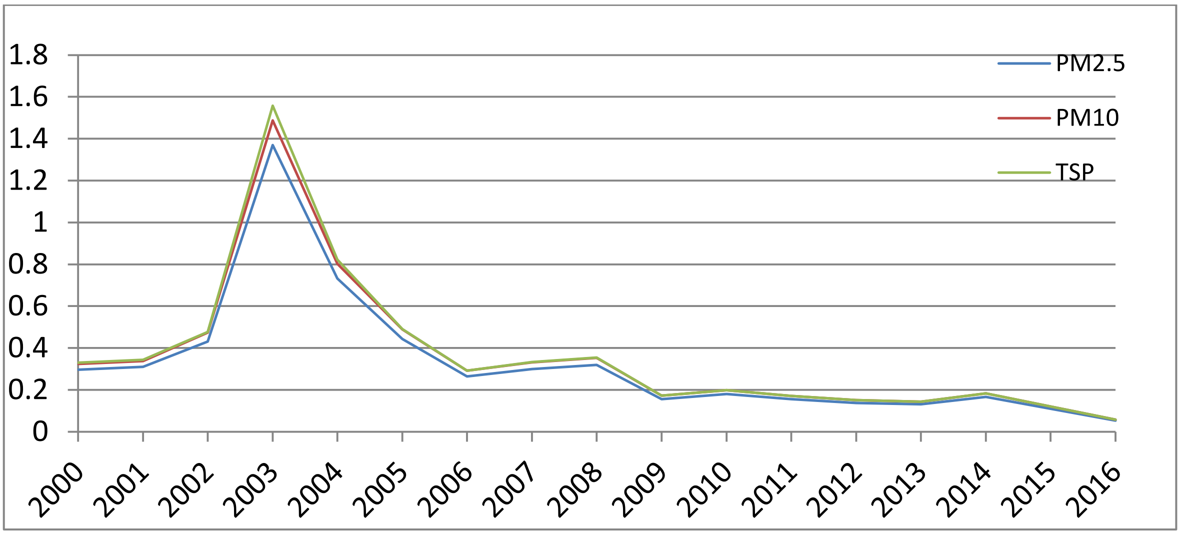


Figure 3.4.1b Emission Trends (kt) of TSP, PM_{10}, $PM_{2.5}$ for NFR 1.A.1.c.

The emissions peaks in 2003 and then decrease after 2010 following the variation of coke production in Romania, decreasing to zero after 2010.

Table 3.4.2 Fuel consumption trends (**TJ**), by fuel type, for NFR 1.A.1.c

Year/Fuel type (Tj)	Gaseous Fuels	Liquid Fuels	Solid Fuels	Biomass
2000	32203	10437	753	14
2001	38856	10447	805	32
2002	43545	18535	552	26
2003	37377	14225	10010	23
2004	34141	22341	2762	16
2005	36875	21460	250	6
2006	26484	12910	106	2

2007	15319	15757	38	2
2008	18449	15904	173	0
2009	15953	7185	123	8
2010	18311	8805	62	1
2011	15997	7584	59	0
2012	16048	6581	52	2
2013	16909	6496	0	1
2014	18586	8365	9	1
2005	12031	5468	9	1
2016	16603	2104	15	2

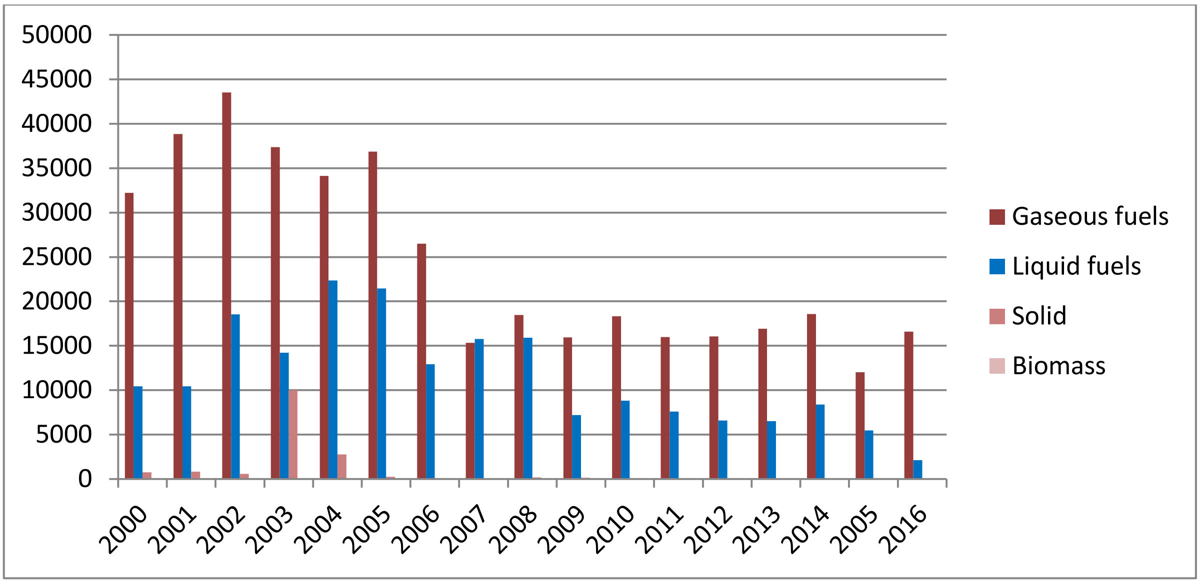


Figure 3.4.2 Fuel consumption [TJ] trends, by fuel type, for NFR 1.A.1.c

3.5 NFR 1.A.2.a Stationary combustion in manufacturing industries and construction: Iron and steel

Emissions arising from fuel combustion in iron and steel industries have been estimated by using fuel (liquid, solid and gaseous) consumption data from the EUROSTAT complete energy balances, annual data (nrg_110a), category *Final energy consumption/Industry/Iron & steel industry* and default Tier 1 emission factors (2016 EMEP/EEA Guidebook, NFR 1.A.2, Tables 3.2-3.5). Iron and steel production was key source for SOx, Pb, Hg, Ni and PCBs in 2016.

Table 3.5.1. Emission Trends (kt) for NFR 1.A.2.a. for Main Pollutants, Particulate Matter, BC and CO

Year/Pollutant (kt)	NOx	NMVOC	SOx	NH_3	TSP	BC	CO
2000	14.771	4.633	32.491	0.000	4.636	0.348	35.303
2001	13.626	4.473	32.614	0.000	4.629	0.334	35.229
2002	13.938	5.030	38.683	0.001	5.446	0.364	41.471
2003	14.368	5.452	42.875	0.000	6.009	0.385	45.822
2004	16.856	6.362	51.034	0.000	7.153	0.462	54.380
2005	18.406	6.632	53.653	0.000	7.544	0.507	57.085
2006	18.936	6.561	52.880	0.000	7.458	0.518	56.283
2007	12.829	5.544	43.967	0.000	6.109	0.352	46.963
2008	11.138	4.950	40.087	0.000	5.560	0.315	42.691
2009	7.103	2.883	22.970	0.000	3.204	0.194	24.511
2010	7.376	3.363	27.790	0.000	3.849	0.215	29.514
2011	6.976	3.143	25.471	0.000	3.530	0.198	27.126
2012	5.564	2.427	18.327	0.000	2.545	0.143	19.721
2013	5.880	2.533	18.710	0.000	2.601	0.146	20.201
2014	5.836	2.489	17.942	0.000	2.496	0.140	19.445
2015	6.622	2.883	21.936	0.000	3.047	0.172	23.577
2016	6.114	2.691	20.919	0.000	2.903	0.163	22.412

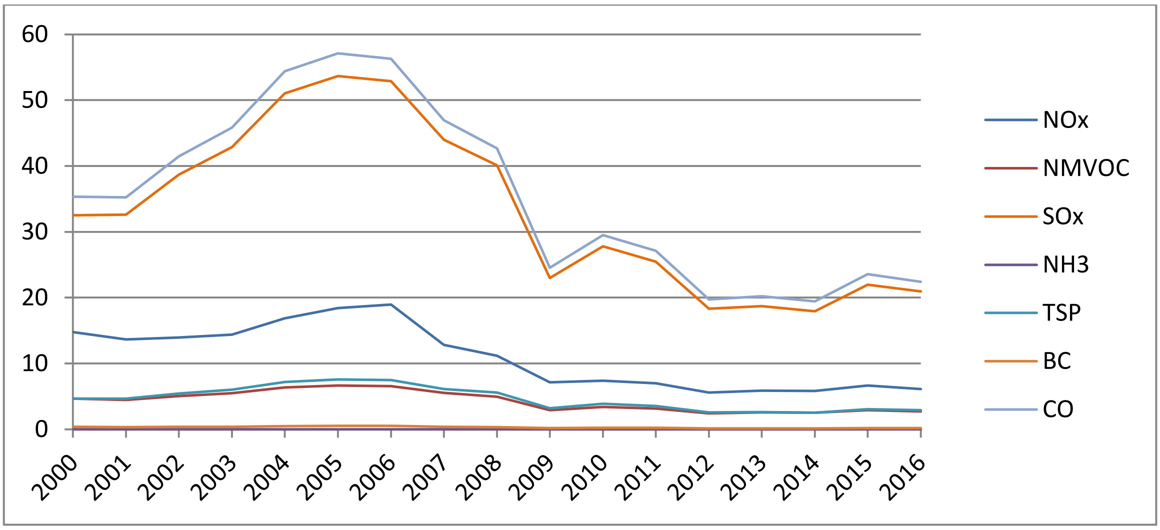


Figure 3.5.1. Emission Trends for NFR 1.A.2.a. for NOx, SOx, NMVOC, NH_3, TSP, BC and CO (kt)

Main pollutants trends follow activity data trend, with a peak in 2005-2006 and then constantly decreasing for the entire time series. Most important decreases were recorded for NOx (67%), SOx (61%) and NMVOC (59%).

Table 3.5.2. Total Emission Trends (*t*) of Heavy Metals for NFR 1.A.2.a.

Year/Pollutant	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
2000	4.771	0.064	0.312	0.148	0.483	0.625	0.463	0.068	7.421
2001	4.799	0.065	0.310	0.148	0.486	0.628	0.466	0.068	7.417
2002	5.715	0.077	0.363	0.175	0.578	0.748	0.555	0.080	8.747
2003	6.345	0.085	0.401	0.194	0.641	0.830	0.616	0.089	9.652
2004	7.550	0.101	0.474	0.231	0.762	0.987	0.733	0.105	11.489
2005	7.924	0.107	0.495	0.242	0.801	1.037	0.769	0.110	12.113
2006	7.799	0.105	0.488	0.238	0.788	1.021	0.757	0.109	11.973
2007	6.534	0.088	0.413	0.200	0.659	0.854	0.635	0.091	9.825
2008	5.961	0.080	0.375	0.182	0.601	0.779	0.579	0.083	8.943
2009	3.407	0.046	0.215	0.104	0.344	0.445	0.331	0.047	5.149
2010	4.135	0.056	0.258	0.126	0.417	0.540	0.401	0.057	6.193
2011	3.789	0.051	0.238	0.116	0.382	0.495	0.368	0.052	5.680
2012	2.726	0.037	0.175	0.084	0.275	0.356	0.265	0.038	4.090
2013	2.782	0.037	0.180	0.086	0.281	0.363	0.270	0.039	4.179
2014	2.667	0.036	0.174	0.083	0.269	0.348	0.259	0.038	4.009
2015	3.262	0.044	0.209	0.100	0.329	0.426	0.317	0.046	4.898
2016	3.111	0.042	0.198	0.096	0.314	0.406	0.302	0.043	4.667

Figure 3.5.2.a Total Emission Trends (t) for NFR 1.A.2.a. for Pb and Zn

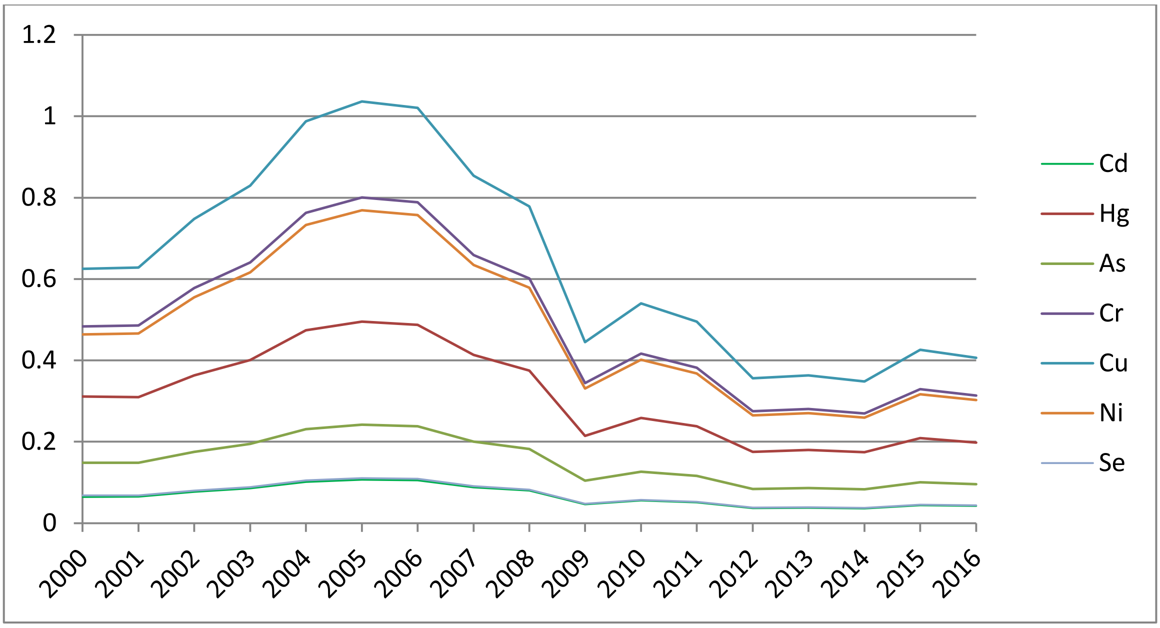


Figure 3.5.2.b Total Emission Trends (t) for NFR 1.A.2.a. for As, Cd, Cr, Cu, Hg, Ni and Se

All heavy metals emissions showed important decreases compared to peak 2005 emissions, especially Cu (60%), Zn (61%) and Hg (60%),

Table 3.5.3 Fuel consumption trends (TJ) by fuel type, for NFR 1.A.2.a.

Year/Fuel type	Liquid Fuels	Solid Fuels	Gaseous Fuels	Biomass
2000	8971	35592	54197	6
2001	7564	35807	47979	3
2002	5969	42634	47272	24
2003	5012	47341	48734	6
2004	6326	56335	52222	0
2005	8631	59126	50668	0
2006	10151	58188	49469	9
2007	1136	48755	51498	6
2008	523	44482	42891	0
2009	1597	25420	25481	0
2010	76	30854	27012	0
2011	119	28275	27346	2
2012	111	20338	26867	0
2013	164	20758	29794	1
2014	169	19903	31160	1
2015	214	24339	31094	2
2016	164	23213	27212	0

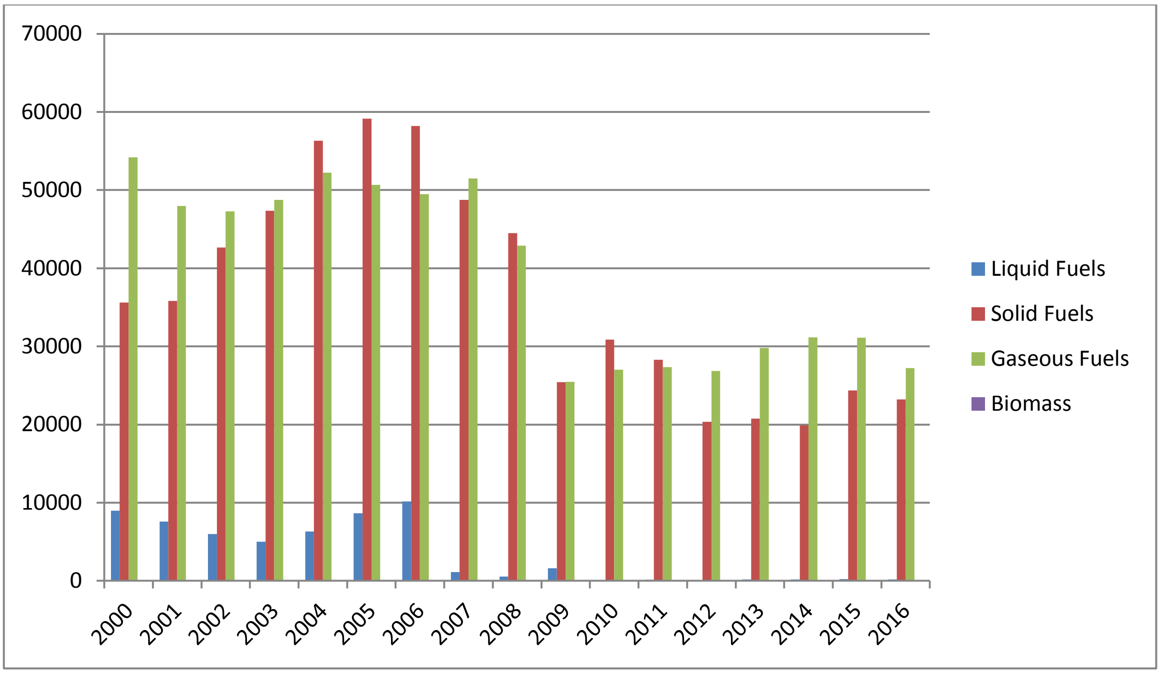


Figure 3.5.3 Fuel consumption trends (TJ), by fuel type, for NFR 1.A.2.a

The iron and steel industry uses mostly gaseous fuels, which in 2016 decreased by 46% compared to the year 2000.

Since iron and steel industry is key category for a couple of pollutants, further work is necessary with a purpose of achieving higher tier estimation.

The NFR categories 1.A.2.b Non-ferrous Metals, 1.A.2.c Chemicals, 1.A.2.d Pulp, Paper and Print, 1.A.2.e Food Processing, Beverages and Tobacco and 1.A.2.f Non-metallic Minerals as well as 1.A.2.gvii Mobile Combustion in manufacturing industries and construction are included under NFR 1.A.2.gviii (details in the next section).

3.6 NFR 1.A.2.g.viii Stationary combustion in manufacturing industries and construction: Other

This category includes emissions from fuel combustion in all industries except Iron and steel, which was considered at NFR 1.A.2. Emissions have been estimated by applying Tier 1 emission factors (2016 EMEP/EEA Guidebook, NFR 1.A.2, Tables 3.2-3.5) to fuel consumption data from the EUROSTAT annual energy balances, category *Final energy consumption/Industry* (the sum of all industries) from which was subtracted the fuel amounts used at Iron and steel industry (NFR 1.A.2.a). As planned improvements, for the next submission it is expected to split the fuel consumption and emissions from NFR 1.A.2 category, on the specific industries and NFRs. So far, with the actual approach, NFR 1.A.2.gviii is key category for emissions of NOx, NMVOC, SOx, Cd, Hg, Zn.

Table 3.6.1. Emission Trends (kt) of NOx, NMVOC, SOx, Particulate Matter, BC and CO for NFR 1.A.2.g.viii

Year/Pollutant (kt)	NOx	NMVOC	SOx	PM10	TSP	BC	CO
2000	36.4907	8.2278	9.6342	3.5482	3.6807	0.0052	20.6532
2001	42.4131	8.7078	11.7185	3.7649	3.9017	0.0059	22.8435
2002	42.5564	10.3840	13.2694	4.4813	4.6584	0.0066	27.0988
2003	33.6809	11.7109	10.8147	4.8130	5.0216	0.0067	27.8420
2004	33.9570	8.5730	11.4210	3.6970	3.8470	0.0055	22.7870
2005	31.5037	8.1624	10.5504	3.4192	3.5587	0.0054	21.3790
2006	28.6299	8.2213	9.5376	3.5080	3.6545	0.0049	20.9260
2007	31.8808	8.9521	8.9181	3.8788	4.0354	0.0050	21.6893
2008	29.5571	7.5913	10.8018	3.1834	3.3152	0.0052	20.6330
2009	19.3603	6.4783	9.8613	2.8516	2.9829	0.0040	18.5474
2010	17.9841	6.8720	8.9291	2.9277	3.0644	0.0041	18.5231
2011	21.5801	6.4801	7.4972	2.6006	2.7115	0.0043	16.3483
2012	23.8504	7.4512	13.3321	3.7087	3.8784	0.0040	23.2485
2013	20.4390	7.0083	10.3920	3.3382	3.4904	0.0036	20.1561
2014	21.4590	6.8766	9.9197	3.2317	3.3758	0.0037	19.4455
2015	22.6163	6.5385	10.2553	3.2213	3.3619	0.0034	19.1712
2016	22.4499	6.8582	8.7380	3.2937	3.4353	0.0033	18.5315

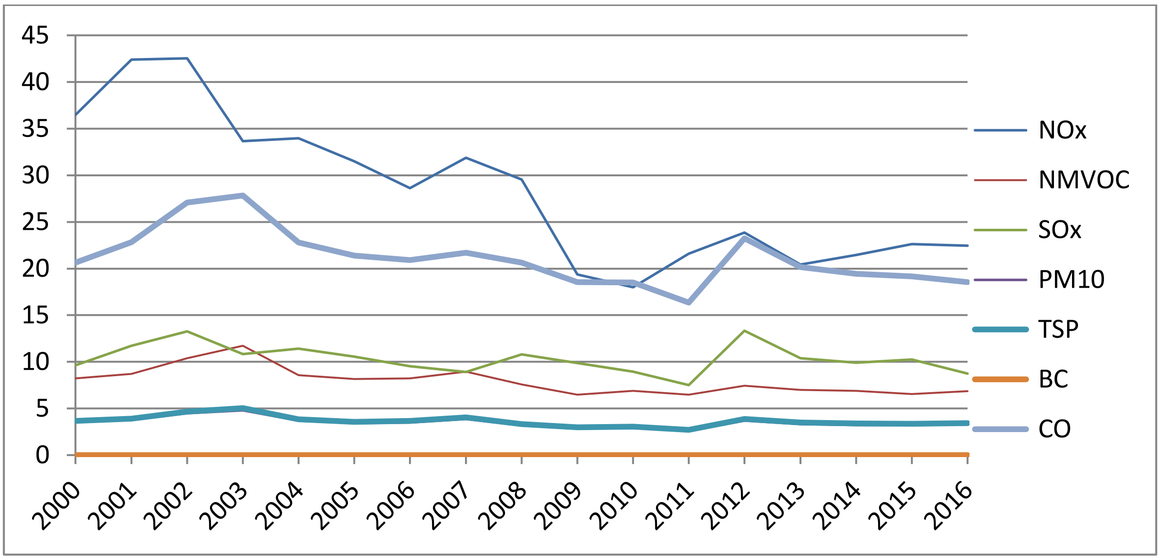


Figure 3.6.1 Emission Trends (kt) of NOx, NMVOC, SOx, Particulate Matter, BC and CO for NFR 1.A.2.g.viii

Table 3.6.2 Emission Trends (t) of relevant heavy metals and total PAH for NFR 1.A.2.g. viii

Year/Pollutant	Pb (t)	Cd (t)	Hg (t)	Ni (t)	Zn (t)	Diox (g)	Total PAH (t)	PCB (kg)
2000	1.3723	0.1568	0.1468	0.1280	8.6621	2.8518	2.5072	1.3608
2001	1.5928	0.1437	0.1736	0.1504	8.6362	3.1314	2.9020	1.6830
2002	1.9471	0.1979	0.2001	0.1826	10.9156	3.9041	3.2360	1.9989
2003	1.8675	0.2771	0.1877	0.1709	13.2763	4.1369	2.8229	1.6823
2004	1.6920	0.1623	0.1716	0.1591	8.9740	3.3390	2.7046	1.7641

2005	1.5737	0.1513	0.1645	0.1480	8.3241	3.1099	2.4855	1.6394
2006	1.4974	0.1751	0.1491	0.1392	9.0282	3.0981	2.3455	1.4759
2007	1.4220	0.2061	0.1404	0.1303	10.3064	3.1400	2.4153	1.2930
2008	1.5946	0.1319	0.1655	0.1510	7.5220	3.0436	2.4341	1.7195
2009	1.5655	0.1334	0.1440	0.1477	7.0952	2.9730	2.1024	1.6792
2010	1.4895	0.1535	0.1385	0.1393	7.6872	2.9540	1.9691	1.5258
2011	1.1820	0.1275	0.1258	0.1106	6.6246	2.3977	1.7678	1.1941
2012	2.0788	0.1667	0.1692	0.1961	9.0811	3.8812	2.8407	2.2582
2013	1.6855	0.1684	0.1395	0.1575	8.6234	3.3073	2.3280	1.7409
2014	1.5870	0.1604	0.1353	0.1483	8.2876	3.1302	2.2594	1.6340
2015	1.5936	0.1516	0.1312	0.1492	8.0677	3.0982	2.3392	1.6662
2016	1.4117	0.1728	0.1162	0.1304	8.6918	2.9316	2.1617	1.3714

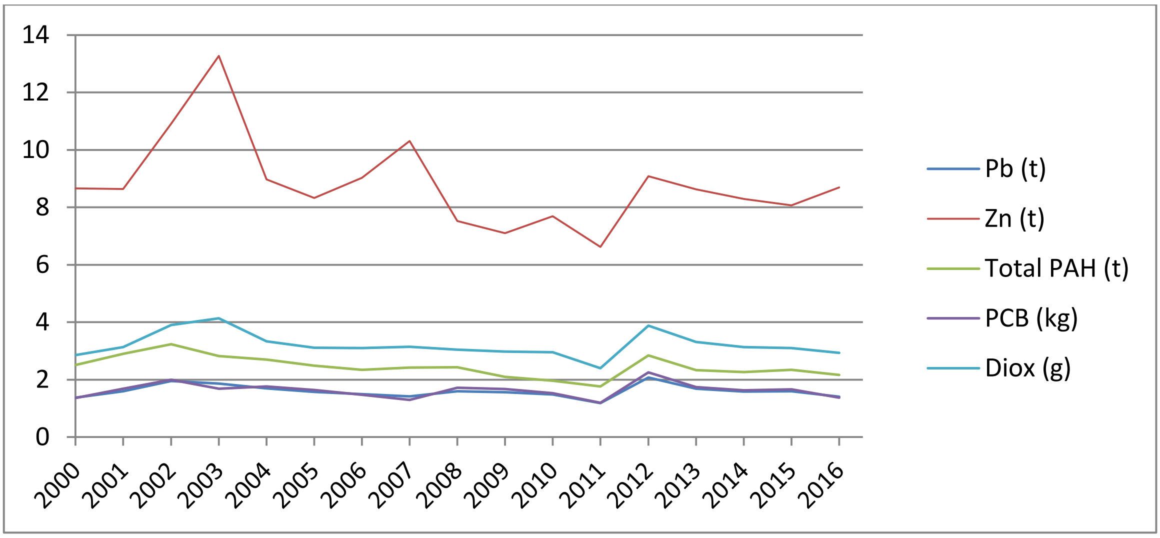


Figure 3.6.2a. Emission trends (t) of Pb, Zn total PAH, PCB and PCDD/ PCDF for NFR 1.A.2.g. viii

Figure 3.6.2b. Emission trends (t) of Cd, Hg and Ni for NFR 1.A.2.g. viii

Variations in emission trends of pollutants are due to different ratios of solid/liquid/ gasesous/ biomass fuels along the timeseries, which contribute with different emission factors for each pollutant. Hg and Ni emissions are highly influenced by solid fuel consumption variation, and Cd and Zn by biomass and solid fuels.

Table 3.6.3 Fuel consumption trends (TJ) by fuel type, for NFR 1.A.2.gviii.

Year/Fuel type	Liquid Fuels	Solid Fuels	Gaseous Fuels	Biomass
2000	47321	8001	132930	10923
2001	55355	9897	154405	9646
2002	51609	11754	173159	13558
2003	33585	9889	174712	19916
2004	39708	10373	145809	11019
2005	35406	9640	145097	10280
2006	32043	8678	129410	12244
2007	38959	7601	124800	14776
2008	32122	10112	142375	8719
2009	17085	9875	109183	8877
2010	14123	8972	111171	10551
2011	21347	7021	116375	8821
2012	25342	13280	102087	10968
2013	21071	10237	92032	11519
2014	23171	9608	93381	10988
2015	26986	9798	82995	10283
2016	27553	8063	78572	12154

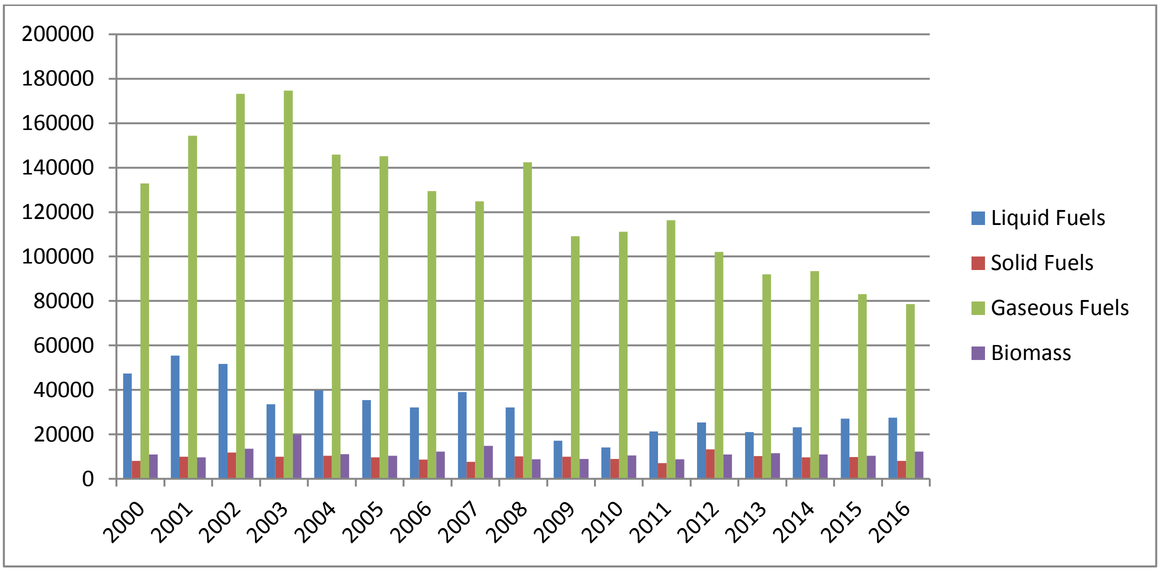


Figure 3.6.3 Fuel consumption trends (TJ), by fuel type, for NFR 1.A.2.gviii

The fuel consumtion in industry generally decreased, which is in line with production decrease of most industries considered under NFR 1.A.2.gviii.

3.7 NFR1.A.4. Small combustion overview

NFR 1.A.4 includes emissions from fuel combustion in small facilities, in commercial or institutional buildings, for space and water heating in housholds, fuel combustion in agriculture, forestry and fishing industries as well as emissions from mobile sources in households and gardening, from agriculture and forestry. Small combustion for district heating is included under NFR 1.A.1, while small combustion in industry is reported under NFR 1.A.2.
A summary of activities covered by NFR 1.A.4 is given bellow.

Table 3.7.1 Source description for NFR 1.A.4

NFR	NFR name	Source description, actual reporting aggregation
1A4ai	Commercial/institutional	Fuel combustion in commercial and institutional buildings (stationary). Mobile sources (1A4aii) belonging to commercial/institutional sector were also included at 1A4ai.
1A4bi	Residential	Fuel combustion in households (such as heating and water warming). Mobile sources for household and gardening (1A4bii) were also included at 1A4bi.
1A4ci	Agriculture/Forestry/Fishing: Stationary	Stationary fuel combustion in agriculture, forestry and fishing industries (such as farms). It also includes the National fishing (1A4ciii)
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	Off-road vehicles and other machineries used in farms and in forestry works
1A5a	Other stationary (including military)	Included at 1A4ai.
1A5b	Other, Mobile (including military, land based and recreational boats)	Included at 1A4ai.

3.8 NFR 1.A.4.a.i Commercial / Institutional

The 2000-2015 emissions were estimated by applying Tier 1 emission factors (2016 EMEP/EEA Guidebook, NFR 1.A.4 Small combustion, Tables 3.7 – 3.10 Tier 1 emission factors for NFR category 1.A.4.a/c, 1.A.5.a) to activity data from EUROSTAT (energy balances, annual data - nrg_110a), sum of categories *Final energy consumption/Other Sectors /Services* and *Non-specified.* 2016 data were provided by the N.I.S., in the national energy balance.

NFR 1.A.4.ai is a key source for Ni in 2016 (12% of the national total). Compared to past inventories, Ni highly increased by recalculation with 2016 EMEP/EEA Guidebook. This is due to the change of the emission factor, Tier 1, Liquid fuel (Table 3-9 Tier 1 emission factors for

NFR category 1.A.4.a/c, 1.A.5.a, using liquid fuels) from 0.008 mg/GJ in the 2013 EMEP/EEA Guidebook to 125 mg/GJ in the 2016 EMEP/EEA Guidebook.

Table 3.8.1. Emission Trends (kt) of gaseous pollutants, PM and BC from NFR 1.A.4ai

Year/Pollutant (kt)	NOx	NMVOC	SOx	NH_3	PM_{10}	CO	BC
2000	2.674	0.649	1.312	0.026	0.332	2.089	0.089
2001	5.038	2.422	1.744	0.203	1.105	5.520	0.312
2002	4.683	2.288	1.583	0.236	1.220	5.287	0.375
2003	5.495	2.576	1.396	0.228	1.167	5.451	0.355
2004	9.858	2.782	3.019	0.188	1.340	6.812	0.435
2005	10.075	3.646	2.532	0.288	1.648	7.937	0.526
2006	9.251	3.988	1.363	0.268	1.350	7.348	0.402
2007	9.611	3.313	1.797	0.223	1.277	6.572	0.415
2008	7.316	2.752	1.396	0.206	1.116	5.488	0.359
2009	5.130	2.508	0.627	0.183	0.860	4.508	0.253
2010	5.255	2.600	0.660	0.192	0.901	4.694	0.265
2011	6.148	1.851	1.152	0.108	0.687	3.695	0.231
2012	5.737	1.763	1.008	0.100	0.623	3.433	0.208
2013	5.221	1.651	0.842	0.088	0.540	3.113	0.177
2014	5.044	1.558	0.980	0.075	0.508	3.085	0.160
2015	5.338	2.276	1.040	0.165	0.862	4.478	0.259
2016	5.417	2.478	0.865	0.190	0.935	4.685	0.284

Table 3.8.2. Emission Trends (t) of heavy metals from NFR 1.A.4ai

Year/Pollutant (t)	Pb	Cd	Hg	As	Cr	Cu	Ni
2000	0.188	0.012	0.011	0.008	0.083	0.037	0.689
2001	0.352	0.074	0.017	0.012	0.229	0.077	1.137
2002	0.328	0.085	0.012	0.009	0.274	0.082	1.538
2003	0.300	0.082	0.013	0.010	0.256	0.076	1.381
2004	0.449	0.071	0.023	0.019	0.356	0.115	2.848
2005	0.446	0.105	0.020	0.018	0.401	0.120	2.711
2006	0.313	0.096	0.017	0.015	0.284	0.081	1.448
2007	0.312	0.081	0.016	0.015	0.316	0.090	2.205
2008	0.263	0.075	0.012	0.012	0.267	0.075	1.737
2009	0.181	0.065	0.009	0.008	0.172	0.047	0.728
2010	0.191	0.068	0.009	0.008	0.179	0.049	0.751
2011	0.175	0.040	0.010	0.010	0.182	0.052	1.433
2012	0.156	0.037	0.009	0.009	0.163	0.047	1.260
2013	0.133	0.032	0.008	0.008	0.137	0.039	1.031
2014	0.151	0.028	0.010	0.009	0.127	0.040	0.960
2015	0.219	0.060	0.011	0.009	0.187	0.055	1.019
2016	0.208	0.068	0.010	0.008	0.200	0.056	1.017

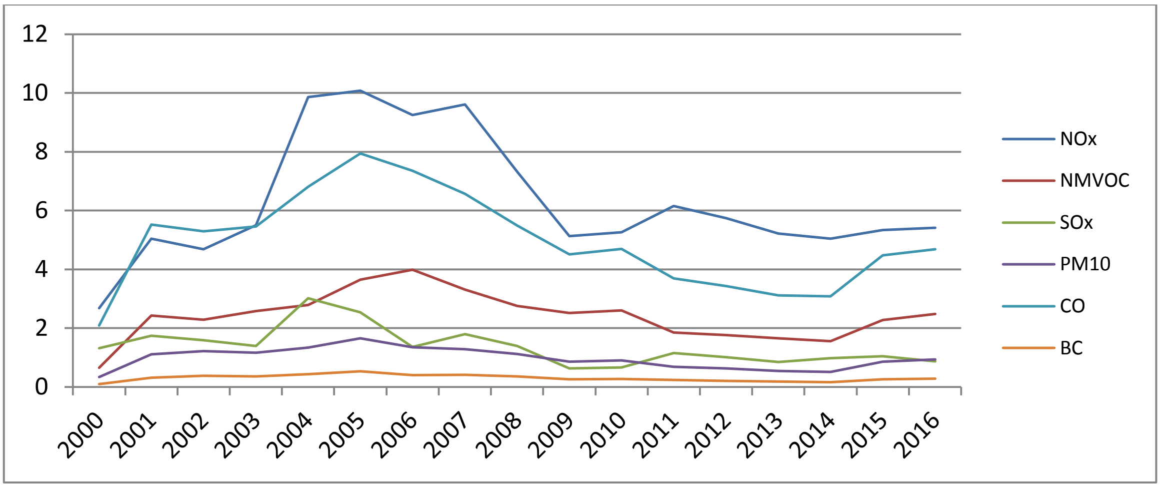


Figure 3.8.1 Emission Trends (kt) of NOx, NMVOC, SOx, PM10, BC and CO for NFR 1.A.4.a

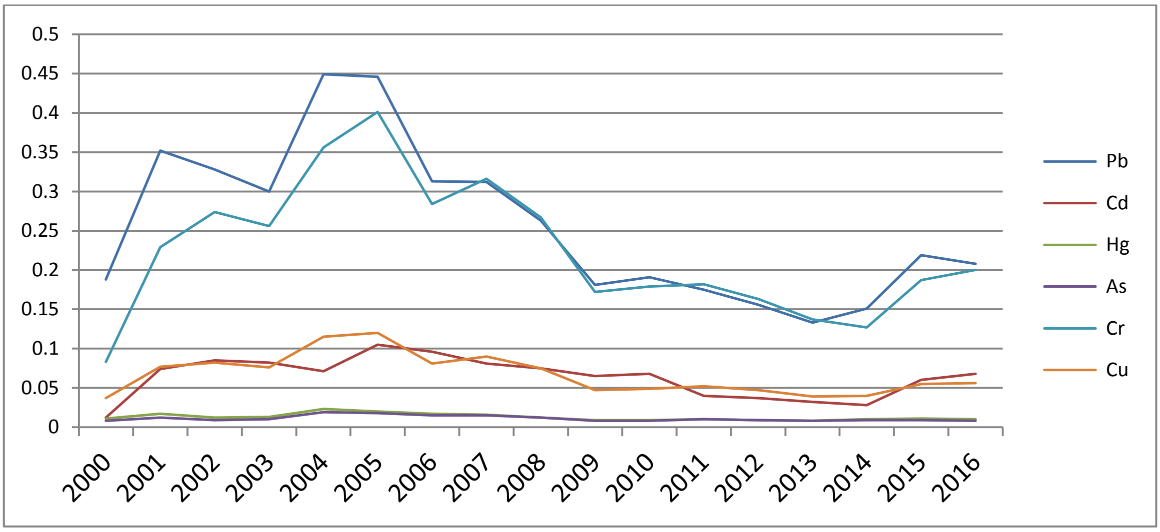


Figure 3.8.2a. Emission trends (t) of heavy metals from NFR 1.A.4a (except Ni)

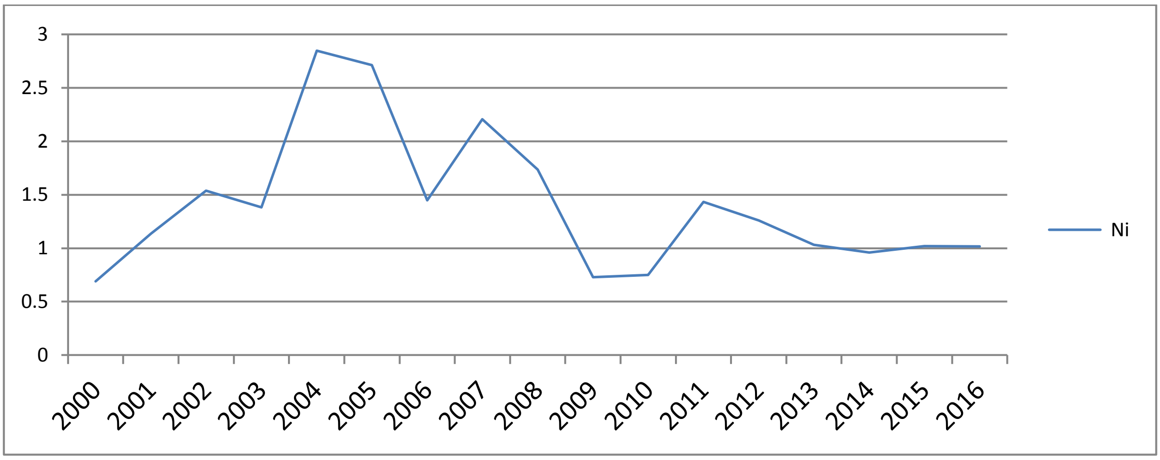


Figure 3.8.2b. Emission trends (t) of Ni from NFR 1.A.4a

Trend of heavy metals follow mostly the variation of liquid fuel consumption, contributing more than the other fuels to emissions from this source. Details are given in the next table and chart.

Table 3.8.3 Fuel consumption trends (TJ) by fuel type, for NFR 1.A.4a

Year/Fuel type	Liquid Fuels	Solid Fuels	Gaseous Fuels	Biomass
2000	5399	940	10743	702
2001	8906	990	22188	5486
2002	12156	437	4162	6367
2003	10915	343	20732	6167
2004	22601	973	31237	5084
2005	21507	476	36529	7779
2006	11438	193	68368	7231
2007	17532	58	49825	6039
2008	13805	16	34887	5575
2009	5741	8	39474	4950
2010	5921	23	40087	5192
2011	11410	31	32228	2930
2012	10028	17	32710	2694
2013	8200	27	33668	2367
2014	7619	261	33540	2037
2015	8049	0	32774	4462
2016	8047	35	33521	5143

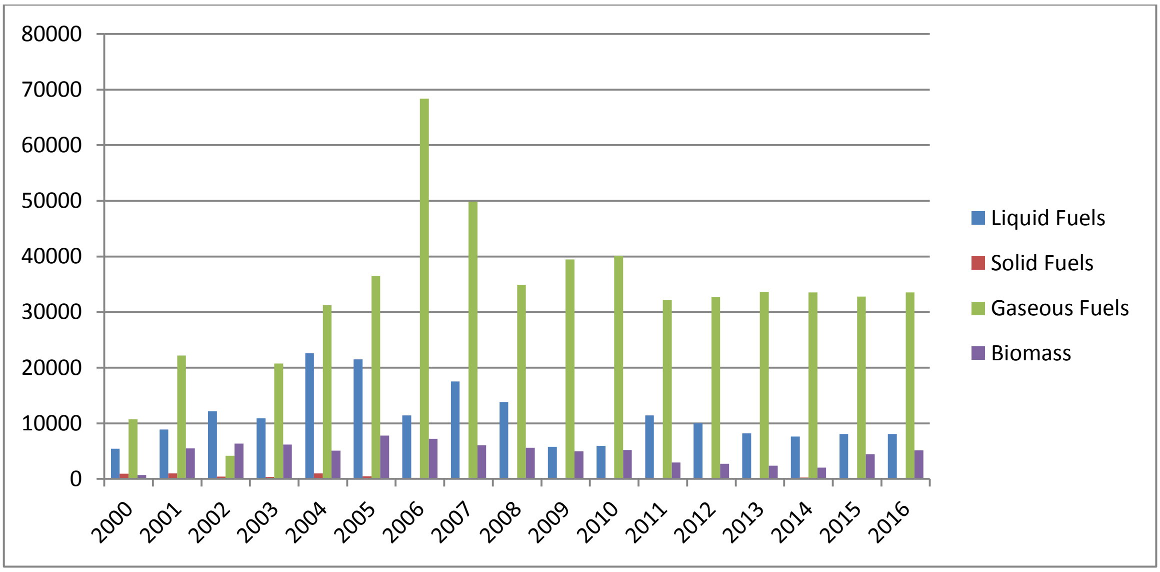


Figure 3.8.3 Fuel consumption trends (TJ), by fuel type, for NFR 1.A.4.a

The national statistics database, which is available earlier in the year compared to EUROSTAT statistics, does not distinguish between fuel consumption in services (commnercial/ institutional) – coresponding to NFR 1.A.4, and other fuel consumption (coresponding to NFR

1.A.5). Therefore, the dataseries were always reported with NFR 1.A.5 included under NFR 1.A.4.

The planned improvement foresees the spliting of NFR 1.A.5 from NFR 1.A.4 category, based on Eurostat energy balances which allow the distinction, for the historical data series.

3.9 NFR 1.A.4.bi Residential

Residential heating was, as for 2016, key source category for NOx (5.84% of National Total), NMVOC (28% of National Total), $PM_{2.5}$ (81% of National Total), PM_{10} (65% of National Total), TSP (48.6% of National Total), CO (67.7% of National Total), Pb (9.4% of National Total), Cd (53% of National Total), Cr (23.7% of National Total), Zn (54% of National Total), PCDD/F (63% of National Total), PAHs (65.5% of National Total) and HCB (27.1% of National Total).

The activity data consists of fuel consumptions provided, for the years 2000-2015, by EUROSTAT (energy balances, annual data - nrg_110a, *Final energy consumption/Other Sectors /Residential)* and for 2016 by the N.I.S, in the national energy balance.

The emission factors are provided by the 2016 EMEP/EEA Guidebook.

Tier 1 methodology was applied for solid, gaseous and liquid fuels, with emission factors from Small combustion chapter, *Tables 3.3* to *3.5, Tier 1 emission factors for NFR category 1.A.4.b.*

Tier 2 methodology was applied for wood combustion, with following percentages of technologies in 2016: conventional stoves burning wood and similar wood waste 91% (*Small combustion, Table 3.40 Tier 2 emission factors for NFR category 1.A.4.b.i*) , conventional boilers < 50 kW burning wood and similar wood waste 7% (*Table 3.43 Tier 2 emission factors for NFR category 1.A.4.b.i*), pellet stoves and boilers burning wood pellets 2% (*Table 3.44 Tier 2 emission factors for NFR category 1.A.4.b.i*).

Table 3.9.1 Fuel consumptions (TJ) for Residential heating

Year/Fuel type	Liquid fuels	Solid fuels	Gaseous fuels	Biomass
2000	6523	1766	104546	102725
2001	2223	296	96169	73306
2002	163	988	111760	74362
2003	2862	661	122687	91822
2004	3972	1531	120720	111392
2005	5054	568	119670	114395
2006	6145	420	120046	107639
2007	6833	441	104994	112254

2008	3807	1966	100489	143331
2009	516	580	102737	142124
2010	120	418	102120	147635
2011	200	810	107214	131745
2012	255	1166	114585	137482
2013	0	1061	110921	130169
2014	463	2922	99751	130588
2015	695	3355	103914	123550
2016	309	2361	106897	124547

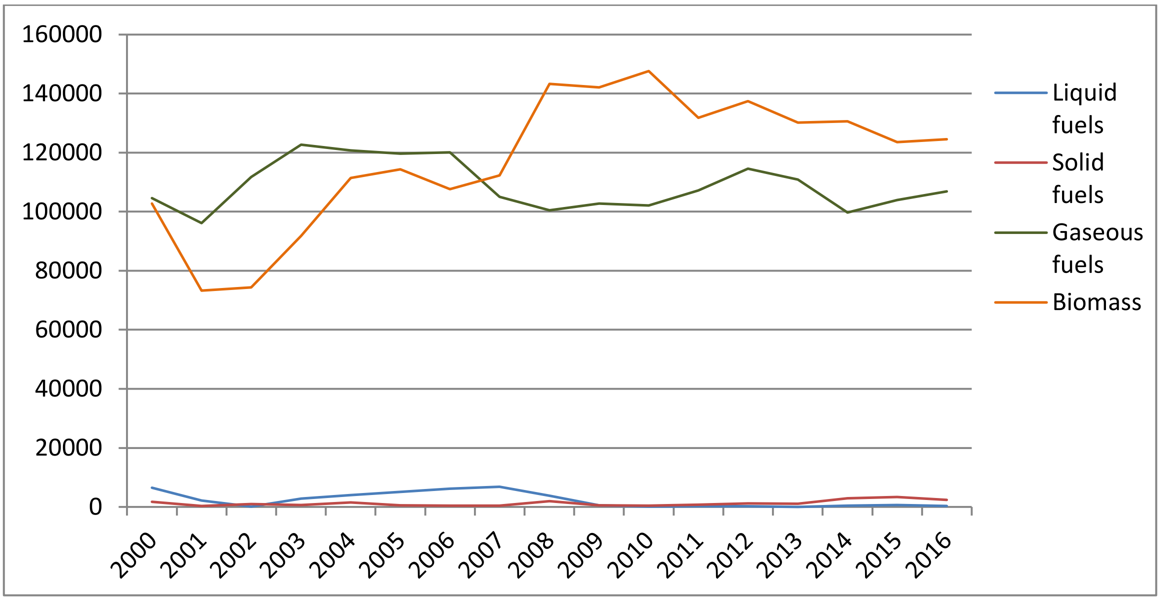


Figure 3.9.1 Fuel consumptions trend (TJ) for Residential heating (NFR 1.A.4.bi)

Table 3.9.2 Emission Trends (kt) of Main Pollutants, Particulate Matter, BC and CO for NFR 1.A.4.b.i

Year/Pollutant	NOx	NMVOC	SOx	$PM_{2.5}$	PM_{10}	TSP	BC	CO
2000	11.242	60.289	3.207	74.217	76.190	80.187	7.595	418.313
2001	8.892	42.596	1.257	52.600	54.002	56.815	5.396	294.500
2002	9.713	43.568	1.752	53.644	55.071	57.952	5.492	302.156
2003	11.287	53.500	1.842	66.004	67.762	71.298	6.767	370.284
2004	12.365	65.202	2.917	80.329	82.466	86.784	8.226	451.854
2005	12.452	65.791	2.159	81.314	83.479	87.831	8.348	455.127
2006	12.104	61.864	1.958	76.476	78.512	82.602	7.852	427.937
2007	11.667	64.481	2.142	79.734	81.858	86.124	8.188	445.857
2008	13.089	82.944	3.643	102.317	105.038	110.540	10.487	574.591
2009	12.820	81.586	2.152	100.908	103.597	108.999	10.364	563.347
2010	13.041	84.652	2.039	104.741	107.534	113.137	10.761	584.200
2011	12.510	75.783	2.224	93.661	96.156	101.173	9.615	523.756
2012	13.230	79.243	2.614	97.871	100.476	105.725	10.042	548.112
2013	12.634	75.012	2.420	92.650	95.117	100.085	9.507	518.808
2014	12.314	76.131	4.129	93.675	96.160	101.219	9.584	528.750

2015	12.215	72.332	4.458	88.873	91.228	96.037	9.083	503.232
2016	12.291	72.425	3.549	89.186	91.554	96.361	9.130	502.629

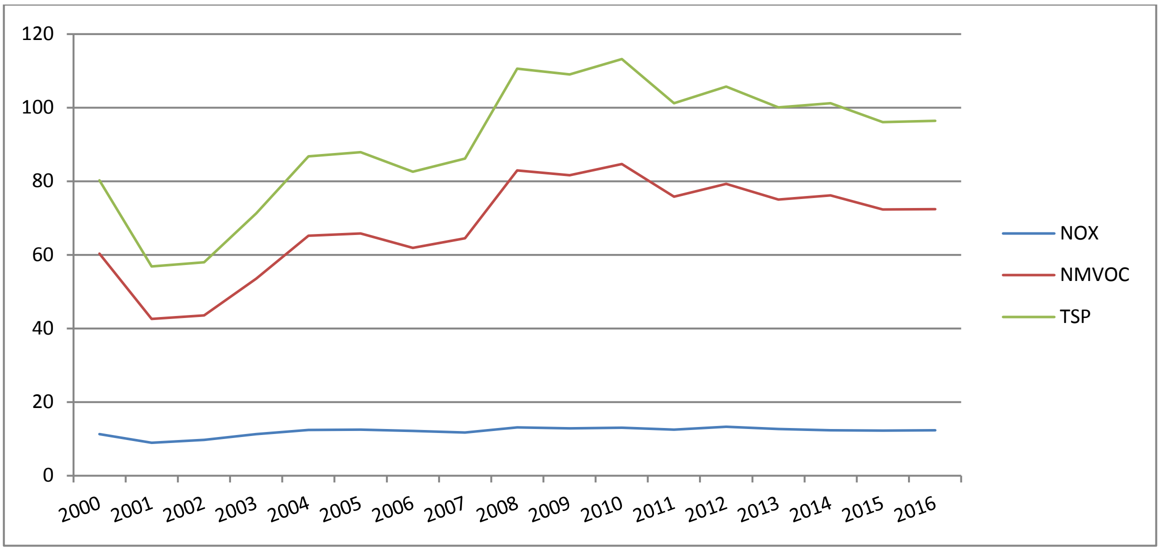


Figure 3.9.2a Emission Trends (kt) of NOx, NMVOC and TSP for NFR 1.A.4.b.i

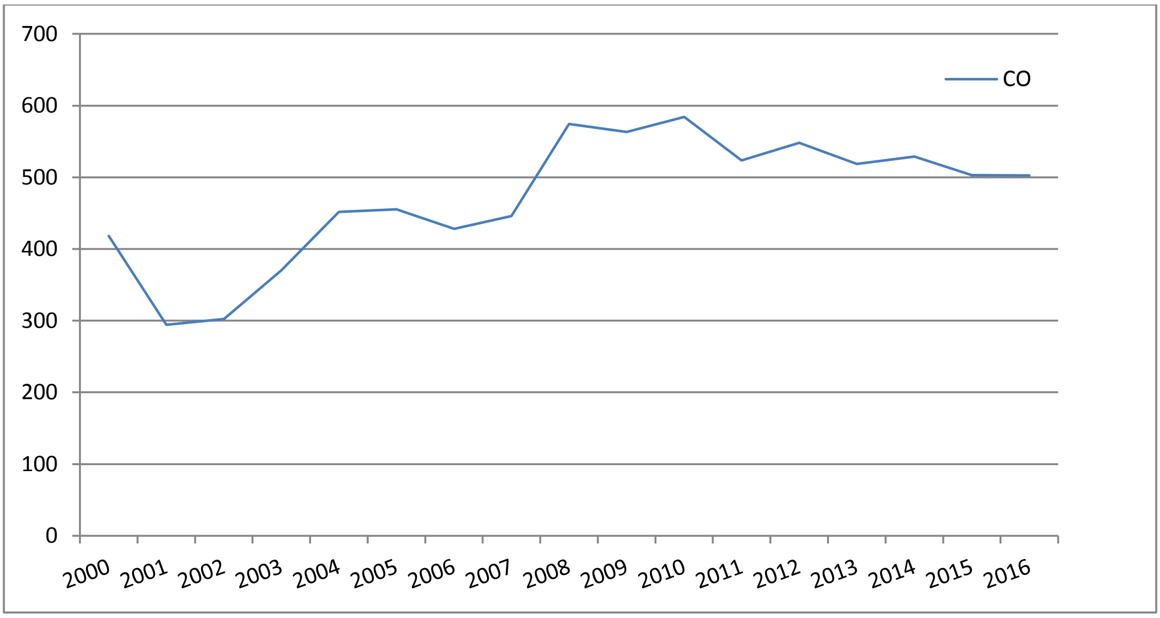


Figure 3.9.2b Emission Trends (kt) of CO for NFR 1.A.4.b.i

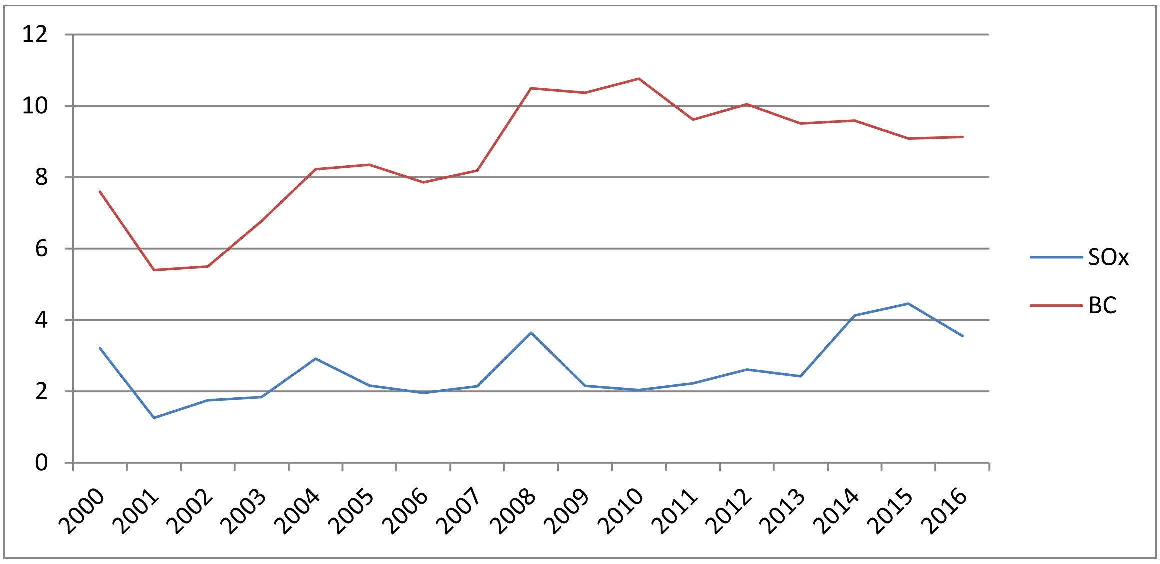


Figure 3.9.2c Emission Trends (kt) of SOx and BC for NFR 1.A.4.b.i

All pollutant emissions for this category follow the trends of statistical fuel consumption data for solid and biomass (those fuels have the highest Tier 1 emission factors).

The highest increases for the 2000-2016 period were recorded for NMVOC and CO (20%), and TSP and PM (20%).

Table 3.9.3 Emission Trends (t) of Pb, Cd, Cr and Zn for NFR 1.A.4.b.i

Year/Pollutant	Pb	Cd	Cr	Zn
2000	3.0034	1.3381	2.3838	52.9866
2001	2.0179	0.9534	1.6899	37.5989
2002	2.1364	0.9682	1.7215	38.2909
2003	2.5653	1.1947	2.1200	47.1597
2004	3.2068	1.4504	2.5800	57.3714
2005	3.1627	1.4880	2.6385	58.6975
2006	2.9611	1.4000	2.4815	55.2059
2007	3.0884	1.4600	2.5882	57.5741
2008	4.1257	1.8663	3.3195	73.8197
2009	3.9129	1.8485	3.2755	72.8955
2010	4.0406	1.9199	3.4004	75.6813
2011	3.6626	1.7139	3.0393	67.6319
2012	3.8638	1.7890	3.1753	70.6476
2013	3.6527	1.6938	3.0059	66.8801
2014	3.9059	1.7021	3.0364	67.5042
2015	3.7722	1.6112	2.8794	63.9961
2016	3.6699	1.6227	2.8912	64.2878

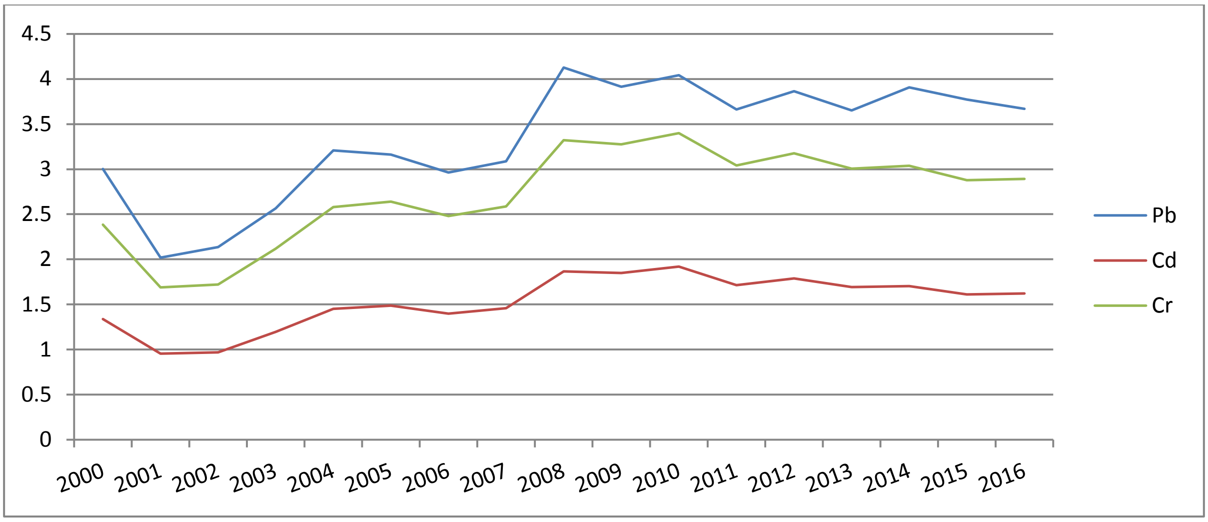


Figure 3.9.3a Emission Trends (t) of Pb, Cd and Cr for category NFR 1.A.4.bi

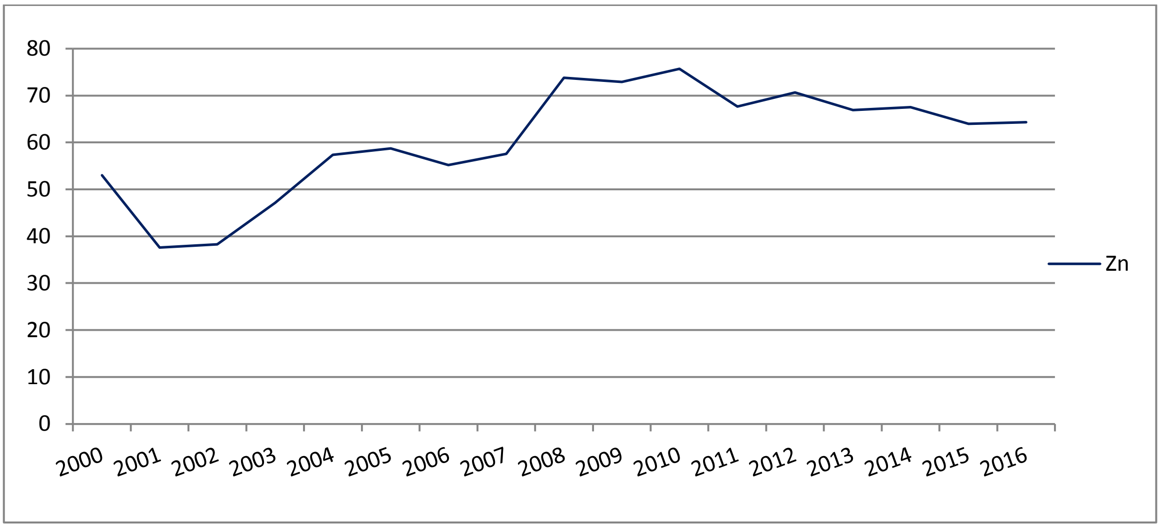


Figure 3.9.3b Emission Trends (t) of Zn for category NFR 1.A.4.bi

Heavy metals emissions increased during the 2000-2016 period, as following: Pb (22%), Cd, Cr and Zn (21%).

Table 3.9.4 Emission Trends of PCDD/F (g I-TEQ) and Total PAHs (t) for NFR 1.A.4.b.i

Year/Pollutant	PCDD/F (g I-TEQ)	Total 4 PAHs (t)
2000	81.271	36.537
2001	57.243	25.301
2002	58.627	26.215
2003	71.938	31.924
2004	87.814	39.311

2005	88.576	39.214
2006	83.267	36.806
2007	86.818	38.387
2008	111.896	50.135
2009	109.843	48.616
2010	113.946	50.353
2011	102.056	45.284
2012	106.761	47.512
2013	101.050	44.950
2014	102.847	46.581
2015	97.792	44.543
2016	97.765	44.086

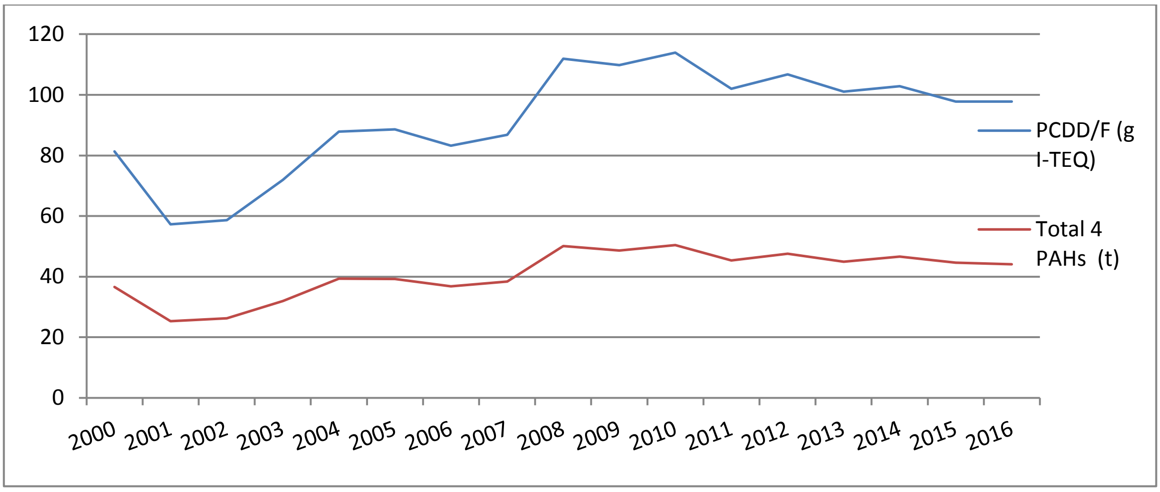


Figure 3.9.4 Emission Trends of PCDD/F (g I-TEQ) and Total PAHs (t) for NFR 1.A.4.b.i

POPs emissions increased during the 2000-2016 period, as following: PCDD/F (20.3%) and Total PAHs (20.6%).

3.10 NFR 1.A.4.c.i Agriculture/Forestry/Fishing

The emissions for the years 2000-2015 were estimated by applying Tier 1 emission factors (2016 EMEP/EEA Guidebook, NFR 1.A.4 Small combustion, Tables 3.7 – 3.10 Tier 1 emission factors for NFR category 1.A.4.a/c, 1.A.5.a,) to fuel consumption from EUROSTAT energy balances, annual data (nrg_110a): *Final energy consumption/Other Sectors / Agriculture / Forestry.* From oil category, only the fuel oil was allocated to this category (the other liquid fuels were used at NFR 1.A.4.c.ii – Off-road vehicles and other machinery);

NFR 1.A.4.c.i is not key category for any pollutant.

Table 3.10.1 Emission Trends of main pollutants for NFR 1.A.4.c.i

Year/Pollutant	NOx	NMVOC	SOx	PM10	BC	CO	Pb
2000	0.084	0.064	0.011	0.021	0.005	0.115	0.005
2001	0.067	0.068	0.010	0.026	0.007	0.126	0.006
2002	0.137	0.093	0.099	0.039	0.007	0.243	0.020
2003	0.121	0.061	0.160	0.033	0.005	0.244	0.027
2004	0.130	0.061	0.068	0.020	0.003	0.154	0.012
2005	0.152	0.084	0.128	0.035	0.006	0.250	0.023
2006	0.175	0.133	0.226	0.068	0.012	0.432	0.042
2007	0.271	0.516	0.195	0.249	0.063	1.124	0.071
2008	0.456	0.287	0.329	0.130	0.027	0.775	0.064
2009	0.423	0.255	0.321	0.107	0.019	0.706	0.061
2010	0.393	0.211	0.286	0.083	0.014	0.595	0.052
2011	0.323	0.163	0.289	0.071	0.011	0.520	0.050
2012	0.273	0.147	0.020	0.037	0.009	0.243	0.009
2013	0.426	0.580	0.300	0.271	0.065	1.312	0.088
2014	0.278	0.167	0.248	0.073	0.012	0.497	0.046
2015	0.325	0.199	0.294	0.088	0.015	0.592	0.055
2016	0.380	0.180	0.350	0.082	0.013	0.601	0.060

Table 3.10.2 Fuel consumptions (TJ) fo NFR 1.A.4.ci: Agriculture/Forestry/Fishing, stationary

Year/Fuel type	Liquid fuels	Solid fuels	Gaseous fuels	Biomass
2000	0	10	938	137
2001	0	9	680	171
2002	0	114	1371	170
2003	40	184	950	72
2004	0	79	1487	65
2005	0	150	1566	114
2006	0	264	1436	254
2007	0	211	1245	1564
2008	258	352	3581	561
2009	43	369	4155	418
2010	0	334	4184	285
2011	40	334	3174	199
2012	0	18	3376	226
2013	0	334	3010	1603
2014	0	290	2761	258
2015	0	343	3206	315
2016	139	396	3372	214

3.11 NFR 1.A.4.c.ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery

Off-road vehicles and other machineries emissions include fuel combustion in mobile sources from agricultural/forestry sector. Diesel and gasoline fuel consumptions from the energy balances, category *Final energy consumption/Other Sectors / Agriculture / Forestry/ Fishing*, were allocated to this category. Data for 2016 were provided by N.I.S. and Tier 1 emission factors were used (2016 EMEP/EEA Guidebook, NFR 1.A.4 Non road mobile machinery, Table 3.1 for gasoline and diesel oil)

NFR 1.A.4.cii is not key category for any pollutant.

Table 3.11.1 Emission Trends of main pollutants for NFR 1.A.4.cii off road Agriculture/Forestry/Fishing

Year/Pollutant	NOx	NMVOC	SOx	PM_{10}	BC	CO
2000	8.456	3.667	0.514	0.514	0.274	10.454
2001	5.787	1.531	0.343	0.336	0.187	4.481
2002	5.159	1.223	0.305	0.297	0.167	3.608
2003	4.187	1.369	0.251	0.247	0.135	3.957
2004	4.360	1.386	0.251	0.257	0.141	4.013
2005	3.836	1.075	0.119	0.224	0.124	3.137
2006	4.873	3.450	0.303	0.317	0.158	9.674
2007	4.044	1.098	0.115	0.235	0.131	3.208
2008	3.828	1.624	0.106	0.232	0.124	4.635
2009	6.587	1.337	0.185	0.376	0.213	3.995
2010	6.714	1.683	0.191	0.389	0.217	4.947
2011	8.607	1.284	0.246	0.484	0.278	3.956
2012	10.241	3.134	0.003	0.602	0.331	9.093
2013	8.412	1.994	0.002	0.485	0.272	5.884
2014	8.298	1.572	0.005	0.472	0.268	4.726
2015	8.869	2.962	0.003	0.525	0.287	8.552
2016	9.394	1.590	0.006	0.531	0.303	4.832

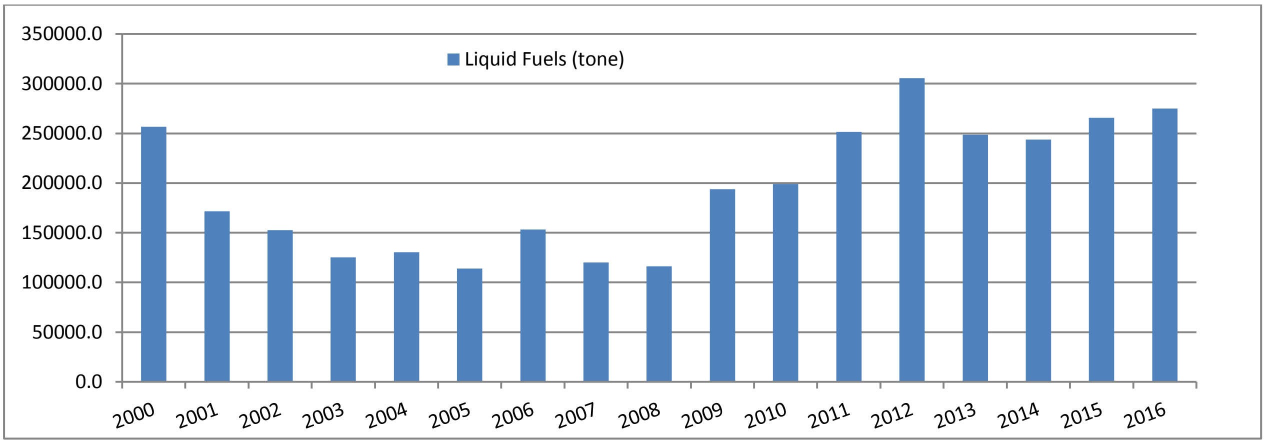


Figure 3.11.1 Fuel consumption trends (tone), for NFR 1.A.4.cii, off road Agriculture/Forestry/Fishing

3.12 NFR 1.A.3.a.i(i) – 1.A.3.ii(i) Aviation transport

The emissions from the civil aviation includes both, air pollution from national and international aviation, according with the flight phases: for landing and take-off (LTO) cycles comprise under NFRs International aviation LTO (civil) (NFR 1.A.3.ai(i)), Domestic aviation LTO (civil) (NFR 1.A.3.aii(i)) and for the Cruise cycle (phase for floating over long distance at high altitude (>3000ft (914.4 m)) under two memo items: NFR 1.A.3.ai(ii) and NFR 1.A.3.aii(ii) - International and domestic aviation cruise (civil). This category does not include military aviation activities. The values of pollutants due to the aviation activities for the period 2005÷2015 were taken from the EUROCONTROL values. For the period 2000÷2004, there is a lack of information as regards to EUROCONTROL values for pollutants arising from aviation activities.

Table 3.12.1. Fuel burnt (tonnes), the time series 2005÷2016, Aviation transport

Year/Fuel burnt [t]	NFR 1A3ai(i)	NFR 1A3aii(i)	Memo item 1A3ai(ii)	Memo item 1A3aii(ii)
2005	16850.47	3180.26	107700.24	8109.26
2006	19615.08	3594.43	127245.28	8909.44
2007	25950.37	4694.09	170242.07	10847.79
2008	29441.04	5756.02	206924.12	14088.73
2009	29120.20	6369.11	200587.17	15530.53
2010	31152.48	6411.82	213601.98	15874.32
2011	31612.13	5370.95	213317.27	13238.78
2012	31898.99	4495.79	220257.70	11779.79
2013	31644.76	3908.51	217537.90	9808.26
2014	35738.74	3708.58	233871.35	9080.91
2015	39514.95	3936.81	254183.73	9353.27
2016	45456.24	6618.82	295565.63	14458.85

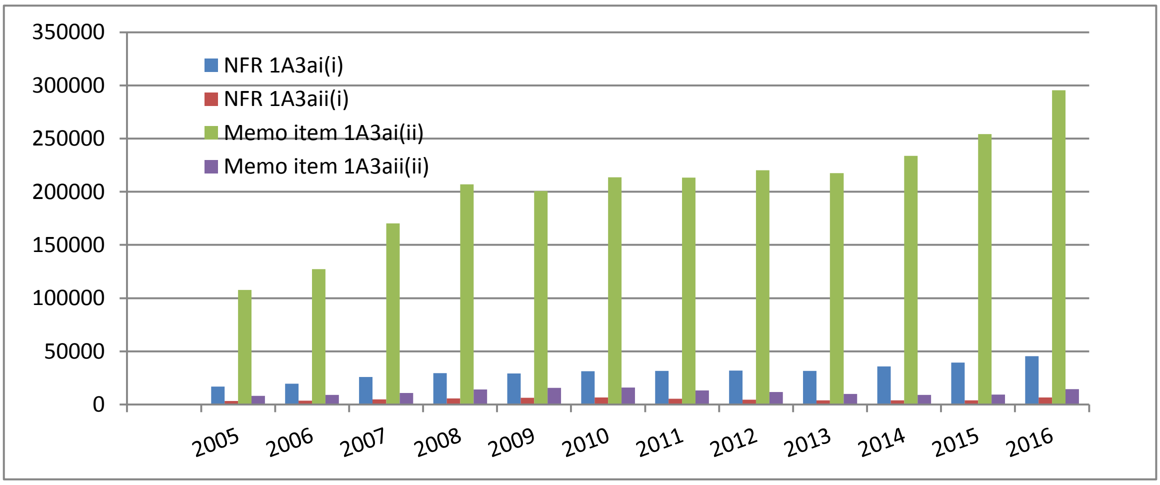


Figure 3.12.1. Fuel burnt (tonnes), the time series 2005÷2016, Aviation transport

Table 3.12.2. The emissions trends (kt), NFR 1.A.3.aii(i) - DOMESTIC aviation LTO

Year/Pollutant	NOx [kt]	NMVOC [kt]	SOx [kt]	CO [kt]	∑ ($PM_{2.5}$ PM_{10})[kt]
2005	0.030092	0.005340	0.002671	0.046251	0.0002807
2006	0.035866	0.007463	0.003019	0.050431	0.0003975
2007	0.049189	0.008269	0.003943	0.061659	0.0005305
2008	0.063543	0.007962	0.004835	0.074937	0.0008446
2009	0.071488	0.008925	0.005350	0.091709	0.0007952
2010	0.070027	0.009291	0.005386	0.079221	0.0007689
2011	0.059273	0.006406	0.004512	0.062534	0.0008234
2012	0.050068	0.005502	0.003776	0.058276	0.0006338
2013	0.044230	0.004037	0.003283	0.045211	0.0004299
2014	0.041591	0.003896	0.003115	0.043091	0.0003814
2015	0.044259	0.005314	0.003307	0.047174	0.0004467
2016	0.076581	0.006144	0.005560	0.073911	0.0008585

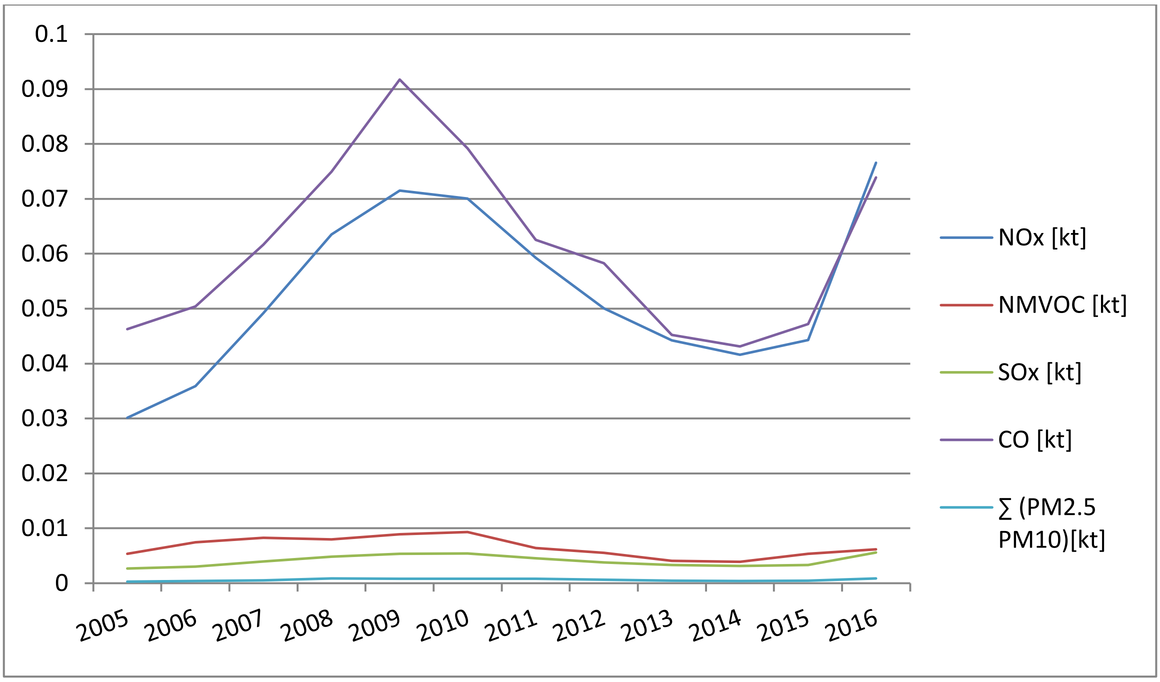


Figure 3.22.2. The emissions trends (kt), NFR 1.A.3.aii(i) - DOMESTIC aviation LTO

3.13 NFR 1.A.3.b.i – 1.A.3.b.v Road transport

This sector includes emissions from Passenger Cars, Light Duty Vehicles, Heavy Duty Vehicles and Busses, Mopeds and Motorcycles, as well as Gasoline Evaporation and Road and tire/break wear.

Emissions were estimated using latest version of COPERT 4 software. Activity data were provided by the Romanian Auto Registry (for fleet data 2005-2016) and N.I.S. (for fuel consumption 2000-2016). Default COPERT 4 sulphur and heavy metals contents have been taken into account for emission estimations. The fuel balance has been adjusted by means of adjusting the mileages, so calculated fuel consumptions match the statistical ones by less than 1% deviation.

For the period 2000÷2004, the calculations were made by Tier 1 methodology, that fuel consumptions – fuel sold quantities – was used as the input values because there was a lack of information necessary to run COPERT.

Road transport was for 2016 the key category for NOx (almost 42% of National Total), NMVOC (9% of National Total), CO (17,2% of National Total), Cu (85.3% of National Total) and Zn (14.2% of National Total).

Table 3.13.1. Contribution main pollutions (%) for Road transport for 2016

NFR	NOx (as NO2)	NMVOC	CO	Cu	Zn
1A3bi Passenger cars	12.86%	3.96%	12.49%	0.39%	4.45%
1A3bii Light duty vehicles	5.42%	0.78%	2.47%	0.09%	1.21%
1A3biii Heavy duty vehicles and buses	23.73%	1.35%	1.85%	0.18%	2.78%
1A3biv Mopeds & motorcycles	0.03%	0.22%	0.38%	0.00%	0.02%
1A3bv Gasoline evaporation	NA	2.82%	NA	NA	NA
1A3bvi Automobile tyre and brake wear	NA	NA	NA	84.67%	5.74%
1A3bvii Automobile road abrasion	NA	NA	NA	NA	NA
TOTAL	**42.05%**	**9.14%**	**17.19%**	**85.34%**	**14.20%**

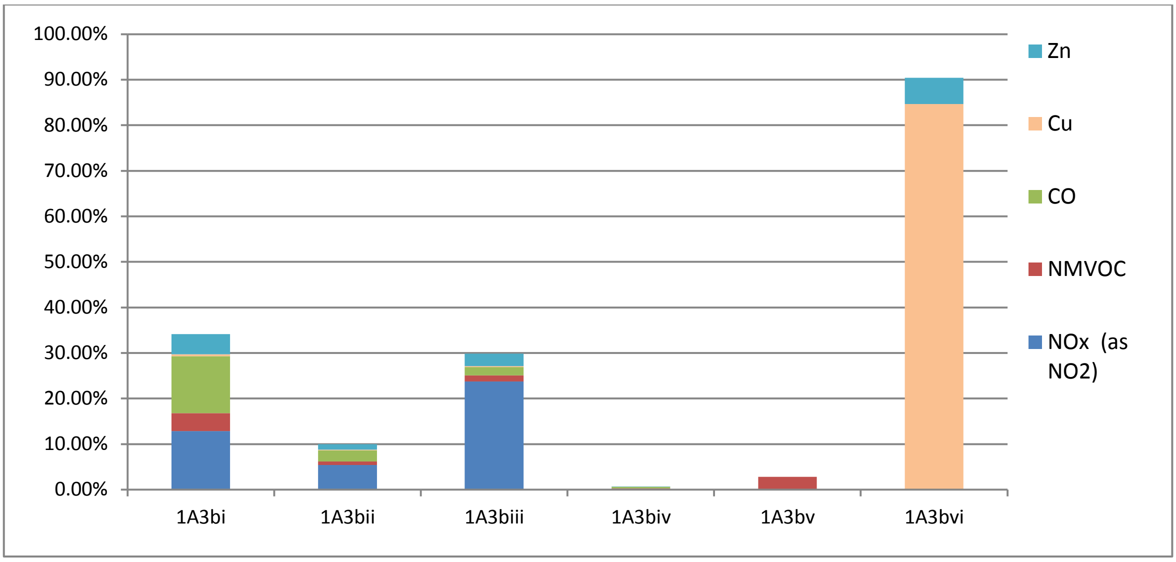


Figure 3.13.1. Key category analysis (KCA) for Road transport for 2016

The pollution is produced by all types of vehicles: the national fleet listed by passenger cars (PCs), light duty vehicles (LDVs), heavy duty vehicles (HDVs), buses and motorcycles& mopeds, sorted by a type of fuel and EURO emission standards.

Table 3.13.2. Fleet evolution for 2005 – 2016 (Vehicles)

YEAR	Passenger Cars – Gasoline&Gasoline-Hybrid	Passenger Cars - Diesel	Light Commercial Vehicles-Gasoline	Light Commercial Vehicles - Diesel	Heavy Vehicles & Busses - Diesel	Mopeds & Motorcycles-Gasoline
2005	2403652	531086	155951	188506	217808	42281
2006	2566473	735042	165721	232966	239358	56848
2007	2663005	878212	159836	262753	275852	91591
2008	2892163	1120927	160997	305222	293753	126907
2009	3000360	1229908	159311	322429	291475	142075
2010	2985051	1321954	151099	331007	291210	148001
2011	2947667	1374744	145355	358752	295685	157328
2012	3004762	1479473	141386	397814	303454	149815
2013	3086111	1605702	137555	436478	310619	176288
2014	3161141	1741099	134074	475379	322269	184261
2015	3242073	1905592	130674	515391	339095	191307
2016	3341731	2119555	127149	561171	355718	199645

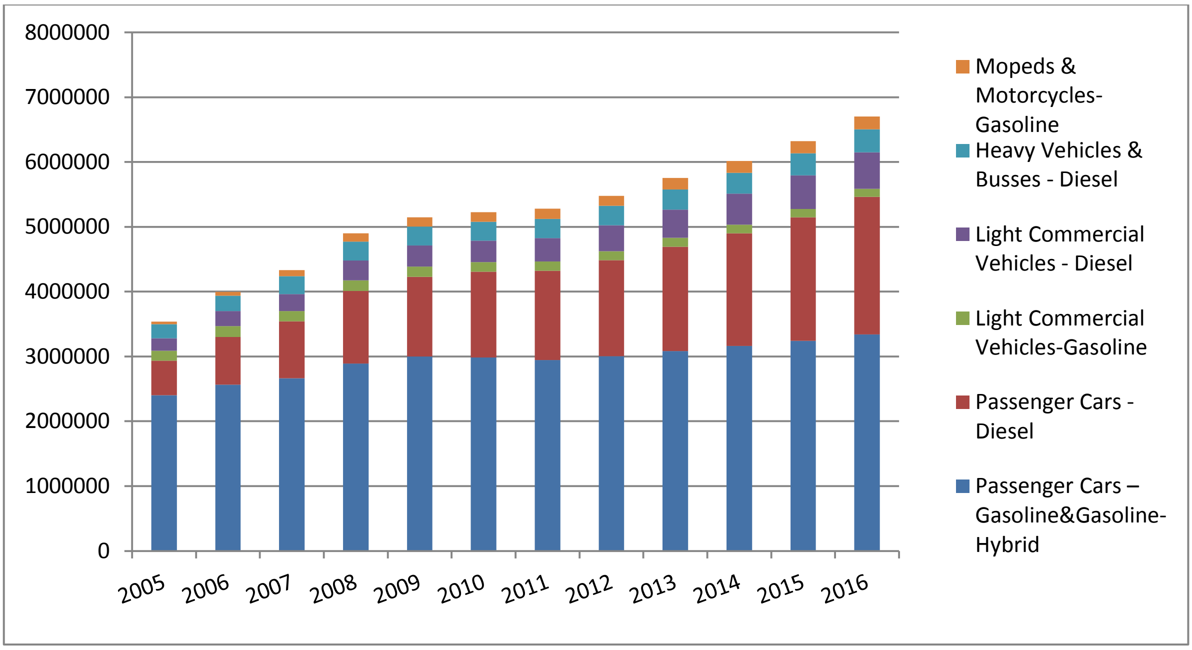


Figure 3.13.2. Fleet evolution for 2005 – 2016

Compared to 2005 data, Diesel Passenger cars show in 2016 the highest increase of almost 299%, followed by Gasoline Passenger cars with 39%, Light Commercial Vehicles – Diesel with 198%, Heavy Vehicles & Busses – Diesel with 63.3%, Mopeds & Motorcycles- Gasoline with 372%.

Table 3.13.3. Fuel consumptions (tonnes) for Road Transport

YEAR	Diesel (fossil & bio) [t]	Gasoline (fossil & bio) [t]	LPG [t]
2000	1369990	1230649	0
2001	1773104	1576270	0
2002	1891843	1537308	3106
2003	2141295	1563305	7246
2004	2163247	1619112	84885
2005	2119797	1537631	47595
2006	2420148	1437019	15993
2007	2442112	1448666	31988
2008	2956224	1443952	43941
2009	3002354	1439701	64985
2010	2893027	1358592	16997
2011	3019924	1294197	71982
2012	3437729	1370143	49994
2013	3326795	1305836	45958
2014	3478998	1364746	50962
2015	3473000	1317000	55000
2016	3947000	1403000	65059

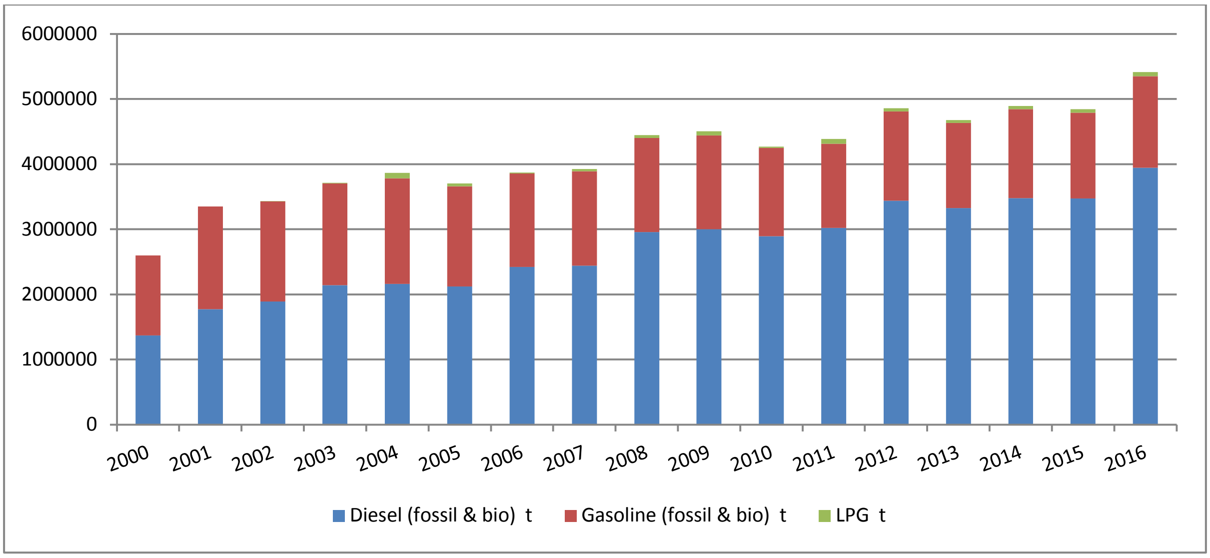


Figure 3.13.3. Fuel consumptions (tonnes/an) for Road Transport

For the period 2000÷2004, the estimates are based on Tier 1 methodology with emission factors from the 2016 EMEP/EEA Guidebook, Table 3.5 to Table 3.12.

Table 3.13.4. NOx emissions from NFR 1.A.3.b, road transport – evolution 2000÷2016

Year	NOx (as NO_2) 1A3bi / Passenger cars	1A3bii / Light duty vehicles	1A3biii / Heavy duty vehicles and buses	1A3biv / Mopeds & motorcycles
2000	10.840	3.914	37.502	0.11113
2001	14.463	4.594	47.927	0.11050
2002	14.728	4.824	49.925	0.11097
2003	15.040	5.392	56.992	0.10961
2004	15.956	4.940	60.683	0.10902
2005	34.947	9.128	52.176	0.01726
2006	32.221	9.320	54.491	0.02223
2007	29.658	7.372	52.495	0.03608
2008	28.873	9.483	55.043	0.04389
2009	28.965	8.906	53.814	0.04827
2010	25.352	8.220	50.222	0.04795
2011	25.074	8.495	50.592	0.04876
2012	28.140	10.701	48.107	0.04456
2013	24.931	9.404	50.572	0.05377
2014	26.178	8.451	51.534	0.06009
2015	25.383	10.415	48.613	0.05845
2016	27.095	11.426	49.992	0.06236

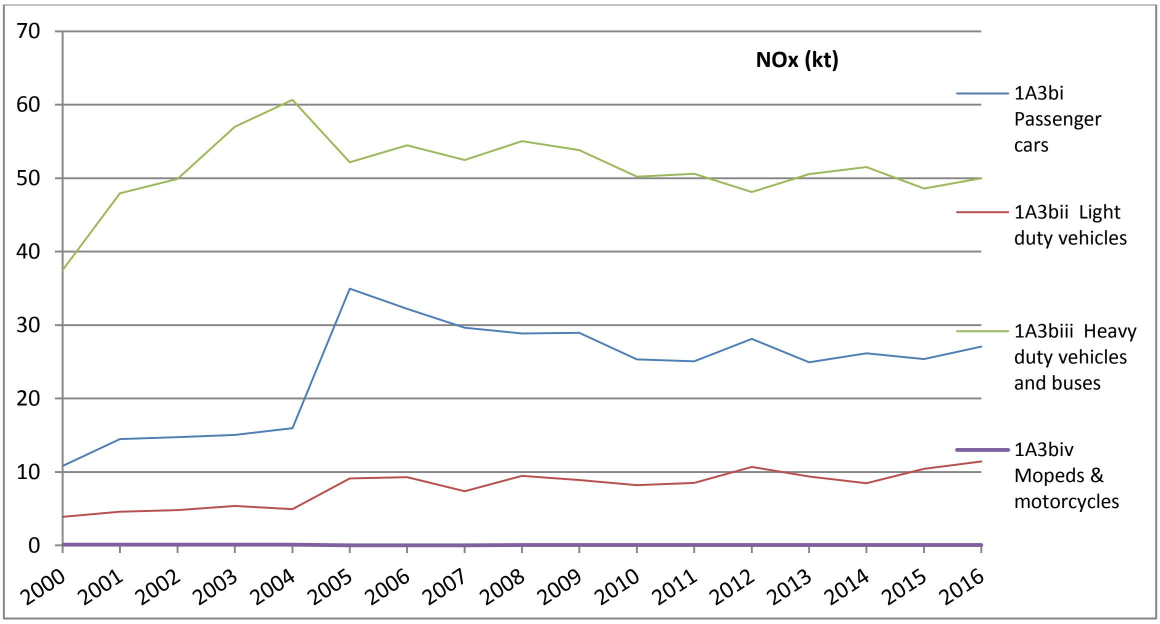


Figure 3.13.4. NOx emissions trend from NFR 1.A.3.b, road transport – evolution 2000÷2016

Table 3.13.5. Main pollutant emissions from Road Transport (kt)

Year/Pollutant	NOx	NMVOC	CO	Total PM (exhaust)
2000	52.36713	17.57387	132.08231	1.44774
2001	67.09432	21.76582	164.64955	1.86767
2002	69.58787	21.58828	162.25383	1.99478
2003	77.53326	22.38071	167.18951	2.24813
2004	81.68838	24.12120	178.98623	2.24267
2005	96.26758	51.38164	330.69778	5.25695
2006	96.05398	46.39731	288.36758	5.47676
2007	89.56090	41.63169	235.88068	4.98094
2008	93.44255	37.84886	212.55912	5.50873
2009	91.73269	35.24139	194.57049	5.38229
2010	83.84172	29.06003	162.86122	5.02355
2011	84.20959	27.79348	150.80387	5.07156
2012	86.99291	28.01811	148.17717	5.50288
2013	84.96099	24.80692	134.87100	5.15554
2014	86.22330	24.08385	133.27777	5.04887
2015	84.47022	22.62537	124.42895	5.14835
2016	88.57425	23.61535	127.57379	5.47339

Notes - For years 2000-2004 used Tier 1methodology calculations.

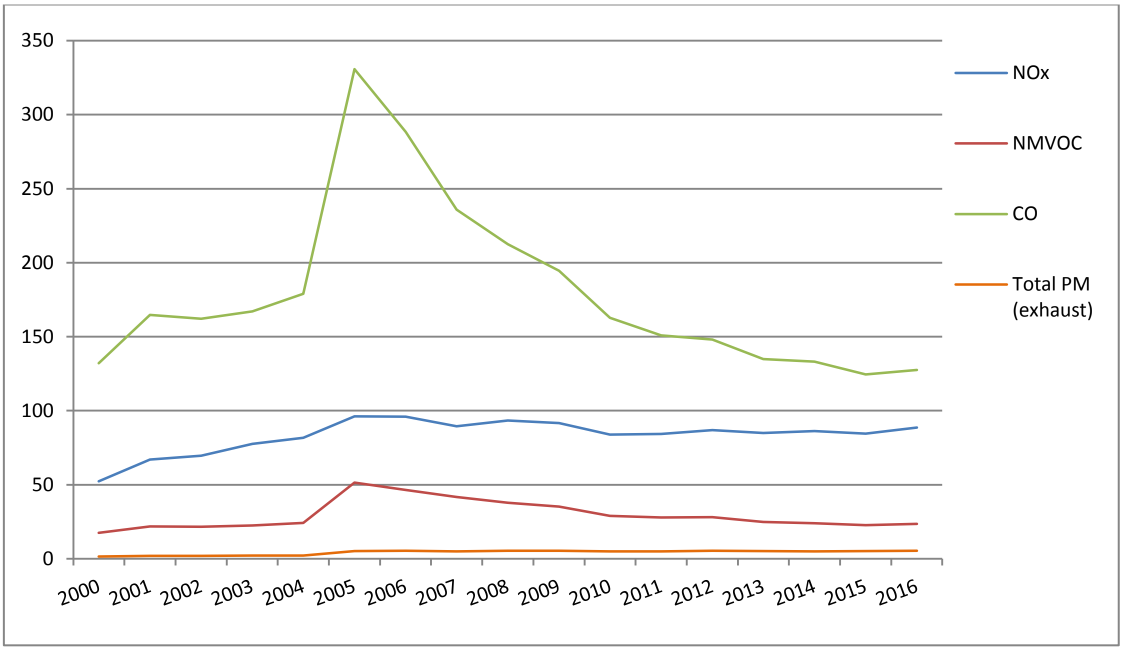


Figure 3.13.5 Main pollutant emissions trends from Road Transport (kt)

Table 3.13.6. Heavy metals emissions from Road Transport (t)

Year/Pollutant	Pb	Cd	Ni
2000	0.11185	0.00000	0.00000
2001	0.14422	0.00000	0.00000
2002	0.14911	0.00000	0.00000
2003	0.16294	0.00000	0.00000
2004	0.16592	0.00000	0.00000
2005	1.76946	0.04289	0.13398
2006	1.87217	0.04448	0.14001
2007	1.94676	0.04526	0.14445
2008	2.18074	0.05075	0.16096
2009	2.21462	0.05148	0.16333
2010	2.10188	0.04868	0.15471
2011	2.16412	0.04993	0.15875
2012	2.32589	0.05485	0.17159
2013	2.25542	0.05283	0.16588
2014	2.30064	0.05504	0.17025
2015	2.31003	0.05551	0.17098
2016	2.52725	0.06018	0.18667

The emissions have a trend of upward until 2004, and from 2005 it is on a downward trend until 2016. This is the result of improved gasoline quality, low fuel consumption, engine with efficient combustion and the emergence of Euro 1,2,3,4,5 pollution standards.

The emissions from road transportation were calculated for the time series 2000-2004 using Tier 1 methodology of the 2016 EMEP/EEA Guidebook, for 2005-2014 using Copert 4V11.3 software and for 2015-2016 using Copert 4v11.4.

For NFR category 1.A.3.biv Road Transport: Mopeds & Motorcycles, were checked all the information included in the software COPERT4 V4.11 as annual mileage, average speed and shares at TERT recommendations. The reduced number in mopeds/motorcycles fleet and the low sulphur content conducted to a number with decimals for SOx emissions that COPERT software represented it with 0.00 value.

As recommended by TERT in 2017, Romania estimated the particulate matters for NFR 1.A.3.b.vi and 1.A.3.b.vii in its 2018 submission.

Table 3.13.7. Calculation particulate matters [kt] for NFR 1.A.3.b.vi, Automobile tyre and brake wear

Year/Pollutant	$PM_{2.5}$	PM_{10}
2005	0.579	1.1103
2006	0.611	1.1702
2007	0.633	1.2135
2008	0.712	1.3621
2009	0.728	1.3899
2010	0.693	1.3216
2011	0.715	1.3618
2012	0.785	1.4842
2013	0.754	1.4298
2014	0.776	1.4662
2015	0.784	1.4789
2016	0.856	1.6130

Table 3.13.8. Calculation particulate matters [kt] for NFR 1.A.3.b.vii, Automobile road abrasion

Year/Pollutant	$PM_{2.5}$	PM_{10}	TSP
2005	0.2773	0.5103	1.0205
2006	0.2926	0.5386	1.0773
2007	0.3101	0.5708	1.1416
2008	0.3471	0.6389	1.2778
2009	0.3574	0.6577	1.3155
2010	0.3419	0.6292	1.2584
2011	0.3530	0.6498	1.2996
2012	0.3854	0.7089	1.4179
2013	0.3772	0.6943	1.3886
2014	0.3978	0.7321	1.4642
2015	0.4008	0.7377	1.4753
2016	0.4362	0.8028	1.6056

3.14 NFR 1.A.3.c Railways

The emissions from railway activities were estimated using Tier 1 default emission factors from 2016 EMEP/EEA Guidebook, Table 3-1 and the quantity of diesel oil sold as activity data, for rail transport was provided by the N.I.S. statistics. Only Diesel Oil consumptions were taken into account in order to avoid double-counting with energy and electricity production sector.

The diesel consumption for railways on time series 2000÷2016, shows fluctuations and a constant decrease, following the evolution for period of 2014÷2016.

Table 3.14.1. The emissions trends, for years 2000÷2016, NFR 1.A.3.c – Railway

Year/Pollutant	NOx [kt]	NMVOC [kt]	SOx [kt]	CO [kt]	Cd [t]	Cu [t]
2000	15.039	1.335	0.57400	3.071	0.00287	0.48790
2001	7.493	0.665	0.28600	1.530	0.00143	0.24310
2002	10.061	0.893	0.38400	2.054	0.00192	0.32640
2003	8.908	0.791	0.34000	1.819	0.00170	0.28900
2004	10.218	0.907	0.39000	2.087	0.00195	0.33150
2005	5.107	0.453	0.14753	1.043	0.00097	0.16568
2006	3.691	0.328	0.14753	0.754	0.00070	0.11973
2007	9.442	0.838	0.36038	1.928	0.00180	0.30633
2008	8.780	0.779	0.33510	1.793	0.00168	0.28484
2009	6.606	0.586	0.25215	1.349	0.00126	0.21433
2010	7.477	0.663	0.28537	1.527	0.00143	0.24256
2011	10.113	0.897	0.38602	2.065	0.00193	0.32810
2012	9.537	0.846	0.00364	1.947	0.00182	0.30940
2013	8.436	0.749	0.00322	1.723	0.00161	0.27370
2014	5.607	0.498	0.00219	1.145	0.00107	0.18190
2015	5.816	0.516	0.00227	1.188	0.00111	0.18870
2016	5.659	0.502	0.00216	1.156	0.00108	0.18360

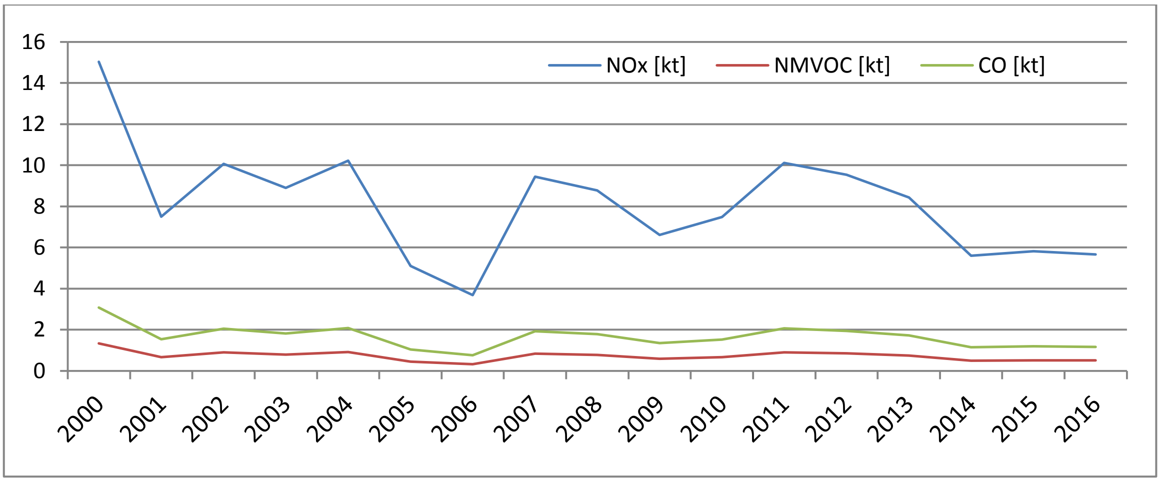


Figure 3.14.1. The emissions trends (kt), NOx, NMVOC, CO for years 2000÷2016, NFR 1.A.3.c – Railway

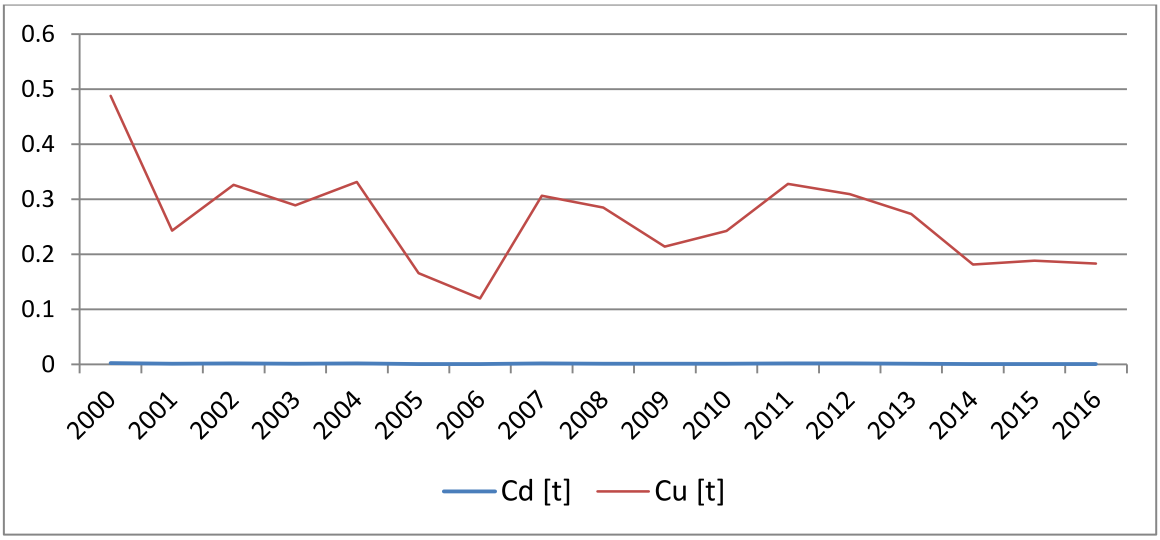


Figure 3.14.2. The emissions trends (t), Cd and Cu for years 2000÷2016, NFR 1.A.3.c – Railway

The fleet data have been collected by locomotive type (line-haul, shunting locomotives and rail cars), so that Tier 2 emissions estimation can be applied. However, as this sector is mostly under 1% of the national totals for main pollutants, Tier 1 methodology was used for calculation.

3.15 NFR 1.A.3.d.ii National navigation (Shipping)

The emissions from shipping activities were estimated using Tier 1 emission factors and fuel sold for national navigation, as provided by N.I.S.

The fuel consumption for navigation on the 2000÷2016 time series shows fluctuations, according with the evolution of the national navigation sector in Romania.

In the 2016 the emissions from National Navigation (NFR 1.A.3.dii) category represents 1.49% NOx, 0.433% NMVOC, 0.743% SOx, 0.0399% CO of total national emissions.

Table 3.15.1. The emissions trends, for years 2000÷2016, NFR 1.A.3.dii - National navigation

Year/ Pollutant	NOx [kt]	NMVOC [kt]	SOx [kt]	CO [kt]	Particulate matter total[kt]	Heavy metals (HMs) [t]
2000	4.001	0.143	1.01932	0.37715	0.2243	0.17533
2001	0.941	0.034	0.23984	0.08874	0.0528	0.04125
2002	2.355	0.084	0.60000	0.22200	0.1320	0.10320
2003	1.020	0.036	0.25983	0.09614	0.0572	0.04469
2004	1.569	0.056	0.39973	0.14790	0.0879	0.06875
2005	3.175	0.113	0.80880	0.29926	0.1779	0.13911

2006	3.093	0.110	0.78804	0.29157	0.1734	0.13554
2007	6.437	0.230	1.64000	0.03813	0.3608	0.28208
2008	5.487	0.196	1.39806	0.51728	0.3076	0.24047
2009	3.702	0.132	0.94318	0.34898	0.2075	0.16223
2010	4.559	0.163	1.16152	0.42976	0.2555	0.19978
2011	4.004	0.143	1.02000	0.37740	0.2244	0.17544
2012	3.297	0.118	0.84000	0.31080	0.1848	0.14448
2013	3.219	0.115	0.82000	0.30340	0.1804	0.14104
2014	2.905	0.104	0.74000	0.27380	0.1628	0.12728
2015	3.376	0.120	0.86000	0.31820	0.1892	0.14792
2016	3.140	0.112	0.80000	0.29600	0.1760	0.13760

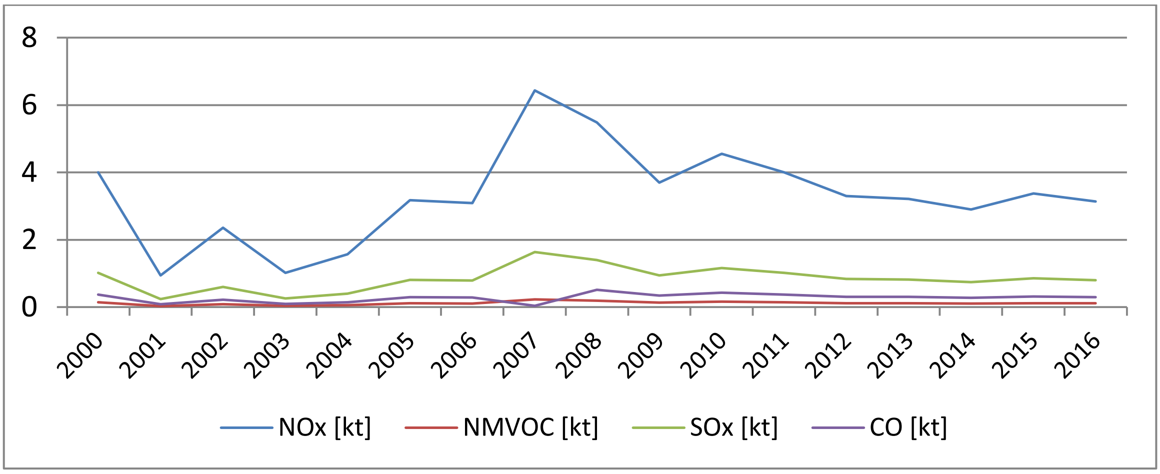


Figure 3.15.1a. The emissions trends, for years 2000÷2016, NFR 1.A.3.dii - National navigation NOx, NMVOC, SOx, CO (kt)

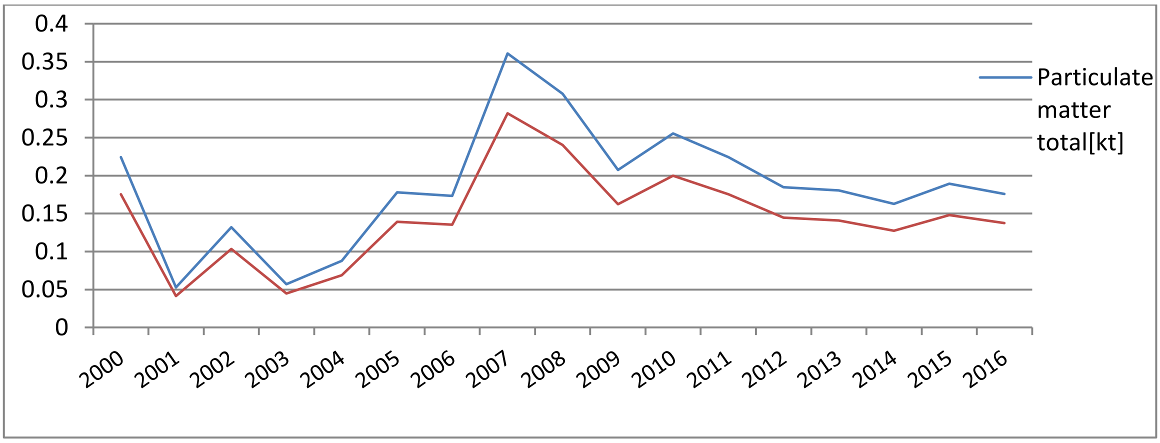


Figure 3.15.1b. The emissions trends, for years 2000÷2016, NFR 1.A.3.dii - National navigation Particulate matter total (kt) and Heavy metals (t)

The emissions from NFR 1.A.3.di(ii) - International inland waterways are marked with IE notation, sources included to the memo item NFR 1.A.3.di(i) - International maritime navigation. The calculation was made using Tier 1 emission factors (Table 3-1 from 2016 EMEP/EEA Guidebook) and bunker fuel oil sold from Energy Balance, as provided by N.I.S.

Table 3.15.2. The data activity, NFR 1.A.3.di(i) - International maritime navigation (memo item)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Data activity (Bunker fuel oil) [t]	20,000	18,000	6,000	11,000	9,000	14,000	41,000	79,000	44,000	31,000

3.16 NFR 1.B.1.a Coal mining and handling

For NFR 1.B.1.a, NMVOC ,TSP, $PM_{2.5}$ and PM_{10} emissions from coal mining and handling were considered. Activity data provided by the N.I.S. and from the Romania's Greenhouse Gas Inventory – N.I.R., improving the consistency between data for NFR and CRF. Default 2016 EMEP/EEA Guidebook emission factors (Tier 2) were used.

To apply the Tier 2 methodology the activity data and the emission factors needed to be stratified according to the different techniques that may occur in the country. The approach followed to apply a Tier 2 methodology was to stratify the coal mining/storage/handling in the country to model the different product and process types occurring in the national coal mining industry into the inventory by :

- defining the production using each of the separate product and/or process types (together called 'technologies' in the formulae below) separately, and
- applying technology specific emission factors for each process type.

As a result, it splited NFR 1.B.1.a into two SNAPs:

- Open cast mining with default 2016 EMEP/EEA Guidebook emission factors (Tier 2, Table 3-2);
- Underground mining with default 2016 EMEP/EEA Guidebook emission factors (Tier 2, Table 3-3).

The emissions of NMVOC,TSP, $PM_{2.5}$ and PM_{10} were recalculated on 2005-2016 time series and newly calculated on 2000-2004 time series.
NMVOC emissions from this category are the key source, representing 1.8% of the total national emissions of NMVOCs in 2016.

Table 3.16.1 Emissions Trend (kt) for NFR 1.B.1.a for NMVOC

Year/Pollutant	NMVOC
2000	28.033
2001	29.509
2002	27.248
2003	25.717
2004	23.570
2005	21.414
2006	18.971

2007	12.336
2008	11.316
2009	9.889
2010	8.437
2011	9.482
2012	8.914
2013	6.428
2014	5.559
2015	5.486
2016	4.596

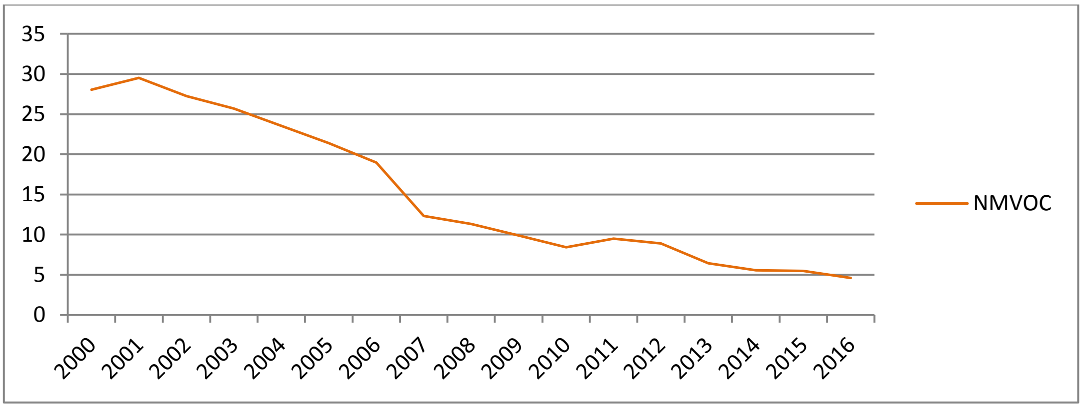


Figure 3.16.1 Emissions Trend (kt) for NFR 1.B.1.a for NMVOC

It is to be noticed that NMVOC emissions recalculated with new activity data, decreased from 2000 to 2016 by 83.6%.

3.17 NFR 1.B.1.b Fugitive emissions from solid fuels: solid fuel transformation

The emissions from coke production were accounted. Activity data is represented by coke production, taken from N.I.S. Default 2016 EMEP/EEA Guidebook emission factors were used. Coke production has been decreasing from 1613000 t in 2000 down to 0 t in 2010 and has been 0 t for the time period 2011-2016 .

Table 3.17.1. Activity data trends (t product) for NFR 1.B.1.b coke production

Year	AD (t coke production)
2000	1613000
2001	1413000
2002	1866000
2003	1638000
2004	1675000
2005	1891000
2006	1790000

2007	1647000
2008	1138000
2009	341000

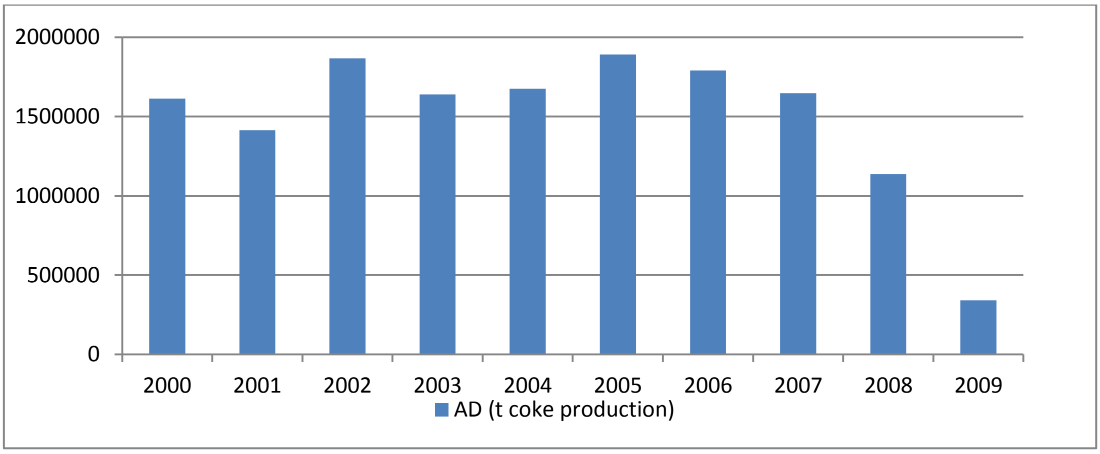


Figure 3.17.1. Activity data trends (t product) for NFR 1.B.1.b coke production

The pollutants emissions trend had the same variation as the activity data, it decreased to zero in the years without production.

3.18 NFR 1.B.2.a.i Oil

For NFR 1.B.2.a.i, NMVOC emissions from oil exploration, production,transport were taken into account for this category. Activity data were oil produced and imports from the Energy Balance provided by N.I.S. Activity data fluctuates,increasing and decreasing during the 2000-2016 time series. Default 2016 EMEP/EEA Guidebook emission factors (Table 3-1, Tier 1) were used.

For 2005-2016 time series, emissions of NMVOC were recalculated and, new calculated for 2000-2004 time series.

The emissions are calculated based on Tier 1 methodology for process emissions from oil exploration, production and transport, applying the general equation:

$E_{pollutant} = AR_{production} \times EF_{pollutant}$ where:

- Epollutant - is the emission of a pollutant (kg) ;
- ARproduction - is the annual production of oil and imports (in Mg) ;
- EFpollutant - is the emission factor of the relevant pollutant (in kg pollutant / Mg oil produced and imports).

Tabel 3.18.1 Emissions Trend (kt) for NFR 1.B.2.a.i for NMVOC

Year/Pollutant (kt)	NMVOC
2000	2.209
2001	2.356
2002	2.487
2003	2.221

2004	2.604
2005	2.825
2006	2.735
2007	2.656
2008	2.628
2009	2.278
2010	2.022
2011	1.935
2012	1.822
2013	1.886
2014	2.156
2015	2.120
2016	2.254

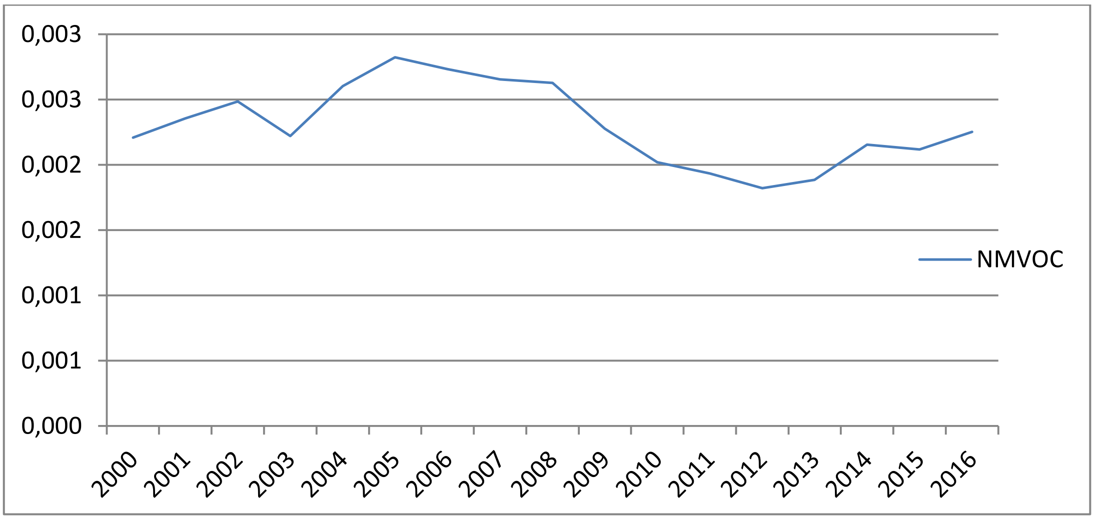


Figure 3.18.1 Emissions Trend (kt) for NFR 1.B.2.a.i for NMVOC

Pollutant emissions trend for NMVOC varies according to the activity data variation.

3.19 NFR 1.B.2.a.iv Refining, storage

For NFR 1.B.2.a.iv, activity data is represented by refinery oil inputs from the Energy Balance provided by N.I.S., together with default 2016 EMEP/EEA Guidebook emission factors (Table 3-1,Tier 1).

The emissions were calculated based on Tier 1 methodology for process emissions from oil refining and storage, applying the general equation:
Epollutant = ARproduction× EFpollutant where:

- Epollutant - is the emission of a pollutant (kg) ;
- ARproduction - is the annual refinery oil inputs in the transformation (in Mg) ;
- EFpollutant - is the emission factor of the relevant pollutant (in kg pollutant / Mg oil inputs in the transformation).

Tabel 3.19.1 Activity data trends (t product) for NFR 1.B.2.a.iv

Year/Pollutant	AD (t)
2000	10843951
2001	11489380
2002	12042445
2003	10902840
2004	12595902
2005	14109338
2006	13470486
2007	13171653
2008	13100469
2009	11320492
2010	10157510
2011	9825279
2012	9215363
2013	9492470
2014	10538486
2015	10448250
2016	11485997

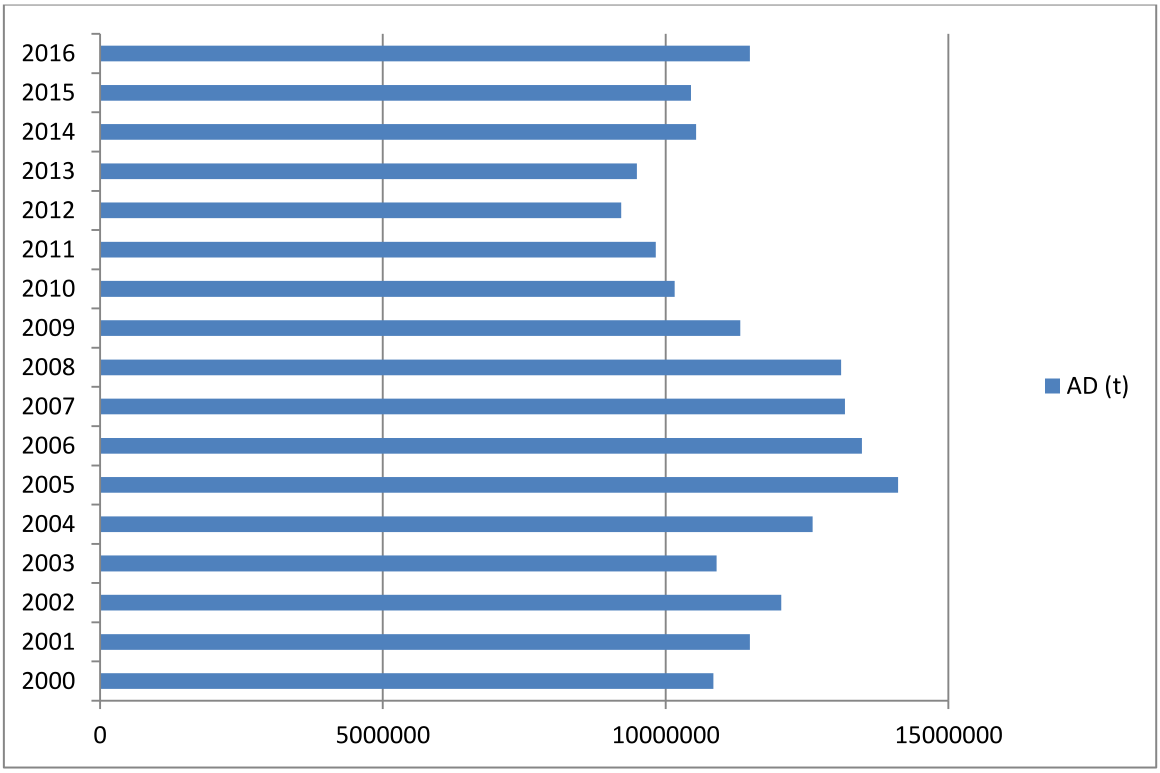


Figure 3.19.1 Activity data trends (t product) for NFR 1.B.2.a.iv

Tabel 3.19.2 Emissions Trend (kt) for NFR 1.B.2.a.iv for SO_x and NO_x

Year	SO_x	NO_x
2000	6.723	2.603
2001	7.124	2.758
2002	7.466	2.890
2003	6.760	2.617
2004	7.809	3.023
2005	8.748	3.386
2006	8.352	3.233
2007	8.166	3.161
2008	8.122	3.144
2009	7.019	2.717
2010	6.298	2.438
2011	6.092	2.358
2012	5.714	2.212
2013	5.885	2.278
2014	6.534	2.529
2015	6.478	2.508
2016	7.121	2.757

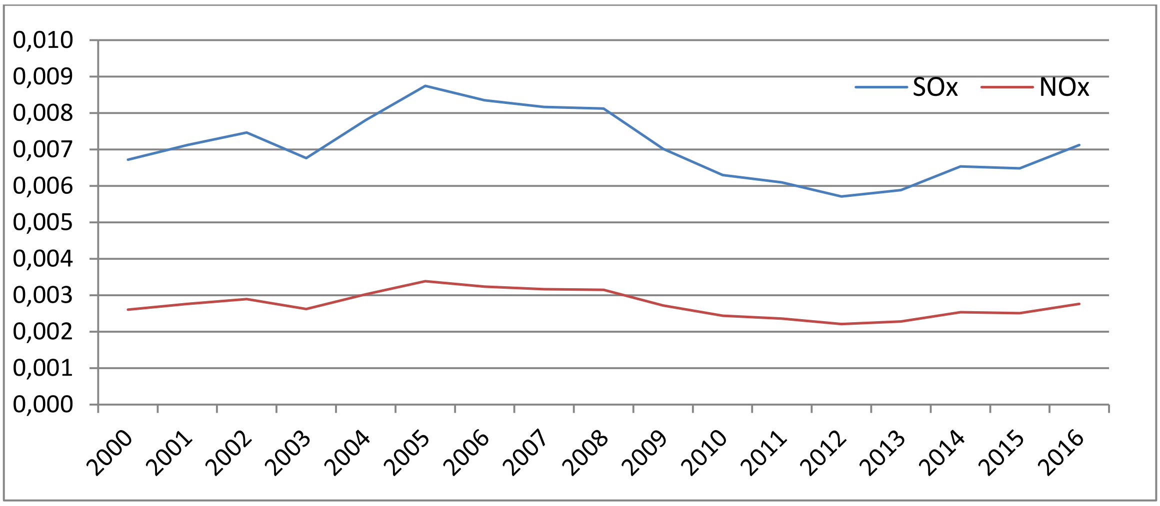


Figure 3.19.2 Emissions Trend (kt) for NFR 1.B.2.a.iv for SO_x and NO_x

Pollutant emissions trends for SOx and NOx vary according to the activity data variation.

3.20 NFR 1.B.2.a.v Distribution of oil products

For NFR 1.B.2.a.v, statistical activity data consisted of gasoline refinery gross outputs and imports minus exports.

AD = (Refinery gross outputs + Imports) – Exports (Gg)

Old activity data have been revised. The new activity data provided by the N.I.S. and by the Romania's Greenhouse Gas Inventory, improved the consistency between data for NFR and CRF. Tier 1 (Table 3-1 from NFR 1.B.2.a.v) default emission factor for oil from 2016 EMEP/EEA Guidebook was used.

Tabel 3.20.1. Emissions Trend (kt) for NFR 1.B.2.a.v for NMVOC

Year/Pollutant	NMVOC
2000	3.036
2001	3.480
2002	3.234
2003	3.288
2004	3.084
2005	3.166
2006	2.842
2007	3.344
2008	2.846
2009	3.394
2010	3.199
2011	2.627
2012	2.629
2013	2.599
2014	2.697
2015	2.605
2016	2.816

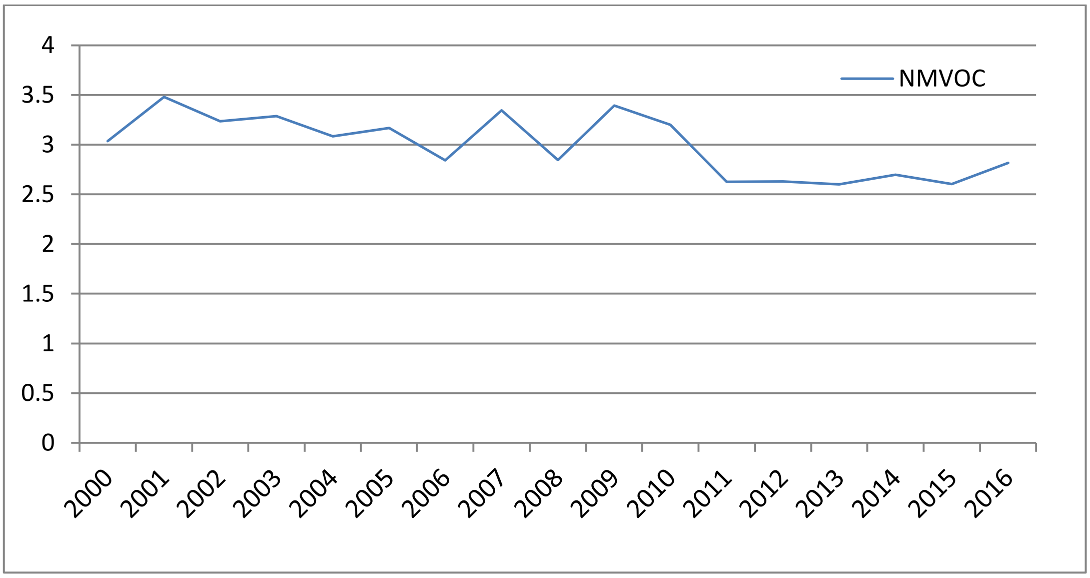


Figure 3.20.1. Emissions Trend (kt) for NFR 1.B.2.a.v for NMVOC

The emissions of NMVOC follow the activity data trend of NFR 1.B.2.a.v Distribution of oil products.

3.21 NFR 1.B.2.b Natural gas

This source includes emissions from the exploration, production and transport for natural gas. The emission factor for source NMVOC was corrected with Tier 1 default emission factor for natural gas from 2016 EMEP/EEA Guidebook (Table 3-2). Activity data has been doubled: the old emission factor for natural gas was applied for extracted natural gas as activity data and once more, the old emission factor was applied for gas production and imports.

Currently, activity data is represented by the extracted natural gas and imports and it is taken from the Energy Balance provided by N.I.S.(includes loading and first treatment of natural gas) to which the emissions factor applies for natural gas from 2016 EMEP/EEA Guidebook (Table 3-2, Tier 1). With this method it were recalculated the 2005-2015 time series and newly calculated the 2000-2004 time series.

Tabel 3.21.1. Emissions Trend (kt) for NFR 1.B.2.b. for NMVOC

Year/Pollutant	NMVOC
2000	1.711
2001	1.644
2002	1.681
2003	1.890
2004	1.792
2005	1.722
2006	1.779
2007	1.622
2008	1.567
2009	1.317
2010	1.313
2011	1.399
2012	1.381
2013	1.231
2014	1.164
2015	1.129
2016	1.128

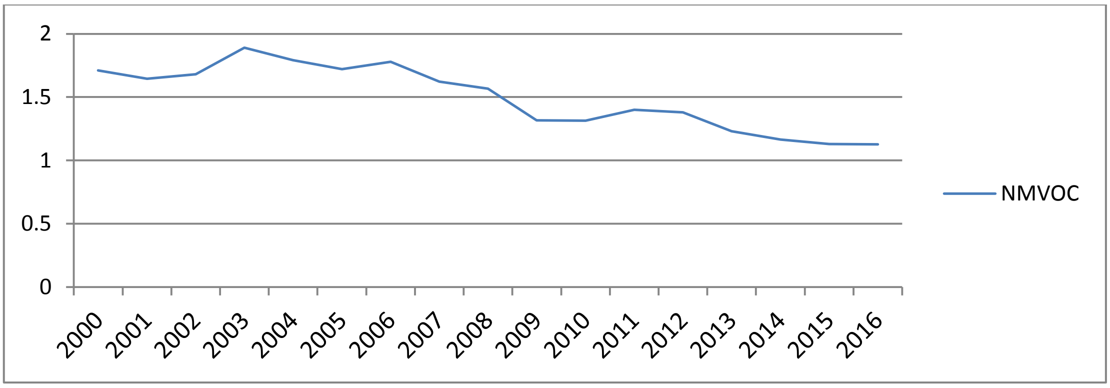


Figure 3.21.1. Emissions Trend (kt) for NFR 1.B.2.b. for NMVOC

It is observed that the emissions trend of NMVOC is decreasing for the 2005-2016 time period.

3.22 NFR 1.B.2.c Venting and flaring

For NFR 1.B.2.c, activity data is represented by the category "losses" of natural gas from the Energy Balance provided by N.I.S, together with default 2016 EMEP/EEA Guidebook emission factors (Table 3-1,Tier 1).

The emissions are calculated based on Tier 1 methodology for this process, applying the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant - is the emission of a pollutant (kg) ;
- ARproduction - is the annual loose of natural gas (1000 m^3) *(assumption: flare gas density =0.85 kg/m^3)*
- EFpollutant - is the emission factor of the relevant pollutant (in kg pollutant / Mg gas burned).

Tabel 3.22.1. Emissions Trend (kt) for NFR 1.B.2.c. for SOx, NO_X AND NMVOC

Year	NO_X	NMVOC	SO_x
2000	0.45206	0.58123	0.00420
2001	0.56125	0.72160	0.00521
2002	0.61602	0.79202	0.00572
2003	0.87702	1.12760	0.00814
2004	0.64246	0.82602	0.00597
2005	0.85566	1.10014	0.00795
2006	1.32434	1.70273	0.01230
2007	0.64648	0.83118	0.00600
2008	0.66834	0.85929	0.00621
2009	0.47228	0.60722	0.00439
2010	0.50950	0.65507	0.00473
2011	0.49028	0.63036	0.00455
2012	0.49405	0.63521	0.00459

2013	0.19379	0.24915	0.00180
2014	0.11713	0.15060	0.00109
2015	0.10745	0.13815	0.00100
2016	0.13571	0.17448	0.00126

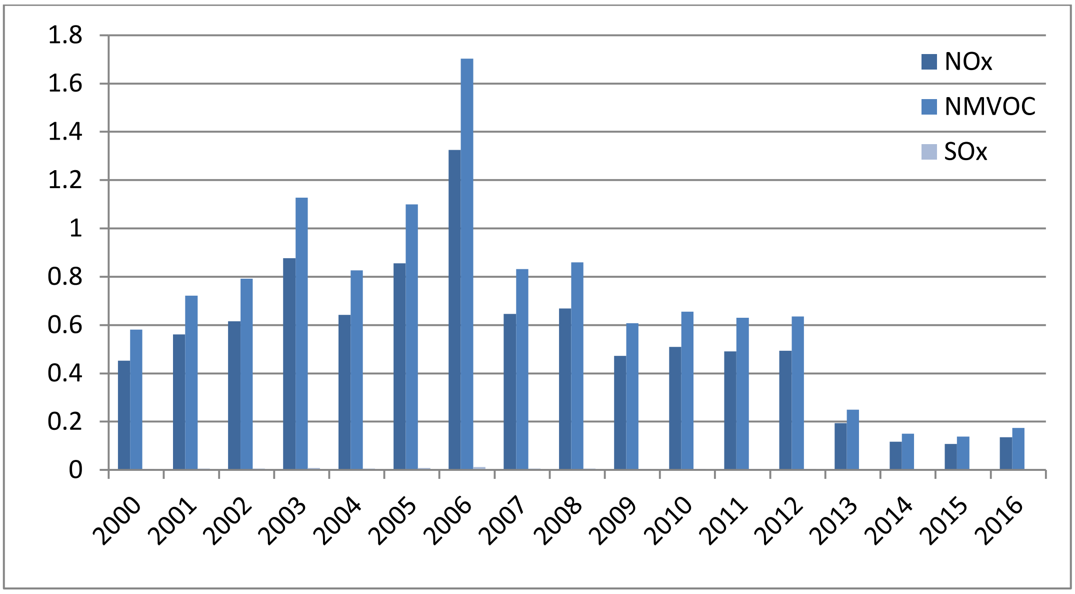


Figure 3.22.1. Emissions Trend (kt) for NFR 1.B.2.c for SO_x,NO_X and NMVOC

For the 2000-2004 period, SO_x, NO_x and NMVOC emissions recorded variations, increasing from 2004 to 2006, when it recorded a peak and then decreasing until 2016.

4. NFR 2 – INDUSTRIAL PROCESSES AND PRODUCT USE

The industrial processes and product use sector is a key category of NMVOC, PM_{10}, TSP, Pb, Cd, Hg, As, Cr, Ni, Zn, PCDD/F, PAHs and PCBs.

Table 4.1. The key category for Industrial Processes and product use

Pollutant	NFR code	Category	Level assessment (%)
NMVOC	2D3a	Domestic solvent use including fungicides	18.72%
NMVOC	2D3g	Chemical products	4.00%
NMVOC	2D3f	Dry cleaning	2.28%
NMVOC	2H2	Food and beverages industry	2.24%
NMVOC	2D3i	Other solvent use (please specify in the IIR)	1.52%
PM10	2D3b	Road paving with asphalt	3.16%
TSP	2D3b	Road paving with asphalt	10.03%
TSP	2B10a	Chemical industry: Other (please specify in the IIR)	9.04%
TSP	2A2	Lime production	4.63%

Pb	2C1	Iron and steel production	60.52%
Cd	2C1	Iron and steel production	13.00%
Hg	2C1	Iron and steel production	15.74%
As	2C1	Iron and steel production	21.72%
Cr	2C1	Iron and steel production	42.70%
Ni	2C1	Iron and steel production	17.61%
Zn	2C1	Iron and steel production	11.25%
PCDD/F	2C1	Iron and steel production	20.67%
PAHs	2C1	Iron and steel production	9.52%
PCBs	2C1	Iron and steel production	69.88%

IPPU sector mainly contributes to the Pb and PCBs emissions of the Inventory (more than 60%), Cr emissions (more than 40%), NMVOC emissions (more than 30%), TSP emissions (more than 25%), Hg, AS, Ni and PCDD/ PCDF (more than 20%), Cd (almost 20%) and with a relatively low contribution to the emissions of the rest of pollutants reported.

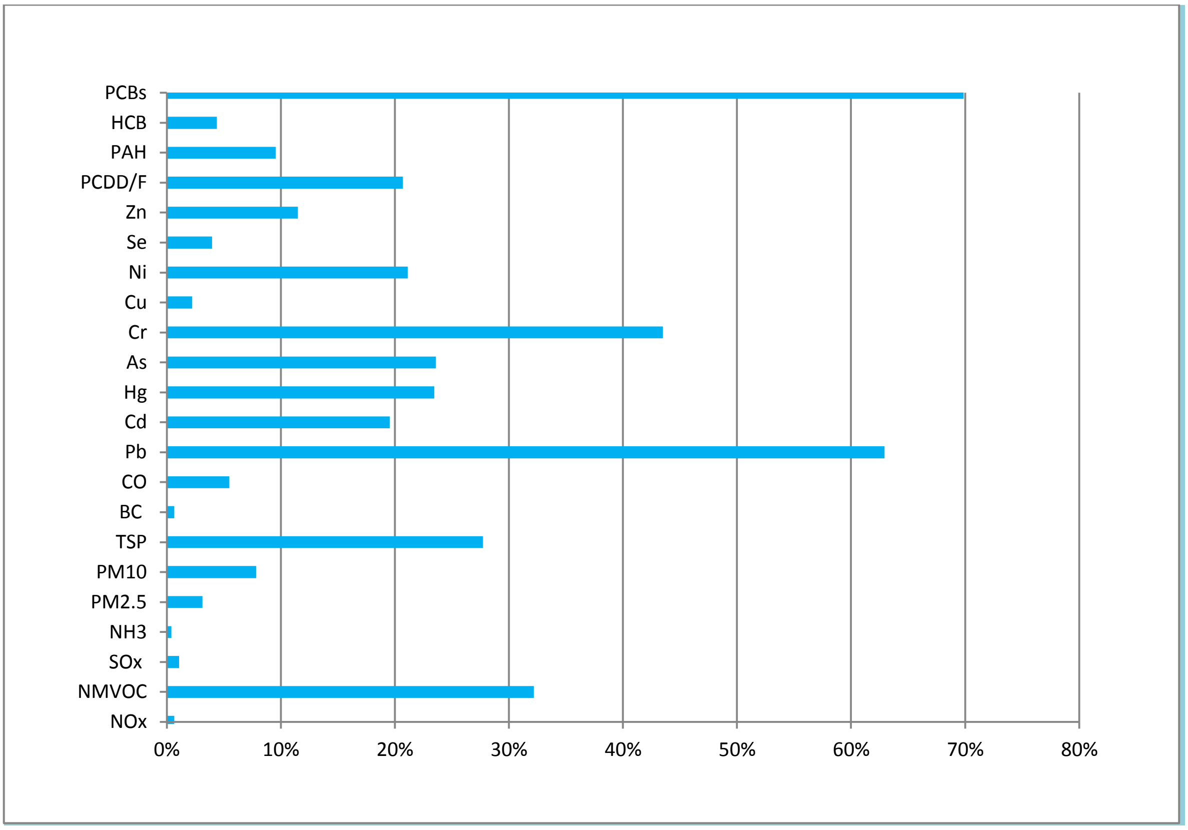


Figure 4.1. Emissions of pollutants (%) for IPPU sector in 2016

This sector only covers process related emissions arising from industrial processes. Emissions due to fuel combustion in manufacturing industries have been allocated to NFR 1.A.2 Fuel Combustion in Manufacturing Industries and Construction.

4.1 NFR 2.A.1 Cement production

This activity covers emissions from cement manufacture process. The present chapter only considers emissions of particulate matter from cement plants. According to the 2016 EMEP/EEA 2016 Guidebook emissions from the kiln are a combination of combustion and process emissions but the emissions of the main pollutants — NOx, sulphur oxides (SOx), CO, non-methane volatile organic compounds (NMVOC) and NH3 — as well as heavy metals and persistent organic pollutants (POPs) are assumed to originate mainly from the combustion of the fuel. These emissions are therefore treated in under NFR 1.A.2, which addresses combustion in cement production.

The methodology for estimating emissions from cement production applies the general equation:

$E_{pollutant} = AR_{production} \times EF_{pollutant}$ where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the cement production
- EFpollutant is the emission factor for this pollutant.

The emission factors used to calculate the emissions from cement production are from 2016 EMEP/EEA Guidebook, chapter 2.A.1 Cement production, Table 3.1.

The activity data used for emission calculations is the annual national total clinker production from the "PRODROM" statistics, provided by the N.I.S..

Table 4.1.1. Activity data trends (t product) for NFR 2.A.1. Cement production

Year	t product
2000	5005776
2001	5218308
2002	4984020
2003	4995763
2004	5661243
2005	6006960
2006	6916220
2007	7670400
2008	7780028
2009	5841148
2010	5201629
2011	5751215
2012	5873601
2013	5061670
2014	5466540
2015	6203413
2016	5932979

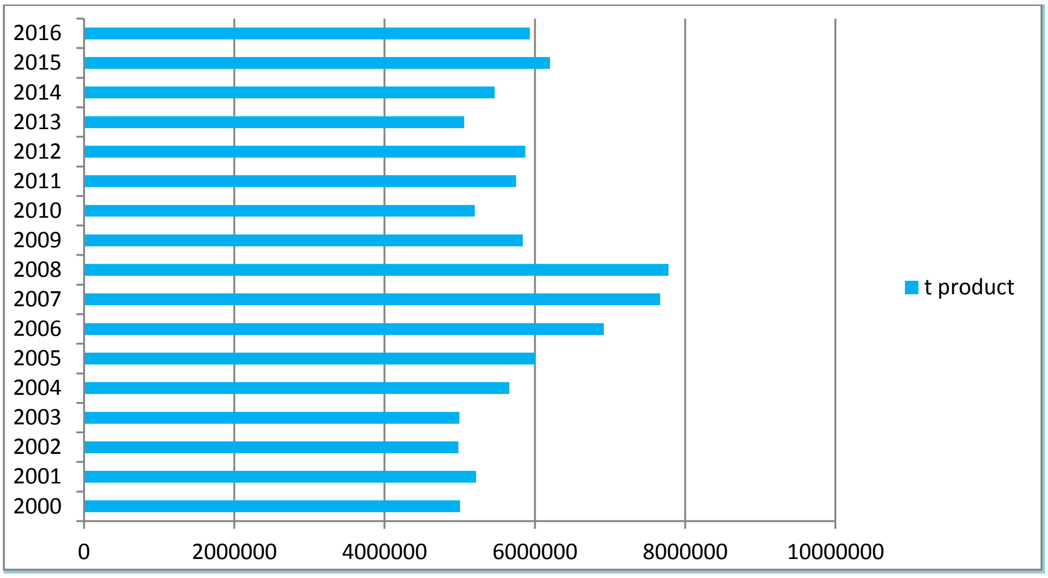


Figure 4.1.1. Activity data trend (t product) for NFR 2.A.1. Cement production

The emissions trends for particles from the cement production are shown in the following table and figure.

Table 4.1.2. Emission Trends (kt) for NFR 2.A.1 Cement Production

Year/Pollutant	$PM_{2.5}$	PM_{10}	TSP
2000	0.651	1.171	1.302
2001	0.678	1.221	1.357
2002	0.648	1.166	1.296
2003	0.649	1.169	1.299
2004	0.736	1.325	1.472
2005	0.781	1.406	1.562
2006	0.899	1.618	1.798
2007	0.997	1.795	1.994
2008	1.011	1.821	2.023
2009	0.759	1.367	1.519
2010	0.676	1.217	1.352
2011	0.748	1.346	1.495
2012	0.764	1.374	1.527
2013	0.658	1.184	1.316
2014	0.711	1.279	1.421
2015	0.806	1.452	1.613
2016	0.771	1.388	1.543

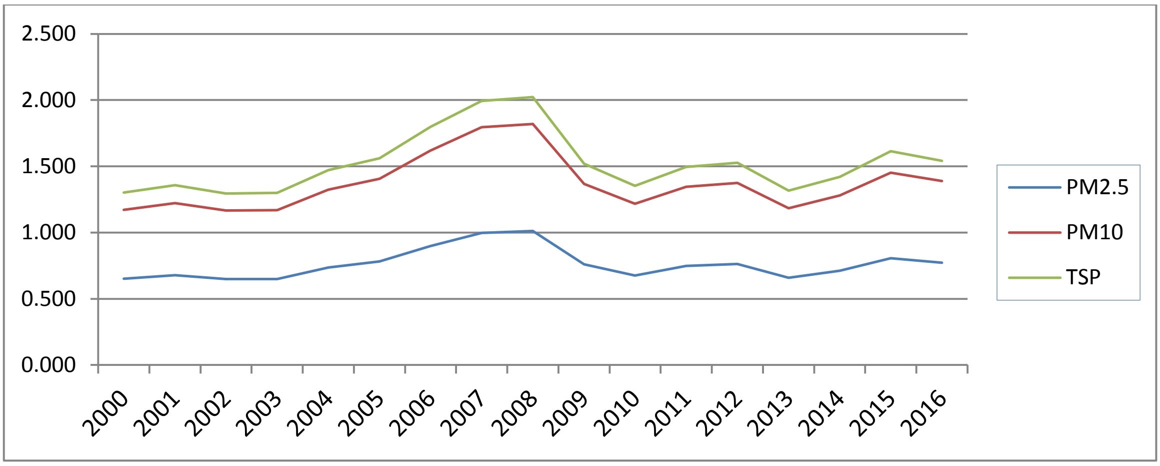


Figure 4.1.2. Emission Trends (kt) for NFR 2.A.1 Cement Production

The particulate matter emissions from this activity followed the activity data trend: for the 2000-2004 time period emissions recorded variations, increasing from 2005 to 2008 when it recorded a peak and decreasing afterwards until 2010. For the 2010-2016 time period emissions recorded variations related to clinker production activity.

The recalculations since the previous submission have been performed due to incorrect activity data used (cement production was used instead of clinker production). The emissions have been recalculated for all years in the time series.

4.2 NFR 2.A.2 Lime production

The production of lime causes emissions from both processes and combustion. Emissions are calculated for particulate fractions only. Emissions from combustion activities are a treated under NFR 1.A.2. The lime production was a key category for emissions of TSP in 2016.

The methodology for estimating emissions from lime production applies the general equation:

$E_{pollutant} = AR_{production} \times EF_{pollutant}$ where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the lime production
- EFpollutant is the emission factor for this pollutant.

The emission factors used to calculate the emissions from lime production are from 2016 EMEP/EEA Guidebook, chapter NFR 2.A.2 Lime production, Table 3.1.

Lime production is taken from the Statistical Yearbook provided by the N.I.S. and from the Romania's Greenhouse Gas Inventory – N.I.R., improving the consistency between data for

NFR and CRF. These data are structured by type of lime: calcium quicklime and dolomitic lime. For the period 2000-2008 calcium quicklime production is taken from the Statistical Yearbook provided by the N.I.S applying a correction factor value. For the period 2009-2016 calcium quicklime production is taken from the economic operators. For dolomitic lime produced, the N.I.S. activity data are used for the 2000-2016 period.

Table 4.2.1. Activity data trend (t product) for NFR 2.A.2. Lime production

Year	t product
2000	1473370
2001	1668797
2002	1603870
2003	1605351
2004	1721815
2005	1508340
2006	1679159
2007	2010625
2008	1783767
2009	1190696
2010	1338946
2011	1327031
2012	1163034
2013	1128363
2014	1232673
2015	1056202
2016	1061930

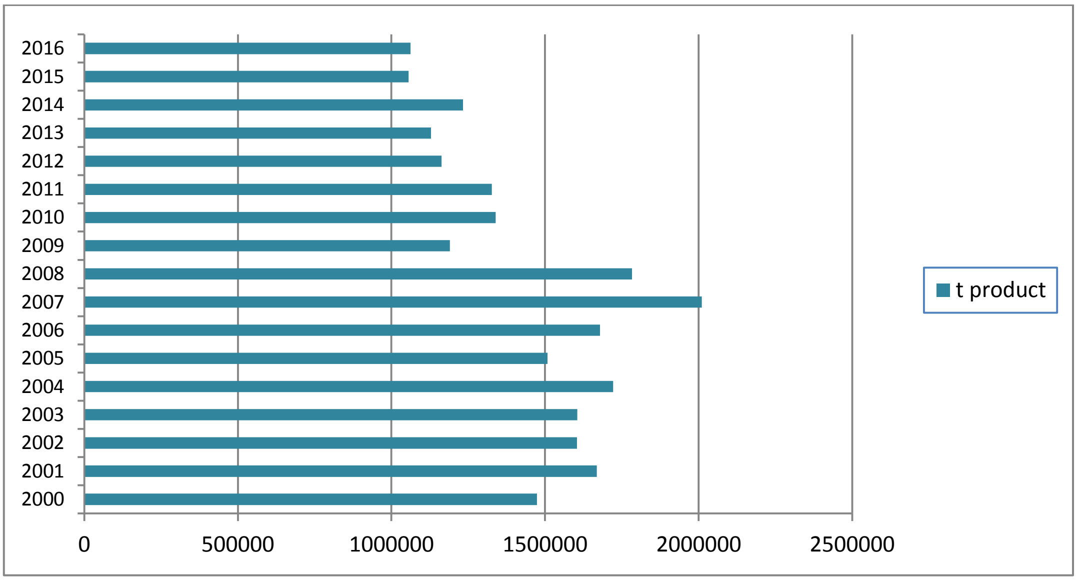


Figure 4.2.1. Activity data Trend (t) for NFR 2.A.2. Lime production

The emission trends for particles from lime production are shown in the following table and figure.

Table 4.2.2. Emission Trends (kt) for NFR 2.A.2. Lime production

Year/Pollutant	$PM_{2.5}$	PM_{10}	TSP
2000	1.031	5.157	13.260
2001	1.168	5.841	15.019
2002	1.123	5.614	14.435
2003	1.124	5.619	14.448
2004	1.205	6.026	15.496
2005	1.056	5.279	13.575
2006	1.175	5.877	15.112
2007	1.407	7.037	18.096
2008	1.249	6.243	16.054
2009	0.833	4.167	10.716
2010	0.937	4.686	12.051
2011	0.929	4.645	11.943
2012	0.814	4.071	10.467
2013	0.790	3.949	10.155
2014	0.863	4.314	11.094
2015	0.739	3.697	9.506
2016	0.743	3.717	9.557

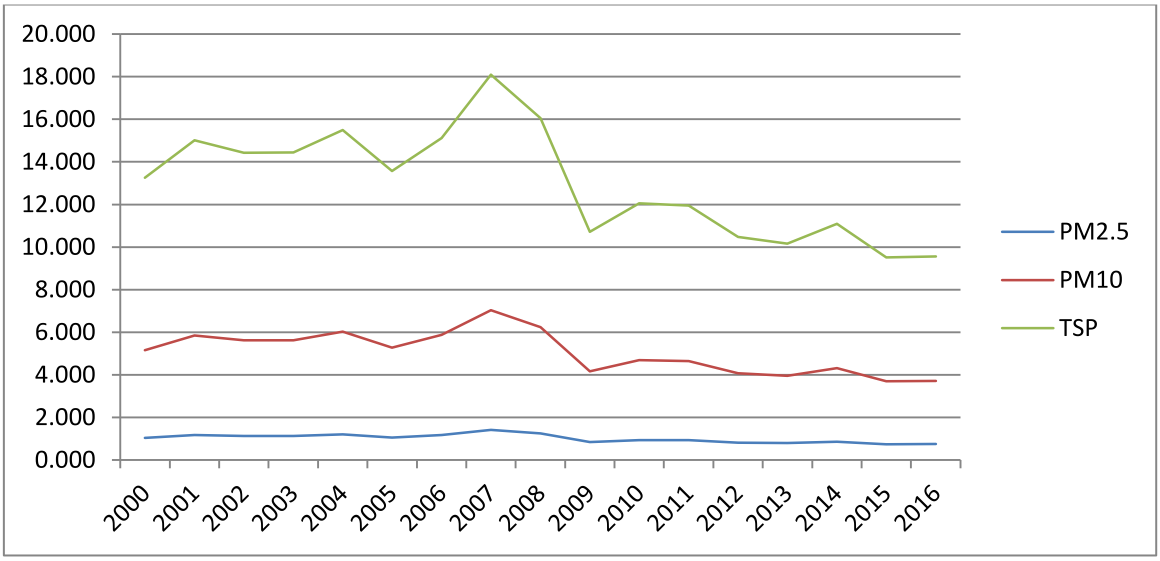


Figure 4.2.2. Emission Trends (kt) for NFR 2.A.2. Lime production

The emissions of $PM_{2.5}$, PM_{10} and TSP follow the activity data trends for lime production which varied substantially from year to year due to high variation of industry outputs.

The recalculations since the previous submission have been performed due to incorrect activity data used (the activity data used was the sum of quicklime and slaked lime, which implies double counting). The emissions have been recalculated for all years in the time series.

4.3 NFR 2.A.3 Glass production

This source is new in this year's submission. This activity covers emissions released during the production of the particular types of glass:

- Flat glass;
- Container glass;
- Glass wool.

Emissions from combustion activities within the glass industry are treated under NFR 1.A.2.
The methodology for estimating emissions from glass production applies the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the glass production
- EFpollutant is the emission factor for this pollutant.

This equation is applied at the national level, using annual national total glass production.

The emission factors used to calculate the emissions from glass production are from 2016 EMEP/EEA Guidebook, chapter 2.A.3 Glass production, Table 3.1.

The glass production is taken from the Statistical Yearbook provided by the N.I.S. and from the Romania's Greenhouse Gas Inventory – N.I.R., improving the consistency between data for NFR and CRF. The data and information on glass production was collected from economic operators. The glass quantity from the data collected from the economic operators is higher compared to the one provided by the N.I.S. due to the fact that data collected from the operators are the melted glass quantity and data from the N.I.S. represents the glass quantity sold.

Table 4.3.1. Activity data trend (t product) for NFR 2.A.3. Glass production

Year	t product
2000	389050
2001	404129
2002	404129
2003	538154
2004	385632
2005	301849
2006	284044
2007	461812
2008	451039
2009	358022
2010	400305

2011	386431
2012	377079
2013	373584
2014	363756
2015	394660
2016	411330

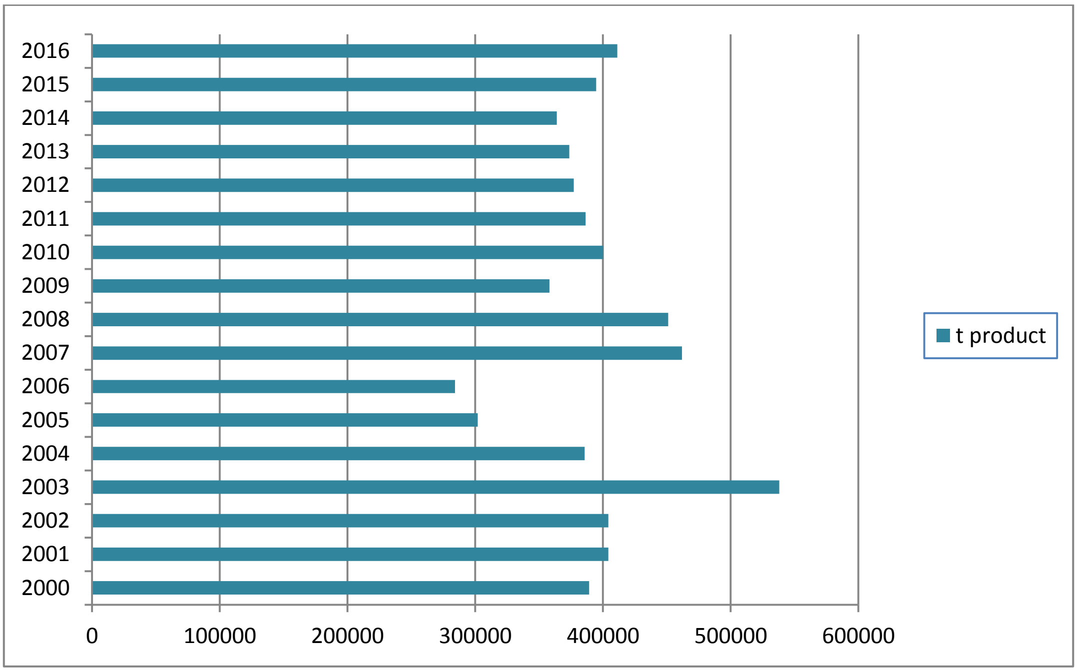


Figure 4.3.1. Activity data Trend (t) for NFR 2.A.3. Glass production

The emission trends for the glass production are shown in the following table and figure.

Table 4.3.2. Emission Trends (kt) for NFR 2.A.3 Glass production

Year/Pollutant	$PM_{2.5}$	PM_{10}	TSP
2000	0.093	0.105	0.117
2001	0.097	0.109	0.121
2002	0.097	0.109	0.121
2003	0.129	0.145	0.161
2004	0.093	0.104	0.116
2005	0.072	0.082	0.091
2006	0.068	0.077	0.085
2007	0.111	0.125	0.139
2008	0.108	0.122	0.135
2009	0.086	0.097	0.107
2010	0.096	0.108	0.120
2011	0.093	0.104	0.116
2012	0.090	0.102	0.113
2013	0.090	0.101	0.112
2014	0.087	0.098	0.109
2015	0.095	0.107	0.118
2016	0.099	0.111	0.123

Figure 4.3.2. Emission Trends (kt) for NFR 2.A.3. Glass production

The emissions of $PM_{2.5}$, PM_{10} and TSP vary for the 2000-2016 time series together with the variation of glass production activity data.

4.4 NFR 2.A.5.a Quarrying and mining of minerals other than coal

The emissions of particulates are relevant for quarrying and mining of minerals other than coal. Emissions of particulates were not estimated and the notation key NE was used. It is foreseen to explore approaches of collecting the data needed to calculate emissions for this source to provide an estimate of the emissions for the next submissions.

4.5 NFR 2.A.5.b Construction and demolition

The emissions of particulates are relevant for construction and demolition. Emissions of particulates were not estimated and the notation key NE was used. Activity data is represented by the area affected by that specific type of construction and/or demolition and this type of data is not collected by N.I.S.

4.6 NFR 2.B.1 Ammonia production

This activity covers emissions from ammonia manufacture process.

The methodology for estimating emissions from ammonia production applies the general equation:

$Epollutant = ARproduction \times EFpollutant$ where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the ammonia production
- EFpollutant is the emission factor for this pollutant.

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from ammonia productions is not included.

The activity data used for emission calculations is the annual national total ammonia production from the Statistical Yearbook provided by the N.I.S. Ammonia production data between 2013 and 2016 are confidential.

Table 4.6.1. Activity data trend (t) for NFR 2.B.1. Ammonia production

Year	t production
2000	1254695
2001	1154726
2002	1137457
2003	1444661
2004	1422136
2005	1611000
2006	1580000

2007	1371000
2008	1275000
2009	1139000
2010	1392000
2011	1588000
2012	1543000

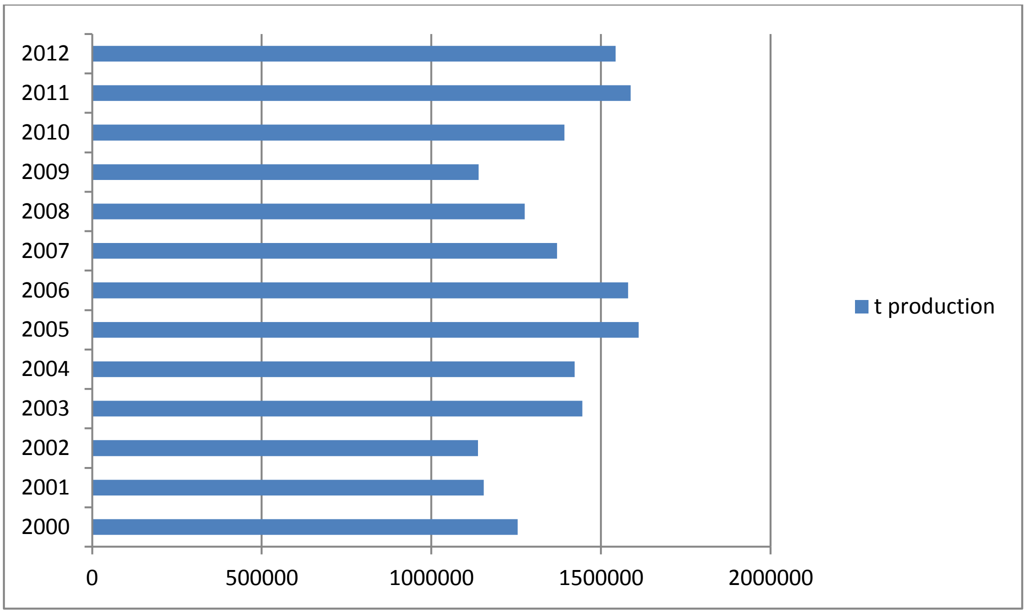


Figure 4.6.1. Activity data trend (t) for NFR 2.B.1. Ammonia production

The emission trends are shown below in the following table and figures.

Table 4.6.2 Total Emission Trends (kt) for NFR 2.B.1. Ammonia production

Year/Pollutant	**NOx**	**CO**	**NH_3**
2000	1.2547	0.1255	0.0125
2001	1.1547	0.1155	0.0115
2002	1.1375	0.1137	0.0114
2003	1.4447	0.1445	0.0144
2004	1.4221	0.1422	0.0142
2005	1.6110	0.1611	0.0161
2006	1.5800	0.1580	0.0158
2007	1.3710	0.1371	0.0137
2008	1.2750	0.1275	0.0128
2009	1.1390	0.1139	0.0114
2010	1.3920	0.1392	0.0139
2011	1.5880	0.1588	0.0159
2012	1.5430	0.1543	0.0154

2013	1.1270	0.1127	0.0113
2014	1.1930	0.1193	0.0119
2015	0.6070	0.0607	0.0061
2016	0.5370	0.0537	0.0054

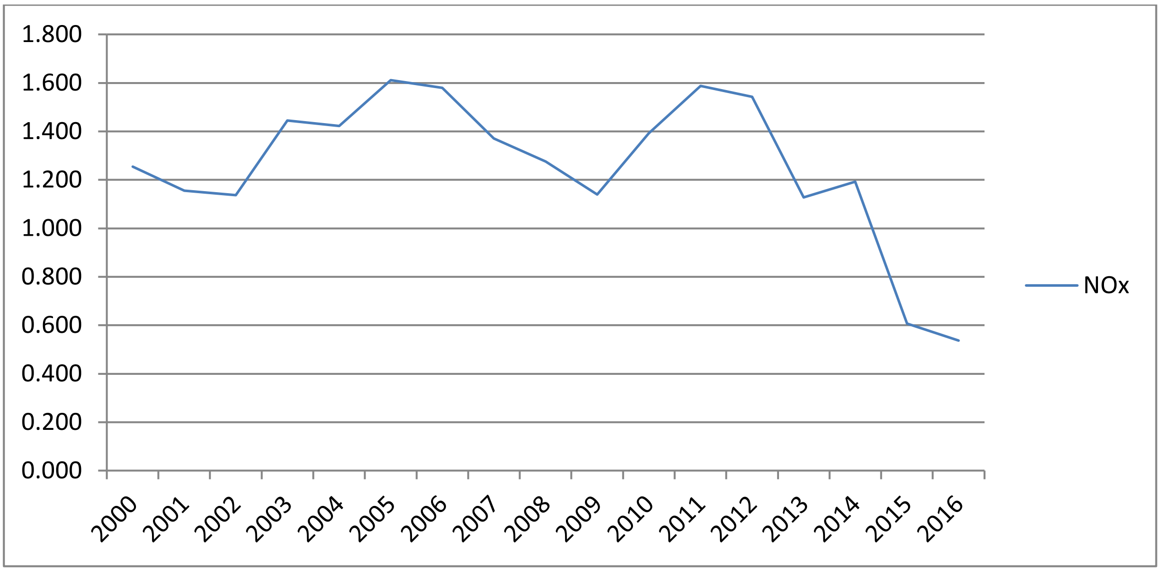


Figure 4.6.2a Total Emission Trends (kt) for NOx for NFR 2.B.1. Ammonia production

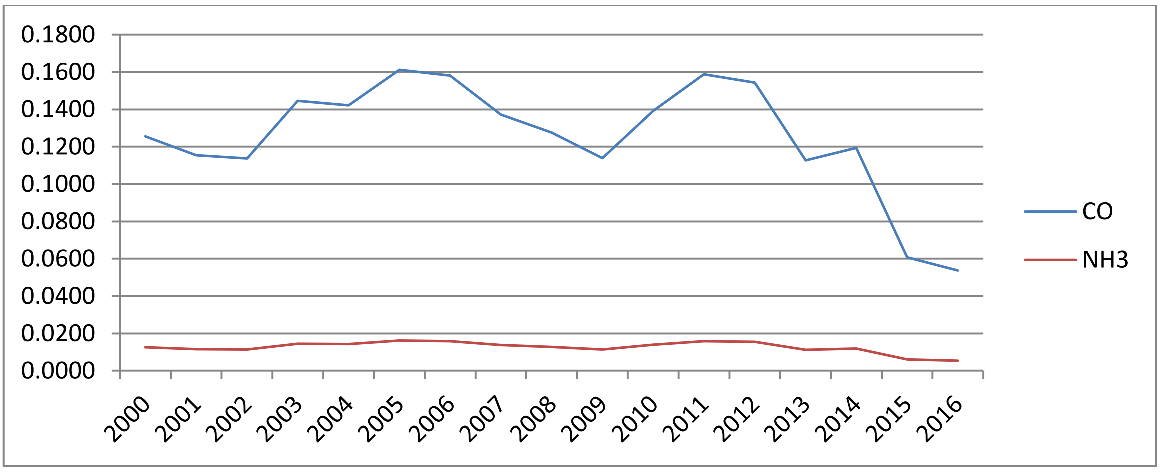


Figure 4.6.2b Total Emission Trends (kt) for CO and NH_3 for NFR 2.B.1. Ammonia production

NOx, NH_3 and CO emissions reached a peak level in 2006 and 2011, due to peaks in activity data (ammonia production) for those years.

4.7 NFR 2.B.2 Nitric acid production

This activity covers emissions from nitric acid manufacture process.

The methodology for estimating emissions from nitric acid production applies the general equation:

$E_{pollutant} = AR_{production} \times EF_{pollutant}$ where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the nitric acid production
- EFpollutant is the emission factor for this pollutant.

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from nitric acid production is not included.

The activity data used for emission calculations is the annual national total nitric acid production from the "PRODROM" statistics, provided by the N.I.S. These data are confidential.

The emission trends are shown below in the following table and figure.

Table 4.7.1. Emission data trend (kt) for NFR 2.B.2. Nitric acid production

Year/Pollutant	NOx
2000	3.4432
2001	2.1544
2002	2.3506
2003	2.8813
2004	3.1821
2005	4.5755
2006	6.5358
2007	4.3619
2008	4.4706
2009	3.3225
2010	4.7399
2011	3.9776
2012	3.8325
2013	3.5065
2014	3.6419
2015	0.6718
2016	0.4200

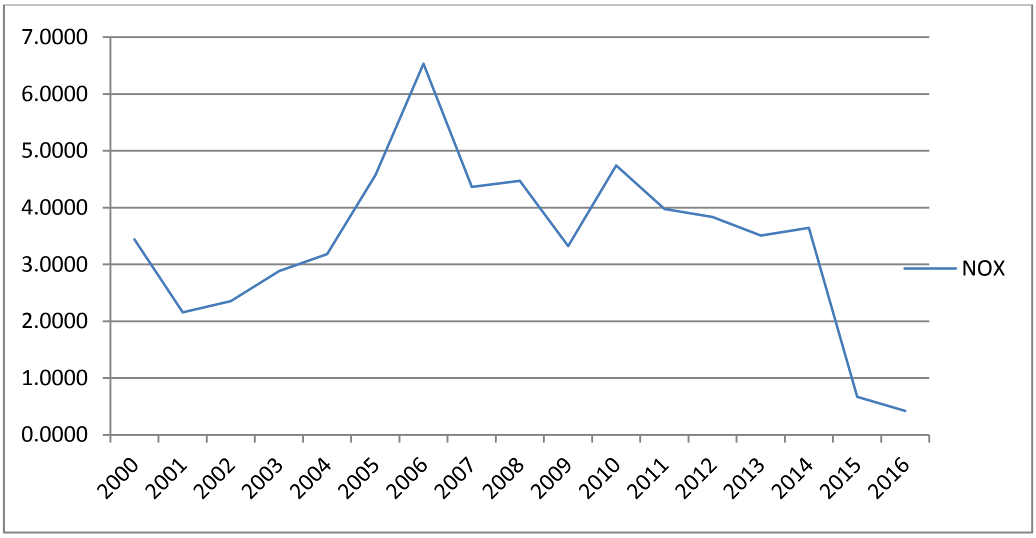


Figure 4.7.1. Total Emission trends (kt) for NOx for NFR 2.B.2. Nitric acid production

The emissions of NOx followed the activity data trend for nitric acid production, with peaks in 2006 and 2010 and with major decrease after 2014.

4.8 NFR 2.B.3 Adipic acid production

This activity covers emissions from adipic acid manufacture process. This source is new in this year's submission.

The methodology for estimating emissions from adipic acid production applies the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the adipic acid production
- EFpollutant is the emission factor for this pollutant.

The emission factors used to calculate the emissions from adipic acid production are from 2016 EMEP/EEA Guidebook, chapter NFR 2.B Chemical industry, Table 3.4.

The activity data used for emission calculations is the annual national total adipic acid production from the "PRODROM" statistics, provided by the N.I.S. The adipic acid productions were 9.258 kt for the year 2000 and 5.322 kt for the year 2001. There is no adipic acid production since the year 2002.

4.9 NFR 2.B.5 Carbide production

This activity covers emissions from carbide manufacture process. This source is new in this year's submission.

The methodology for estimating emissions from calcium carbide production applies the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the calcium carbide production
- EFpollutant is the emission factor for this pollutant.

The emission factors used to calculate the emissions from calcium carbide production are from 2016 EMEP/EEA Guidebook, chapter NFR 2.B Chemical industry, Table 3.5.

The activity data used for emission calculations is the annual national total calcium carbide production from the Statistical Yearbook provided by the N.I.S. There is no calcium carbide production since the year 2007.

Table 4.9.1. Activity data trend (kt Carbide) for NFR 2.B.5 Carbide production

Year	kt production
2000	55
2001	53
2002	53
2003	45
2004	63
2005	34
2006	20

The emission trends are shown below in the following figure.

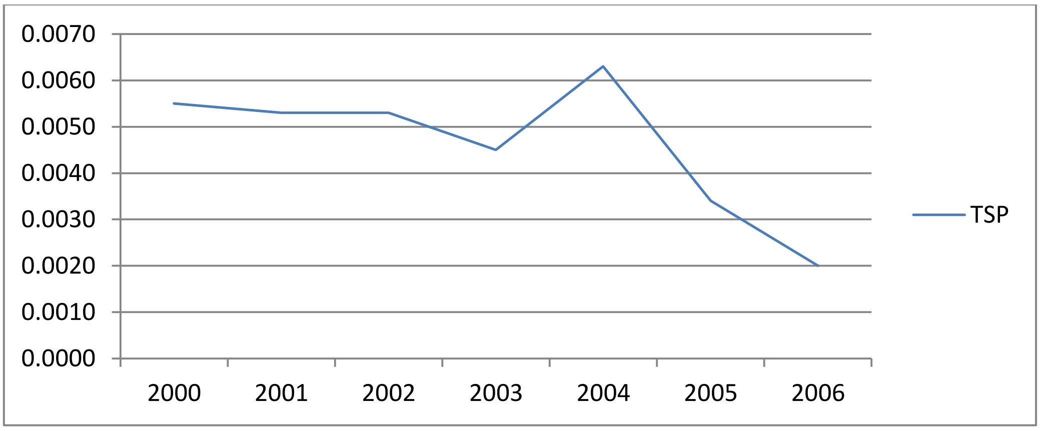


Figure 4.9.1. Total Emission trends (kt) for TSP for NFR 2.B.5 Carbide production

TSP emissions followed the activity data trend for carbide production, with a peak in 2004.

4.10 NFR 2.B.7 Soda ash production

This activity covers emissions from soda ash manufacture process.

The methodology for estimating emissions from soda ash production applies the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the soda ash production
- EFpollutant is the emission factor for this pollutant.

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions for soda ash production is not included.

The activity data used for emission calculations is the annual national total soda ash production from the Statistical Yearbook provided by the N.I.S. These data are confidential.

The emission trends are shown below in the following table and figure.

Table 4.10.1. Emission trends (kt) for NFR 2.B.7 Soda Ash production

Year/Pollutant	NH_3	TSP
2000	0.3519	0.0391
2001	0.4029	0.0448
2002	0.4089	0.0454
2003	0.3653	0.0406
2004	0.3584	0.0398
2005	0.3114	0.0346
2006	0.4077	0.0453
2007	0.4068	0.0452
2008	0.4446	0.0494
2009	0.3681	0.0409
2010	0.3393	0.0377
2011	0.3753	0.0417
2012	0.3852	0.0428
2013	0.3825	0.0425
2014	0.3771	0.0419
2015	0.4545	0.0505
2016	0.4644	0.0516

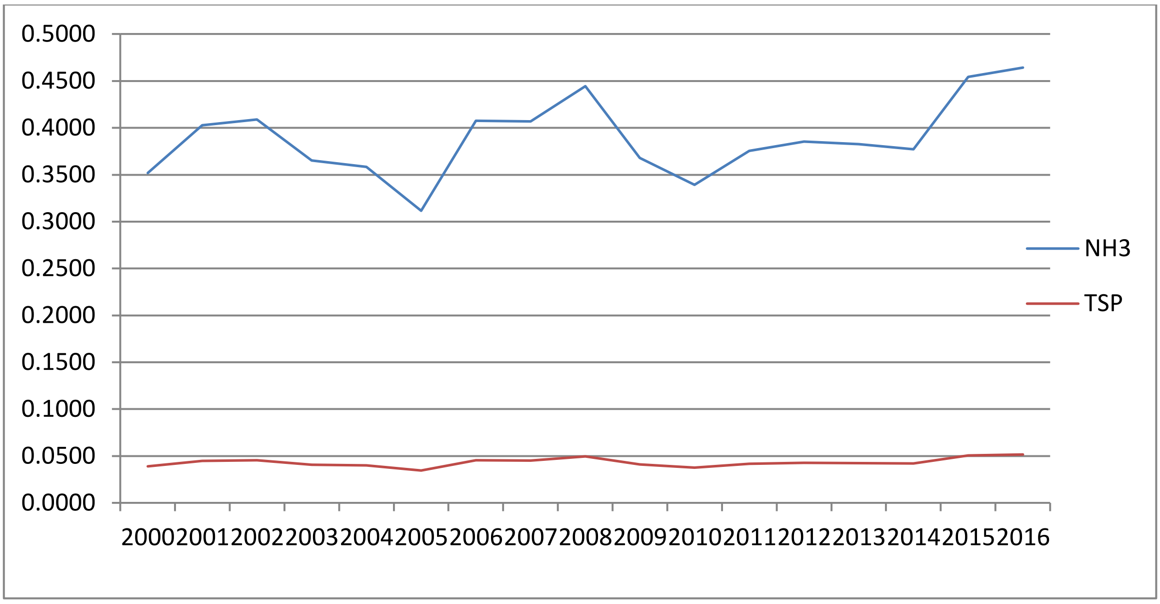


Figure 4.10.1. Emission trends (kt) for NFR 2.B.7 Soda Ash production

The emissions of NH_3 and TSP follow the activity data trends for soda ash production which varied substantially from year to year due to high variation of industry outputs.

4.11 NFR 2.B.10.a Other chemical industry

This source includes a large collection of different chemical production processes, listed below with corresponding SNAP codes:

- 040407 NPK fertilisers;
- 040408 Urea (not available between 2000-2004);
- 040409 Carbon black (production sttoping in year 2003);
- 040501 Ethylene;
- 040502 Propylene;
- 040506 Polyethylene Low Density (production starting in year 2001);
- 040507 Polyethylene High Density (production starting in year 2001);
- 040508 Polyvinylchloride (production starting in year 2003);
- 040509 Polypropylene;
- 040511 Polystyrene (production starting in year 2001);
- 040514 Styrene-butadiene rubber (SBR);
- 040516 Ethylene oxide (production starting in year 2003).

The Other chemical industry production was a key category for emissions of TSP in 2016.
The methodology for estimating emissions from chemical production applies the general equation:

$$\text{Epollutant} = \sum_{\text{technologies}} \text{ARproduction, technology x EFtechnology, pollutant}$$

where:

- ARproduction, technology = the production rate within the source category, using this specific technology
- EFtechnology, pollutant = the emission factor for this technology and this pollutant

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from other chemical industry production is not included.

The activity data used for emission calculations are represented by the total productions of each product, from the Statistical Yearbook provided by the N.I.S. These data are confidential.

The emission trends are shown below in the following table and figures.

Table 4.11.1. Total Emission Trends (kt) for NFR 2.B.10.a Other chemical industry

Year/Pollutant	NMVOC	$PM_{2.5}$	PM_{10}	TSP
2000	8.740	0.0043	0.0173	52.728
2001	8.039	0.0045	0.0179	47.025
2002	7.893	0.0027	0.0184	46.028
2003	11.494	0.0014	0.0191	67.537
2004	10.606	0.0012	0.0234	61.278
2005	14.301	0.2637	0.3741	84.721
2006	10.009	0.1466	0.2167	57.540
2007	10.304	0.1847	0.2709	58.670
2008	15.334	0.2011	0.2880	89.886
2009	8.423	0.0835	0.1145	48.476
2010	10.143	0.0278	0.0402	59.678
2011	11.045	0.0896	0.1231	64.697
2012	8.769	0.1411	0.1895	50.825
2013	6.580	0.1048	0.1408	37.400
2014	6.919	0.0561	0.0763	39.485
2015	4.265	0.0579	0.0789	23.177
2016	3.604	0.0215	0.0310	18.674

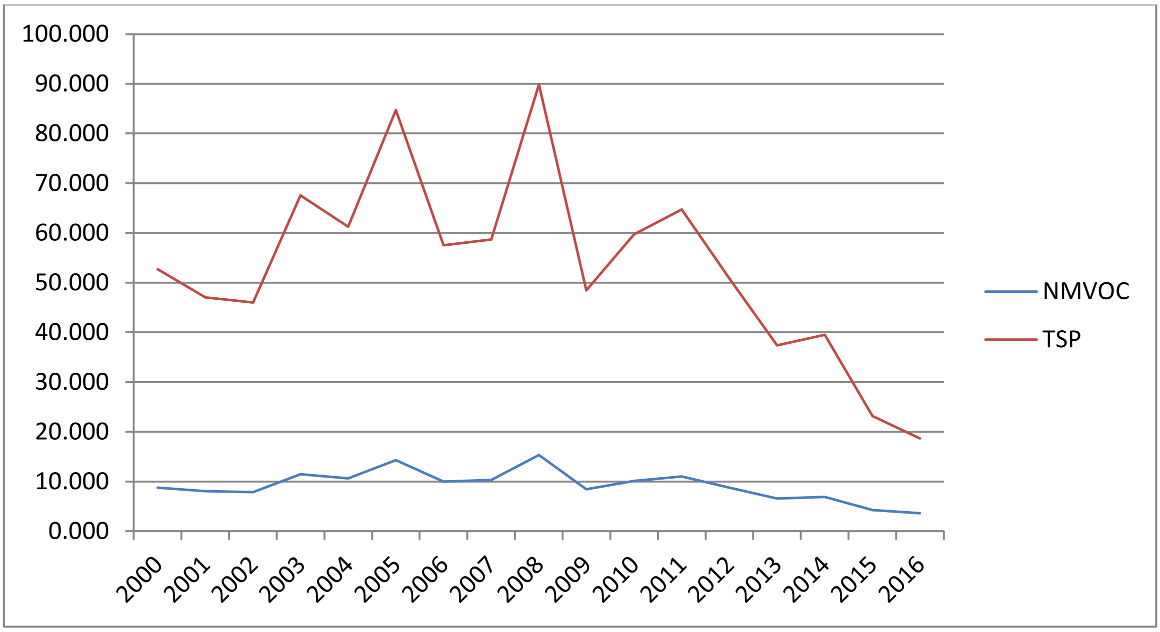


Figure 4.11.1a Total Emission Trends (kt) for NMVOC, TSP for NFR 2.B.10.a Other chemical industry

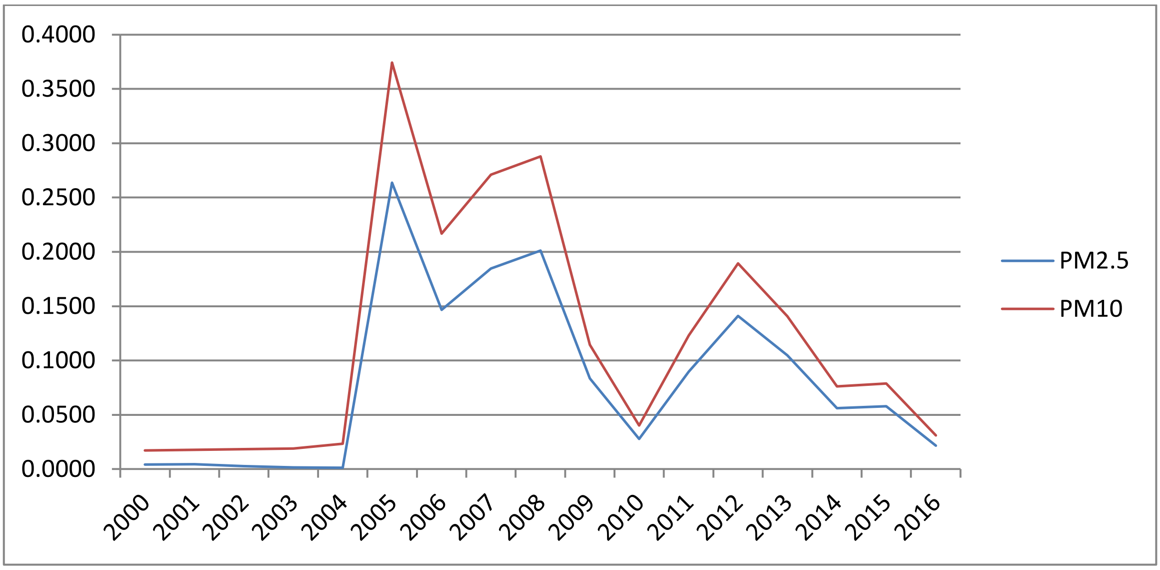


Figure 4.11.1b Total Emission Trends (kt) for NFR $PM_{2.5}$ and PM_{10} for 2.B.10.a Other chemical industry

The emissions of $PM_{2.5}$ and PM_{10} from those activities follow the activity data trends of other chemical industries which varied substantially from year to year due to high variation of industry outputs.

The time series of NMVOCs have been recalculated due to the emission factor error used to estimate emissions from ethylene production.

4.12 NFR 2.C.1 Iron and steel production

This source category covers the following activities with corresponding SNAP codes:

- 040202 Blast furnace charging;
- 040206 Basic oxygen furnace steel plant;
- 040207 Electric furnace steel plant;
- 040208 Rolling mills;
- 040209 Sinter and pelletizing plants.

In this sector are reported only the process emissions in iron and steel production. The emissions from combustion activities within the iron and steel industry are reported under NFR 1.A.2.a.
This sector was a key category for emissions of Pb, Cd, Hg, As, Cr, Ni, Zn, PCDD/F, PAHs and PCBs and it was the most important source of emissions of PCBs, Pb and Cr in 2016.

The methodology for estimating emissions from iron and steel production applies the general equation:

$$Epollutant = \sum_{technologies} ARproduction, technology \text{ x } EFtechnology, pollutant$$

where:
- ARproduction, technology = the production rate within the source category, using this specific technology
- EFtechnology, pollutant = the emission factor for this technology and this pollutant

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from iron and steel production is not included.

The activity data used for emission calculations are represented by the total productions of each product from the Statistical Yearbook provided by the N.I.S. These data are confidential.

The emission trends are shown below in the following table and figures.

Table 4.12.1. Total Emission Trends for NFR 2.C.1. Iron and steel production

Year/ Pollutant	Pb (t)	Cd (t)	Hg (t)	As (t)	Cr (t)	Ni (t)	Zn (t)	PCDD/F (g I-TEQ)	PAHs (t)	PCBs (kg)
2000	33.328	0.495	0.295	1.482	8.128	1.726	18.702	43.434	9.688	19.765
2001	35.258	0.518	0.310	1.579	8.665	1.802	19.771	45.801	10.228	20.890
2002	39.804	0.521	0.325	1.916	10.554	1.768	22.188	49.991	12.112	24.169
2003	41.086	0.557	0.343	1.937	10.655	1.908	22.951	52.132	12.559	24.997
2004	43.617	0.618	0.375	2.001	10.994	2.135	24.421	56.049	13.152	26.348
2005	44.623	0.681	0.403	1.943	10.650	2.391	25.088	58.672	13.024	26.510

2006	44.342	0.697	0.408	1.889	10.340	2.460	24.969	58.842	12.699	26.094
2007	44.352	0.699	0.409	1.885	10.318	2.469	24.978	58.909	12.650	26.047
2008	35.420	0.583	0.337	1.453	7.940	2.075	19.996	47.713	9.753	20.445
2009	19.422	0.328	0.188	0.781	4.260	1.170	10.980	26.371	5.263	11.124
2010	25.506	0.495	0.272	0.889	4.811	1.808	14.555	36.374	6.265	13.943
2011	25.873	0.528	0.286	0.848	4.572	1.940	14.812	37.585	6.075	13.853
2012	23.240	0.470	0.255	0.771	4.161	1.724	13.298	33.638	5.526	12.515
2013	21.416	0.373	0.212	0.836	4.552	1.341	12.127	29.401	5.503	11.962
2014	22.151	0.397	0.223	0.840	4.571	1.434	12.569	30.716	5.671	12.347
2015	23.996	0.402	0.231	0.970	5.293	1.436	13.560	32.517	6.472	13.713
2016	23.619	0.396	0.227	0.954	5.205	1.414	13.346	32.017	6.405	13.531

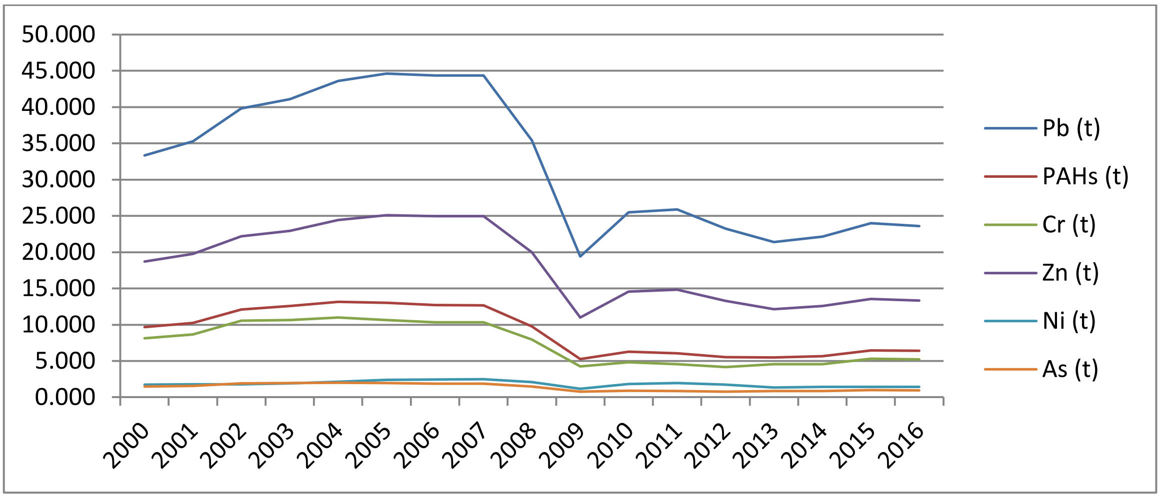


Figure 4.12.1.a Total Emission Trends for NFR 2.C.1. Iron and steel production for Pb, PAHs, Cr, Zn, Ni and As (t)

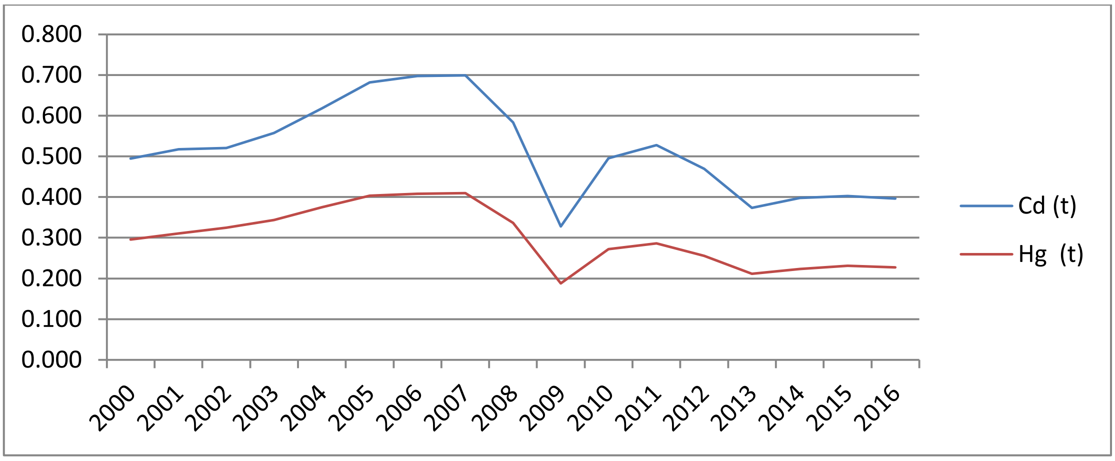


Figure 4.12.1.b Total Emission Trends for NFR 2.C.1. Iron and steel production for Cd, Hg (t)

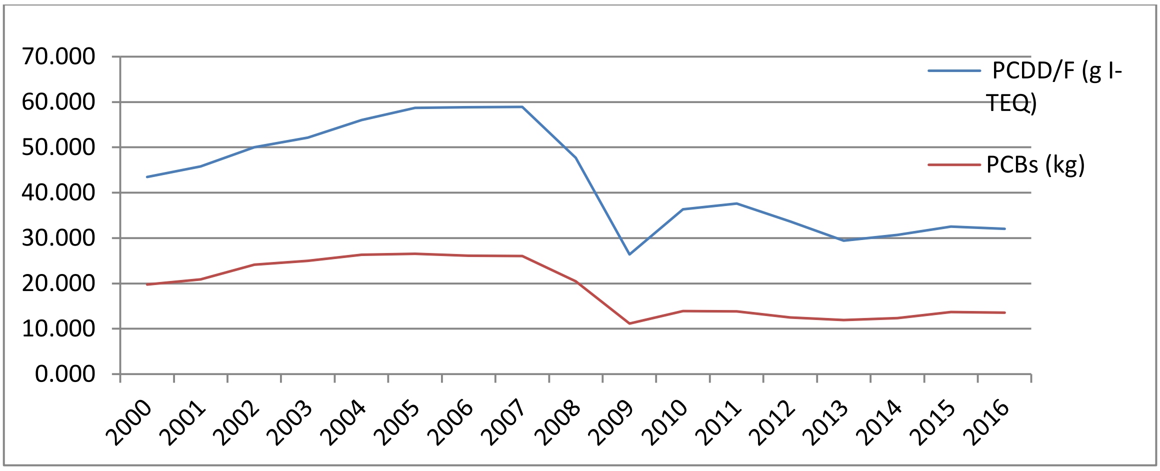


Figure 4.12.1.c Total Emission Trends for NFR 2.C.1. Iron and steel production for PCDD/F (g I-TEQ) and PCBs (kg)

The emissions from iron and steel production follow the activity data trends which varied substantially from year to year due to high variation of industry outputs.There has been a sudden decrease in emissions for year 2009, according to the decrease in activity data.

4.13 NFR 2.C.2 Ferroalloys production

The activity data is represented by the total production of ferroalloys, from the “PRODROM” statistics, provided by the N.I.S. These data are confidential. There is no ferroalloys production since year 2013.

4.14 NFR 2.C.3 Aluminum production

The methodology for estimating emissions from aluminum production applies the general equation:

$E_{pollutant} = AR_{production} \times EF_{pollutant}$ where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the aluminum production production
- EFpollutant is the emission factor for this pollutant.

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from aluminum production is not included.

The activity data used for emission calculations is the annual national total aluminum production, from the “PRODROM” statistics, provided by the N.I.S. These data are confidential.

The emission trends are shown below in the following table.

Table 4.14.1. Total Emission Trends for SOx, CO (kt) and PAHs (t) for NFR 2.C.3. Aluminum production

Year/Pollutant	CO (kt)	SOx (kt)	PAHs (t)
2000	20.7925	0.8664	0.0208
2001	21.5784	0.8991	0.0216
2002	22.3908	0.9330	0.0224
2003	23.7658	0.9902	0.0238
2004	25.8310	1.0763	0.0258
2005	28.6204	1.1925	0.0286
2006	32.0230	1.3343	0.0320
2007	31.5090	1.3129	0.0315
2008	37.4938	1.5622	0.0375
2009	24.1721	1.0072	0.0242
2010	24.9018	1.0376	0.0249
2011	26.8796	1.1200	0.0269
2012	24.3044	1.0127	0.0243
2013	23.7028	0.9876	0.0237
2014	23.4954	0.9790	0.0235
2015	24.7621	1.0318	0.0248
2016	24.9090	1.0379	0.0249

The emissions of CO, SOx and PAHs follow the activity data trends for aluminum production which varied substantially from year to year due to high variation of industry outputs.

The time series have been recalculated due to changes between the EFs of 2013 EMEP/EEA Guidebook and 2016 EMEP/EEA Guidebook for NFR 2.C.3. Aluminum production.

4.15 NFR 2.C.5. Lead production

The methodology for estimating emissions from lead production applies the general equation:

$$Epollutant = \sum_{technologies} ARproduction, technology \text{ x } EFtechnology, pollutant$$

where:

- ARproduction,technology = the production rate within the source category, using this specific technology
- EFtechnology,pollutant = the emission factor for this technology and this pollutant

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from lead production is not included.

The activity data used for emission calculations are represented by primary and secondary lead productions from the "PRODROM" statistics, provided by the N.I.S. These data are confidential.

The emission trends are shown below in the following table and figure.

Table 4.15.1 Total Emission Trends for NFR 2.C.5 Lead production

Year/Pollutant	Pb (t)	Zn (t)	PCBs (kg)
2000	0.08375	0.01156	0.000052
2001	0.09175	0.01343	0.000043
2002	0.09330	0.01365	0.000043
2003	0.11522	0.01686	0.000053
2004	0.10069	0.01474	0.000047
2005	0.12003	0.01668	0.000072
2006	0.09269	0.01257	0.000062
2007	0.11814	0.01630	0.000073
2008	0.11654	0.01612	0.000072
2009	0.02007	0.00236	0.000020
2010	0.02450	0.00278	0.000026
2011	0.01631	0.00197	0.000015
2012	0.00214	0.00017	0.000004
2013	0.00450	0.00066	0.000002
2014	0.00527	0.00077	0.000002
2015	0.00541	0.00079	0.000003
2016	0.01568	0.00083	0.000035

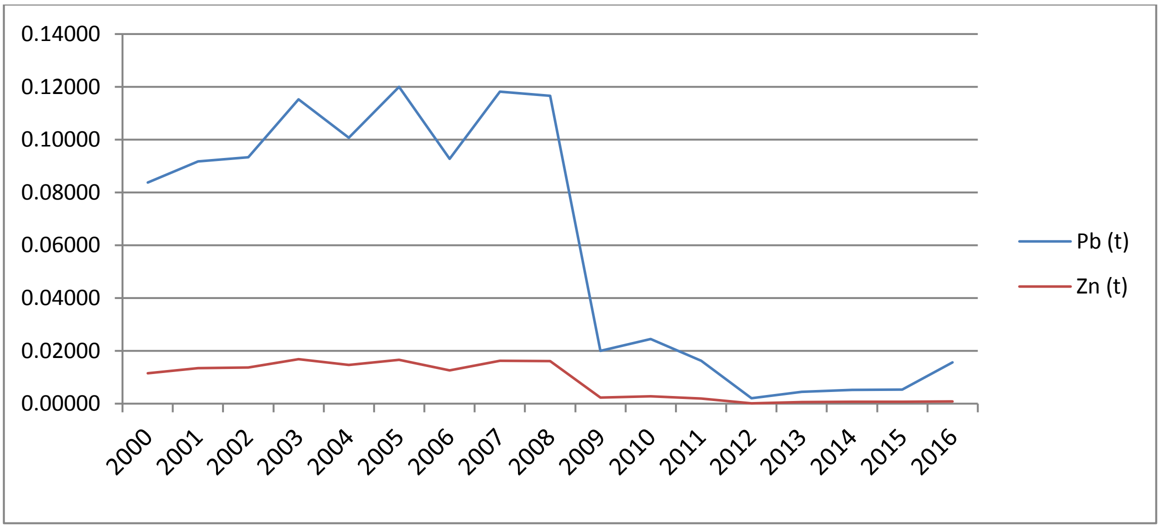


Figure 4.15.1 Total Emission Trends for NFR 2.C.5 Lead production

The emissions of Pb and Zn from those activities follow the activity data trends which varied substantially from year to year due to high variation of industry outputs and with considerable decrease after 2008.

The recalculations since the previous submission has been performed due to the application of Tier 2 methodology.

4.16 NFR 2.C.6 Zinc production

The methodology for estimating emissions from zinc production applies the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the zinc production production
- EFpollutant is the emission factor for this pollutant.

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from zinc production is not included.

The activity data used for emission calculations is the annual national total zinc production, from the "PRODROM" statistics, provided by the N.I.S. These data are confidential.

The emission trends are shown below in the following table and figure.

Table 4.16.1 Total Emission Trends (t) for NFR 2.C.6 Zinc production

Year/Pollutant	Pb (t)	Zn (t)
2000	0.01040	0.2600
2001	0.00960	0.2400
2002	0.00760	0.1900
2003	0.01020	0.2550
2004	0.01060	0.2650
2005	0.01136	0.2840
2006	0.00874	0.2185
2007	0.01169	0.2922
2008	0.01240	0.3099
2009	0.00008	0.0019
2010	0.00005	0.0011
2011	0.00005	0.0013
2012	0.00007	0.0016
2013	0.00004	0.0011
2014	0.00002	0.0004
2015	0.00004	0.0010
2016	0.00006	0.0016

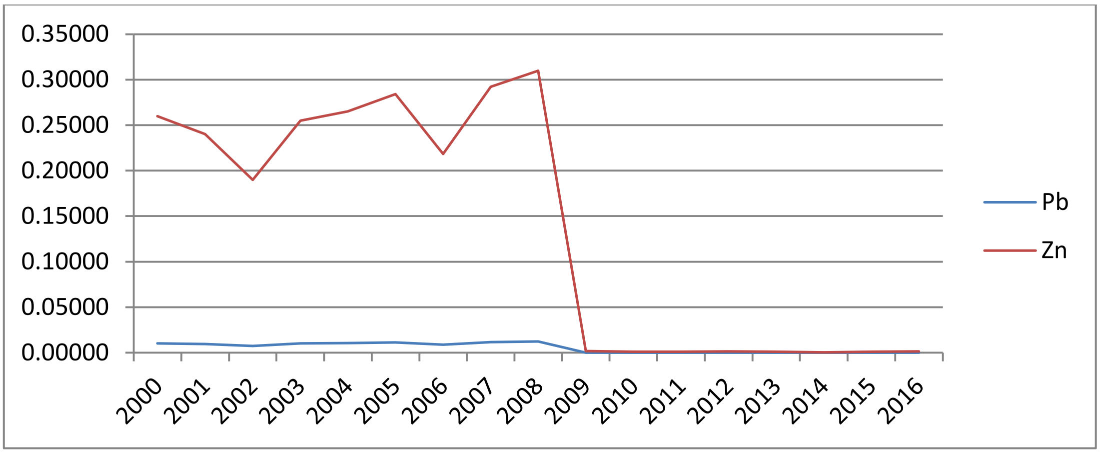


Figure 4.16.1 Total Emission Trends (t) for NFR 2.C.6 Zinc production

The 2016 emissions of Pb and Zn from zinc production decreased by more than 99% compared to the emissions in the year 2000, after reaching a peak level in 2008. This decrease is due to a high and sudden decrease in activity data starting with year 2009.

The time series have been recalculated due to changes between the EFs of 2013 EMEP/EEA Guidebook and 2016 EMEP/EEA Guidebook for NFR 2.C.6 Zinc production.

4.17 NFR 2.C.7.a Copper production

The activity data is represented by total copper production, from the "PRODROM" statistics, provided by the N.I.S. These data are confidential. There is no copper production since 2009.

Emissions from copper production have been recalculated due to changes between the EFs of 2013 EMEP/EEA Guidebook and 2016 EMEP/EEA Guidebook for NFR 2.C.6 Copper production.

4.18 NFR 2.D.3.a Domestic solvent use including fungicides

This was a key category for emissions of NMVOC in 2016. According to the 2016 EMEP/EEA Guidebook, this source includes emissions from the domestic use of solvent-containing products such as:

- Cosmetics and toiletries;
- Household products;
- Construction/DIY;
- Car care products;
- Pesticides;

There are also included the domestic use of pharmaceutical products and the emissions of other pollutants, such as Hg.

The methodology for estimating emissions from this source is to multiply the population of the country with a emission factor because the only available information from N.I.S. refers to population spendings for these products and not for amount of products used. Further research and information is needed in order to apply a product and/or solvent based Tier 2 methodology.

The emission factor used to calculate the NMVOCs emissions is from 2016 EMEP/EEA Guidebook, chapter NFR 2.D.3.a Domestic solvent use including fungicides, Table 3.5 (the sum of EFs is 2.462 kg NMVOC/capita).

Activity data represents the total population of Romania and is provided by N.I.S.

Table 4.18.1. Activity data trends (caput) for NFR 2.D.3.a Domestic solvent use including fungicides

Year/Activity data	caput
2000	22809546
2001	22779441
2002	21627509
2003	21521142
2004	21382354
2005	21257016
2006	21130503
2007	20635460
2008	20440290
2009	20294683
2010	20199059
2011	20095996
2012	20020074
2013	19953089
2014	19875542
2015	19759968
2016	19644350

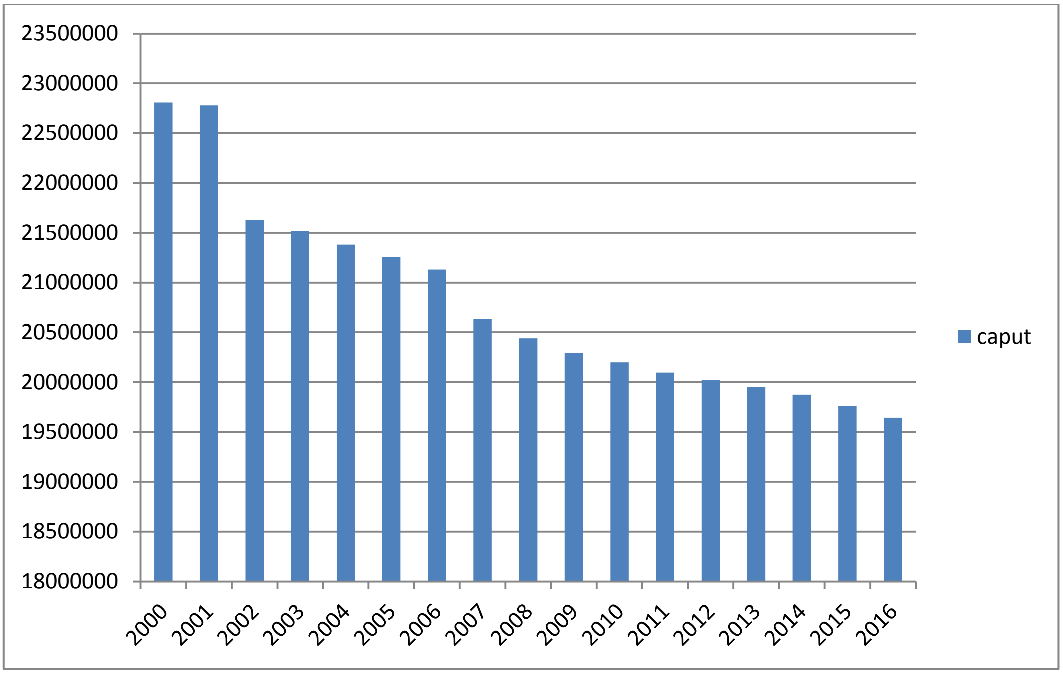


Figure 4.18.1. Activity data trends (caput) for NFR 2.D.3.a Domestic solvent use including fungicides

The emission trends are shown below in the following table and figure.

Table 4.18.2. Emission trends (kt) for NFR 2.D.3.a Domestic solvent use including fungicides

Year/Pollutant	NMVOC
2000	56.157
2001	56.083
2002	53.247
2003	52.985
2004	52.643
2005	52.335
2006	52.023
2007	50.805
2008	50.324
2009	49.966
2010	49.730
2011	49.476
2012	49.289
2013	49.125
2014	48.934
2015	48.649
2016	48.364

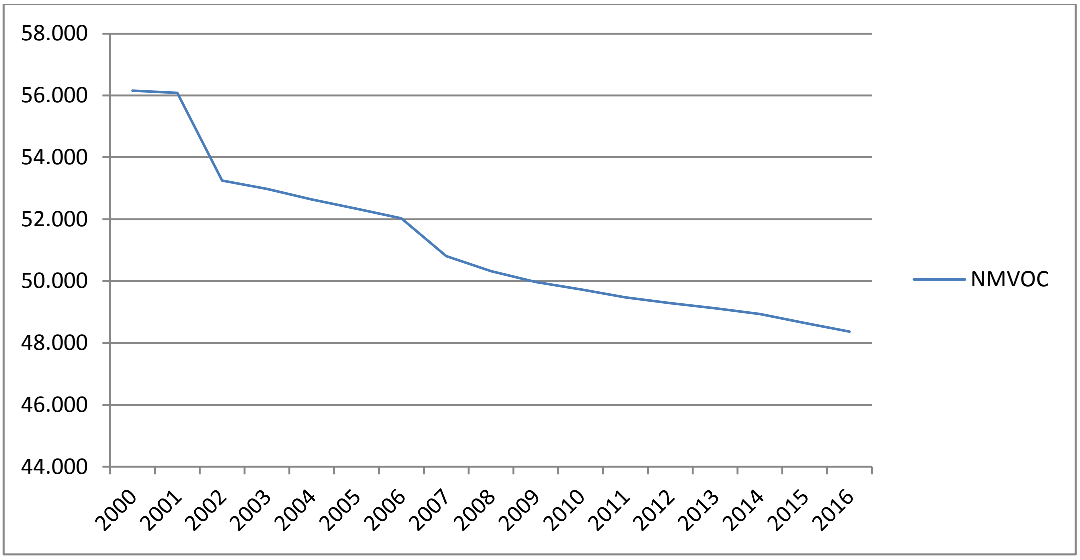


Figure 4.18.2. Emission trends (kt) for NFR 2.D.3.a Domestic solvent use including fungicides

The NMVOC emissions follow the activity data trends for domestic solvent use, including fungicides, which varied substantially from year to year due to variations in statistical population data.

The recalculations since the previous submission are:
- changed NMVOC emission factor;
- a minor correction to the activity data for years 2013 and 2014 according with changes made by N.I.S.

The emissions of NMVOC have been recalculated for the whole period 2005-2015.

4.19 NFR 2.D.3.b Road Paving with Asphalt

This section covers emissions from asphalt paving operations as well as subsequent releases from the paved surfaces. This was a key category for emissions of TSP and PM_{10} in 2016.

The methodology for estimating emissions from road paving with asphalt applies the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the road paving with asphalt
- EFpollutant is the emission factor for this pollutant.

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from road paving with asphalt is not included.

The activity data used for emission calculations is the annual national total bitumen production, from the "PRODROM" statistics, provided by the N.I.S. These data are confidential.

The emission trends are shown below in the following table and figure.

Table 4.19.1. Total Emission Trends (kt) for NFR 2.D.3.b Road paving with asphalt

Year/Pollutant	PM_{10}	TSP
2000	0.670	3.125
2001	0.466	2.176
2002	0.468	2.182
2003	0.571	2.664
2004	2.856	13.330
2005	2.029	9.470
2006	2.848	13.292
2007	7.181	33.513
2008	1.599	7.461
2009	4.152	19.376
2010	4.934	23.028
2011	4.725	22.049
2012	5.411	25.251
2013	6.053	28.249
2014	6.275	29.286
2015	6.288	29.345
2016	4.437	20.707

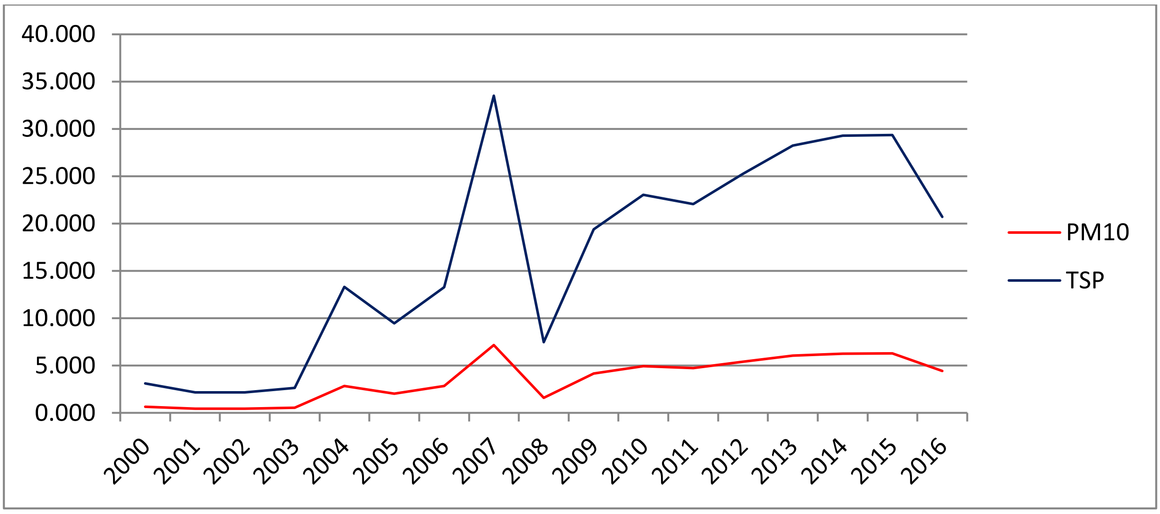


Figure 4.19.1. Total Emission Trends (kt) for NFR 2.D.3.b Road paving with asphalt

The emissions PM_{10} and TSP follow the activity data trend, with an important increase from 2005 to 2007, when it recorded a peak, a sudden decrease from 2007 to 2008 and an increasing trend afterwards until 2015.

4.20 NFR 2.D.3.c Asphalt Roofing

This activity covers emissions from the asphalt roofing industry.

The methodology for estimating emissions from asphalt roofing industry applies the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the the asphalt roofing
- EFpollutant is the emission factor for this pollutant.

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from asphalt roofing is not included.

The activity data used for emission calculations is the annual national total production of the asphalt roofing industry, from the "PRODROM" statistics provided by the N.I.S. These data are confidential between 2013-2016.

Table 4.20.1. Activity Data Trend (t asphalt) for NFR 2.D.3.c Asphalt Roofing

Year	t asphalt
2000	23317.5
2001	24000.0
2002	24000.0
2003	21000.0
2004	12000.0
2005	12144.0
2006	8790.0
2007	2269.0
2008	1434.0
2009	1000.0
2010	222.0
2011	163.5
2012	180.0

The emission trends are shown below in the following table and figure.

Table 4.20.2. Total Emission Trends (kt) for NFR 2.D.3.c Asphalt Roofing

Year/Pollutant	NMVOC	PM2.5	PM10	TSP	CO
2000	0.003031	0.001865	0.009327	0.037308	0.000222
2001	0.003120	0.001920	0.009600	0.038400	0.000228
2002	0.003120	0.001920	0.009600	0.038400	0.000228
2003	0.002730	0.001680	0.008400	0.033600	0.000200
2004	0.001560	0.000960	0.004800	0.019200	0.000114
2005	0.001579	0.000972	0.004858	0.019430	0.000115
2006	0.001143	0.000703	0.003516	0.014064	0.000084
2007	0.000295	0.000182	0.000908	0.003630	0.000022
2008	0.000186	0.000115	0.000574	0.002294	0.000014
2009	0.000130	0.000080	0.000400	0.001600	0.000010
2010	0.000029	0.000018	0.000089	0.000355	0.000002
2011	0.000021	0.000013	0.000065	0.000262	0.000002
2012	0.000023	0.000014	0.000072	0.000288	0.000002
2013	0.000017	0.000010	0.000052	0.000206	0.000001
2014	0.000016	0.000010	0.000048	0.000192	0.000001
2015	0.000012	0.000008	0.000038	0.000151	0.000001
2016	0.000008	0.000005	0.000023	0.000094	0.000001

After 2009 there was a significant decrease in the asphalt roofing industry, and all emissions (NMVOC, $PM_{2.5}$, PM_{10}, TSP and CO) followed this trend.

4.21 NFR 2.D.3.d Coating applications

This source category refers to the use of paints by industry, and by the commercial and domestic sectors. The following activities with corresponding SNAP codes are included:

- Decorative coating application:
  - 060103 Coating applications: construction and buildings;
  - 060104 Coating applications: domestic use.
- Industrial coating application:
  - 060101 Coating applications: manufacture of automobiles;
  - 060102 Coating applications: car repairing;
  - 060108 Other industrial coating applications.

The methodology for estimating emissions applies the general equation:

$$\text{Epollutant} = \sum_{\text{technologies}} \text{ARuse, technology x EFtechnology, pollutant}$$

where:

- ARuse,technology = the use of paint within the source category, using this specific technology,
- EFtechnology,pollutant = the emission factor for this technology and this pollutant.

Due to the confidentiality puposes, the presentation of emission factors used to estimate emissions from coating applications is not included.
The activity data are represented by numbers of passenger cars and other vehicle type (splitted by cars, buses, trucks) provided by the N.I.S and by total paint consumption and total paint applied provided by the economic operators. These data are confidential between 2000-2004 and 2013-2016. For the period 2000-2004 there are no available data provided by the economic operators.

The emission trends are shown below in the following table and figure.

Table 4.21.1. Emission trends (kt) for NFR 2.D.3.d Coating applications

Year/Pollutant	NMVOC
2000	0.897
2001	0.914
2002	0.918
2003	1.145
2004	1.429
2005	7.307
2006	6.629
2007	11.349
2008	8.072
2009	3.545
2010	3.976
2011	4.743
2012	4.739
2013	3.591
2014	1.845
2015	2.340
2016	1.611

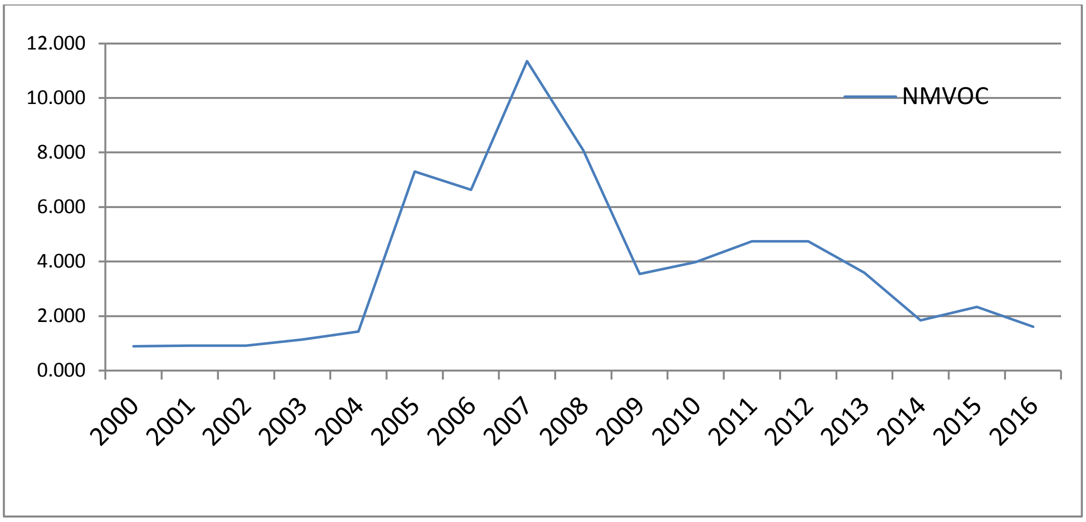


Figure 4.21.1. Emission trends (kt) for 2.D.3.d Coating applications

The emissions of NMVOC from the coating applications follow the activity data trends which varied substantially from year to year due to high variation of industry outputs, with an important increase from 2005 to 2007, when a peak was recorded and then a sudden decrease from 2008 to 2009.

4.22 NFR 2.D.3.e Degreasing

In the 2016 EMEP/EEA Guidebook this source category is defined as: ,,Degreasing is a process for cleaning products from water-insoluble substances such as grease, fats, oils, waxes, carbon deposits, fluxes and tars. In most cases the process is applied to metal products, but also plastic, fibreglass, printed circuit boards and other products are treated by the same process."

The methodology for estimating emissions from this source applies the general equation:

$Epollutant = ARproduction \times EFpollutant$, and is applied at the national level, using annual national total chemical production data.

The emission factor used to calculate the emissions is from 2016 EMEP/EEA Guidebook, chapter 2.D.3.e Degreasing, Table 3-1.

The activity data used for emission calculations is the annual national total organic solvents production provided by the N.I.S. in the Statistical Yearbook. No activity data are available for the period 2000-2004. Further research and information is needed.

Table 4.22.1. Activity data trends (kt) for NFR 2.D.3.e Degreasing

Year	kt solvent
2005	0.08
2006	0.10
2007	0.09
2008	5.64
2009	3.71
2010	3.50
2011	4.73
2012	4.03
2013	4.13
2014	3.90
2015	3.21
2016	3.83

The emission trends are shown below in the following table and figure.

Table 4.22.2. Emission trends (kt) for NFR NFR 2.D.3.e Degreasing

Year/Pollutant	NMVOC
2005	0.037
2006	0.046
2007	0.040
2008	2.595
2009	1.708
2010	1.610
2011	2.176
2012	1.856
2013	1.904
2014	1.796
2015	1.477
2016	1.763

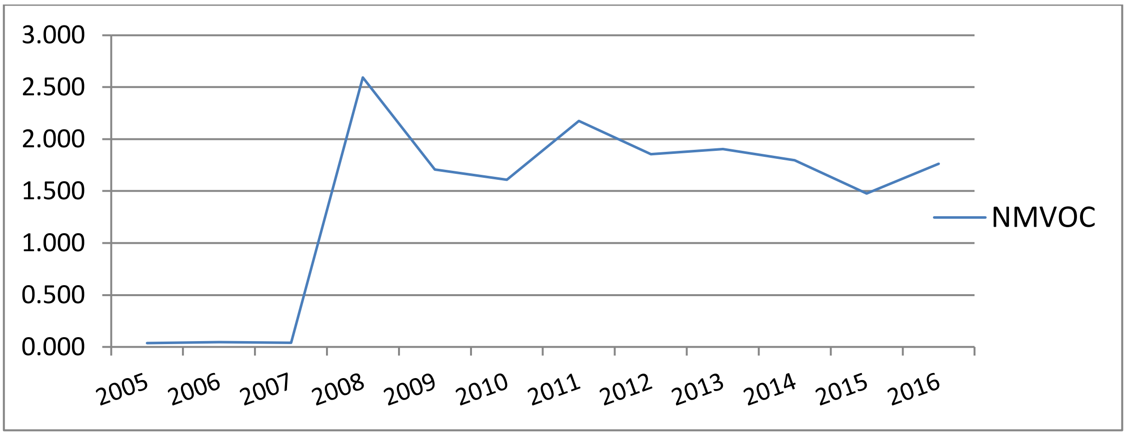


Figure 4.22.2. Emission trends (kt) for NFR NFR 2.D.3.e Degreasing

The emissions of NMVOC from degreasing activities follow the activity data trends which varied substantially from year to year due to high variation of industry outputs.

4.23 NFR 2.D.3.f. Dry cleaning

This source category refers to NMVOC emissions from processes using organic solvents to remove contamination furs, leather, down leathers, textiles or other objects made of fibres. This was a key category for emissions of NMVOC in 2016.

The methodology for estimating emissions from this source is to multiply the population of the country with a default emission factor based on the inhabitants (the amount of textile treated, as activity data is not available). Further research and information is needed.

The emission factor used to calculate the NMVOCs emissions is 0.3 kg/inhabitant/year, based on 2016 EMEP/EEA Guidebook, chapter NFR 2.D.3.f Dry cleaning, pag. 7.

The activity data represents the total population of Romania and is provided by N.I.S. (see Table 4.18.1.).

The emission trends are shown below in the following table and figure.

Table 4.23.2. Emission trends (kt) for NFR 2.D.3.f Dry cleaning

Year/Pollutant	NMVOC
2000	6.843
2001	6.834
2002	6.488
2003	6.456
2004	6.415
2005	6.377
2006	6.339
2007	6.191
2008	6.132
2009	6.088
2010	6.060
2011	6.029
2012	6.006
2013	5.986
2014	5.963
2015	5.928
2016	5.893

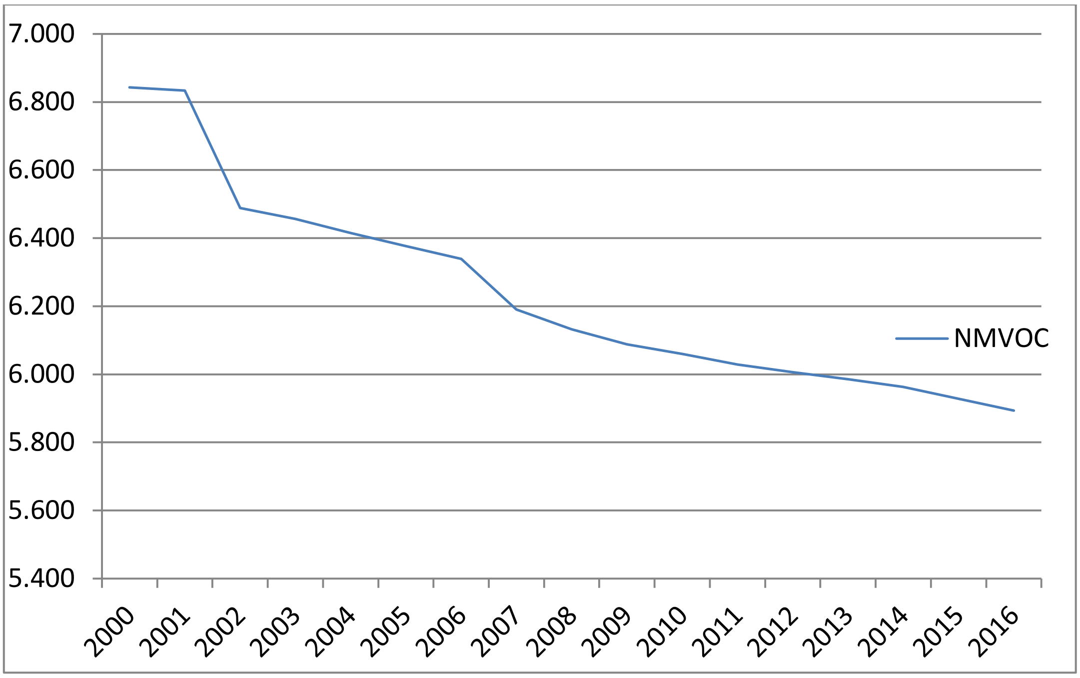


Figure 4.23.2. Emission trends (kt) for NFR 2.D.3.f Dry cleaning

The emissions of NMVOC from dry cleaning activities follow the activity data trends which varied substantially from year to year due to variations in statistical population data.

The recalculation since the previous submission is a minor correction to the activity data for the years 2013 and 2014, according with the changes made by N.I.S.

4.24 NFR 2.D.3.g Chemical products

The following chemical products are included:

- 060302 Polyvinylchloride processing;
- 060303 Polyurethane foam processing (not available between 2000-2004);
- 060304 Polystyrene foam processing (not available between 2000-2004);
- 060305 Rubber processing (production sttoping in 2014);
- 060307 Paints manufacturing;
- 060308 Inks manufacturing (not available between 2000-2007);
- 060309 Glues manufacturing.

This was a key category for emissions of NMVOC in 2016.

The methodology for estimating emissions from chemical products applies the general equation:

$$Epollutant = \sum_{technologies} ARuse, technology \times EFtechnology, pollutant$$

where:

- ARuse,technology = the use of a specific chemical product,
- EFtechnology,pollutant = the emission factor for this technology and this pollutant.

The emissions were estimated, based on 2016 EMEP/EEA Guidebook, chapter NFR 2.D.3.g Chemical products Table 3-1, Table 3-3, Table 3-4, Table 3-5, Table 3-11.

The activity data consist of the total productions of each product. These data are provided by the N.I.S. in the Statistical Yearbook and by the economic operators (polyurethane foam processing).

Table 4.24.1. Activity data trends (kt) for NFR 2.D.3.g Chemical products

Year	Kt product
2000	217.43
2001	256.92
2002	273.93
2003	307.81
2004	368.86
2005	375.81
2006	515.77
2007	585.57
2008	660.25
2009	367.71
2010	387.67
2011	418.71
2012	587.46
2013	647.63
2014	642.21
2015	646.39
2016	616.45

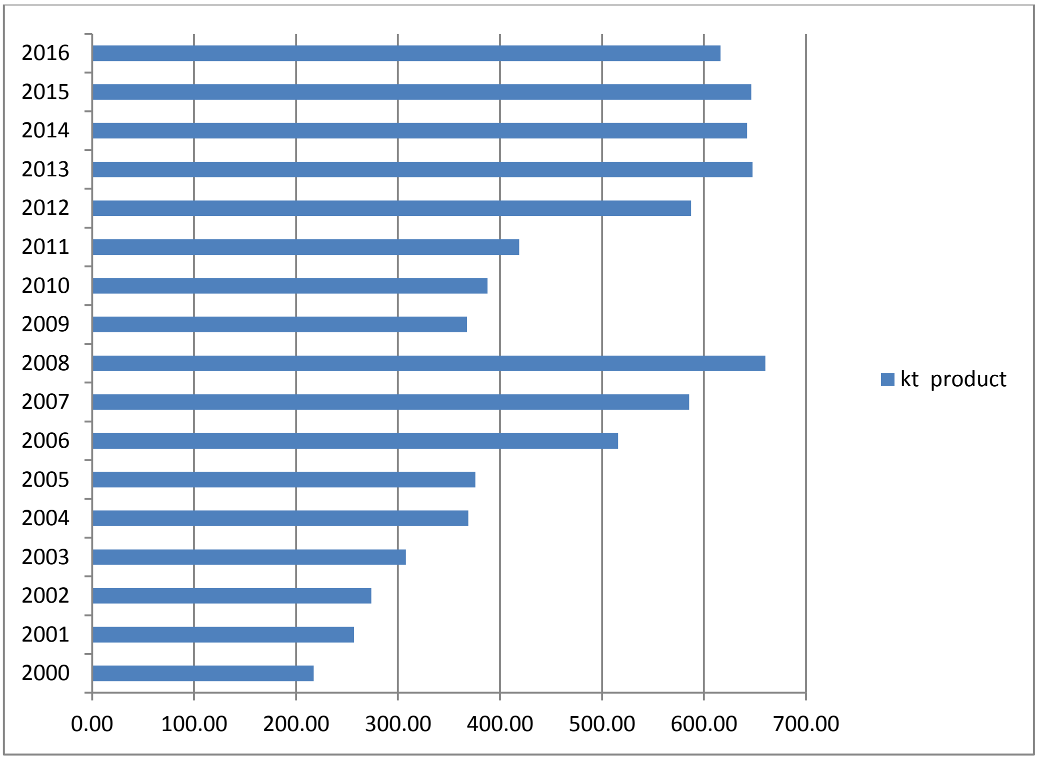


Figure 4.24.1. Activity data trends (kt) for NFR 2.D.3.g Chemical products

The emission trends are shown below in the following table and figure.

Table 4.24.2. Emission trends (kt) for NFR 2.D.3.g Chemical products

Year/Pollutant	NMVOC
2000	2.199
2001	2.620
2002	2.805
2003	3.165
2004	3.787
2005	5.039
2006	22.073
2007	22.183
2008	20.897
2009	7.292
2010	7.803
2011	8.168
2012	11.259
2013	12.769
2014	11.159
2015	10.163
2016	10.332

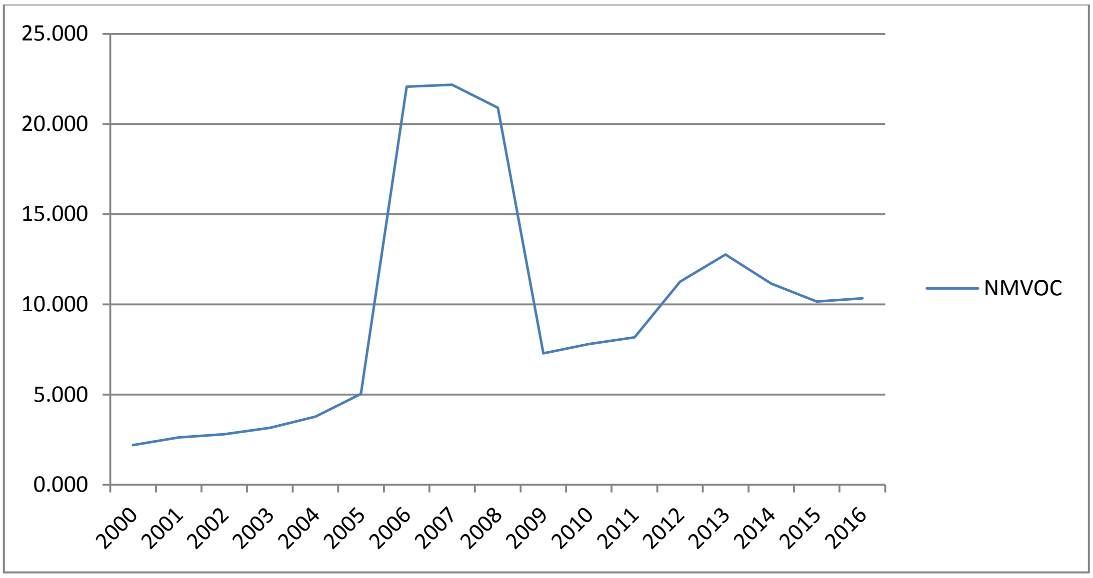


Figure 4.24.2. Emission trends (kt) for NFR 2.D.3.g Chemical products

The emissions of NMVOC from the chemical products follow the activity data trends which varied substantially from year to year due to high variation of industry outputs.

The recalculations since the previous submission are:

- changed NMVOC emission factor for SNAP 060302 due to change between the EFs of 2013 EMEP/EEA Guidebook and 2016 EMEP/EEA Guidebook;
- a correction for SNAP 060307 due to the activity data error used.

The emissions of NMVOC have been recalculated for the whole period 2005-2015.

4.25 NFR 2.D.3.h Printing

This chapter covers emissions from printing industry.

The methodology for estimating emissions applies the general equation:

$E_{pollutant} = AR_{production} \times EF_{pollutant}$ where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate
- EFpollutant is the emission factor for this pollutant.

The emissions were estimated, based on 2016 EMEP/EEA Guidebook, chapter NFR 2.D.3.h Printing, Table 3-1.

The activity data represent the total ink consumption for printing activities. These data are provided by the the economic operators. For period 2000-2004 there are no available data.

Table 4.25.1. Activity data trends (kt Ink used) for NFR 2.D.3.h Printing

Year	kt Ink used
2005	0.081
2006	0.493
2007	0.501
2008	0.602
2009	1.406
2010	1.691
2011	3.120
2012	2.718
2013	1.299
2014	1.517
2015	1.420
2016	2.484

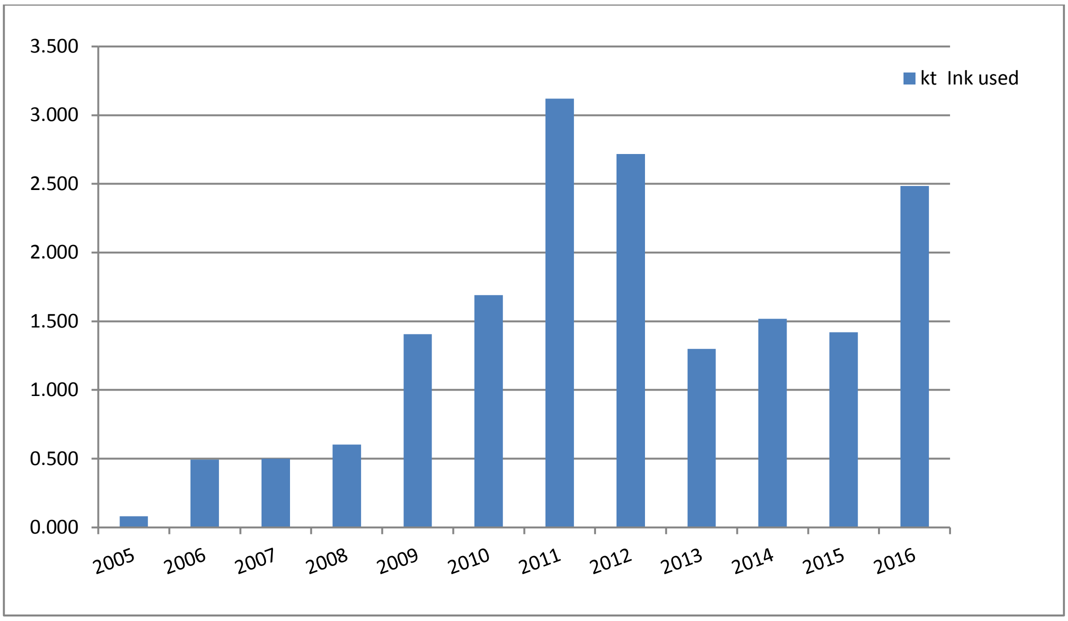


Figure 4.25.1. Activity data trends (kt Ink used) for NFR 2.D.3.h Printing

The emission trends are shown below in the following table and figure.

Table 4.25.2. Emission trends (kt) for NFR 2.D.3.h Printing

Year/Pollutant	NMVOC
2005	0.041
2006	0.247
2007	0.251
2008	0.301
2009	0.703
2010	0.845
2011	1.560
2012	1.359
2013	0.649
2014	0.758
2015	0.710
2016	1.242

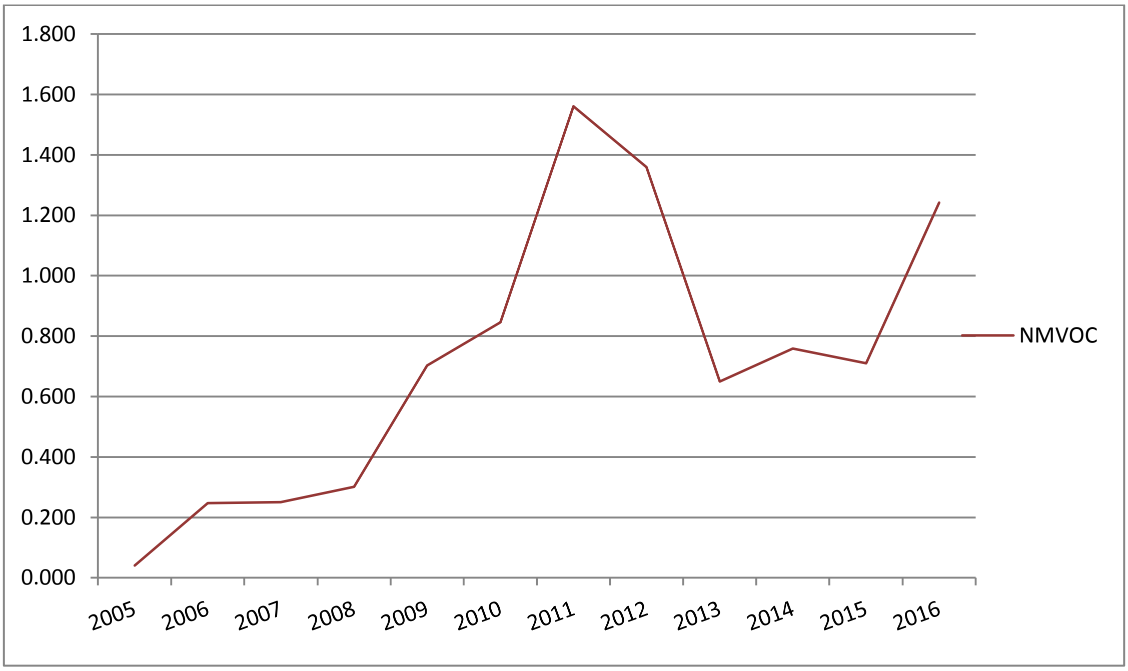


Figure 4.25.2. Emission trends (kt) for NFR 2.D.3.h Printing

The emissions of NMVOC follow the activity data trends from printing industry which varied substantially from year to year due to high variation of printing industry.

Recalculations have been made for the 2013-2015 years because it was identified an error in the activity data used.

4.26 NFR 2.D.3.i Other solvent use

In this sector only the underseal treatment and conservation of vehicles are considered. Unfortunately there is not available activity data and further research and information is needed. According to 2016 EMEP/EEA Guidebook: “The factor should be selected according to the most reliable activity data available, and the IIASA factor should only be used when no activity data is available.” Therefore, the activity data used are the total population provided by N.I.S. in the Statistical Yearbook (see Table 4.18.1.) and the IIASA factor in Table 3-10.

Table 4.26.2. Emission trends (kt) for NFR 2.D.3.i Other solvent use

Year/Pollutant	NMVOC
2000	4.562
2001	4.556
2002	4.326
2003	4.304
2004	4.276
2005	4.251
2006	4.226
2007	4.127
2008	4.088
2009	4.059
2010	4.040
2011	4.019
2012	4.004
2013	3.991
2014	3.975
2015	3.952
2016	3.929

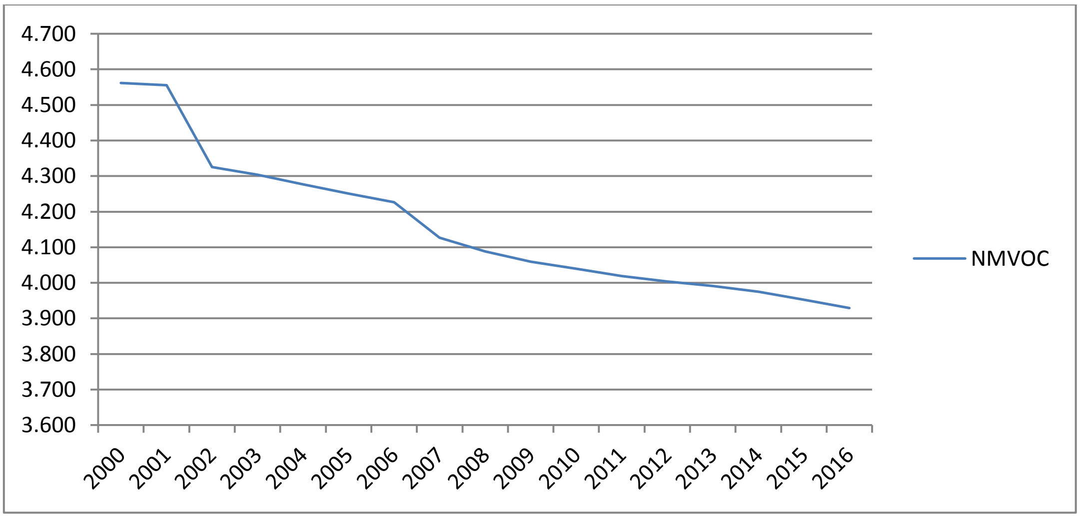


Figure 4.26.2. Emission trends (kt) for NFR 2.D.3.i Other solvent use

In the previous submission, the emissions of this subcategory were reported under NFR 2.G. Other product use.
The recalculation since the previous submission is a minor correction to the activity data for years 2013 and 2014, according with changes made by N.I.S.

4.27 NFR 2.G Other product use

The emissions due to the use of fireworks and smoking tobacco are reported here. NMVOCs emissions reported here at the last submission are now reported under NFR 2.D.3.i Other solvent use.

The emissions due to use of fireworks are calculated by multiplying the fireworks consumption and the emission factor from 2016 EMEP/EEA Guidebook, chapter 2.G, Table 3-13 - Consumption of fireworks = Production + Import – Export (the amount used equals the production amount plus the imported amount minus the exported amount).
No activity data are available for production.
The emissions from the combustion (smoking) of tobacco are calculated by multiplying the tobacco consumption and the emission factor from 2016 EMEP/EEA Guidebook, chapter 2.G, Table 3-14 - Consumption of tobacco = Production + Import – Export.

The production, import and export data of tobacco and of fireworks are provided by the N.I.S.

Table 4.27.1. Activity data trend (t) for NFR 2.G Other product use

Year	tobacco	fireworks
2000	36788.78	138.03
2001	42037.65	402.58
2002	37288.89	715.48
2003	40034.45	940.11
2004	43648.88	1574.32
2005	43856.45	1592.65
2006	40534.33	846.95
2007	31444.26	70.88
2008	33998.31	624.52
2009	30510.81	260.92
2010	18957.80	792.29
2011	24879.21	651.49
2012	25013.45	498.31
2013	22870.60	735.46
2014	20124.44	623.84
2015	21959.88	795.50
2016	26902.60	296.41

The emission trends are shown below in the following tables and figures.

Table 4.27.2. Emission Trends (kt) for NFR 2.G Other product use

Year/Pollutant	NOx	NMVOC	SOx	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
2000	0.0663	0.1781	0.0004	0.1527	0.9933	0.9933	0.9933	0.0045	2.0280
2001	0.0758	0.2035	0.0012	0.1745	1.1350	1.1351	1.1351	0.0051	2.3192
2002	0.0673	0.1805	0.0022	0.1547	1.0068	1.0069	1.0069	0.0045	2.0597
2003	0.0723	0.1938	0.0028	0.1661	1.0810	1.0810	1.0810	0.0049	2.2126
2004	0.0790	0.2113	0.0048	0.1811	1.1786	1.1787	1.1787	0.0053	2.4163
2005	0.0794	0.2123	0.0048	0.1820	1.1842	1.1843	1.1843	0.0053	2.4279
2006	0.0732	0.1962	0.0026	0.1682	1.0945	1.0945	1.0945	0.0049	2.2395
2007	0.0566	0.1522	0.0002	0.1305	0.8490	0.8490	0.8490	0.0038	1.7331
2008	0.0614	0.1646	0.0019	0.1411	0.9180	0.9180	0.9180	0.0041	1.8778
2009	0.0550	0.1477	0.0008	0.1266	0.8238	0.8238	0.8238	0.0037	1.6830
2010	0.0343	0.0918	0.0024	0.0787	0.5119	0.5119	0.5119	0.0023	1.0502
2011	0.0450	0.1204	0.0020	0.1032	0.6718	0.6718	0.6718	0.0030	1.3755
2012	0.0452	0.1211	0.0015	0.1038	0.6754	0.6754	0.6754	0.0030	1.3818
2013	0.0414	0.1107	0.0022	0.0949	0.6175	0.6176	0.6176	0.0028	1.2654
2014	0.0364	0.0974	0.0019	0.0835	0.5434	0.5434	0.5434	0.0024	1.1133
2015	0.0397	0.1063	0.0024	0.0911	0.5930	0.5930	0.5930	0.0027	1.2157
2016	0.0485	0.1302	0.0009	0.1116	0.7264	0.7264	0.7264	0.0033	1.4845

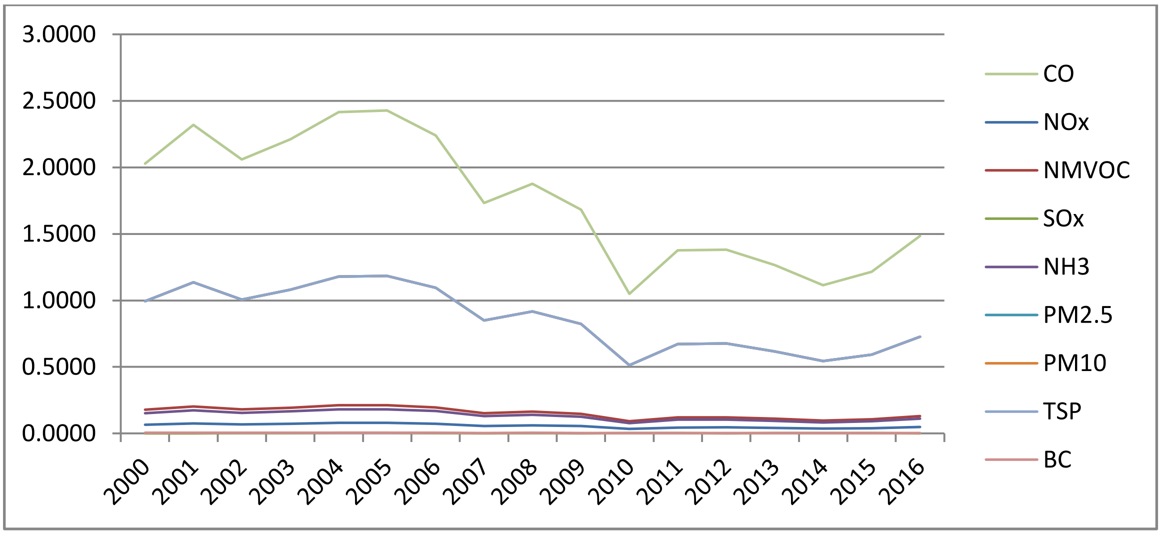


Figure 4.27.1. Emission Trends for NFR 2.G Other product use (kt)

Table 4.27.3. Emission Trends (t) for NFR 2.G Other product use, Heavy metal

Year/Pollutant	Pb	Cd	Hg	As	Cr	Cu	Ni	Zn
2000	0.1082	0.1989	0.0000	0.0002	0.0022	0.2599	0.1035	0.1352
2001	0.3156	0.2276	0.0000	0.0005	0.0063	0.4057	0.1256	0.2182
2002	0.5609	0.2024	0.0000	0.0010	0.0112	0.5190	0.1221	0.2867
2003	0.7370	0.2176	0.0001	0.0013	0.0147	0.6336	0.1363	0.3525
2004	1.2343	0.2380	0.0001	0.0021	0.0246	0.9347	0.1651	0.5272
2005	1.2486	0.2392	0.0001	0.0021	0.0248	0.9440	0.1662	0.5325
2006	0.6640	0.2201	0.0000	0.0011	0.0132	0.5949	0.1349	0.3297

2007	0.0556	0.1699	0.0000	0.0001	0.0011	0.2013	0.0870	0.1033
2008	0.4896	0.1845	0.0000	0.0008	0.0097	0.4609	0.1105	0.2542
2009	0.2046	0.1651	0.0000	0.0003	0.0041	0.2806	0.0902	0.1502
2010	0.6212	0.1035	0.0000	0.0011	0.0124	0.4541	0.0750	0.2572
2011	0.5108	0.1353	0.0000	0.0009	0.0102	0.4236	0.0867	0.2366
2012	0.3907	0.1358	0.0000	0.0007	0.0078	0.3563	0.0825	0.1971
2013	0.5766	0.1246	0.0000	0.0010	0.0115	0.4500	0.0838	0.2530
2014	0.4891	0.1096	0.0000	0.0008	0.0097	0.3857	0.0731	0.2165
2015	0.6237	0.1198	0.0000	0.0011	0.0124	0.4718	0.0832	0.2661
2016	0.2324	0.1457	0.0000	0.0004	0.0046	0.2769	0.0815	0.1497

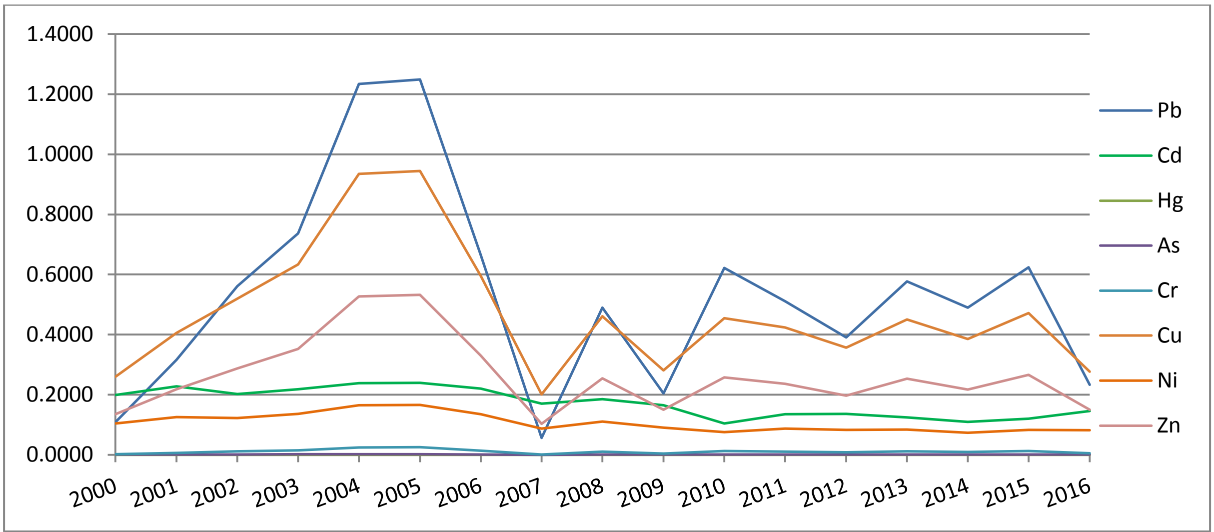


Figure 4.27.2. Emission Trends (t) for NFR 2.G Other product use for Pb, Cd, Hg, As, Cr, Cu, Ni and Zn

Table 4.27.4. Emission Trends for NFR 2.G Other product use for POPs

Year/Pollutant	PCDD/F (g I-TEQ)	PAHs (t)
2000	0.0037	0.0091
2001	0.0042	0.0103
2002	0.0037	0.0092
2003	0.0040	0.0098
2004	0.0044	0.0107
2005	0.0044	0.0108
2006	0.0041	0.0100
2007	0.0031	0.0077
2008	0.0034	0.0084
2009	0.0031	0.0075
2010	0.0019	0.0047
2011	0.0025	0.0061
2012	0.0025	0.0062
2013	0.0023	0.0056
2014	0.0020	0.0050
2015	0.0022	0.0054
2016	0.0027	0.0066

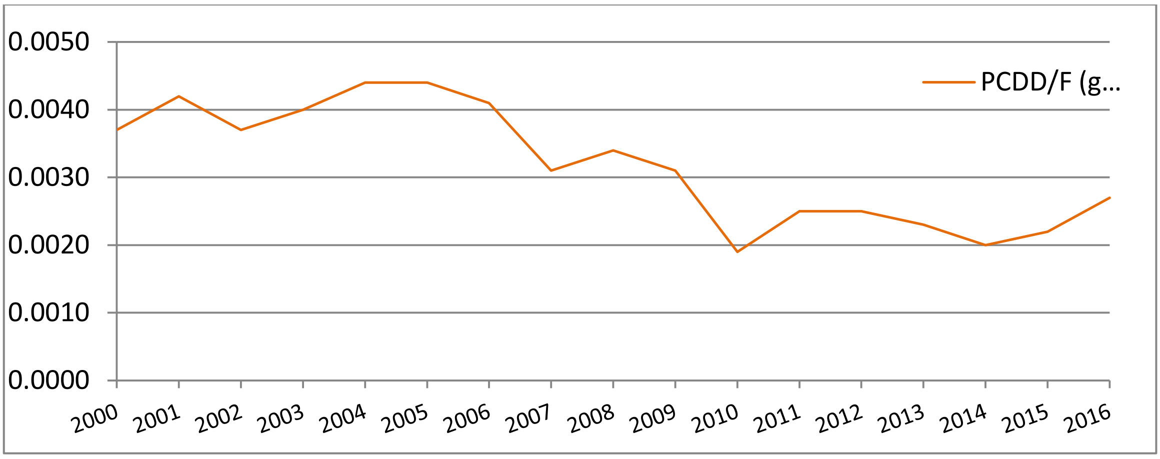


Figure 4.27.3.a Emission Trends (g I-TEQ) for NFR 2.G Other product use for PCDD/F

Figure 4.27.3.b Emission Trends for NFR 2.G Other product use for PAHs (t)

The emissions of all pollutants vary for the 2000-2016 time series together with the variation activity data.

4.28 NFR 2.H.1 Pulp and paper industry

The activity data is represented by the total pulp and paper production from the Statistical Yearbook, provided by the N.I.S. and are confidential. Since 2009 no production have been reported.

4.29 NFR 2.H.2 Food and beverages industry

The following products from food and beverages manufacturing are included:

- Bread;
- Wine;
- Beer;
- Spirits;
- Margarine;
- Coffee roasting.

This was a key category for emissions of NMVOC in 2016.

The methodology for estimating emissions applies the general equation:

$$\text{Epollutant} = \sum_{\text{technologies}} \text{ARproduction, technology x EFtechnology, pollutant}$$

where:

- ARproduction,technology = the production rate within the source category, using this specific technology
- EFtechnology,pollutant = the emission factor for this technology and this pollutant

Due to the confidentiality purposes, the presentation of emission factors used to estimate emissions from foods and beverages industry is not included.

The activity data is taken from the Statistical Yearbook, from the "PRODROM" statistics, provided by the N.I.S. and from Eurostat statistics. These data are confidential since 2010.

The emission trends are shown below in the following table and figure.

Table 4.29.1. Emission trends (kt) for NFR 2.H.2 Food and beverages industry

Year/Pollutant	NMVOC
2000	9.295
2001	4.970
2002	5.140
2003	6.220
2004	5.415
2005	4.943
2006	4.987
2007	5.217
2008	5.062
2009	5.024
2010	5.031
2011	5.127
2012	5.029

2013	5.284
2014	5.497
2015	5.737
2016	5.779

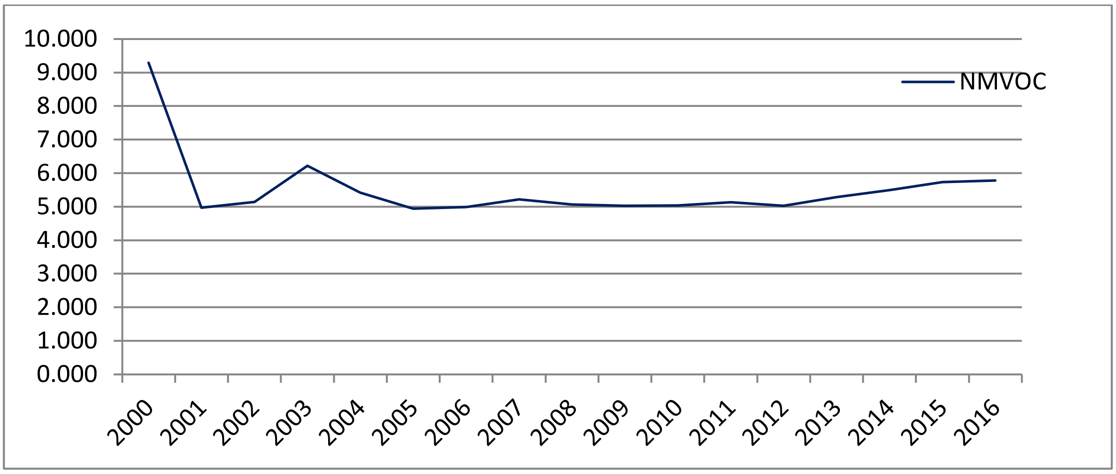


Figure 4.29.1. Emission trends (kt) for NFR 2.H.2 Food and beverages industry

The emissions of NMVOC from food and beverages industry follow the activity data trends which varied substantially from year to year due to high variation of industry outputs.

4.30 NFR 2.I Wood Processing

This category refers to the manufacture of wood and products, manufacture of plywood, reconstituted wood products and engineered wood products and is important for particulate emissions only.

The methodology for estimating emissions from wood processing applies the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate for the wood processing
- EFpollutant is the emission factor for this pollutant.

The emission factors used to calculate the emissions from wood production are from 2016 EMEP/EEA Guidebook, chapter 2.I Wood processing, Table 3.1.

The activity data used for emission calculations is the annual national total timber production from the Statistical Yearbook, provided by the N.I.S. The activity data is multiplied with the density 0.883 t per m^3.

Table 4.30.1. Activity data (1000 m^3) for NFR 2.I Wood Processing

Year/Activity data	1000 m^3 product
2000	1404.65
2001	2530.00
2002	2706.00
2003	2568.00
2004	2987.00
2005	3018.00
2006	3126.00
2007	3369.00
2008	3509.00
2009	3913.00
2010	4416.00
2011	5145.00
2012	5175.00
2013	5836.00
2014	5909.00
2015	5868.00
2016	5452.00

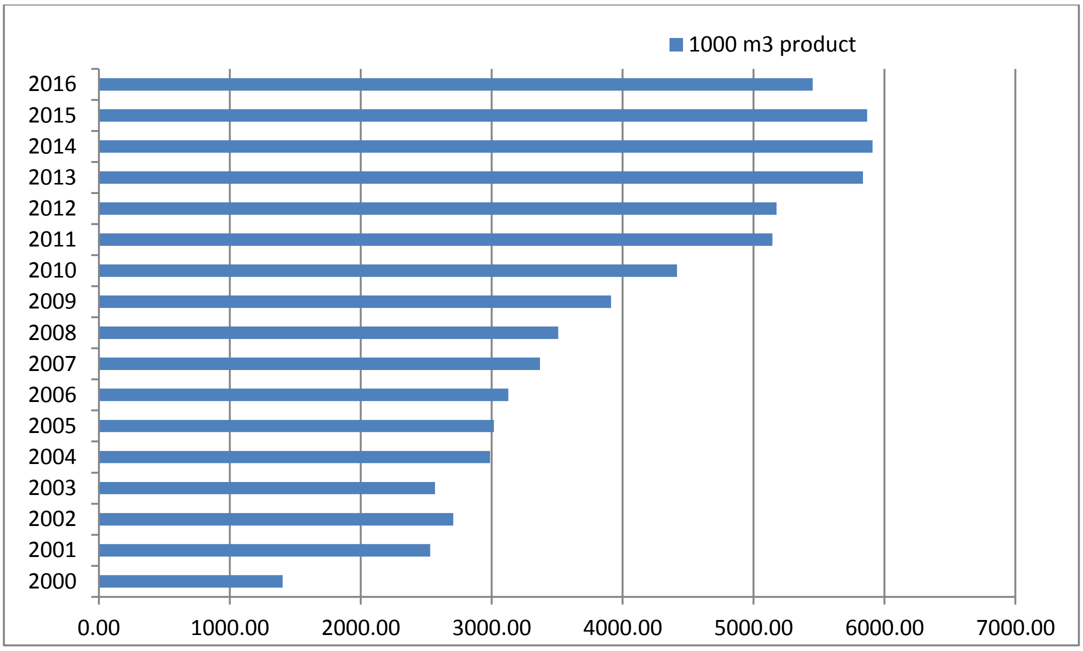


Figure 4.30.1. Activity data trend for NFR 2.I Wood Processing

The emission trends are shown below in the following table and figure.

Table 4.30.2. Emission trends (kt) for NFR 2.I Wood Processing

Year/Pollutant	TSP
2000	1.240
2001	2.234
2002	2.389
2003	2.268
2004	2.638
2005	2.665
2006	2.760
2007	2.975
2008	3.098
2009	3.455
2010	3.899
2011	4.543
2012	4.570
2013	5.153
2014	5.218
2015	5.181
2016	4.814

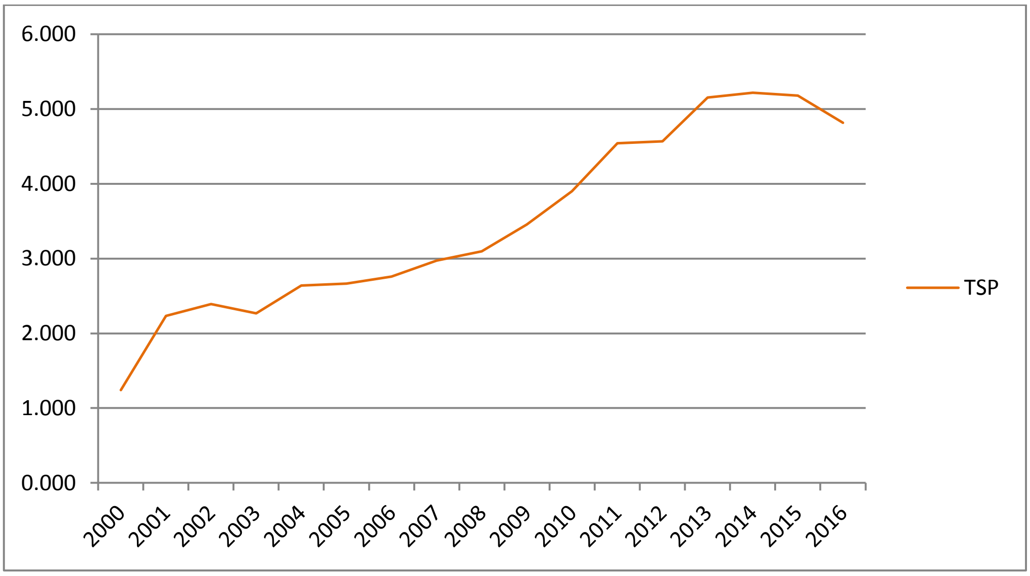


Figure 4.30.2. Emission trends (kt) for NFR 2.I Wood Processing

The emissions of TSP from wood processing activities follow the activity data trends which varied substantially from year to year due to high variation of industry outputs.

5. NFR 3 – AGRICULTURE

The agricultural sector includes emissions from manure management (NFR 3.B), agricultural soils (NFR 3.D) and fields burning of agricultural residue (NFR 3.F). This sector comprises emissions arising from the agricultural and zoo technical activities, including housing, manure storage and grazing, manure treatment and manure application.

The emission calculation is based on the methodologies provided in the 2016 EMEP/EEA Guidebook.

Animal populations, data on fertilizers usage and crop productions are taken from the Statistical Yearbook provided by the N.I.S. and from the Romania's Greenhouse Gas Inventory – N.I.R., improving the consistency between data for NFR and CRF, considering that many of the agricultural activities data for estimation of air pollutants are the same as for greenhouse gas emissions (TERT recommandations).

The emission from the agricultural activities covers a range of pollutants.

Table 5.1 An overview of sources and pollutants in agricultural activities

NFR codes	Long name	Main pollutants				Particulate matter			Other pollutants			
		NOx(as NO2)	NMVOC	SOx (as SOx)	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO	HM [a)]	POPs [b)]
3B	Manure Management	x	x		x	x	x	x				
3Da	Agricultural soils	x			x							
3Dc	Farm-level agricultural operations					x	x	x				
3De	Cultivated crops		x				x					
3F	Field burning of agricultural residues	x	x	x	x	x	x	X	x	x	x	x

[a)] *As, Cd, Cr, Cu, Hg, Ni, Pb, Se and Zn*
[b)] *Dioxins and furanes (PCDD/F) and polycyclic aromatic hydrocarbons (PAH – benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoran-thene and indeno(1,2,3-cd)pyrene*

Table 5.2 - The agricultural contribution of total national emissions in 2016 for the main pollutants.

	NH_3	NOx	SOx	NMVOC	$PM_{2.5}$	PM_{10}	TSP
National total (kt)	167.47	210.63	107.67	258.42	109.97	140.51	206.55
Agriculture total (kt)	147.07	13.28	1.32E-03	47.98	1.72	18.39	31.54
Weight percentage (%)	87.82%	6.30%	1.23E-05	18.57%	1.56%	13.09%	15.27%

The main part of the NH_3 emission (87.82%) is related to the agricultural sector, while the contribution of NMVOC share from agriculture accounts for 18% of the national total. The

TSP, PM_{10} and $PM_{2.5}$ emissions from manure management are 15%, 13% and 1.5%, respectively of the national total. The inventory also includes the NOx emissions from application of inorganic fertilisers and animal manure, which results in 6 % of the national total. The total SOx emissions from agriculture is lower than 1% from the national total.

Tabel 5.3 – Key Sources Categories for 3D Agricultural soils and cultivated crops

Key Sources	NFR Codes	Long name Category
NOx	3Da1	Inorganic N-fertilizers
NMVOC	3De	Cultivated crops
NH3	3Da2a	Animal manure applied to soils
	3Da3	Urine and dung deposited by grazing animals
	3Da1	Inorganic N-fertilizers
PM10	3Dc	Farm-level agricultural operations
TSP	3Dc	Farm-level agricultural operations

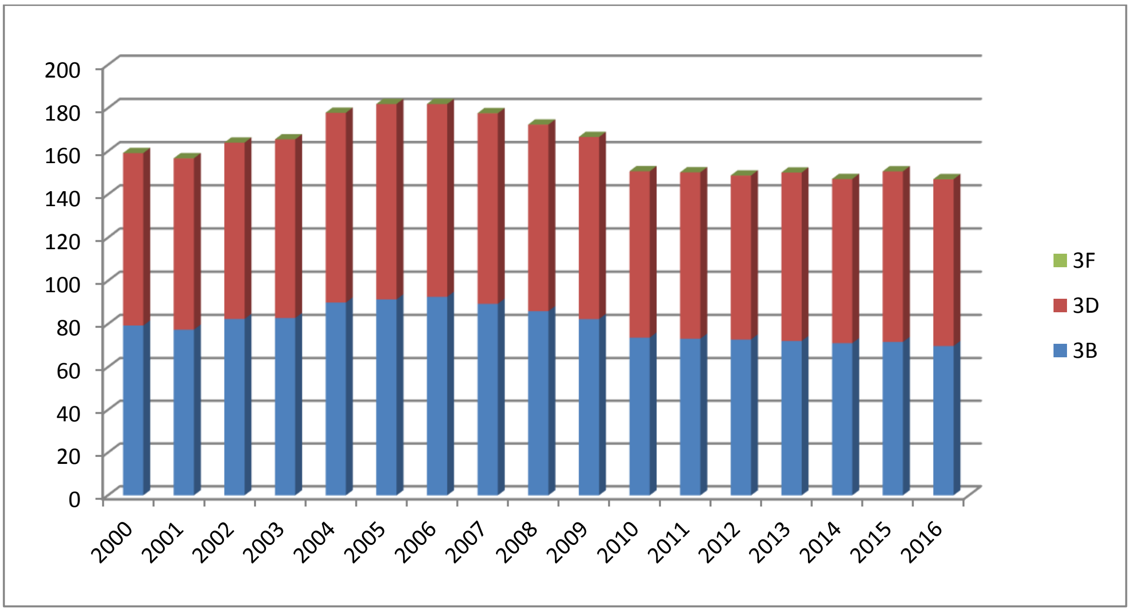


Figure 5.1 Distribution of the NH_3 emission by the agricultural sources for the 2000-2016 period

For the year 2016, the distribution of NH3 emissions by agriculture sources was as follows: 47.48% from manure management, 52.51% from manure applied to soils and only 0.008% from burning fields.

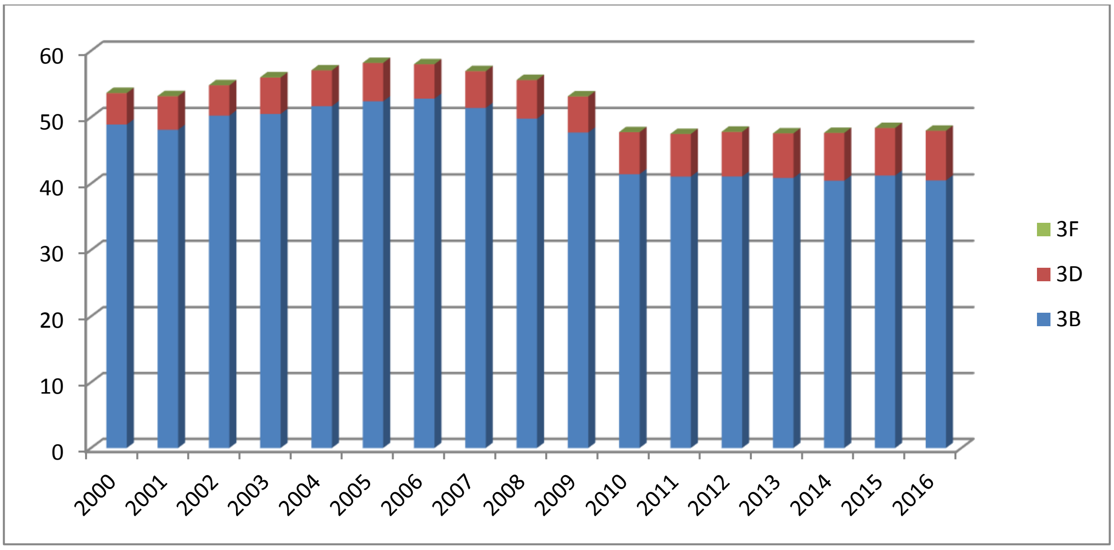


Figure 5.2 Distribution of the NMVOC emissions by the agricultural sources for the 2000-2016 period

For the year 2016, the distribution of NMVOC emissions by agricultural sources was as follows: 84.36% from manure management, 15.59% from manure applied to soils and only 0.039% from burning fields.

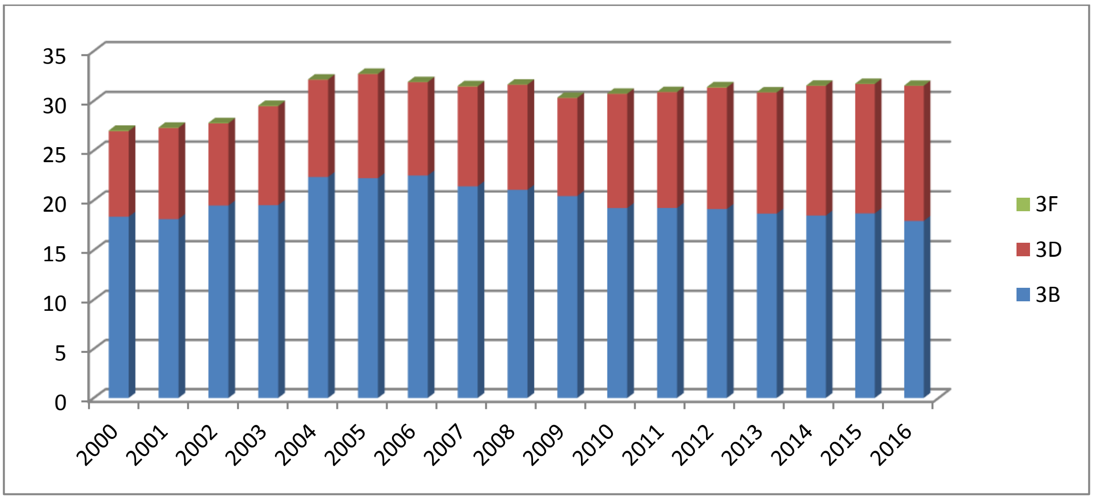


Figure 5.3 Distribution of TSP emissions by the agricultural sources for the 2000-2016 period

For the year 2016, the distribution of TSP emissions by the agricultural sources was as follows: 56.86% from manure management, 43.03% from manure applied to soils and only 0.096% from burning fields.

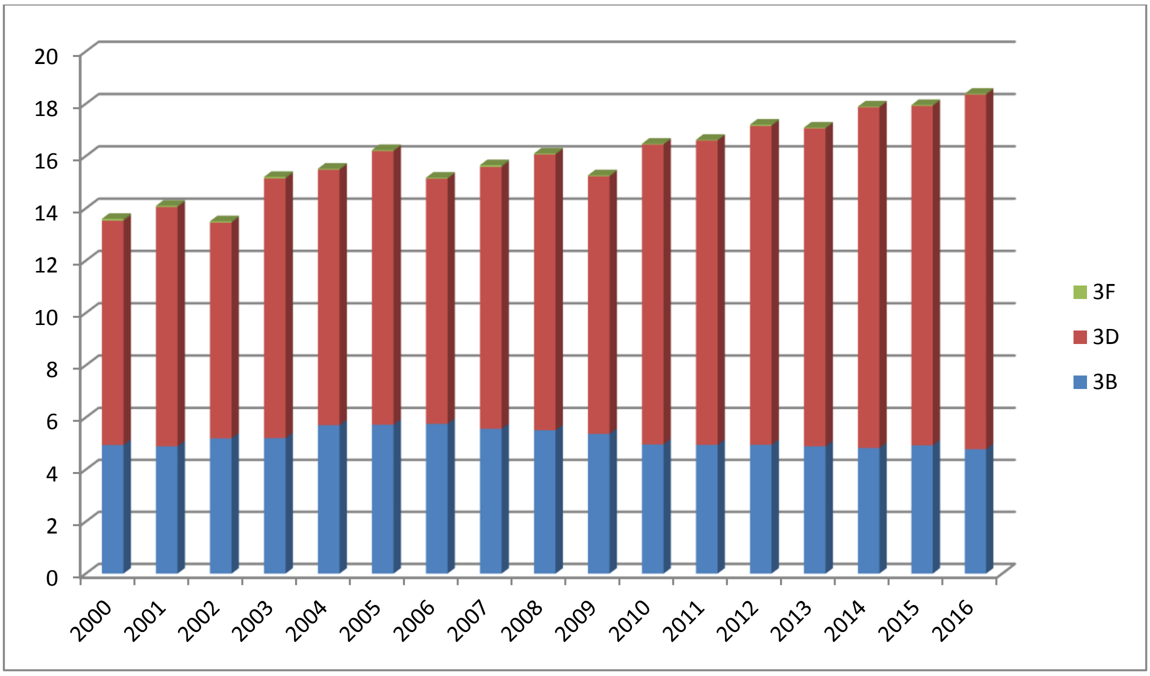


Figure 5.4 Distribution of PM_{10} emissions by the agricultural sources for the 2000÷2016 period

For the year 2016, the distribution of PM_{10} emissions by the agricultural sources was as follows: 73.83% from manure applied to soils, 26% from manure management, and only 0.162% from burning fields.

3B Manure Management

Description

The management of manure has to be considered as the most important source of pollutants, with 48.63% of all agriculture emissions. This chapter contains emissions stemming from animal husbandry. This includes emissions from animal manure, except NFR categories 3.Da.2a - Animal manure applied to soils and 3.Da.3 - Urine and dung deposited by grazing animals.

Majority of the emissions originate from the production of cattle and swine, which contributed with 27%, respectively 22% to the total emissions from manure management.

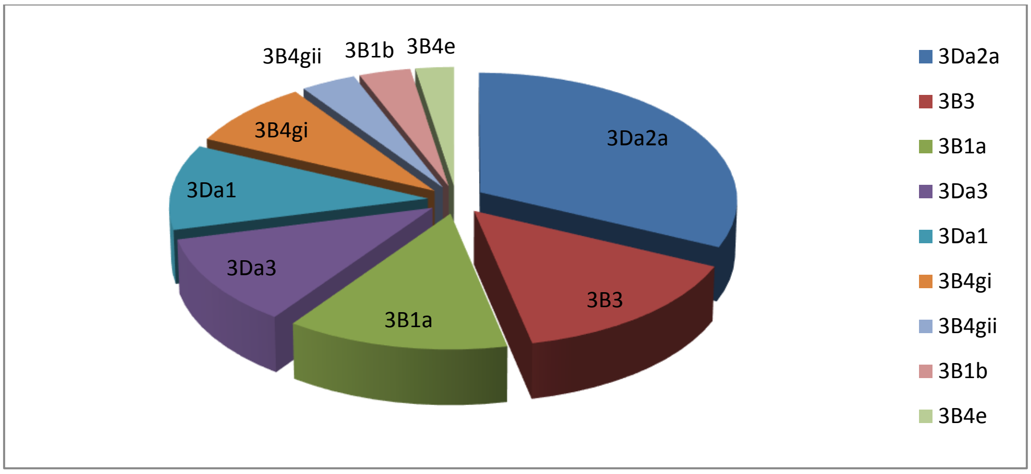


Figure 5.5 - Share of NH_3 emissions by the agriculture sector for 2016

After the period 2001÷2002, for the species of animals raised in Romania there are recorded fluctuations in the number of animals due to the economic context, the emergence of the various associative forms in a new transition economy and the interest shown by farmers for the growth of certain species. So, the interest in dairy products, non-dairy cattle, sheep and goats manifested itself by increasing the number for these categories.

Table 5.3 –Key Categories in 3B Manure Management sector

Key Sources 3B	NFR Codes	Long name Category
NMVOC	3B1a	Dairy-cattle
	3B4gi	Laying hens
	3B1b	Non-dairy cattle
NH_3	3B3	Swine(Fattening pigs, sows)
	3B1a	Dairy-cattle
	3B4gi	Laying hens
TSP	3B4gi	Laying hens

Romania implements Tier 2 methodology for calculations of the ammonia (NH_3) emissions, as follows: Manure management (3B) based on the Excel spreadsheet "3B manure management – appendix B"and the values from Table 3.7 – length of housing period, annual straw use in litter-based, Ncontent of straw, Table 3.9 – NH_3 default EF's and associated parameters, Table 3.10 – proportion of TAN storage for solid and slurry (2016 EMEP/EEA Guidebook).

Recalculation of NH_3 emissions have been performed for the period 2000-2015 for dairy cattle (NFR 3.B.1a), non-dairy cattle (NFR 3.B.1b), swine (NFR 3.B.3- fattening pigs and sows), sheep (NFR 3.B.2) and laying hens (NFR 3.B.4.g.i). For the rest of categories were used Table 3.2 and Table 3.3 values, Tier 1 methodology, 2016 EMEP/EEA Guidebook.

The calculation of NMVOC, NOx and PM emissions is based on Tier 1 methodology (Table 3.4 – NMVOC, Table 3.3 – NO stored manure, Table 3.5 – particulate matter) of the 2016 EMEP/EEA Guidebook.

The livestock for these animal's categories have been taken from N.I.S. database and refined to correlate with the values of the GHG (UNFCCC)- CRF database.

The national data on the proportions of the days that livestock spend in open yard areas are not available. In the absence of country-specific data, the used value of daily TAN deposited to yards by different categories was that provided by the 2016 EMEP/EEA Guidebook.

The main pollutants from manure management were represented by NH_3, NMVOC, PM10, TSP and $PM_{2.5}$ and the values were according to the 2016 EMEP/EEA Guidebook, part Manure Management as follows: NH_3 using Table 3.9, NMVOC – Table 3.4, particle emissions – Table 3.5. The same emissions factors were used for all years.

In the calculation, manure is assumed to be managed as either slurry or solid. The amounts of straw used and the N inputs ($m_{bedding}$) were obtained from the example calculation spreadsheet available on the version of the 2016 EMEP/EEA Guidebook (Table 3.7).

Each emission factor reflects the sum of the emissions from animal housing and manure storage. The emissions resulting from the application of manure to soils and from grazing are reported separately under the NFR categories 3.Da.2.a and 3.Da.3.

Every category of livestock is described by the trend of the activity data and the main pollutants over the period 2000-2016.

5.1 NFR 3.B.1.a Manure management - Dairy cattle

Table 5.1.1. Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.1.a Manure management - Dairy cattle

Year/Activity data	Population Size (1000 head)
2000	1601.173
2001	1562.120
2002	1605.636
2003	1616.236
2004	1566.397
2005	1625.681
2006	1639.362
2007	1572.927
2008	1483.281
2009	1419.027
2010	1178.565

2011	1154.042
2012	1146.938
2013	1154.816
2014	1173.220
2015	1176.145
2016	1176.615

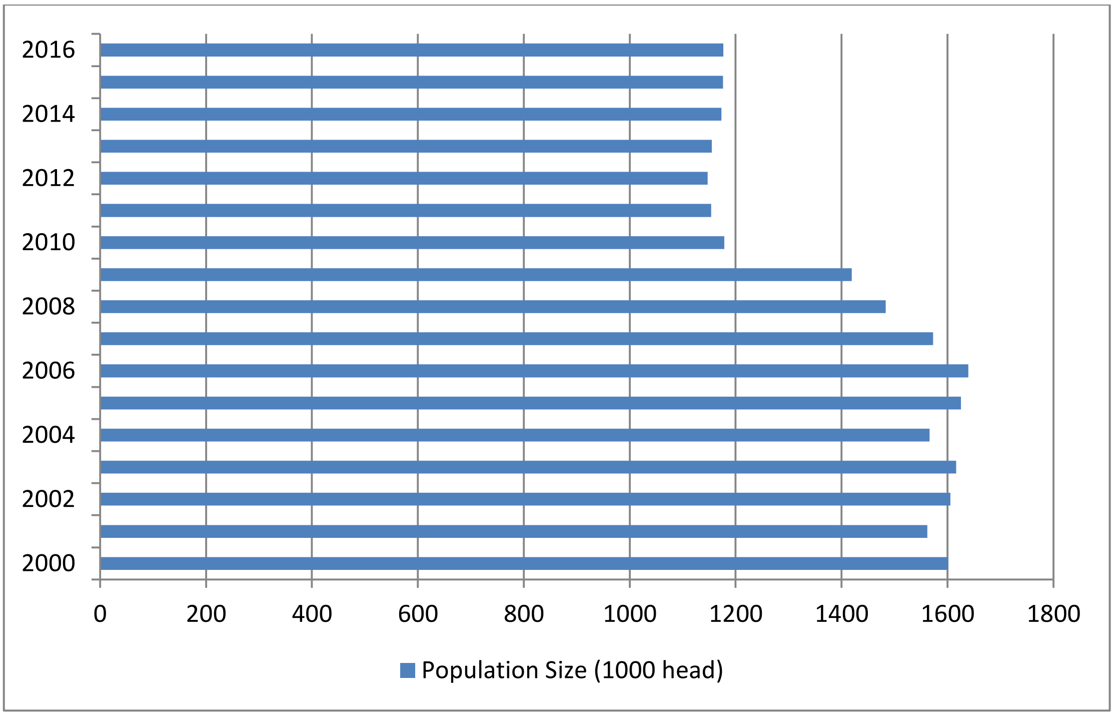


Figure 5.1.1. Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.1.a Manure management - Dairy cattle

Table 5.1.2. Emission trends (kt) for NFR 3.B.1.a Manure management - Dairy cattle

Year/Pollutant	NMVOC	NH_3
2000	20.802	25.510
2001	20.295	24.888
2002	20.860	25.581
2003	20.998	25.750
2004	20.351	24.956
2005	21.121	25.900
2006	21.299	26.118
2007	20.435	25.060
2008	19.271	23.632
2009	18.436	22.608
2010	15.312	18.777
2011	14.993	18.386
2012	14.901	18.273

2013	15.003	18.399
2014	15.242	18.692
2015	15.280	18.738
2016	15.287	18.746

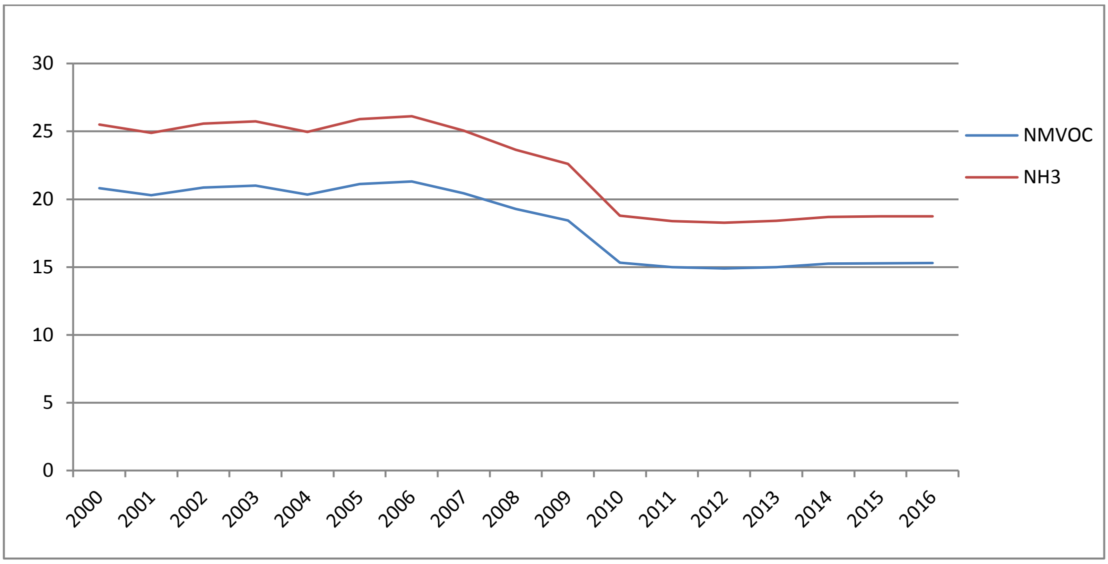


Figure 5.1.2. Emission trends (kt) for NFR 3.B.1.a Manure management - Dairy cattle

The emissions of NMVOC and NH_3 from manure managemet – dairy cattle follow the activity data trends which varied from year to year due variations in livestock.

5.2 NFR 3.B.1.b Manure management - Non-dairy cattle

Table 5.2.1 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.1.b Manure management - Non-dairy cattle

Year/Activity data	Population Size (1000 head)
2000	1234.387
2001	1204.280
2002	1237.828
2003	1246.000
2004	1207.871
2005	1191.182
2006	1253.642
2007	1213.900
2008	1170.214
2009	1063.347

2010	797.106
2011	813.694
2012	841.957
2013	849.366
2014	824.518
2015	897.885
2016	852.818

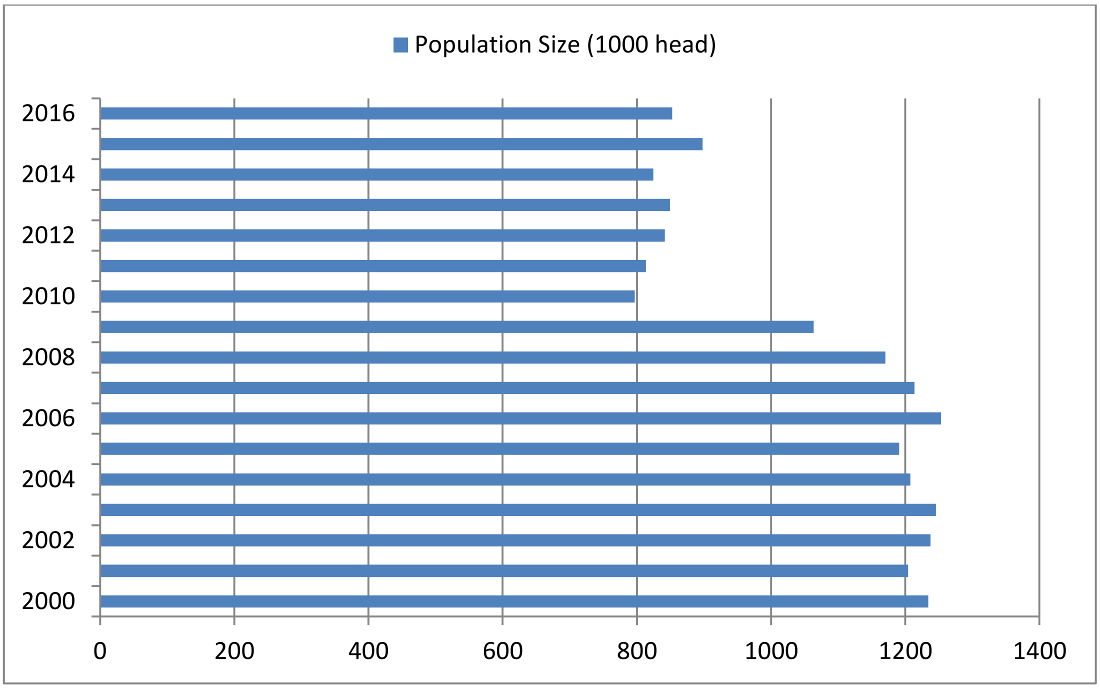


Figure 5.2.1 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.1.b Manure management - Non-dairy cattle

Table 5.2.2 Emission trends (kt) for NFR 3.B.1.b Manure management - Non-dairy cattle

Year/Pollutant	NOx	NMVOC	NH_3
2000	0.105	7.717	7.080
2001	0.102	7.529	6.907
2002	0.105	7.739	7.099
2003	0.106	7.790	7.146
2004	0.102	7.552	6.928
2005	0.101	7.447	6.832
2006	0.106	7.838	7.190
2007	0.103	7.589	6.962
2008	0.099	7.316	6.712
2009	0.090	6.648	6.099
2010	0.068	4.984	4.572
2011	0.069	5.087	4.667
2012	0.071	5.264	4.829

2013	0.072	5.310	4.871
2014	0.070	5.155	4.729
2015	0.076	5.614	5.150
2016	0.072	5.332	4.891

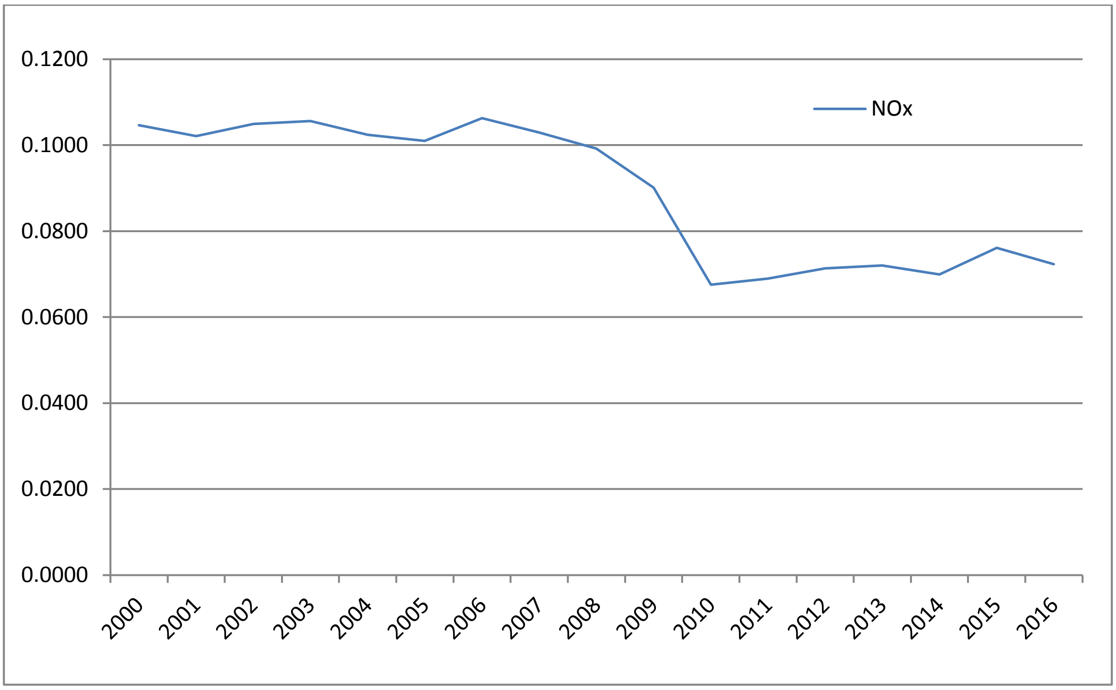


Figure 5.2.2.a Emission trends (kt) for NFR 3.B.1.b Manure management - Non-dairy cattle for NOx

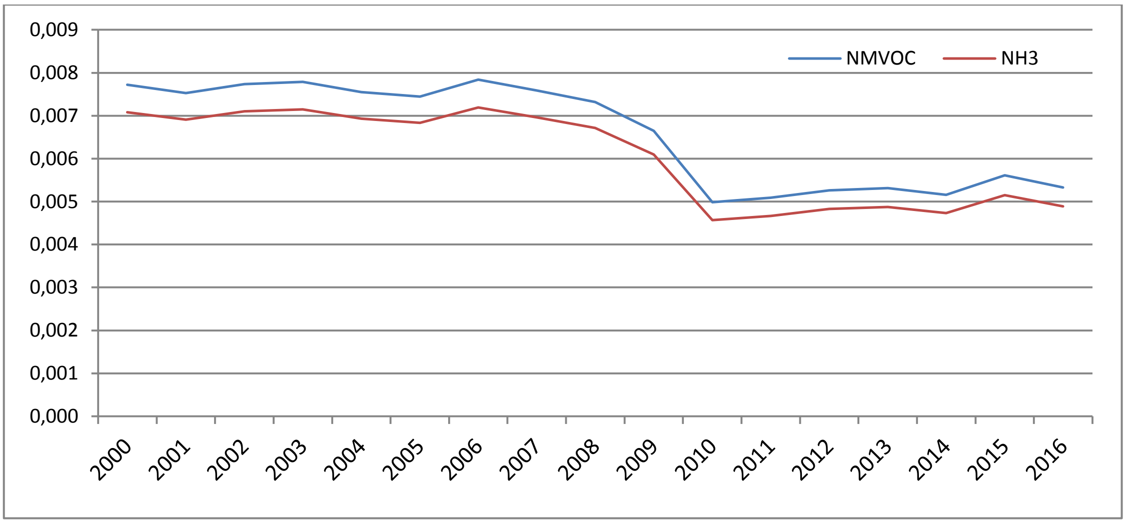


Figure 5.2.2.b Emission trends (kt) for NFR 3.B.1.b Manure management - Non-dairy cattle for NMVOC and NH_3

The emissions of NMVOC and NH_3 from manure management-non-dairy cattle follow the activity data trends which varied from year to year due variations in livestock.

5.3 NFR 3.B.4.a Manure management - Buffalo

Table 5.3.1 Emission trends (*Population Size (1000 head)*)
for NFR 3.B.4.a Manure management - Buffalo

Year/Activity Data	Population Size (1000 head)
2000	34.440
2001	33.600
2002	34.536
2003	34.764
2004	33.793
2005	44.808
2006	40.592
2007	32.156
2008	30.083
2009	29.922
2010	25.434
2011	21.203
2012	20.240
2013	18.226
2014	20.086
2015	18.384
2016	20.280

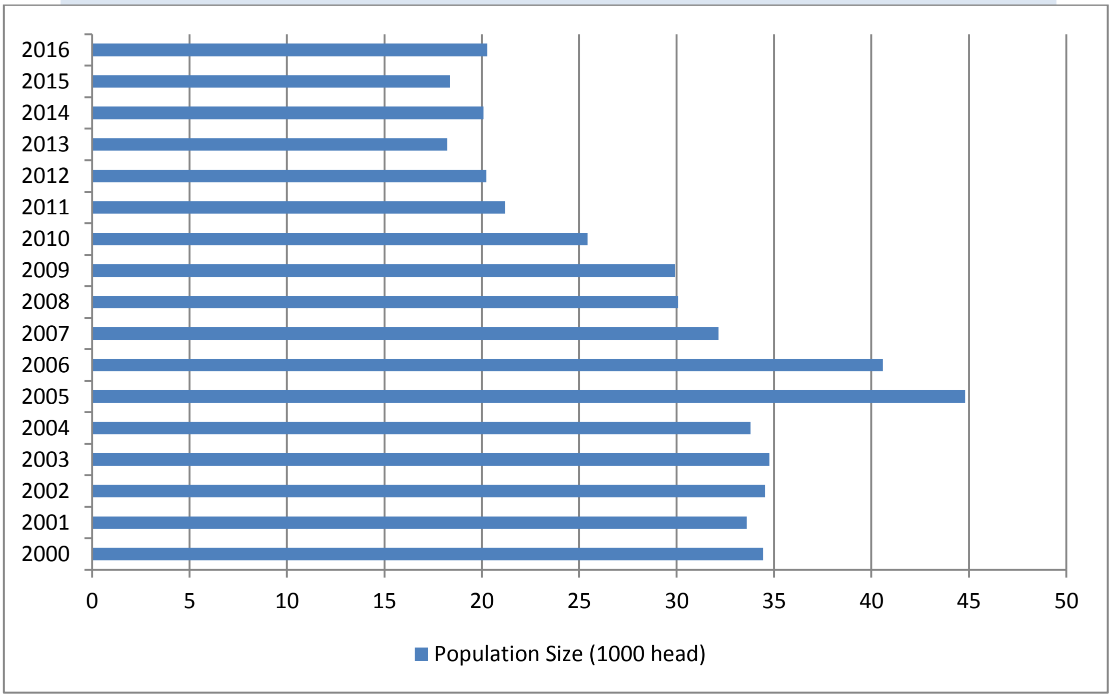


Figure 5.3.1 Emission trends (*Population Size (1000 head)*)
for NFR 3.B.4.a Manure management – Buffalo

Table 5.3.2 Emission trends (kt) for 3.B.4.a Manure management – Buffalo

Year/Pollutant	NMVOC	NH_3	TSP
2000	0.233	0.148	0.050
2001	0.227	0.144	0.049
2002	0.233	0.149	0.050
2003	0.235	0.149	0.050
2004	0.228	0.145	0.049
2005	0.303	0.193	0.065
2006	0.274	0.175	0.059
2007	0.217	0.138	0.047
2008	0.203	0.129	0.044
2009	0.202	0.129	0.043
2010	0.172	0.109	0.049
2011	0.143	0.091	0.031
2012	0.137	0.087	0.029
2013	0.123	0.078	0.026
2014	0.136	0.086	0.029
2015	0.124	0.079	0.027
2016	0.137	0.087	0.029

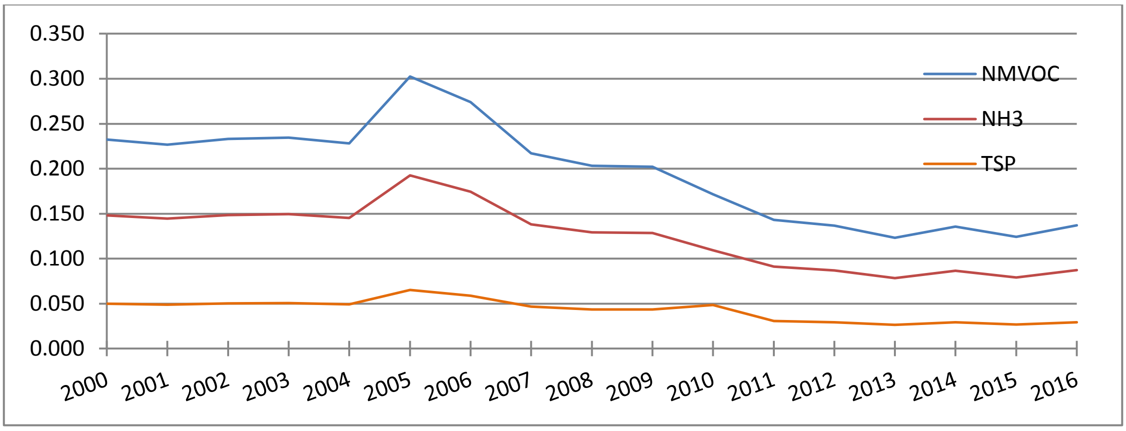


Figure 5.3.2 Emission trends (kt) for NMVOC, NH_3 and TSP
for 3.B.4.a Manure management – Buffalo

The emissions of NMVOC, NH_3 and TSP from the manure management-buffalo follow the activity data trends which varied from year to year due variations in livestock.

5.4 NFR 3.B.2 Sheep

Table 5.4.1 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.2 Manure management – Sheep

Year/Activity data	Population Size (1000 head)
2000	7656.798
2001	7251.185
2002	7312.362
2003	7446.857
2004	7425.327
2005	7610.958
2006	7678.000
2007	8469.195
2008	8881.582
2009	9141.482
2010	8417.437
2011	8533.434
2012	8833.830
2013	9135.678
2014	9518.225
2015	9809.512
2016	9875.483

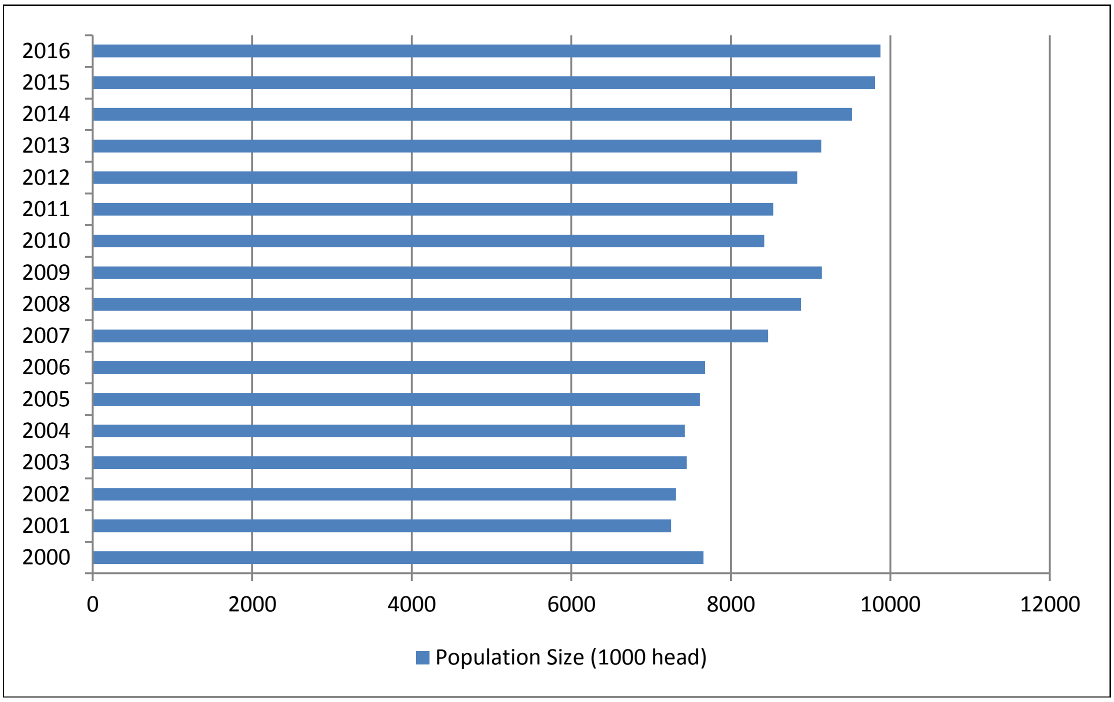


Figure 5.4.1 Activity data (*Population Size (1000 head)*) trends for NFR 3.B.2 Manure management – Sheep

Table 5.4.2 Emission trends (kt) for NFR 3.B.2 Manure management - Sheep

Year/Pollutant	NMVOC	NH_3
2000	1.715	2.817
2001	1.624	2.668
2002	1.638	2.690
2003	1.668	2.740
2004	1.663	2.732
2005	1.705	2.800
2006	1.720	2.825
2007	1.897	3.116
2008	1.990	3.268
2009	2.048	3.363
2010	1.886	3.097
2011	1.912	3.140
2012	1.979	3.250
2013	2.046	3.361
2014	2.132	3.502
2015	2.197	3.609
2016	2.212	3.633

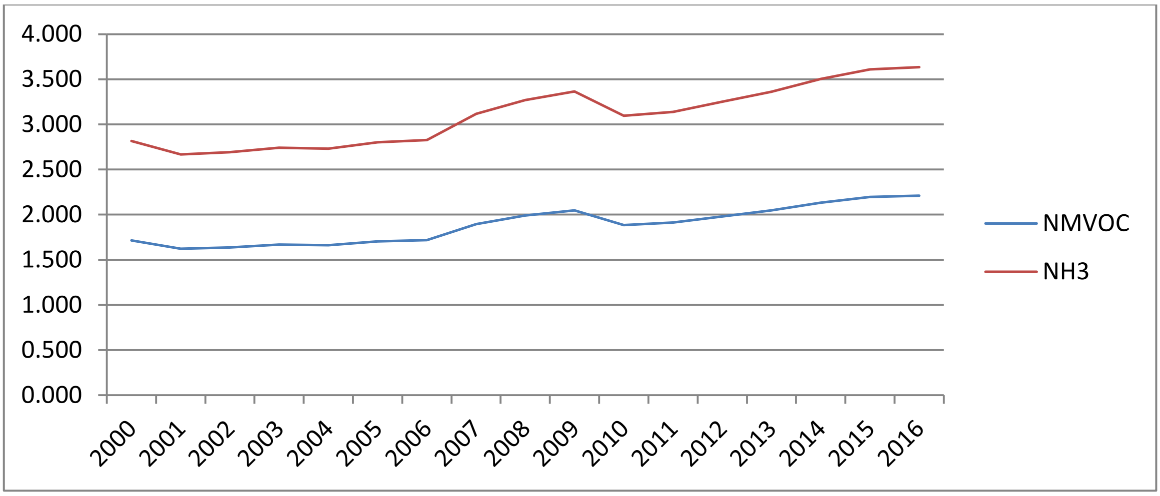


Figure 5.4.2 Emission trends (kt) for 3.B.2 Manure management – Sheep

The NMVOC and NH_3 emissions from manure management - sheep follow the activity data trends which varied from year to year due variations in livestock.

5.5 NFR 3.B.4.d Goats

Table 5.5.1 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.4.d Manure management - Goats

Year/Activity Data	Population Size (1000 head)
2000	538.014
2001	525.144
2002	633.002
2003	678.039
2004	660.716
2005	686.765
2006	727.000
2007	865.070
2008	898.307
2009	917.304
2010	1240.786
2011	1236.143
2012	1265.676
2013	1312.967
2014	1417.176
2015	1440.151
2016	1483.146

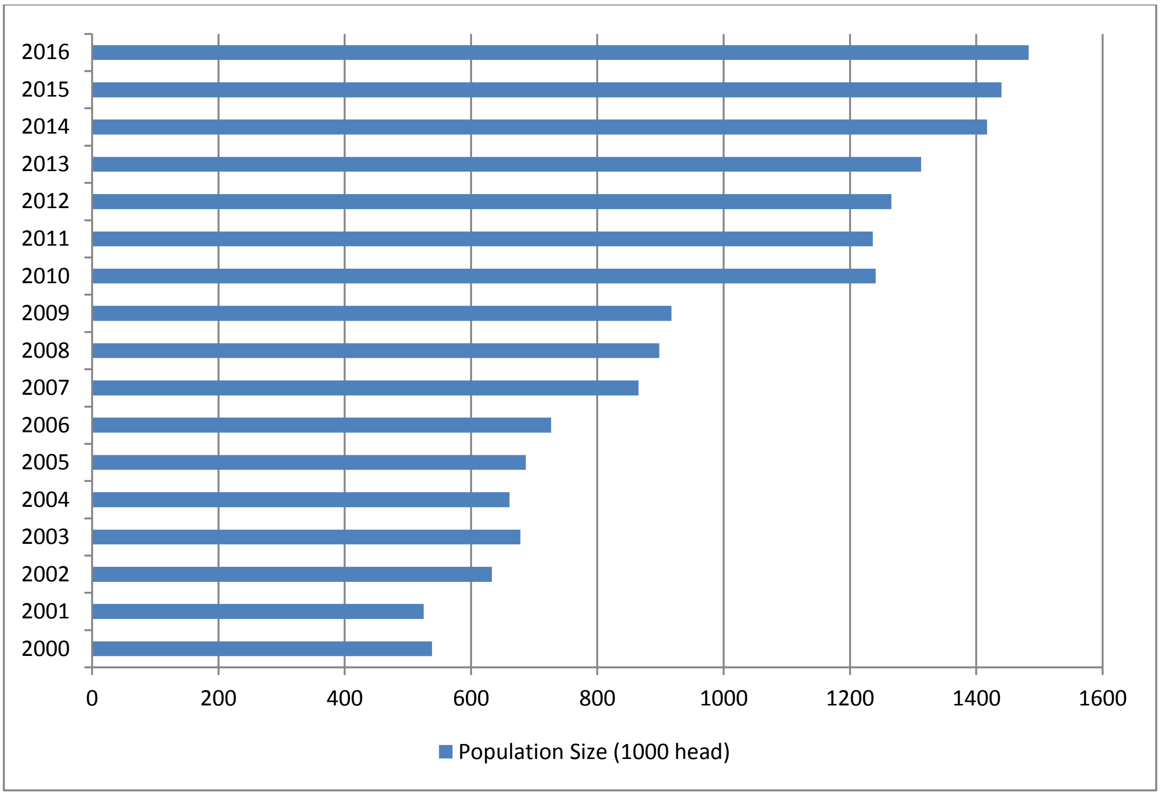


Figure 5.5.1 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.4.d Manure management – Goats

Table 5.5.2 Emission trends (kt) for NFR 3.B.4.d Manure management - Goats

Year/Pollutant	NMVOC	NH_3
2000	0.314	0.215
2001	0.306	0.210
2002	0.369	0.253
2003	0.395	0.271
2004	0.385	0.264
2005	0.400	0.275
2006	0.424	0.291
2007	0.504	0.346
2008	0.524	0.359
2009	0.535	0.367
2010	0.723	0.496
2011	0.721	0.494
2012	0.738	0.506
2013	0.766	0.525
2014	0.826	0.567
2015	0.840	0.576
2016	0.865	0.593

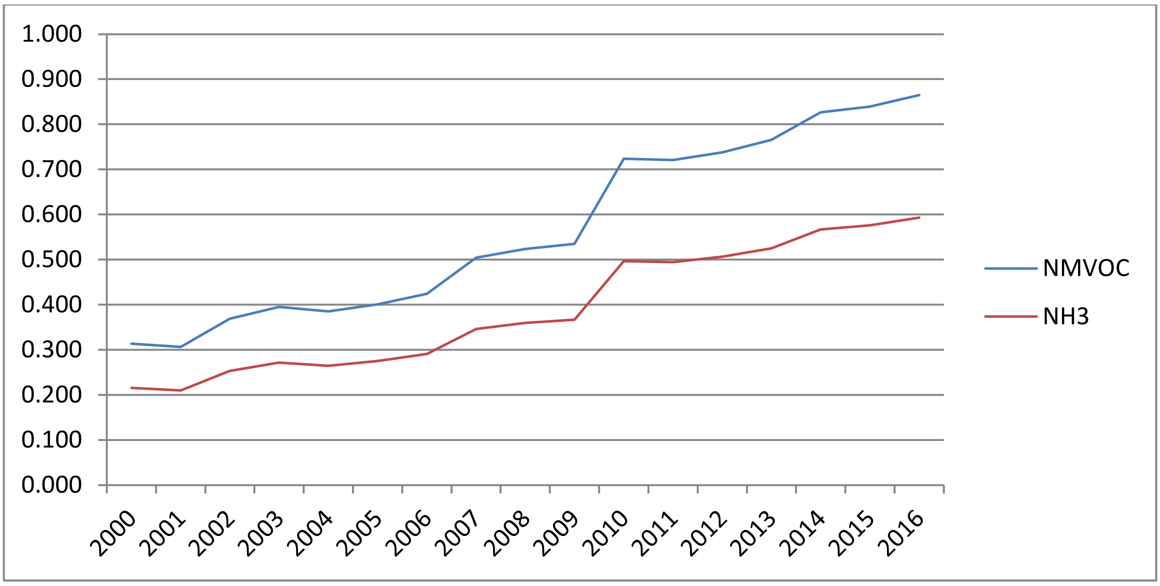


Figure 5.5.2 Emission trends (kt) for NFR 3.B.4.d Manure management - Goats

The emissions of NMVOC and NH_3 from manure management-goats follow the activity data trends which varied from year to year due variations in livestock.

5.6 NFR 3.B.4.e Horses

Table 5.6.1 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.4.e Manure management - Horses

Year/Activity Data	Population Size (1000 head)
2000	864.462
2001	860.306
2002	879.383
2003	896.847
2004	839.586
2005	833.952
2006	805.000
2007	862.000
2008	819.513
2009	763.988
2010	610.857
2011	596.380
2012	574.627
2013	548.245
2014	524.741
2015	503.466
2016	519.906

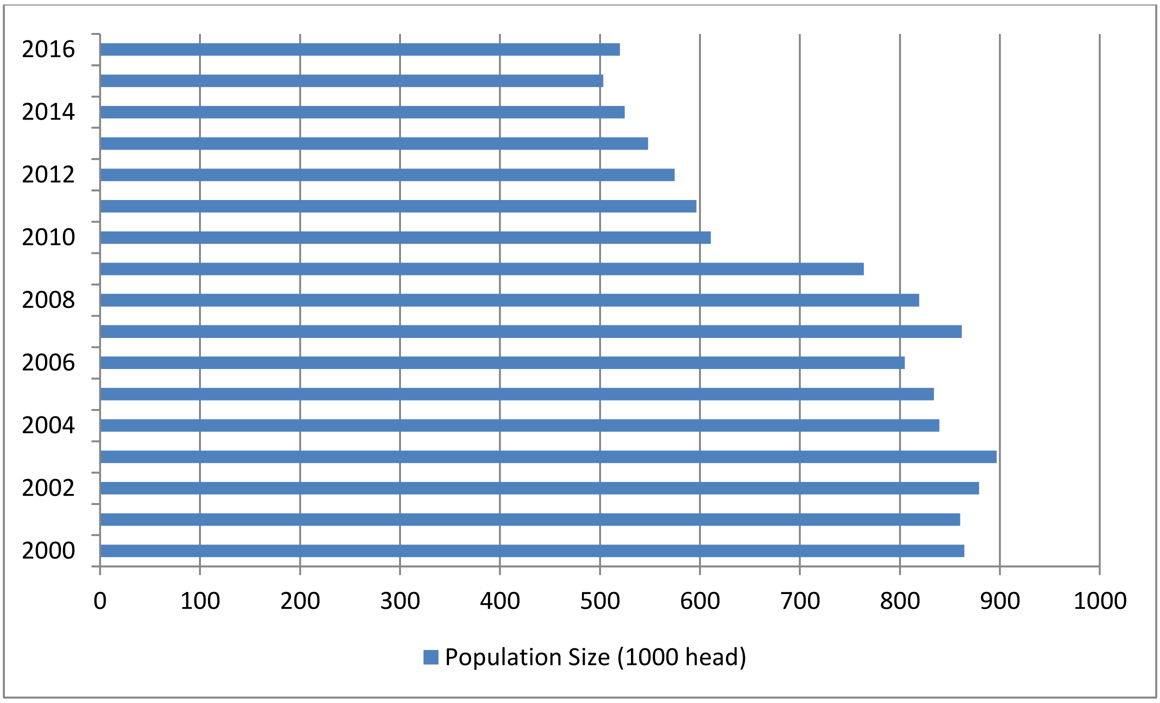


Figure 5.6.1 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.4.e Manure management - Horses

The mules and donkeys are included in horses category.

Table 5.6.2 Emission trends (kt) for NFR 3.B.4.e Manure management - Horses

Year/Pollutant	NMVOC	NH_3
2000	5.211	6.051
2001	5.186	6.022
2002	5.301	6.156
2003	5.406	6.278
2004	5.061	5.877
2005	5.027	5.838
2006	4.853	5.635
2007	5.196	6.034
2008	4.940	5.737
2009	4.605	5.348
2010	3.682	4.276
2011	3.595	4.175
2012	3.464	4.022
2013	3.305	3.838
2014	3.163	3.673
2015	3.035	3.524
2016	3.134	3.639

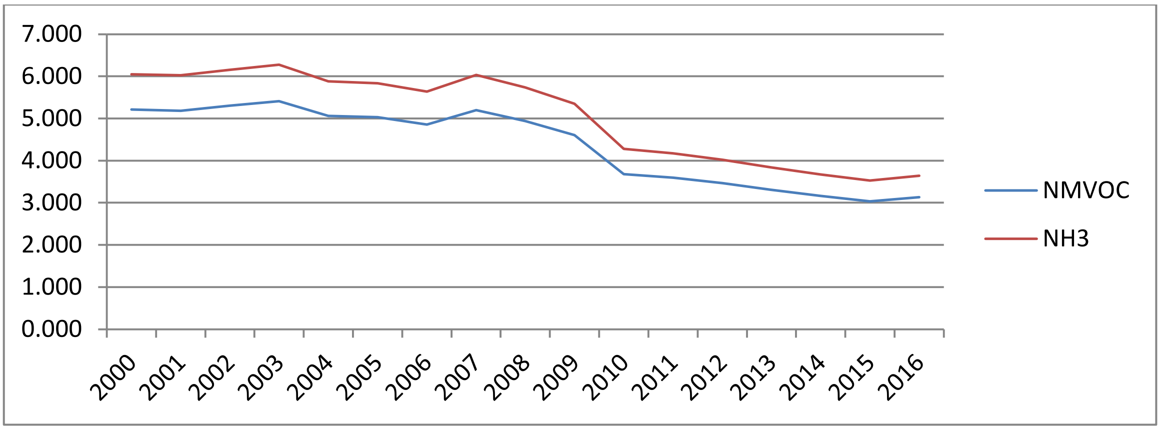


Figure 5.6.2 Emission trends (kt) for NFR 3.B.4.e Manure management – Horses

The emissions of NMVOC and NH_3 from manure management - horses follow the activity data trends which varied from year to year due variations in livestock.

5.7 NFR 3.B.3 Manure management - Swine

Table 5.7.1 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.3 Manure management - Swine

Year/Activity data	*Population Size (1000 head)*
2000	4797
2001	4447
2002	5058
2003	5145
2004	6495
2005	6622.302
2006	6814.605
2007	6564.907
2008	6173.682
2009	5793.415
2010	5428.272
2011	5363.797
2012	5234.313
2013	5180.173
2014	5041.788
2015	4926.928
2016	4707.719

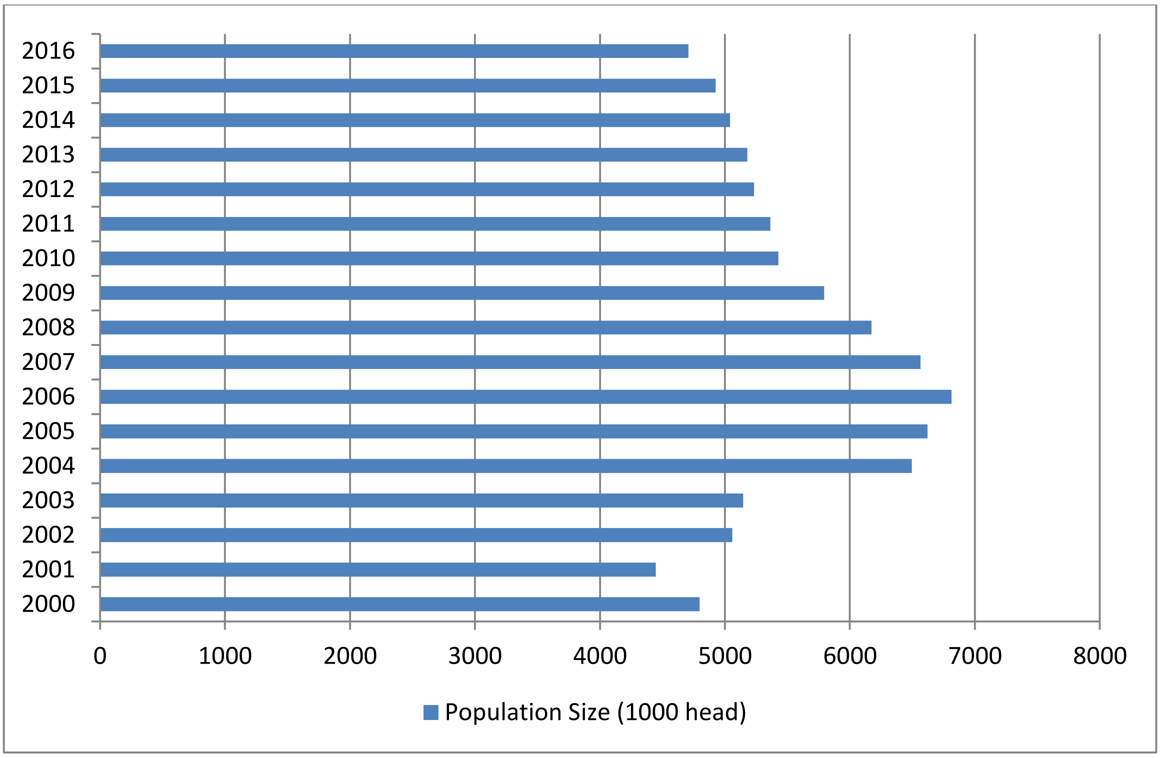


Figure 5.7.2 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.3 Manure management – Swine

Table 5.7.2 Emission trends (kt) for NFR 3.B.3 Manure management - Swine

Year / Pollutant	**NMVOC fatting pigs**	**NH_3 fatting pigs**	**NMVOC sows**	**NH_3 sows**
2000	3.016	17.853	2.465	3.219
2001	2.835	16.413	2.266	3.328
2002	3.204	18.739	2.587	3.607
2003	3.221	19.194	2.650	3.338
2004	4.070	24.218	3.344	4.245
2005	4.219	24.453	3.376	4.928
2006	4.355	25.116	3.469	5.186
2007	4.127	24.431	3.373	4.409
2008	3.836	23.133	3.194	3.751
2009	3.606	21.684	2.994	3.580
2010	3.401	20.242	2.795	3.544
2011	3.394	19.885	2.746	3.793
2012	3.344	19.296	2.664	3.974
2013	3.297	19.140	2.643	3.823
2014	3.214	18.609	2.570	3.770
2015	3.147	18.166	2.508	3.733
2016	3.010	17.345	2.395	3.599

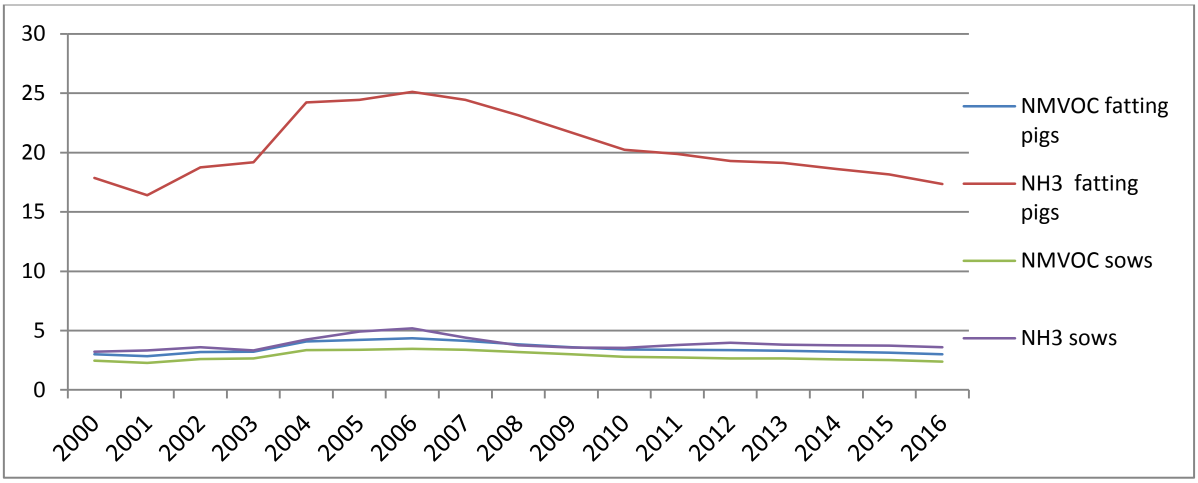


Figure 5.7.2 Emission trends (kt) for NFR 3.B.3 Manure management - Swine

The emissions of NMVOC and NH_3 from manure management - swine follow the activity data trends which varied from year to year due variations in livestock.

5.8 NFR 3.B.4.g.i Manure management - Laying hens

Table 5.8.1 Activity data trends (*Population Size (1000 head)*) for NFR 3.B.4.g.i Manure management - Laying hens

Year/Activity data	*Population Size (1000 head)*
2000	40760.055
2001	42155.612
2002	44666.525
2003	44121.750
2004	51888.883
2005	49725.000
2006	50278.000
2007	45208.000
2008	45529.000
2009	45045.821
2010	44503.511
2011	45463.852
2012	45401.912
2013	42541.300
2014	42738.547
2015	43662.606
2016	40833.096

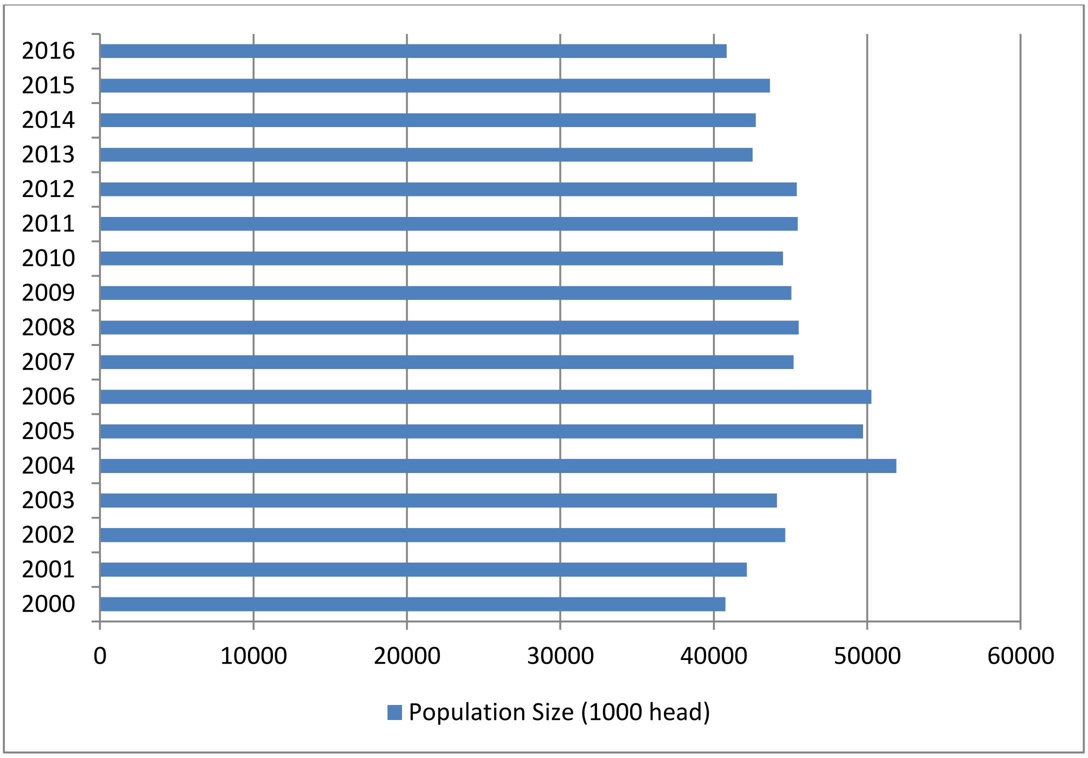


Figure 5.8.1 Activity data trends (*Population Size (1000 head)*) for NFR 3.B.4.g.i Manure management - Laying hens

Table 5.8.2 Emission trends (kt) for NFR 3.B.4.g.i Manure management - Laying hens

Year/Pollutant	NMVOC	NH_3	PM_{10}
2000	6.725	12.040	1.630
2001	6.956	12.452	1.686
2002	7.370	13.194	1.787
2003	7.280	13.033	1.765
2004	8.562	15.327	2.076
2005	8.205	14.688	1.989
2006	8.296	14.851	2.011
2007	7.459	13.354	1.808
2008	7.512	13.448	1.821
2009	7.433	13.306	1.802
2010	7.343	13.145	1.780
2011	7.502	13.429	1.819
2012	7.491	13.411	1.816
2013	7.019	12.566	1.702
2014	7.052	12.624	1.710
2015	7.204	12.897	1.747
2016	6.738	12.061	1.633

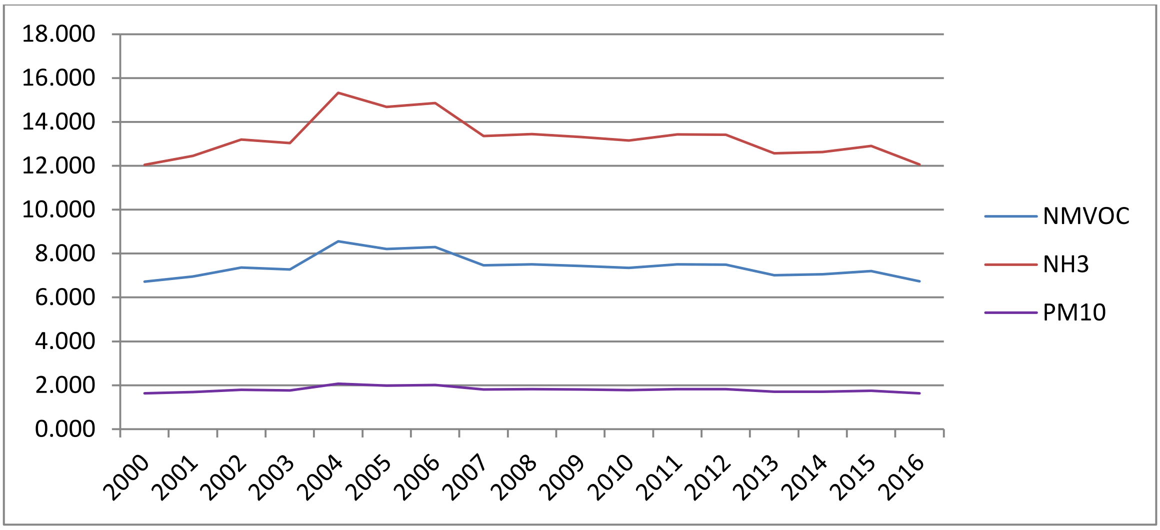


Figure 5.8.2 Emission trends (kt) for NFR 3.B.4.g.i Manure management - Laying hens

The emissions of NMVOC, NH_3 and PM_{10} from manure management – laying hens follow the activity data trends which varied from year to year due variations in livestock.

5.9 NFR 3.B.4.g.ii Manure management – Broilers

Table 5.9.1 Activity data trends (*Population Size (1000 head)*)
for NFR 3.B.4.g.ii Manure management – Broilers

Year/Activity data	*Population Size (1000 head)*
2000	29315.592
2001	29257.713
2002	32712.362
2003	32494.585
2004	35125.522
2005	36827.000
2006	34713.000
2007	36828.000
2008	38844.000
2009	38797.258
2010	36341.348
2011	34377.799
2012	34733.768
2013	36898.951
2014	32708.203
2015	34985.492
2016	34856.758

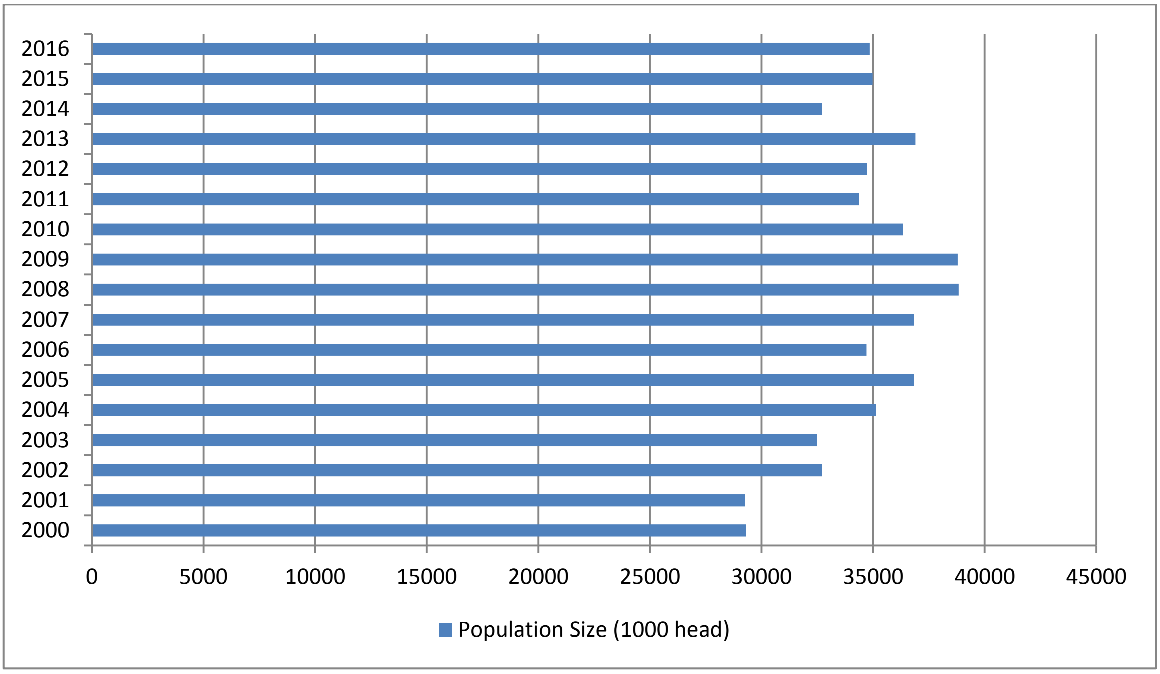


Figure 5.9.1 Activity data trends (*Population Size (1000 head)*) for NFR 3.B.4.g.ii Manure management – Broilers

Table 5.9.2 Emission trends (kt) for NFR 3.B.4.g.ii Manure management - Broilers

Year/Pollutant	NMVOC	NH_3	PM_{10}
2000	3.166	4.397	0.586
2001	3.160	4.389	0.585
2002	3.533	4.907	0.654
2003	3.509	4.874	0.650
2004	3.794	5.269	0.703
2005	3.977	5.524	0.737
2006	3.749	5.207	0.694
2007	3.977	5.524	0.737
2008	4.195	5.827	0.777
2009	4.190	5.820	0.776
2010	3.925	5.451	0.727
2011	3.713	5.157	0.688
2012	3.751	5.210	0.695
2013	3.985	5.535	0.738
2014	3.533	4.906	0.654
2015	3.778	5.248	0.700
2016	3.765	5.229	0.697

Figure 5.9.2 Emission trends (kt) for NFR 3.B.4.g.ii Manure management – Broilers

The emissions of NMVOC, NH_3 and PM_{10} from manure management - broilers follow the activity data trends which varied from year to year due variations in livestock.

For NFR 3.B the most important changes were applying Tier 2 recalculations for NH_3 on key categories and splitting NH_3 emissions, in NFR 3.B, NFR 3.Da.2a and NFR 3.Da.3 according to the 2016 EMEP/EEA Guidebook.

Other emission factors were changed according to the 2016 EMEP/EEA Guidebook.

The previous submission has been performed due to correlate the activity data with GHG values. The emissions have been recalculated for all years in the time series.

5.10 NFR 3.D.a.1 Inorganic N-fertilizers (includes also urea application)

The inorganic N-fertiliser sector represents a key category for agricultural sector for which the emission of NH_3 and NOx were estimated.

The emissions of NH_3 from inorganic N-fertiliser sector contributed in 2016 with 10.53 % of the total emissions from the agricultural sector and the emission of NOx contributed in 2016 with 98 % of the total emissions from the agricultural sector, representing the first source of N_2O emissions in the agriculture sector.

The emission factors were provided by Table 3-1, Tier1 methodology of the 2016 EMEP/EEA Guidebook, due to lack of detailed data.

The amount of inorganic N-fertiliser applied to soils data are provided by N.I.S. The amount of N-fertilizer applied (tones/year) was multiplied by default value of FracGASF of 0.1 (Reference GHG (UNFCCC).

The activity data for this category was correlated with GHG (UNFCCC)- CRF database.

The emission factors, for both NH_3 and NOx, are based on the values given in 2016 EMEP/EEA Guidebook and the same emission factors were used for all years 2000-2016.

Table 5.10.1 Activity data trends [t] for NFR 3.D.a.1 Inorganic N-fertilizers

Year/Activity data	t product
2000	215351.1
2001	241622.1
2002	215163.9
2003	226925.1
2004	243117.9
2005	269275.5
2006	226980.9
2007	238938.3
2008	251897.4
2009	266449.5
2010	275181.3
2011	281999.7
2012	260966.7
2013	310021.2
2014	273205.8
2015	321616.8
2016	309879.9

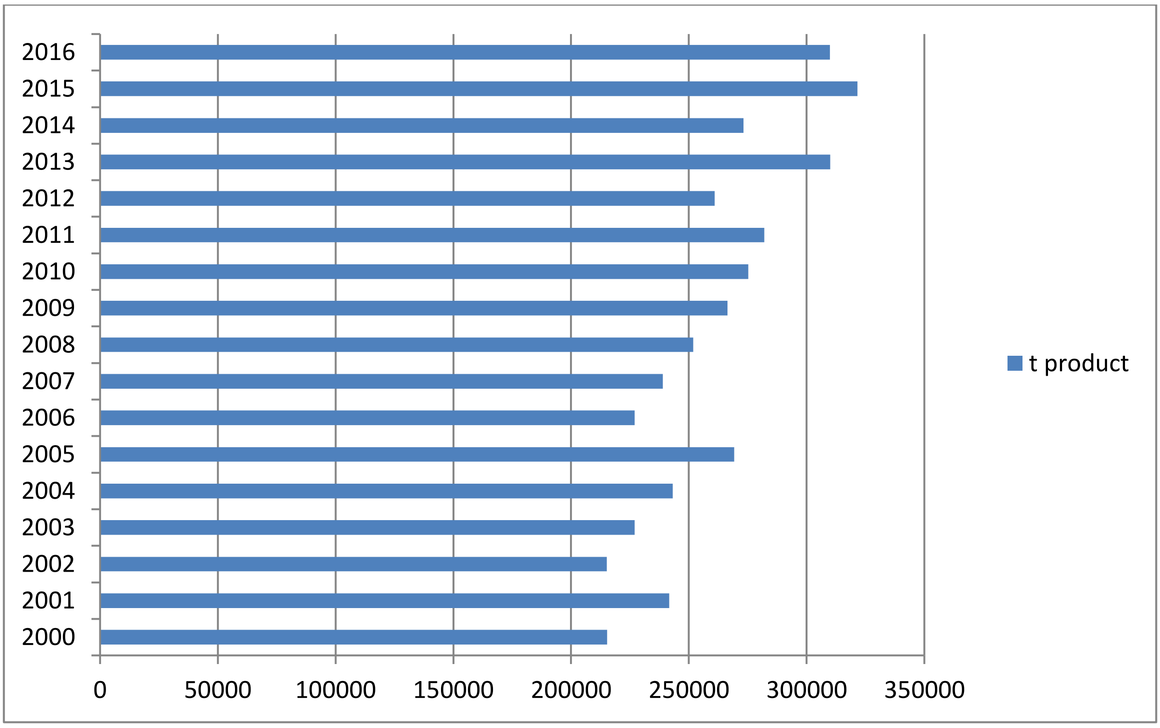


Figure 5.10.1 Activity data trends (t) for NFR 3.D.a.1 Inorganic N-fertilizers

Table 5.10.2 Emission trends (kt) for NFR 3.D.a.1 Inorganic N-fertilizers

Year/Pollutant	NOx	NH_3
2000	8.614	10.768
2001	9.665	12.081
2002	8.607	10.758
2003	9.077	11.346
2004	9.725	12.156
2005	10.771	13.464
2006	9.079	11.349
2007	9.558	11.947
2008	10.076	12.595
2009	10.658	13.322
2010	11.007	13.759
2011	11.280	14.100
2012	10.439	13.048
2013	12.384	15.480
2014	10.908	13.635
2015	12.852	16.065
2016	12.395	15.494

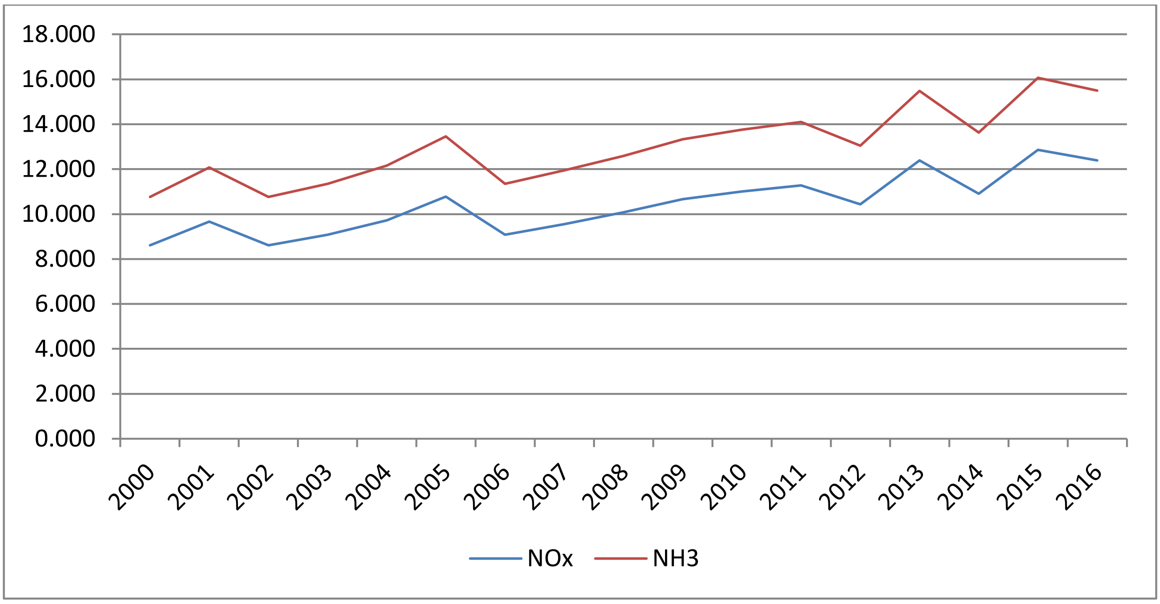


Figure 5.10.2 Emission trends (kt) for NFR 3.D.a.1 Inorganic N-fertilizers (includes also urea application)

The emissions of NOx and NH_3 from inorganic N-fertilizers follow an increased trend due to the activity data.

The recalculations since the previous submission have been performed, applying the new emissions factor for NOx and NH_3 according the 2016 EMEP/EEA Guidebook. The $PM_{2.5}$ and PM_{10} were considered under NFR 3.D.c, NMVOC was considered under NFR 3.D.e following the TERT recommendations. The emissions have been recalculated for all years in the time series.

5.11 NFR 3.D.a.2.a Animal manure applied to soils

For the sector on animal manure applied to soils the emissions of NH_3 were estimated. The emission of NH_3 from animal manure applied to soils contributed in 2016 with 31% from the total emissions on agricultural sector and 27.28% from the total national emissions, which led to consideration of the sector on animal manure applied to soils as a key category.

To calculate emissions of NH_3 from the animal manure applied to soils, an emission factor was estimated and multiplied with TAN ex storage for liquid manure and N ex storage for solid manure for each animal type. The methodology used to calculate the emissions is the Tier2 forNFR 3.B Manure management.

Activity data for emissions resulting from the application of animal manure to soils are the livestock numbers for key category NFR 3.B Manure management.

The emission factor for NH_3 differ between solid manure and liquid manure and also between manure from different livestock categories. This estimate is based on information from 2016 EMEP/EEA Guidebook. The same emission factors are used for all the years 2000-2016.

Table 5.11.1 Emission trends (kt) for NFR 3.D.a.2.a Animal manure applied to soils

Year/Pollutant	NH_3
2000	51.720
2001	50.394
2002	53.608
2003	53.854
2004	58.725
2005	59.676
2006	60.635
2007	58.196
2008	55.920
2009	53.526
2010	47.968
2011	47.715
2012	47.515
2013	47.055

2014	46.608
2015	46.997
2016	45.661

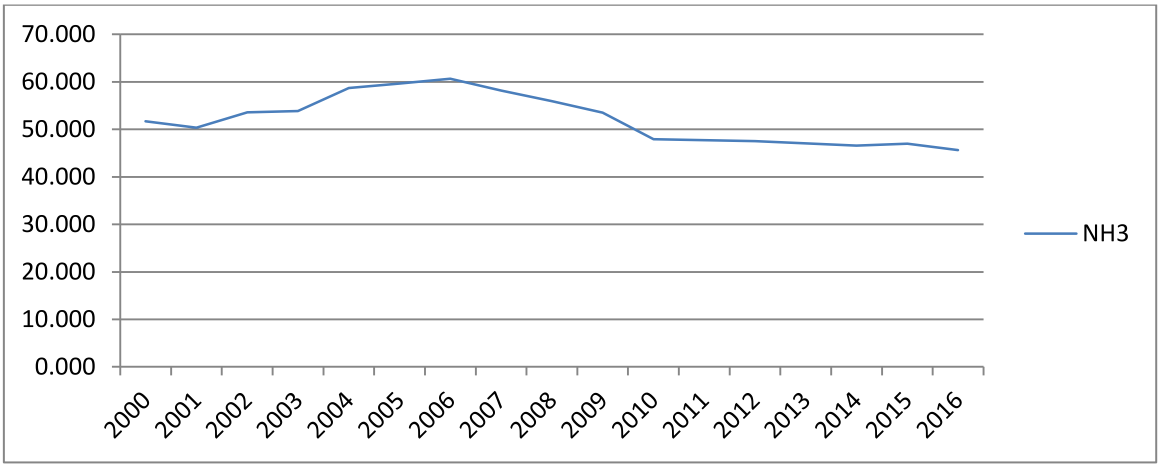


Figure 5.11.1 Emission trends (kt) for NFR 3.D.a.2.a Animal manure applied to soils

The emissions of NH_3 from animal manure applied to soils follow the activity data trend.

For this category a correlation of the activity data with the activity data for livestock number under GHG inventory was performed. Then, the emissions of NH_3 have been calculated for all years using the Tier 2 methodology on key categories and a splitting of NH_3 emissions by NFR 3.B, NFR 3.D.a.2.a and NFR 3.D.a.3 according the 2016 EMEP/EEA Guidebook was conducted. The emissions have been recalculated for all years in the time series.

5.12 NFR 3.D.a.3 Urine and dung deposited by grazing animals

For this new sector, the emission of NH_3 were estimated. The emission of NH_3 from animal manure - urine and dung deposited by grazing animals contributed in 2016 with 9.61% of the total NH_3 emissions and represent 10.93% of the total NH_3 emissions from the agricultural sector.

The NH_3 emissions due to N excretion on pasture were calculated according to the methodology described in chapter Manure management (NFR 3.B). The emissions were reported under 3.D.a.3 Urine and dung deposited by grazing animals.

Activity data for emissions resulting from this sector is the livestock number for key category NFR 3.B Manure management.

The emission factor for NH_3 differ between solid manure and liquid manure and also between manure from different livestock categories. This estimate is based on information from 2016 EMEP/EEA Guidebook. The same emission factors were used for all years 2000-2016.

Table 5.12.1 Emission trends (kt) for NFR 3.D.a.3
Urine and dung deposited during grazing animals

Year/Pollutant	NH_3
2000	17.340
2001	16.854
2002	17.261
2003	17.544
2004	16.985
2005	17.315
2006	17.296
2007	18.097
2008	17.874
2009	17.474
2010	15.312
2011	15.234
2012	15.352
2013	15.480
2014	15.752
2015	15.924
2016	16.081

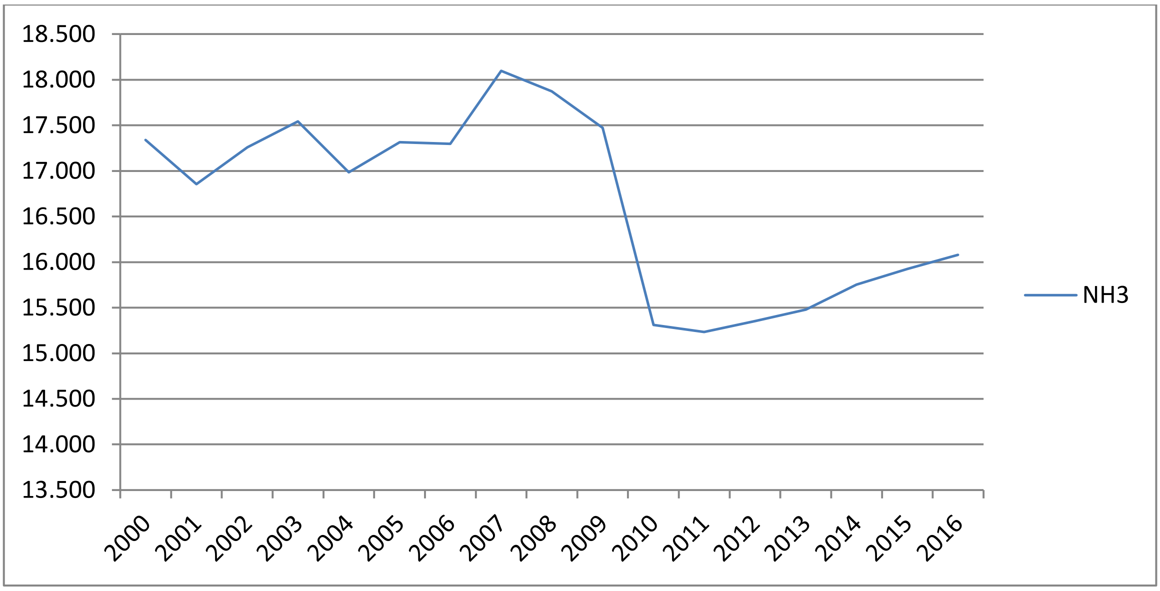


Figure 5.12.1 Emission trends (kt) for NFR 3.D.a.3 Urine and dung deposited during grazing animals

Table 5.12.2 Comparison between the split of NH_3 for categories NFR 3.B, NFR 3.D.a.2.a and NFR 3.D.3

Year/Pollutants	3B-NH_3, [kt]	3Da2a-NH_3, [kt]	3Da3-NH_3, [kt]
2000	79.330	51.720	17.340
2001	77.421	50.394	16.854
2002	82.375	53.608	17.261
2003	82.774	53.854	17.544
2004	89.961	58.725	16.985
2005	91.430	59.679	17.315
2006	92.595	60.635	17.296
2007	89.375	58.196	18.097
2008	85.996	55.920	17.874
2009	82.304	53.526	17.474
2010	73.710	47.968	15.312
2011	73.216	47.715	15.234
2012	72.858	47.515	15.352
2013	72.137	47.055	15.480
2014	71.159	46.608	15.752
2015	71.720	46.997	15.924
2016	69.824	45.661	16.081

For this category a correlation of the activity data for livestock number under GHG inventory was performed. Then, the emissions of NH_3 have been calculated for all years using the Tier 2 methodology on key categories and a splitting of NH_3 emissions by NFR 3.B, NFR 3.D.a.2.a and NFR 3.D.a.3, according the 2016 EMEP/EEA Guidebook was conducted. The emissions have been recalculated for all years in the time series.

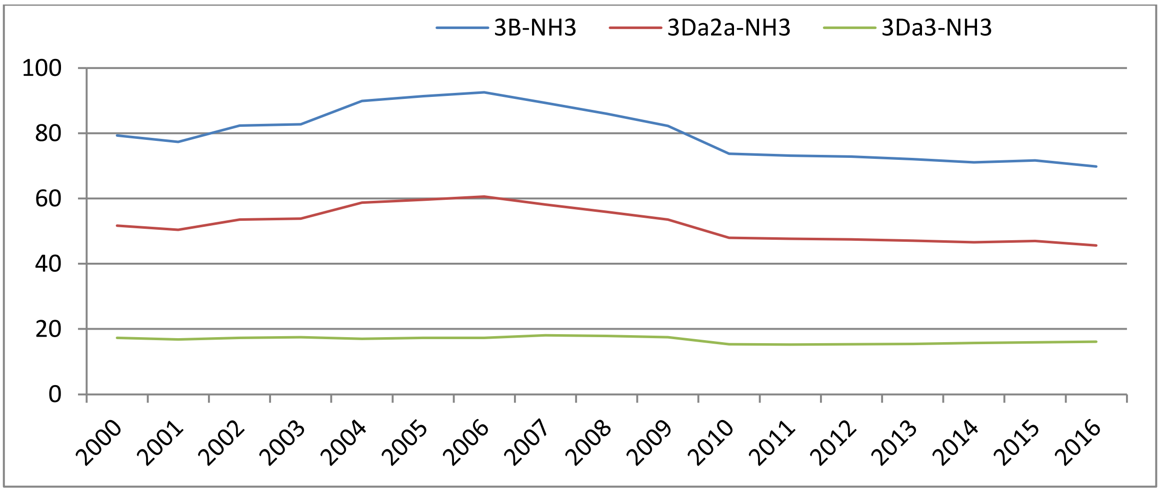


Figure 5.12.2 Comparison between the split of NH_3 for categories NFR 3.B, NFR 3.D.a.2.a and NFR 3.D.3

The emissions of NH_3 from animal manure follow the activity data trend.

5.13 NFR 3.D.c Farm-level agricultural operations including storage, handling and transport of agricultural products

During the agricultural operations such as soil cultivation, harvesting, cleaning, drying and transport emissions of particulate matter occur. The emissions of PM_{10} and TSP from field operations contribute with 9.66% of the total emission of PM_{10} in 2016, and respectively with 6.57% of the total emission of TSP in 2016.

The emissions of PM from field operations are calculated by area of cultivated crops multiplied with emission factor.

As activity data, the area of cultivated crops is used, as provided by the N.I.S. and in correlation with GHG (UNFCCC)- CRF database.

The emission factors used are based on the 2016 EMEP/EEA guidebook.

The emissions represented here are from $PM_{2,5}$ and PM_{10}, the TSP having the same values (i.e. emission factor) as PM_{10}.

Table 5.13.1 Activity data trends (ha) for NFR 3.D.c Farm-level agricultural operations including storage, handling and transport of agricultural products

Year/Activity data	ha
2000	5502443
2001	5874452
2002	5292608
2003	6370573
2004	6267177
2005	6711748
2006	6015346
2007	6422910
2008	6766070
2009	6317769
2010	7357786
2011	7466912
2012	7821665
2013	7800421
2014	8359262
2015	8328061
2016	8702268

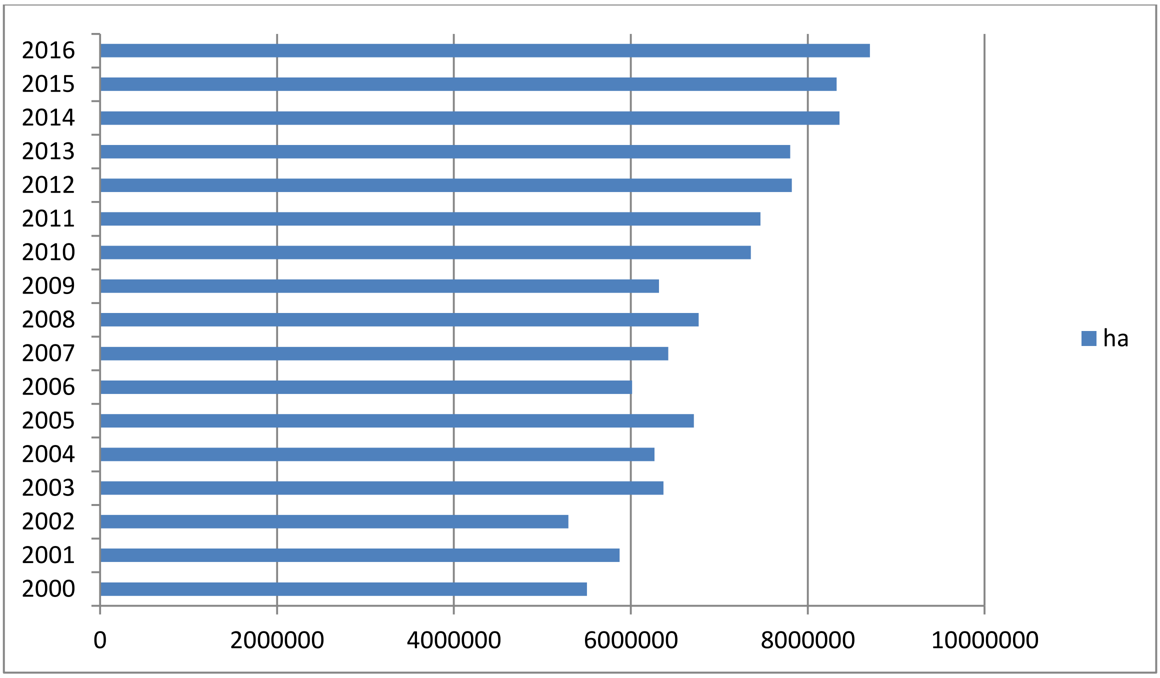


Figure 5.13.1 Activity data trends (ha) for NFR 3.D.c Farm-level agricultural operations including storage, handling and transport of agricultural products

Table 5.13.2 Emission trends (kt) for NFR 3.D.c Farm-level agricultural operations including storage, handling and transport of agricultural products

Year/Pollutant	$PM_{2.5}$	PM_{10}
2000	0.330	8.584
2001	0.352	9.164
2002	0.318	8.256
2003	0.382	9.938
2004	0.376	9.777
2005	0.403	10.470
2006	0.361	9.384
2007	0.385	10.020
2008	0.406	10.555
2009	0.379	9.856
2010	0.441	11.478
2011	0.448	11.648
2012	0.469	12.202
2013	0.468	12.169
2014	0.502	13.040
2015	0.500	12.992
2016	0.522	13.576

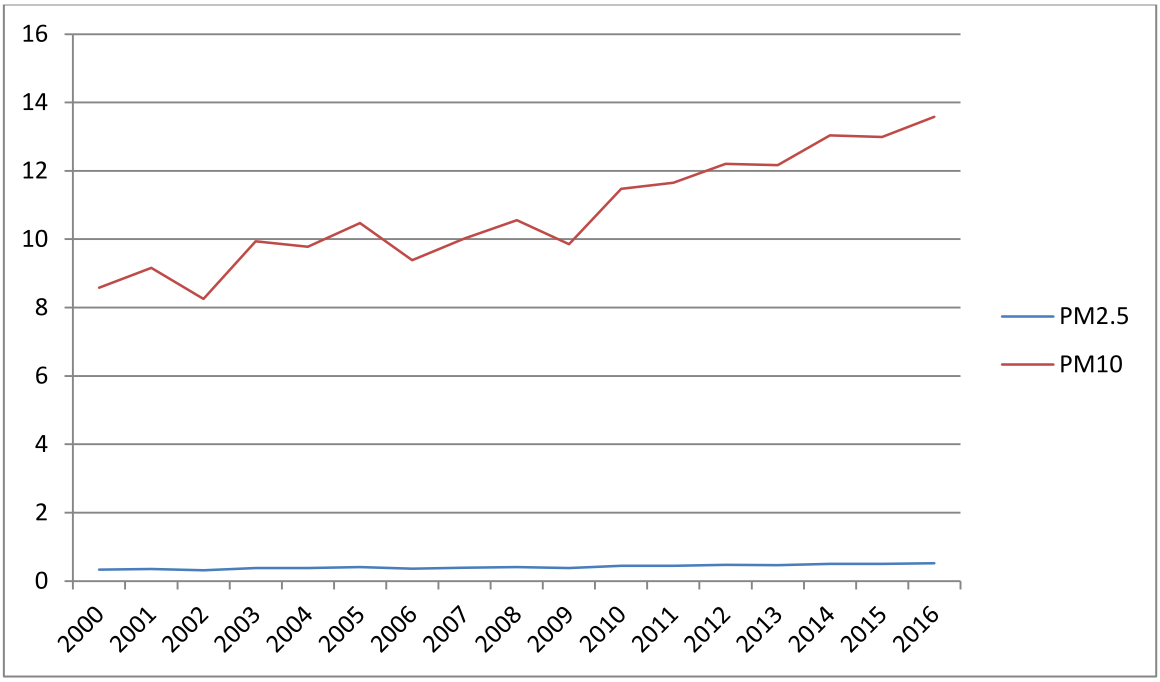


Figure 5.13.2 Emission trends (kt) for NFR 3.D.c Farm-level agricultural operations including storage, handling and transport of agricultural products

The emissions of particulate matter from farm-level agricultural operations follow the activity data trend.

The emissions of $PM_{2.5}$ and PM_{10} for farm-level agricultural operations including storage, handling and transport of agricultural products have been calculated using N.I.S. values for area of cultivated crops and the emissions factors using the Tier 1 methodology according to the 2016 EMEP/EEA Guidebook. The $PM_{2.5}$ and PM_{10} were considered under NFR 3.D.c following the TERT recommendations and a new factor has been considered for TSP. The recalculations were performed for all years in the time series, according the 2016 EMEP/EEA Guidebook.

5.14 NFR 3.D.e Cultivated crops

For the cultivated crops sector the emission of NMVOC were estimated, with a percent of 15.59% from the total NMVOC emissions in agriculture sector.

The emissions of NMVOC from cultivated crops were calculated by area of cultivated crops multiplied with the emission factor.

For the activity data, the area of cultivated crops was provided by the N.I.S..

The emission factors used are based on the 2016 EMEP/EEA Guidebook.

Table 5.14.1 Emission trends (kt) for NFR 3.D.e Cultivated crops

Year/Pollutant	NMVOC
2000	4.732
2001	5.052
2002	4.552
2003	5.479
2004	5.390
2005	5.772
2006	5.173
2007	5.524
2008	5.819
2009	5.433
2010	6.328
2011	6.422
2012	6.727
2013	6.708
2014	7.189
2015	7.162
2016	7.484

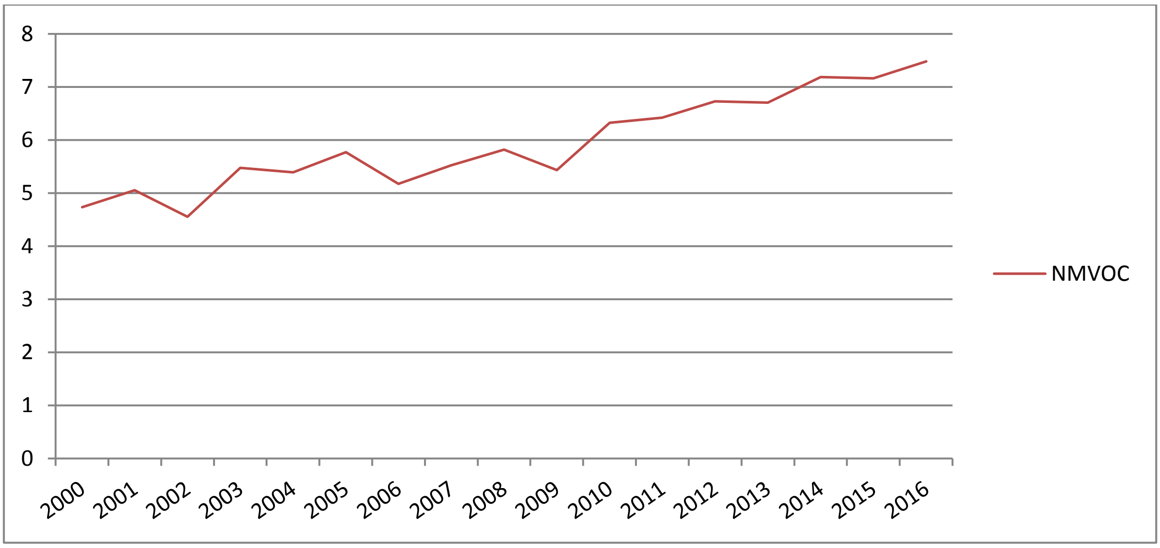


Figure 5.14.1 Emission trends (kt) for NFR 3.D.e Cultivated crops

The emissions of NMVOC from cultivated crops follow the activity data trend.

For this category the activity data represented by area of cultivated crops provided by N.I.S was used. The NMVOC was considered under NFR 3.D.e, following the TERT recommendations. The emissions have been calculated for all years in the time series according the Tier 1 methodology under the 2016 EMEP/EEA Guidebook.

5.15 NFR 3.F Field Burning of Agricultural Residues

The field burning of agricultural residues is a new estimated category and considered as an activity on a small scale in Romania, depending on the variation of cultivated areas. Includes data on different types of crops productions as: wheat, maize, barley, rye and other cereals. Emissions of NH_3, NOx, CO, NMVOC, SOx, PM, BC, heavy metals, dioxins, PAHs, HCB and PCBs are included under this NFR category 3.F. The general amount of the emissions contributes with less than 1% for the total emissions of the agriculture sector, except for PAH's, which represents 12.98% from total national emissions of PAH in 2016, listed as a key category.

The emissions from field burning of agricultural residues are calculated based on the amount of burnt straw given in tonnes dry matter and emission factors given in the 2016 EMEP/EEA Guidebook.

The areas of burnt fields were provided by the GHG (UNFCCC)- CRF database.

The emission factors used are based on 2016 EMEP/EEA Guidebook and a Tier 2 methodology (Table 3-3, Table 3-4,Table 3-5) has been used for each type of cereal. The ratio to calculate the mass of crop residue used the values from the Table 3-2 of the same Guidebook.

Table 5.15.1 Burnt areas (kha)

Year/Activity data	Burnt areas [k ha]
2000	1977.092
2001	1284.522
2002	1462.117
2003	1505.964
2004	1011.728
2005	1041.723
2006	1026.852
2007	1888.692
2008	967.715
2009	1080.976
2010	851.658
2011	806.629
2012	1425.853
2013	869.646
2014	826.589
2015	951.715
2016	846.249

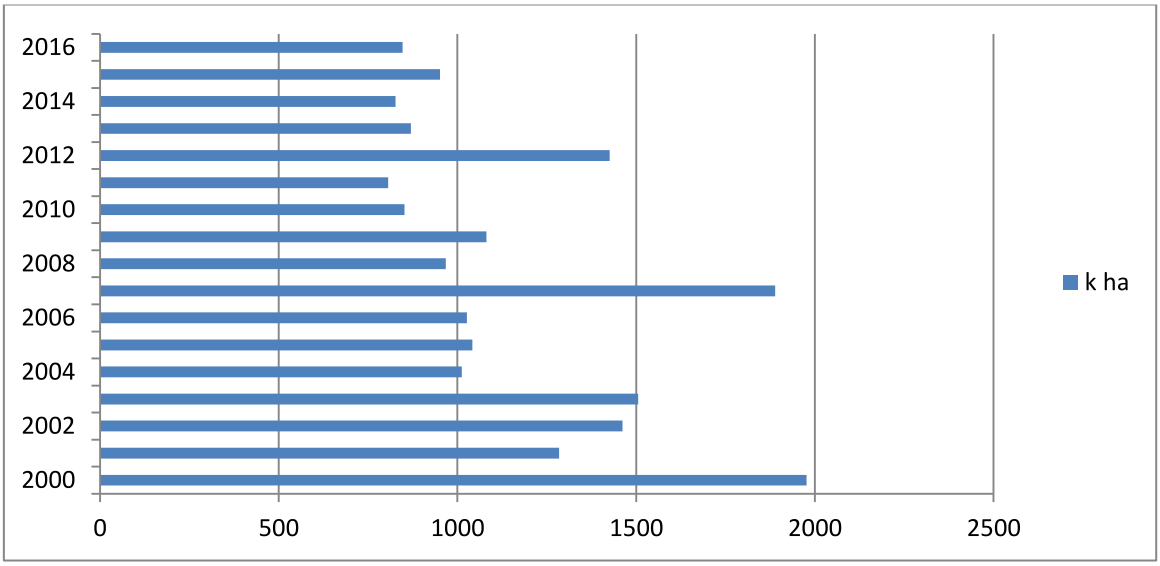


Figure 5.15.1 Burnt areas (kha)

Table 5.15.2 Emission trends (kt) for NFR 3.F Field Burning of Agricultural Residues

Year/Pollutant	Benzo(a)pyren (t)	Benzo(b) fluoranthene (t)	Benzo(k) fluoranthene (t)	Indeno (t)
2000	10.367	5.587	3.273	3.589
2001	5.906	3.281	1.898	2.062
2002	6.849	3.794	2.194	2.386
2003	8.447	4.483	2.645	2.914
2004	5.131	2.783	1.627	1.781
2005	4.592	2.577	1.485	1.608
2006	4.960	2.719	1.584	1.728
2007	9.149	5.015	2.699	3.026
2008	4.480	2.522	1.454	1.573
2009	4.737	2.668	1.532	1.658
2010	3.516	2.011	1.148	1.236
2011	3.923	2.151	1.251	1.364
2012	7.021	3.838	2.235	2.440
2013	3.991	2.221	1.283	1.393
2014	3.772	2.103	1.213	1.317
2015	4.467	2.471	1.431	1.557
2016	3.926	2.178	1.260	1.369

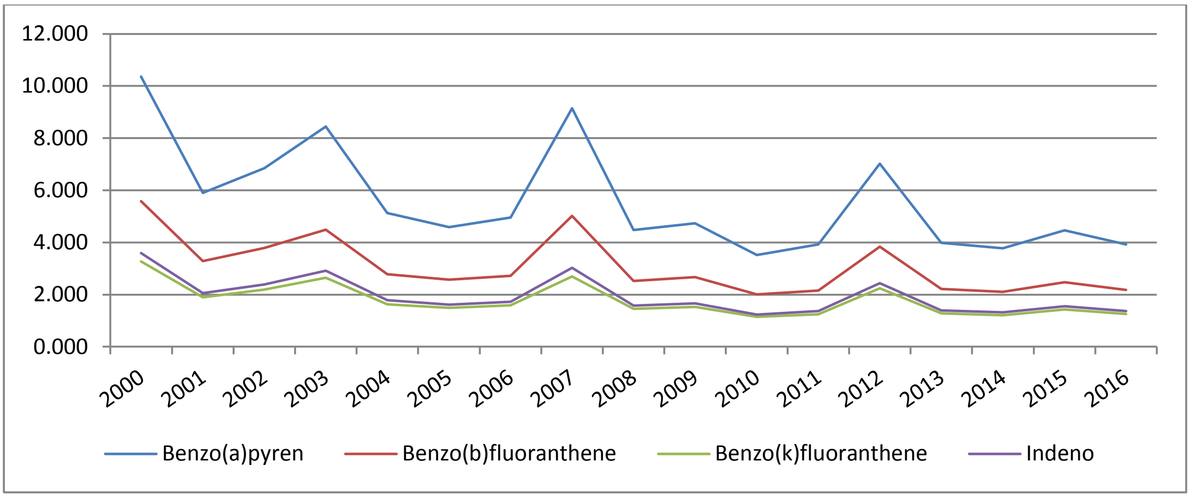


Figure 5.15.2 Emission trends (kt) for NFR 3.F Field Burning of Agricultural Residues

The emissions of PAHs from burnt areals follow the activity data trend.

For this category the activity data represented by burnt areals provided by GHG was used. After TERT review, the emissions have been calculated for all years in the time series according the Tier 2 methodology under the 2016 EMEP/EEA Guidebook.

6. NFR 5 –WASTE

This sector covers emissions from the solid wastes disposal on land, clinical and industrial wastes incineration, small scale waste burning and compost manufacturing.

6.1. NFR 5.A. Biological treatment of waste - Solid waste disposal on land

Activity data are the total CH_4 emissions from the IPCC inventory. Using the expert judgment it has been considered that 98.7% of the total CH_4 emissions are landfill gase.

The NMVOC emissions were recalculated for the period 2005-2016 using emission factors from the 2016 EMEP/EEA Guidebook. Also, for the first time the TSP, $PM_{2.5}$ and PM_{10} emissions were estimated and calculated for this NFR category using the emision factors in the 2016 EMEP/EEA Guidebook and following the Tier 1 methodology (Table 3-1). For the 2000-2004 period were used the information from GHG/IPCC inventory.

The emissions were calculated based on the Tier 1 methodology by applying the general equation:

Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant

- ARproduction is the activity rate (CH_4 in Gg)
- EFpollutant is the emission factor for each pollutant.

The emission factors used to calculate the emissions are from the 2016 EMEP/EEA Guidebook (Tier 1, Table 3.1).

The activity data is presented by the total CH_4 emissions from the GHG/IPCC inventory.

Table 6.1.1 Activity data trends (*CH_4 from annual deposition of MSW at the SWDS [Gg]*) for NFR 5.A Biological treatment of waste - Solid waste disposal on land

Year/Activity data	CH_4 (Gg)
2000	76.872
2001	82.242
2002	87.014
2003	92.810
2004	98.014
2005	102.603
2006	104.645
2007	111.380
2008	114.531
2009	118.820
2010	124.093
2011	103.950
2012	128.409
2013	140.325
2014	140.625
2015	140.606
2016	142.672

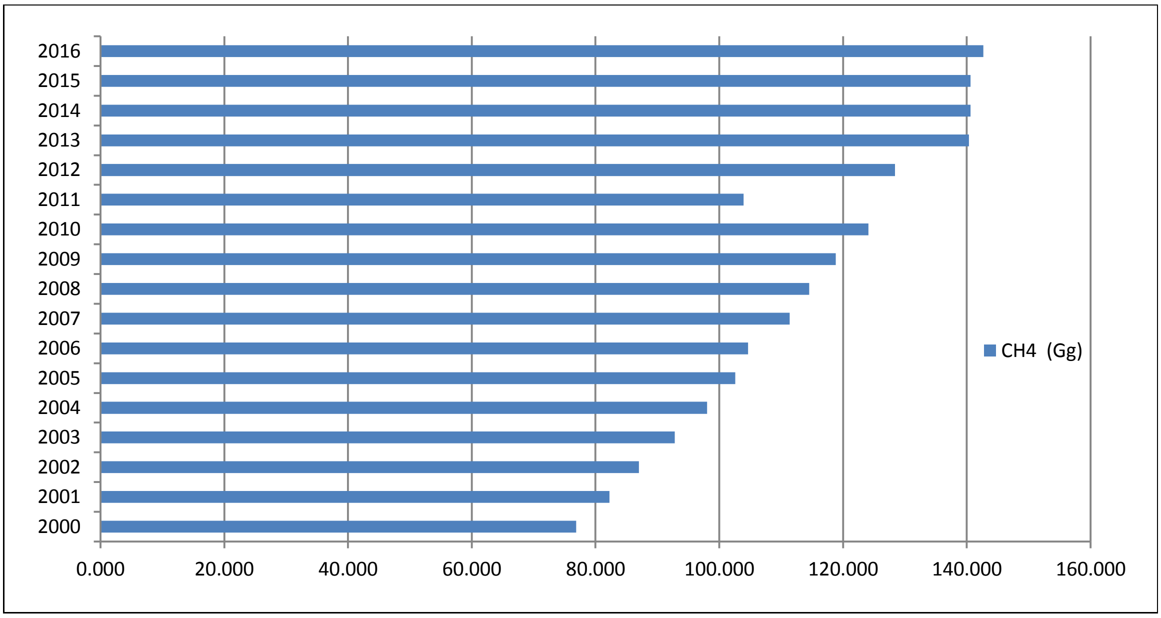


Figure 6.1.1 Activity data trends (*CH_4 from annual deposition of MSW at the SWDS [Gg]*) for NFR 5.A Biological treatment of waste - Solid waste disposal on land

Table 6.1.2 Emission trends (kt for NMVOC) for NFR 5.A Biological treatment of waste – Solid waste disposal on land

Year/Activity data	NMVOC (kt)
2000	1.012
2001	1.082
2002	1.146
2003	1.222
2004	1.291
2005	1.351
2006	1.378
2007	1.467
2008	1.509
2009	1.565
2010	1.634
2011	1.385
2012	1.691
2013	1.848
2014	1.852
2015	1.852
2016	1.879

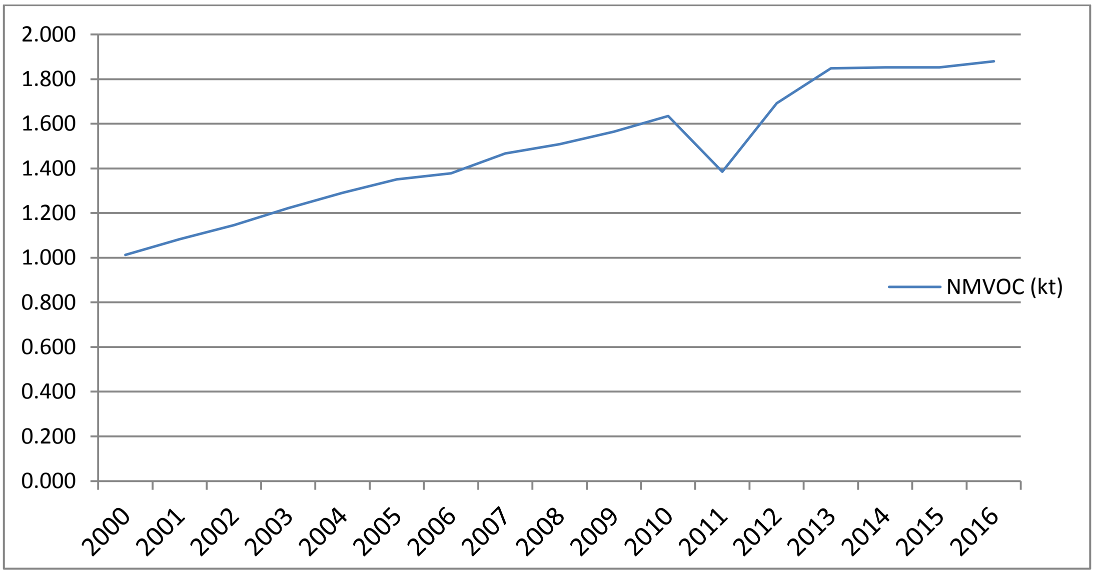


Figure 6.1.2 Emission trends (*kt for NMVOC*) for NFR 5.A Biological treatment of waste – Solid waste disposal on land

NMVOC emissions trend follows the activity data trend - total CH_4 emissions from the IPCC inventory. Comparated to the year 2000, in 2016 the NMVOC emissions increased by almost 85% due to increasing of solid waste disposal on land.

Table 6.1.3 Emission trends (*kt for PM 2.5, PM 10. TSP*) for NFR 5.A Biological treatment of waste – solid waste disposal on land

Year/Pollutant	PM 2.5 (kt)	PM 10 (kt)	TSP (kt)
2000	0.0000214	0.0001421	0.0003005
2001	0.0000229	0.0001521	0.0003215
2002	0.0000242	0.0001609	0.0003400
2003	0.0000259	0.0001716	0.0003628
2004	0.0000273	0.0001812	0.0003832
2005	0.0000286	0.0001897	0.0004011
2006	0.0000292	0.0001935	0.0004091
2007	0.0000310	0.0002059	0.0004354
2008	0.0000319	0.0002118	0.0004477
2009	0.0000331	0.0002197	0.0004645
2010	0.0000346	0.0002295	0.0004851
2011	0.0000293	0.0001944	0.0004109
2012	0.0000358	0.0002374	0.0005020
2013	0.0000391	0.0002595	0.0005486
2014	0.0000392	0.0002600	0.0005497
2015	0.0000392	0.0002600	0.0005496
2016	0.0000398	0.0002638	0.0005577

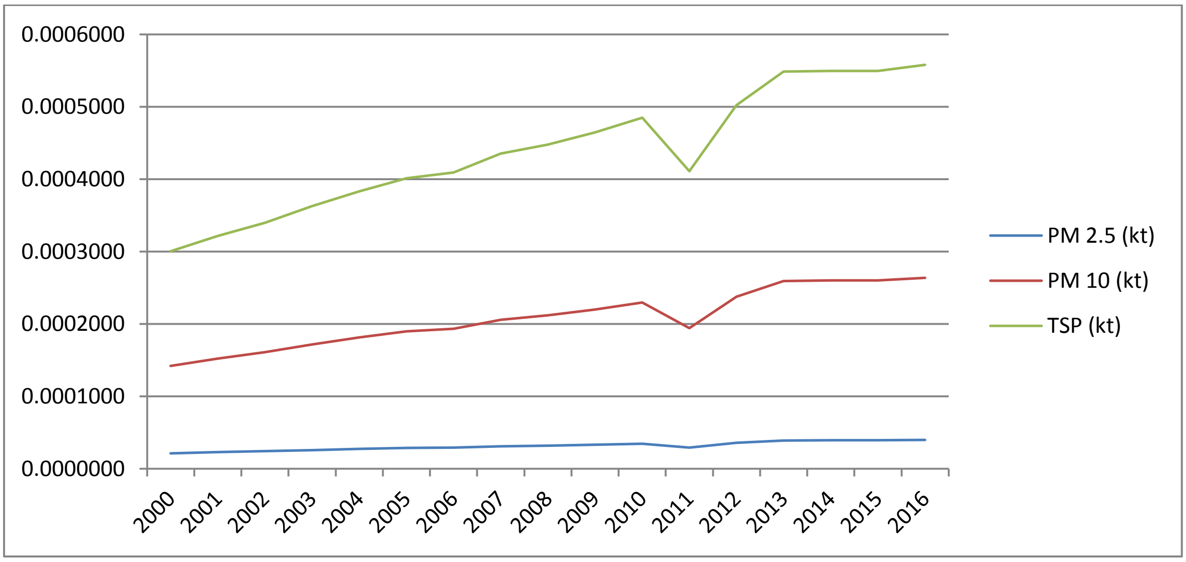


Figure 6.1.3 Emission trends (*kt for PM 2.5, PM 10. TSP*) for NFR 5.A Biological treatment of waste – solid waste disposal on land

The $PM_{2.5}$, PM_{10} and TSP emissions trend follows the activity data trend - total CH_4 emissions from the IPCC inventory.

6.2. NFR 5.C.1.b.i Industrial waste incineration

The emissions from industrial waste incinaration were calculated using the 2016 EMEP/EEA Guidebook (Tier 1 Table 3-1) for 2005-2016 period. There was no activity data for the 2000-2004 period.

The emissions were calculated based on Tier 1 methodology by applying the general equation:
Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate (industrial waste incinerated)
- EFpollutant is the emission factor for each pollutant

The emission factors used to calculate the emissions are from the 2016 EMEP/EEA Guidebook (Tier 1, Table 3-1).
The activity data is represented by the total industrial waste incinerated (in kt) from N.E.P.A.'s inventory.
The NFR 5.C.1.b.iii Clinical waste incineration was included under the NFR 5.C.1.b.i Industrial waste incineration.

Table 6.2.1 Activity data trends (*Waste incinerated [kt]*) for NFR 5.C.1.b.i Industrial waste incineration

Year/Activity data	***Waste incinerated [kt]***
2005	15.56
2006	216.34
2007	3.31
2008	4.00
2009	4.53
2010	33.32
2011	84.82
2012	102.94
2013	64.70
2014	18.45
2015	28.92
2016	28.92

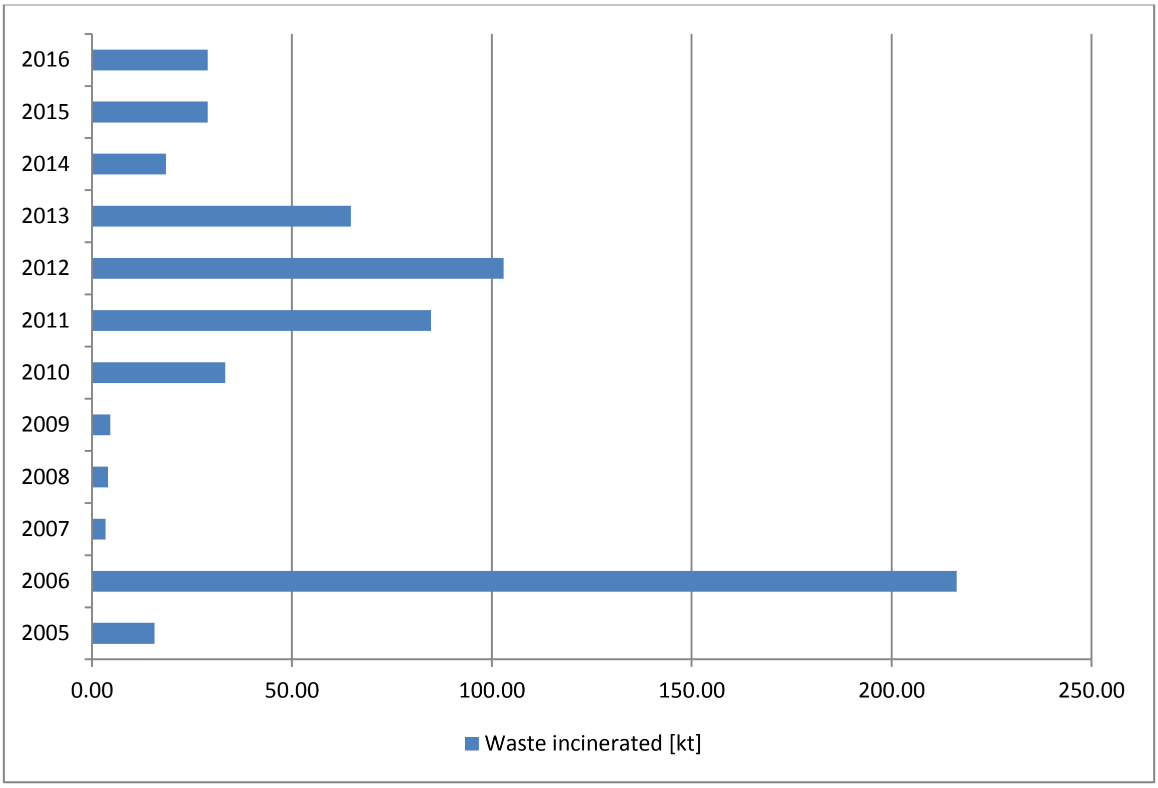


Figure 6.2.1 Activity data trends (*kt waste*) for NFR 5.C.1.b.i Industrial waste incineration

Table 6.2.2 Emission trends (*kt for NOx and NMVOC, t for Pb and g I-TEQ for dioxins*) for NFR 5.C.1.b.i Industrial waste incineration

Year/Pollutant	NOx (kt)	NMVOC (kt)	Pb (t)	PCDD/F (g I-TEQ)
2005	0.014	0.115	0.020	5.447
2006	0.188	1.601	0.281	75.718
2007	0.003	0.024	0.004	1.157
2008	0.003	0.030	0.005	1.401
2009	0.004	0.034	0.006	1.586
2010	0.029	0.247	0.043	11.662
2011	0.074	0.628	0.110	29.687
2012	0.090	0.762	0.134	36.029
2013	0.056	0.479	0.084	22.645
2014	0.016	0.137	0.024	6.459
2015	0.025	0.214	0.038	10.122
2016	0.025	0.214	0.038	10.122

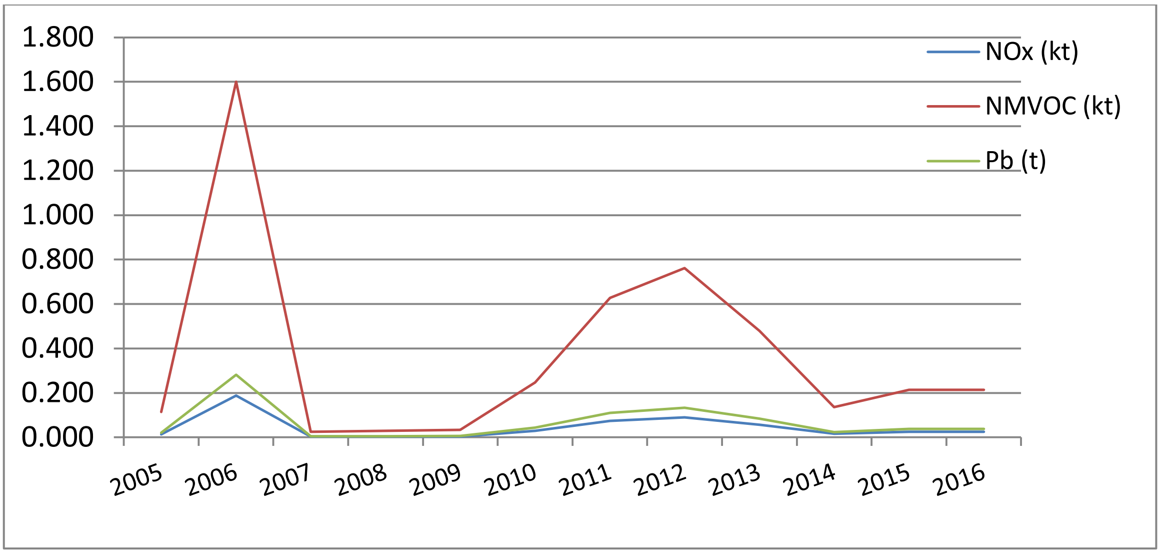


Figure 6.2.2.a. Emission trends (*Kt for NOx and NMVOC, t for Pb*)
for NFR 5.C.1.b.i Industrial waste incineration

Emission trends for NOx, NMVOC and Pb follow the waste incineration activity data trend.

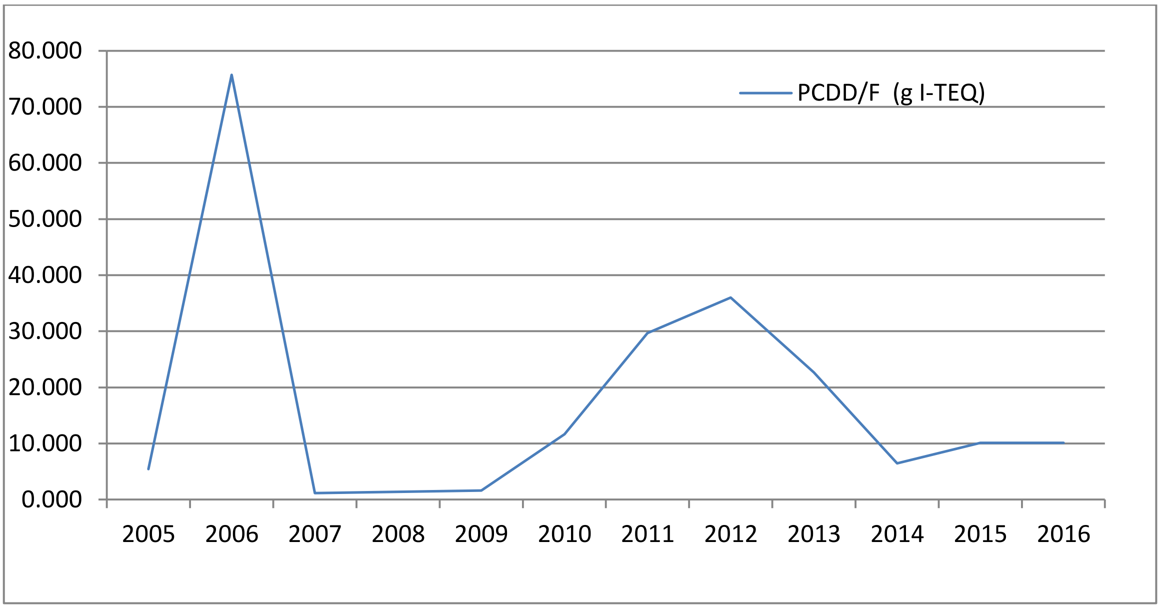


Figure 6.2.2.b. Emission trends (*g I-TEQ for PCDD/F*) for
NFR 5.C.1.b.i Industrial waste incineration

Emission trends for PCDD/F follow the waste incineration activity data trend.

All emissions trends follow the activity data trend – total amounts of incinerated industrial waste taken from NEPA`s waste inventory.

6.3. NFR 5.C.1.b.iii Clinical waste incineration

To aviod double counting of pollutant emissions, NFR 5.C.1.b.iii Clinical waste incineration was included under the NFR 5.C.1.b.i Industrial waste incineration.

6.4. NFR 5.C.2 Open Burning of Waste

This activity covers emissions from open burning of agricultural waste.

The emissions for NFR 5.C.2 were calculated for the 2005-2016 period using the 2016 Guidebook EMEP/EEA Tier 1 Table 3-1. There are no activity data for the 2000-2004 period.

Emissions are calculated based on Tier 1 applying the general equation:
Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate (amount of waste burned)
- EFpollutant is the emission factor for each pollutant

The emission factors used to calculate the emissions are from the 2016 EMEP/EEA Guidebook, Tier 1, Table 3-1.

Activity data for the amount of waste burned (in kt) is estimated by using statistical crops production data from the N.I.S.

Table 6.4.1 Activity data trends (*kt product*) for NFR 5.C.2 Small scale waste burning

Year/Activity data	Amount of waste burned (kt)
2005	144.713
2006	127.860
2007	128.230
2008	130.276
2009	132.061
2010	126.016
2011	130.618
2012	136.007
2013	135.530
2014	136.081
2015	136.590
2016	137.174

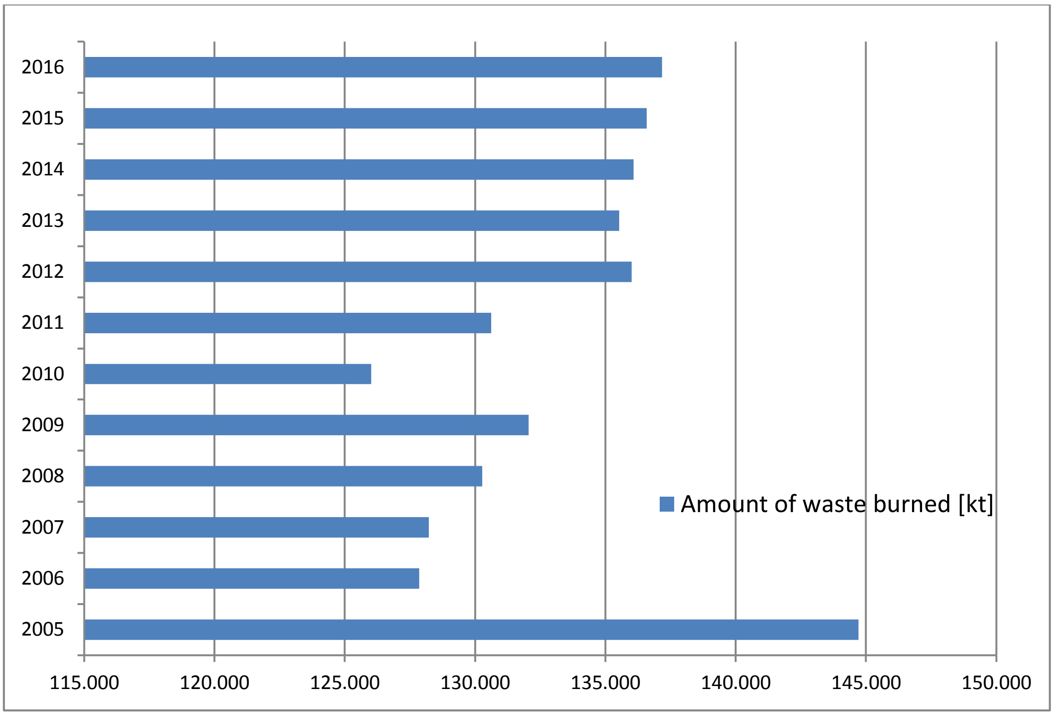


Figure 6.4.1 Activity data trends (*kt product*) for NFR 5.C.2 Small scale waste burning

Table 6.4.2 Emission trends (*kt for NMVOC, $PM_{2.5}$ and PM_{10}, g I-TEQfor PCDD/F and t for Total PAHs*) for NFR 5.C.2 Small scale waste burning

Year/Pollutant	NMVOC (kt)	$PM_{2.5}$ (kt)	PM_{10} (kt)	PCDD/F (g I-TEQ)	Total PAHs (t)
2005	0.1780	0.606	0.653	1.447	1.829
2006	0.1573	0.536	0.577	1.279	1.616
2007	0.1577	0.537	0.578	1.282	1.621
2008	0.1602	0.546	0.588	1.303	1.647
2009	0.1624	0.553	0.596	1.321	1.669
2010	0.1550	0.528	0.568	1.260	1.593
2011	0.1607	0.547	0.589	1.306	1.651
2012	0.1673	0.570	0.613	1.360	1.719
2013	0.1667	0.568	0.611	1.355	1.713
2014	0.1674	0.570	0.614	1.361	1.720
2015	0.1680	0.572	0.616	1.366	1.726
2016	0.1687	0.575	0.619	1.372	1.734

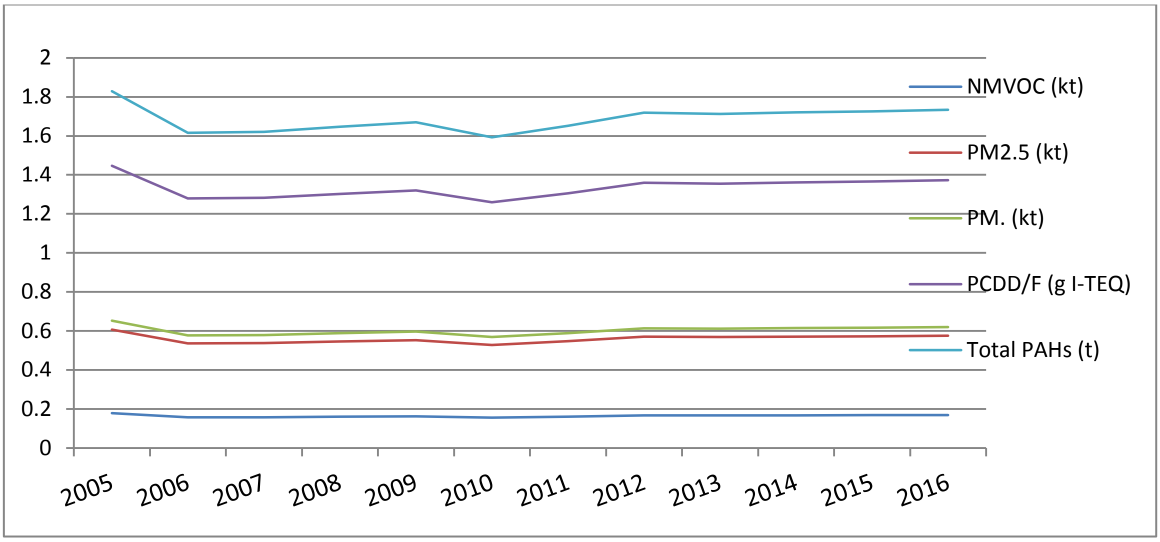


Figure 6.4.2 Emission trends (*kt for NMVOC, $PM_{2.5}$ and PM_{10}, g I-TEQ for PCDD/F and t for Total PAHs*) for NFR 5.C.2 Small scale waste burning

The emissions from this category (NMVOC, $PM_{2.5}$, PM_{10}, PCDD/F and Total PAHs) follow the activity data trend of NFR 5.C.2. Open Burning of Waste.
The NH_3 emissions from this category were not estimated (according to the 2016 EMEP/EEA Guidebook). There are no activity data for the 2000-2004 period.

6.5. NFR 5.B.1 Biological treatment of waste – Composting

This category includes emissions from the compost production.

The emissions for NFR 5.B.1 are NH_3 and were calculated for the 2005-2016 using the 2016 EMEP/EEA Guidebook Tier 2 Table 3-1. There are no activity data for the 2000-2004 period.
Emissions are calculated based on Tier 2 methodology and applies the general equation:
Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate (total quantity of compost produced)
- EFpollutant is the emission factor for this pollutant

The emission factors used to calculate the emissions are from the 2016 EMEP/EEA Guidebook, Tier 2, Table 3-1.
The activity data is represented by the total quantity of compost produced and is taken from waste related data collected by N.E.P.A.

Table 6.5.1 Activity data trends (kt compost) for NFR 5.B.1
Biological treatment of waste – Composting

Year/Activity data	Kt compost
2005	0.220
2006	0.325
2007	2.344
2008	2.360
2009	2.920
2010	1.214
2011	15.095
2012	20.553
2013	30.328
2014	17.150
2015	36.826
2016	50.841

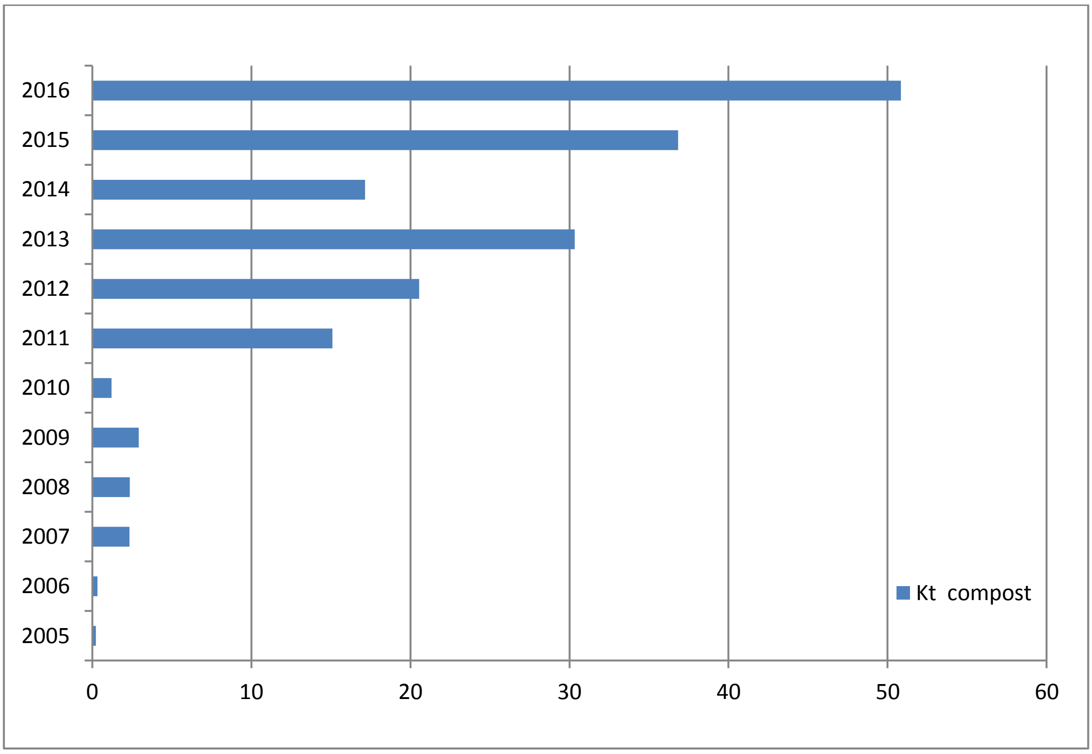


Figure 6.5.1 Activity data trends *(kt compost)* for NFR 5.B.1
Biological treatment of waste – Composting

Table 6.5.2 Emission trends *(kt for NH_3)* for NFR 5.B.1
Biological treatment of waste – Composting.

Year/Pollutant	**NH_3**
2005	0.00005
2006	0.00008
2007	0.00008
2008	0.00057
2009	0.00070
2010	0.00029
2011	0.00362
2012	0.00493
2013	0.00728
2014	0.00410
2015	0.00884
2016	0.01220

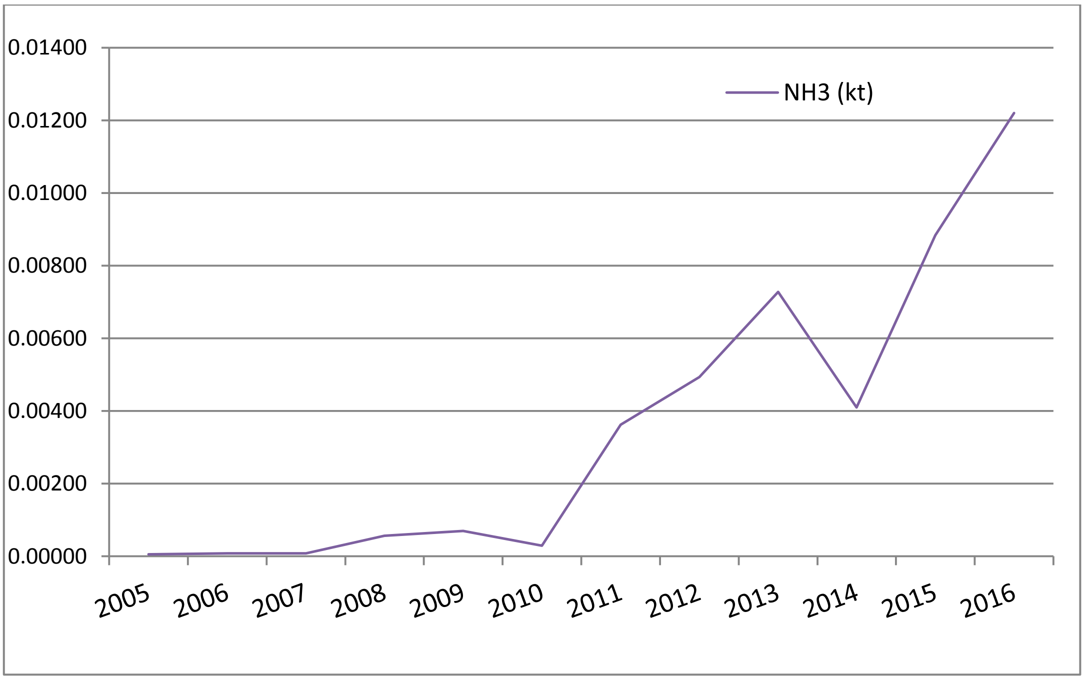


Figure 6.5.2 Emission trends (*kt for NH_3*) NFR 5.B.1
Biological treatment of waste – Composting

The NH_3 emissions from compost production follow the activity data trend.

6.6. NFR 5.D.3 Wastewater handling Latrines

Activities from NFR 5.D.3 includes SNAP 0910 - water handling and SNAP 091007-latrines. The pollutant emissions have been estimated for first time: NMVOC for NFR 5.D.3.-water handling and NH_3 for NFR 5.D.3.-latrines.

NFR 5.D.3. - SNAP 0910 - water handling

The emissions were calculated based on Tier 1 methodology applying the general equation:
Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate (total water handling in 1000mc)
- EFpollutant is the emission factor for this pollutant

The emission factors used to calculate the NMVOC emissions are from the 2016 EMEP/EEA Guidebook, Tier 1, Table 3-1.
The activity data is represented by the water handling taken from the A.N.A.R. There are no activity data for the 2000-2004 period. Further research and information is needed.

NFR 5.D.3. - SNAP 091007 - latrines

The emissions are calculated based on the Tier 2 methodology applyinf the general equation:
Epollutant = ARproduction× EFpollutant where:

- Epollutant is the emission of the specified pollutant
- ARproduction is the activity rate (latrines)
- EFpollutant is the emission factor for this pollutant

The emission factors used to calculate the NH_3 emissions are from the 2016 EMEP/EEA Guidebook, Tier 2, Table 3-1.
The activity data for the NFR 5.D.3. - latrines have been calculated using as a work algorithm percent of the population using latrines. Activity data represents the difference between the total population and the population served by the public water supply system, which decreases by 10% percent (the population using septic tanks). The population statistics data is estimated by using statistical data from N.I.S.

There are no activity data for the 2000-2004 period.

The NH_3 polutant is the key source for NFR 5.D.3 Wastewater handling. Latrines and represents 5.84% of total national NH_3 emissions for the year 2016.

Table 6.6.1 Activity data trends (*waste water handling-1000 m3*) for NFR 5.D.3 Wastewater handling

Year/Activity data	***Waste water handling [1000m3]***
2005	1432288.00
2006	1230988.00
2007	1417751.00
2008	1249768.00
2009	1394457.00
2010	1291500.00
2011	1471220.00
2012	1577620.00
2013	1977613.00
2014	1581360.13
2015	1578513.36
2016	1619318.61

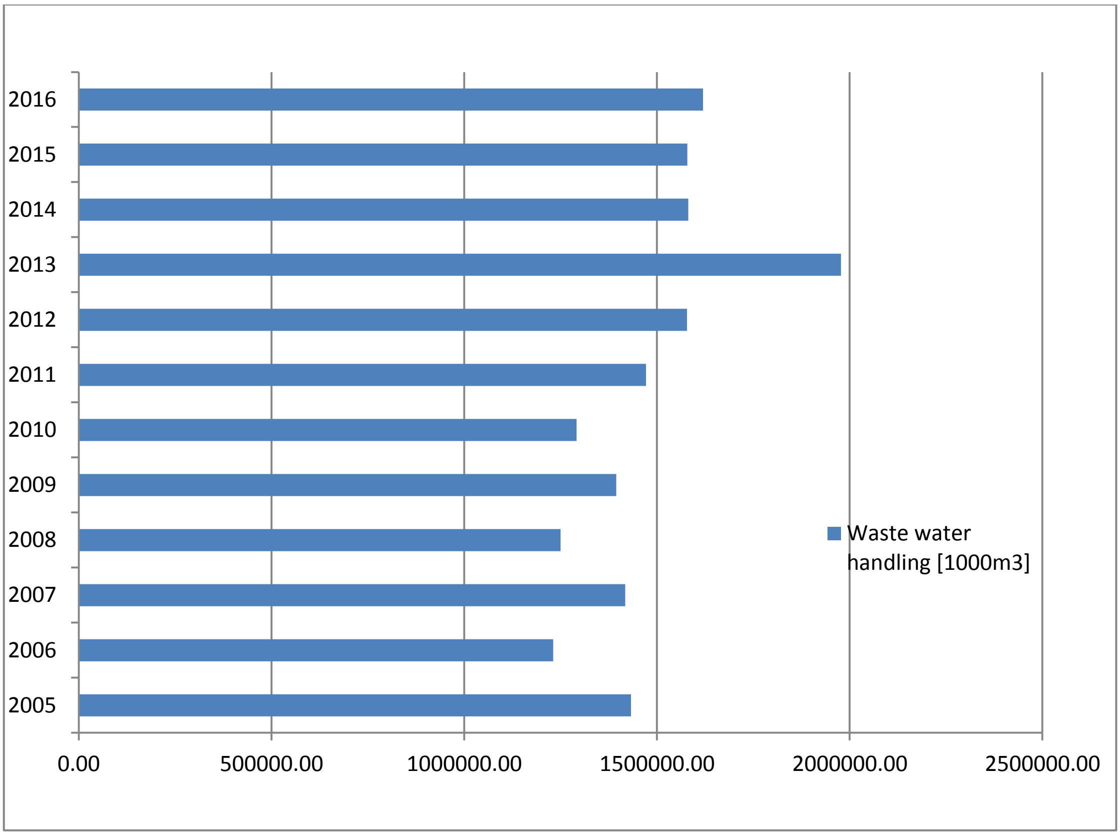


Figure 6.6.1 Activity data trends (*water handling 1000 m3*) for NFR 5.D.3 Wastewater handling

Table 6.6.2 Emission trends *(kt for NMVOC*) for NFR 5.D.3 Wastewater handling

Year/Pollutant	NMVOC (kt)
2005	0.0215
2006	0.0185
2007	0.0213
2008	0.0187
2009	0.0209
2010	0.0194
2011	0.0221
2012	0.0237
2013	0.0297
2014	0.0237
2015	0.0237
2016	0.0243

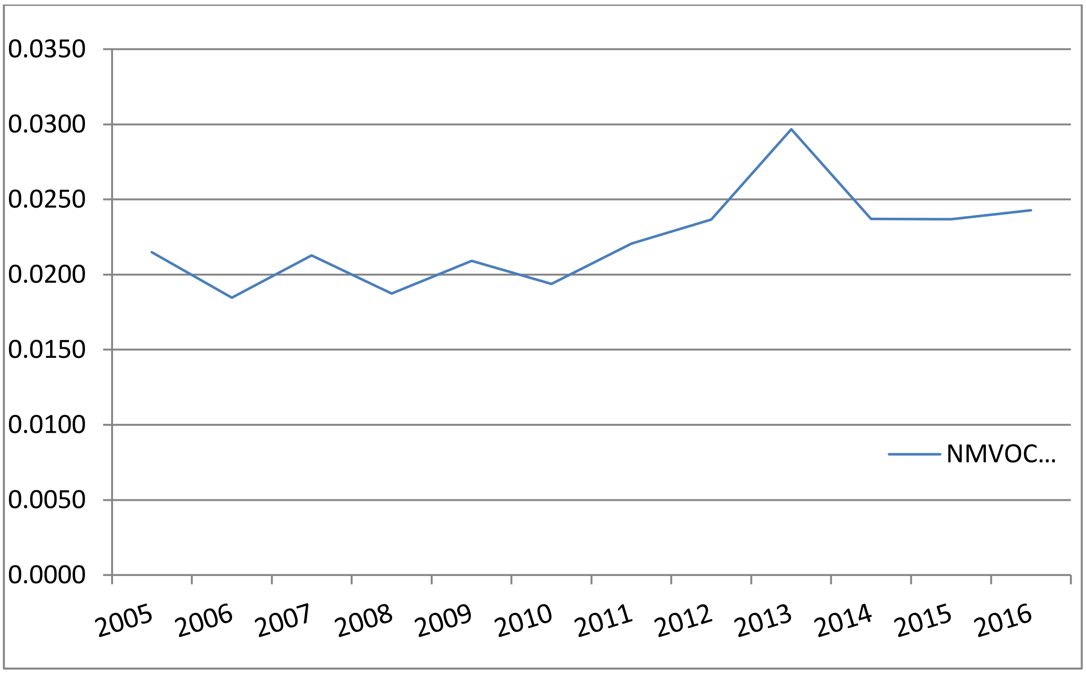


Figure 6.6.2 Emission trends (*kt for NMVOC*) for NFR 5.D.3 Wastewater handling

The NMVOC emissions from NFR 5.D.3 - wastewater handling follow the activity data trend.

Table 6.6.3 Activity data trends (*caput*) for NFR 5.D.3
Wastewater handling-Latrines

Year/Activity data	*Latrines [caput]*
2005	8600000.00
2006	8400000.00
2007	8200000.00
2008	8193253.00
2009	7653770.00
2010	7441243.00
2011	7205791.00
2012	7124867.00
2013	6910981.00
2014	6674164.00
2015	6412994.10
2016	6112116.00

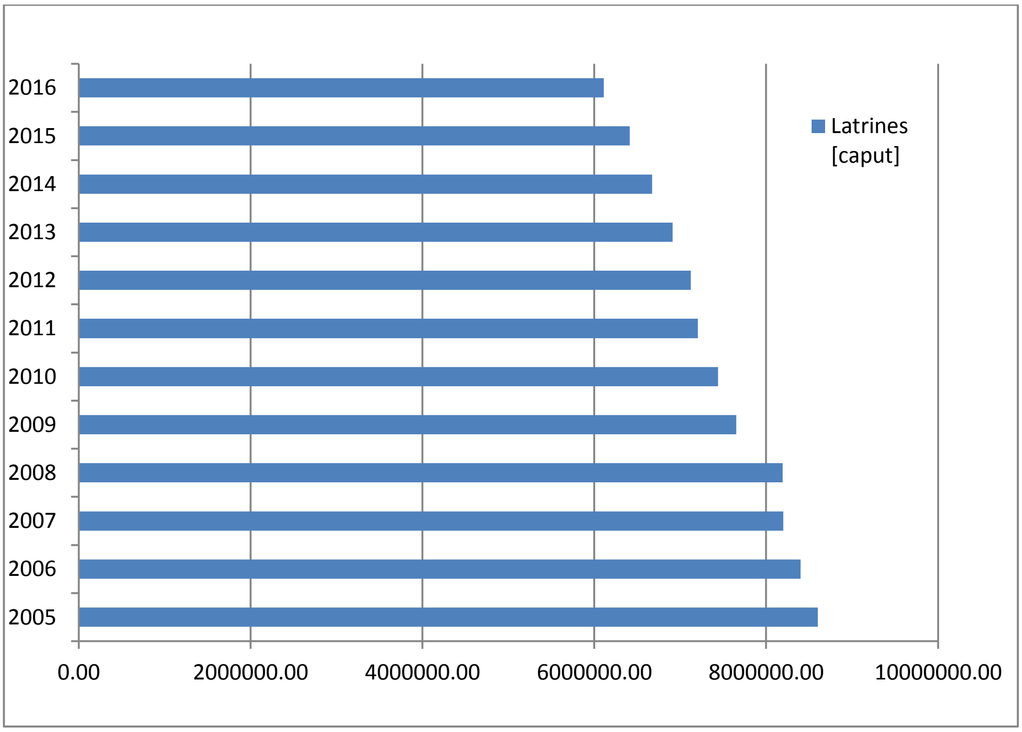


Figure 6.6.3 Activity data trends (*caput*) for NFR 5.D.3
Wastewater handling-Latrines

Table 6.6.4 Emission trends (*kt for NH_3*) for NFR 5.D.3
Wastewater handling-Latrines

Year/Pollutant	**NH_3 (kt)**
2005	13.76
2006	13.44
2007	13.12
2008	13.11
2009	12.25
2010	11.91
2011	11.53
2012	11.40
2013	11.06
2014	10.68
2015	10.26
2016	9.78

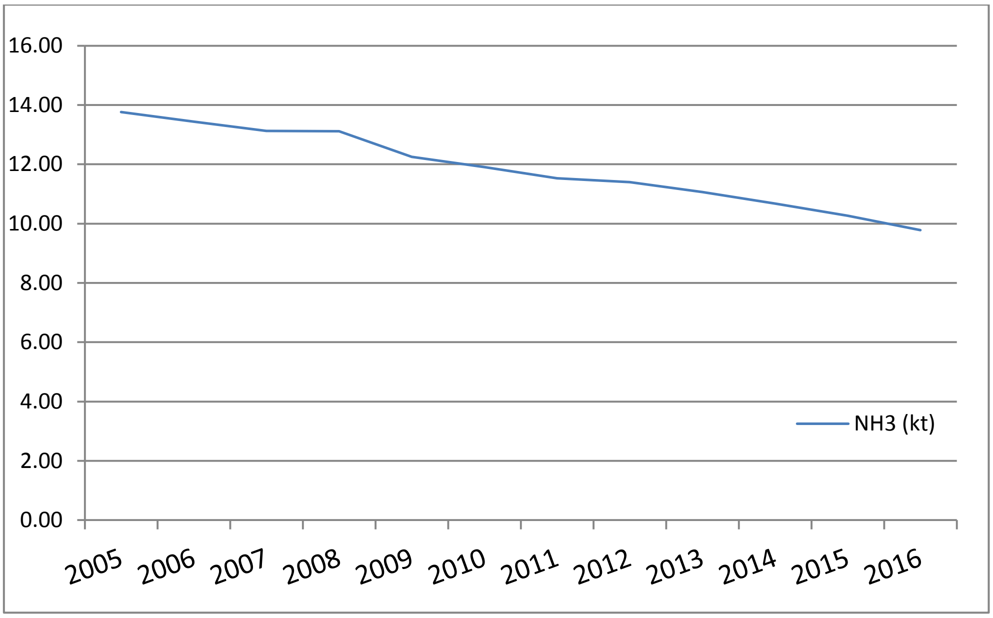


Figure 6.6.4 Emission trends (*kt for NH_3*) for NFR 5.D.3
Wastewater handling-Latrines

The NH_3 emissions from NFR 5.D.3. - latrines follow the activity data trend.

7. RECALCULATIONS AND IMPROVEMENTS

The main objective of recalculation is to improve the emissions inventory and the quality of reports.

Following the Emission Inventory Review in 2017, large part of recommendations from TERT were assessed and implemented. Further research is necessary to gather the data and information necessary to implement the remaining recommendations.

Significant improvements are expected to be developed on the following categories:

- NFR 1.A.2 Stationary combustion in manufacturing industries and construction - by spliting the fuel consumption and emissions, on the specific industries included under this category;
- NFR 1.A.5 Other stationary – by spliting from NFR 1.A.4 category, based on Eurostat energy balances;
- NFR 1.A.4.aii and 1.A.4.bii, Off road mobile sources and machineries - by spliting from NFR 1.A.4.ai and NFR 1.A.4.bi respectively;
- NFR 1.A.3.b Road transport – by using the last version of COPERT (5);
- NFR 2.A.3 Glass Production – by updating to Tier 2 level assessment;
- NFR 2.B.2 Nitric Acid Production – by updating to Tier 2 level assessment;
- NFR 3.B Manure Management – by updating to Tier 2 level assessment for NMVOC.

The present report includes the first version calculations for the timeseries 2000-2004.

Below, the recommendations from TERT, considering revised estimates (RE) and comments, are presented:

Observation	Key Category	NFR, Pollutant(s), Year(s)	Recommendation	RE or TC	Comments
RO-0A-2017-0001	No	0A National Total - National Total for the Entire Territory - Based on Fuel Sold/Fuel Used, SOx, NOx, NH3, NMVOC, PM2.5, 2000-2015	For 0A National Total - National Total for the Entire Territory - Fuel Sold/Fuel Used, SOx, NOx, NH3, NMVOC, PM2.5, 2000-2015, the TERT notes that Romania has not estimated the memo item 1A3 Transport (fuel used). This information is useful for determining the potential differences (under- or over-estimation of emissions resulting from estimates based on fuel consumption (used). Although non-mandatory, the TERT encourages Romania to include the non-fuel sold adjusted estimates from COPERT based on vehicle mileage (vehicle kilometres) and aviation activity plus all other 1A3 estimates in the memo item. During the country visit 2-3 November 2017 the TERT provided some additional advice on this sector (see annex II below).	no	further analysis
RO-0A-2017-0002	No	0A National Total - National Total for the Entire Territory - Based on Fuel Sold/Fuel	For 6A Other, the TERT notes that Romania have used a range of notation keys (e.g. 'NE' for NOX, NMVOC, SOX, NH3 and 'NA' for PM2.5). During the review, Romania indicated that it does not expect to have significant emissions for 6A.	no	NA notation key

		Used, SOx, NOx, NH3, NMVOC, PM2.5, 2000-2015	The TERT recommends that Romania review the use of notation keys and apply the appropriate notation keys ('NE', 'NO', 'IE' according to the definitions in the 2016 EMEP/EEA Guidebook) for the next submission. The TERT also recommends that Romania provide a short explanation where notation 'NE' is used to justify that it is not a significant source of emission.		
RO-1A1-2017-0001	Yes	1A1 Energy Production, SOx, NOx, PM2.5, 2005-2015	For NFR 1A1 Energy Production and 1A2 Stationary Combustion in Manufacturing Industries and Construction, for years 2005-2015, the TERT noted that Romania is estimating NOx, SOx and TSP emissions using annual emissions reported by operators on the basis of stack measurements. When continuous measurements are used to estimate annual emissions, there is a risk that operators have misinterpreted the IED and have used validated average values (after having subtracted the value of the confidence interval) although this subtraction must not be applied in the context of reporting annual emissions. In response to a question raised during the review, Romania stated that emission measurements are done by operators according to requirements in the Directive 2010/75/EU (IED) – Annex 5, part 3. In the opinion of the TERT, bottom-up data based on the "validated average values" defined in the IED cannot be used by the inventory team without adjustment in the framework of a national inventory. The TERT notes that this issue relates to an under-estimate, which could correspond to 20% of SOX, 20% of NOX, 30% of dust of the sector (depending on the fraction of the operators subtracting confidence interval). During the country visit 2-3 November 2017 the TERT provided some additional advice on this sector (see annex II below). The TERT recommend that Romania organise a survey among operators to determine if there is under-reporting and if applicable to derive a methodology to adjust the national emissions over the time series in order to correct for any under reporting.	no	To be further analysed, including by Commission experts
RO-1A1a-2017-0001	Yes	1A1a Public Electricity and Heat Production, SOX, NOX, NH3, NMVOC, PM2.5, 2005-2015	The TERT noted, for NFR 1A1a Public Electricity and Heat Production, for all years that fuel consumption in the NFR tables are not comparable with Eurostat data (important discrepancies are observed when comparing reported activity in NFR tables (1A1a) with Eurostat data (Main activity producer plants (electricity/CHP/Heat only) and own use in electricity, CHP and heat plants)). In response to a question raised during the review, Romania explained that all data from LCP reports (installations >50MW) are considered in the inventory. The TERT concluded that there may be an underestimate if fuel consumption from installations <50MW are not taken into account in the inventory. Romania did not provide a revised estimate to take into account these installations or any other justification indicating the completeness of the inventory for NFR 1A1a. The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends that Romania checks if all fuel consumption is taken into account in NFR 1A1a for the next submission. To do so, the TERT recommends that Romania compares fuels consumption from LCP reports with the national energy balance and/or Eurostat energy balance (please be careful of the fuel group definitions (see Eurostat/IEA energy statistics manual, e.g. LPG is a liquid fuel) and considers estimating emissions for any remaining fuel consumption (the difference between the LCP consumption and the energy balance totals). During the country visit 2-3 November 2017 the TERT provided some additional advice on this sector (see annex II below).	no	recalculated, section 3.2
RO-1A1c-2017-0001	No	1A1c Manufacture of Solid Fuel and Other Energy Industries, SOX, NOX, NH3, NMVOC, PM2.5, 2005-2015	For 1A1c Manufacture of Solid Fuel and Other Energy Industries, SOX, NOX, NH3, NMVOC, PM2.5, Solid fuels, 2005-2015, Romania states in its IIR (page 30) that emissions cover 'fugitive emissions from coke production' whereas NFR 1A1c should cover combustion emissions in manufacture of solid fuel. The TERT noted that emissions are also reported in NFR 1B1b Fugitive Emission from Solid Fuels: Solid Fuel Transformation. In response to a question raised during the review, Romania explained that the statement in the IIR, section 1A1c, is not valid and	no	recalculated, section 3.4

			that Romania applies the methodology and EF provided by the 2016 EMEP/EEA Guidebook which ensures that there is no double-counting. Romania also stated that the IIR will be corrected for the next submission. The TERT accepts the explanation provided by Romania. The TERT notes that this issue does not relate to an over- or under-estimate and recommends that Romania includes correct information in the next submission of its IIR.		
RO-1A2-2017-0001	Yes	1A2 Stationary Combustion in Manufacturing Industries and Construction, SOX, NOX, NH3, NMVOC, PM2.5, 2005-2015	For 1A2 Stationary Combustion in Manufacturing Industries and Construction, SOX, NOX, NH3, NMVOC, PM2.5, 2005-2015 for combustion in Industry, Romania reports emissions for NFR 1A2a, 1A2b and 1A2f. The other NFR relating to combustion in Industry are 'IE'. In the IIR, there is no explanation in which NFR emissions are included. In response to a question raised during the review, Romania provided a file giving details on activity data type and source and on emission factors for sub-categories in NFR 1A2. Romania also explained that emissions from industries with 'IE' notation key are included in NFR 1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-Metallic Minerals. The TERT acknowledged the explanation provided by Romania. The TERT noted that the issue does not relate to an over or underestimation and recommends that Romania considers reallocate 'other stationary combustion in industry' to NFR 1A2gviii Stationary Combustion in Manufacturing Industries and Construction: Other instead of NFR 1A2f in future submissions.	no	recalculated, section 3.5-3.6
RO-1A3ai(ii)-2017-0001	No	1A3ai(ii) International Aviation Cruise (Civil) - Memo Item, SOX, NOX, NH3, NMVOC, PM2.5, 2000 - 2015	For 1A3ai(ii) International Aviation Cruise (Civil) - Memo Item and 1A3aii(ii) Domestic Aviation Cruise (Civil) - Memo Item, SOX, NOX, NH3, NMVOC, PM2.5, for 2000-2015 the TERT noted that there was an under estimate of emissions as 'NE' was reported for all years for both sectors. In response to a question raised during the review, Romania provided revised estimates for 2000 - 2015 and stated that it will be included in the next submission. The TERT agreed with the revised estimates provided by Romania. The TERT recommends that Romania include the revised estimate in its next submission.	RE	provide time series 2005÷2016, section 3.12
RO-1A3biv-2017-0001	No	1A3biv Road Transport: Mopeds & Motorcycles, SOX, 2005, 2010, 2015	For category 1A3biv Road Transport: Mopeds & Motorcycles and pollutant SOX for years 2005, 2010 and 2015 the TERT noted that even though in the 2016 EMEP/EEA Guidebook a method for calculating SOX emissions is provided, Romania has reported zero emissions. In response to a question raised during the review, Romania explained that all road transport emissions have been calculated using COPERT4 v4.11 and exported to the reporting format using the relevant export option of the software. Romania also explained that the fuel sulphur content is very low and the mopeds/motorcycles fleet is very small, and hence SOX emissions from this category are low and do not have a significant impact on SOX national totals. The TERT agreed with the explanation provided by Romania and noted that the issue is below the threshold of significance for technical correction. The TERT recommends that Romania include an estimate and transparent description of the method, data sources and assumptions in its next submission.	no	section 3.13
RO-1A3bvi-2017-0001	No	1A3bvi Road Transport: Automobile Tyre and Brake Wear, PM2.5, 2005-2015	For category 1A3bvi Road Transport: Automobile Tyre and Brake Wear and pollutant PM2.5 for years 2005-2015 the TERT noted that in the NFR tables the activity data are reported as 'NE', whereas emissions are calculated. In response to a question raised during the review, Romania explained that all emissions are calculated using COPERT4 V4.11 and that the notation key 'NE' is assigned by the software. The TERT agreed with the explanation provided by Romania and noted that the issue is below the threshold of significance for technical correction. The TERT recommends that Romania use COPERT5 in the next submission, since it is the latest available version of the software which enables calculation of estimates of Automobile Tyre and Brake Wear.	no	calculated with Tier 1 methodology section 3.13, planned improvements Copert V

RO-1A3bvii-2017-0001	No	1A3bvii Road Transport: Automobile Road Abrasion, PM2.5, 2005, 2010, 2015	For category 1A3bvii Road Transport: Automobile Road Abrasion and pollutant PM2.5 for years 2005-2015 the TERT noted that Romania has not estimated emissions and used the notation key 'NE'. In response to a question raised during the review, Romania provided revised estimates for years 2005, 2010 and 2015 and stated that these estimates will be included in the next submission. The TERT agreed with the revised estimate provided by Romania. The TERT recommends that Romania include the revised estimate in its next submission.	RE	calculated with Tier 1 methodology section 3.13
RO-1A3c-2017-0003	No	1A3c Railways, SOX, NOX, 2005-2015	For 1A3c Railways, SOX, 2005 - 2015 the TERT noted that there were no SOX emission estimates reported. In response to a question raised during the review, Romania provided revised estimates for the years 2005 - 2015 and stated that these estimates will be included in the next submission. The TERT agreed with the revised estimate provided by Romania. The TERT recommends that Romania include the revised estimate in its next submission.	RE	calculated with tier 1 methodology section 3.14
RO-1A3di(ii)-2017-0001	No	1A3di(ii) International Inland Waterways, SOX, NOX, 2005-2015	For 1A3di(ii) International Inland Waterways NOX, SOX, 2005 - 2015 in response to a question raised during the review on whether emissions from this sector had been estimated or not, Romania explained that their statistics only contain data for domestic and not international navigation and were unsure how to obtain fuel consumption data for the latter. The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends that emissions from inland waterways are included in the next submission. The distinction between domestic and international can be approximated by fuel sales with and without national taxes. Bunker fuels are often considered to be international (sea ships as well as inland ships). During the country visit 2-3 November 2017 the TERT provided some additional advice on this sector (see annex II below).	no	calculated section 3.15
RO-1A4ai-2017-0001	No	1A4ai Commercial/Institutional: Stationary, NH3, 2010	The TERT noted in 2010 NFR table, for category 1A4ai Commercial/Institutional: Stationary, that NH3 emissions are reported as 'NE'. The TERT also noted that for all other years of the period 2005-2015, NH3 emissions for this category have been estimated in the NFR tables and thus understands that Romania has a methodology to estimate these emissions. In response to a question raised during the review, Romania explained that it was just a typing error in the reporting table and provided the NH3 emission for 2010. The TERT agreed with the revised estimate provided by Romania. The TERT notes that the revised estimate is under the threshold of significance for 2010. The TERT recommends that Romania includes the revised estimate in its next submission.	RE	resolved; recalculated; section 3.8
RO-1A4aii-2017-0001	No	1A4aii Commercial/Institutional: Mobile, SOX, NOX, 2005-2015	For 1A4aii Commercial/Institutional: Mobile NOX, SOX, NMVOC, NH3 and PM2.5, 2005 - 2015, in response to a question raised during the review Romania explained that emissions from this source were included in 1A4ai Commercial/Institutional: Stationary. The TERT noted that the emission factors applied to this fuel when used in mobile machinery is often significantly different than for stationary sources due to the variable load conditions of mobile engines and the higher regulation of sulphur contents for mobile fuels. The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends that emissions from this source should be reported separately in the next submission.	no	planned improvement
RO-1A4bi-2017-0001	Yes	1A4bi Residential: Stationary, NOX, NH3, NMVOC, PM2.5, 2005-2015	For 1A4bi Residential: Stationary, NOX, NH3, NMVOC, PM2.5, 2005-2015, the TERT noted that it is a key category for several pollutants (NOX, NMVOC, PM2.5, NH3) and that the IIR states that a Tier 1 methodology is applied (page 44). It is also mentioned on page 48 that using a Tier 2 methodology is not yet feasible. The TERT notes that it is good practice to move to higher tier methodology when a source is a key category. This recommendation has already been mentioned in CLRTAP in-depth review of Romania in 2013 (number 54). In response to a question raised during the review, Romania explained that following Ministry	no	Tier 2 for biomass burning implemented section 3.9

			order no. 3299/2012 which is in force since 2013, data have been collected from population and housing census as input to air quality modelling. Further data processing is in progress in order to upgrade to Tier 2 methodology. Romania stated that for the next submission, they will recalculate the emissions starting with year 2012. The TERT acknowledged the explanation provided by Romania. The TERT notes that this issue does not relate to an over- or under-estimate and recommends that Romania keeps up its work to improve the methodology applied for NFR 1A4bi for all years of the time series in the next submissions.		
RO-1A4bii-2017-0001	No	1A4bii Residential: Household and Gardening (Mobile), SOX, NOX, 1990-2015	For 1A4bii Residential: Household and Gardening (Mobile) NOX, SOX, NMVOC, NH3 and PM2.5 years: 1990 - 2015, in response to a question raised during the review Romania explained that emissions from this sector were included in 1A4bi (Residential: Stationary). The TERT noted that the emission factors applied to this fuel when used in mobile machinery is often significantly different than for stationary sources due to the variable load conditions of mobile engines and the higher regulation of sulphur contents for mobile fuels. The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends that emissions from the mobile and stationary elements are estimated and reported separately in the next submission.	no	planned improvement
RO-1A4cii-2017-0001	No	1A4cii Agriculture/Forestry/Fishing: Off-Road Vehicles and Other Machinery, NH3, 2005-2015	For 1A4cii Agriculture/Forestry/Fishing: Off-Road Vehicles and Other Machinery/SOX/ years: 2005 - 2015 the TERT noted that SOX emission estimates were not provided for this source. In response to a question raised during the review, Romania provided revised estimates for the years 2005 to 2015 and stated that it will be included in the next submission. The TERT agreed with the revised estimate provided by the Member State. The TERT recommends that Romania include the revised estimate in its next submission. During the country visit 2-3 November 2017 the TERT provided some additional advice on this sector (see annex II below).	RE	recalculated; section 3.11
RO-1B1a-2017-0001	Yes	1B1a Fugitive Emission From Solid Fuels: Coal Mining and Handling, NMVOC, 2005-2015	For category 1B1a Fugitive Emission from Solid Fuels: Coal Mining and Handling, 2005 - 2015, NMVOC the TERT noted that a Tier 1 methodology was used to estimate emissions while this is a key category. In response to a question raised during the review, Romania provided a revised estimate for year 2005-2015 based on the Tier 2 methodology in the 2016 EMEP/EEA Guidebook. The TERT agreed with the revised estimate provided by Romania. The TERT recommends that Romania includes the revised estimate in its next submission.	RE	Tier 2 has been implemented; recalculated; section 3.16
RO-1B2av-2017-0001	Yes	1B2av Distribution of oil products, NMVOC, 2005-2015	For category 1B2av Distribution of Oil Products and pollutant NMVOC for 1990 - 2015, the TERT noted that Romania applied a Tier 1 methodology while this was a key category. In response to a question raised during the review, Romania explained that information to apply a Tier 2 approach was not available. Romania provided the calculation details, and while checking this the TERT found a large inconsistency between the activity data used by Romania and the Eurostat final energy consumption of gasoline. In response to a second question, Romania provided an updated activity dataset and a revised estimate for its tier 1 estimate for all years. The TERT agreed with the revised estimate. The TERT recommends that Romania includes the revised estimate in its next submission. Additionally, the TERT recommends Romania collect the information needed to move to a Tier 2 approach if possible.	RE	revised and recalculated; section 3.20
RO-1B2b-2017-0001	No	1B2b Fugitive Emissions from Natural Gas (exploration, production, processing, transmission, storage, distribution and other), NMVOC, 2005-2015	For category 1B2b Fugitive Emissions from Natural Gas, NMVOC for 1990 - 2015 the TERT noted that there may be an under-estimate of emissions because it was unclear if all the segments from the natural gas system were taken into account in the calculations. In response to a question raised during the review, Romania explained that the emission factors used were from the 2016 EMEP/EEA Guidebook (Tier 1 approach) including all sub-processes. While checking this, Romania identified errors in the calculation and provided to the TERT a	no	revised and recalculated; section 3.21

			preliminary revised estimate. However, when checking the underlying data of this revised estimate, the TERT found an apparent inconsistency in the activity data between the natural gas production in the revised estimate provided by Romania and the natural gas production statistics from Eurostat. The statistics provided by Romania show a decreasing trend in natural gas production (17 to 11 billion m3 from 2005 to 2015) while Eurostat reports around 10 billion m3 for all years between 2005-2015. The TERT notes that this discrepancy will not result in a revision that is above the threshold of significance and recommend that Romania clarify the difference in natural gas production between the national statistics and Eurostat for the next submission. Additionally, the TERT recommends Romania provide a clear description of the methodology including the activity data and emission factors in tabular form in the IIR for the next submission.		
RO-1B2c-2017-0001	No	1B2c Venting and Flaring (oil, gas, combined oil and gas), SOX, NOX, NH3, NMVOC, PM2.5, 2005-2015	For category 1B2c Venting and Flaring the TERT noted that PM2.5 and SOX were reported as 'NE' (Not Estimated). In addition, there was a lack of transparency regarding the methodology used to calculate emissions of NOX and NMVOC. In response to a question raised during the review, Romania stated that a Tier 1 approach from the 2016 EMEP/EEA Guidebook was used, and "losses" from the energy balance were used as activity statistics. Romania provided a draft revised estimate including all NECD pollutants for flaring from oil and gas extraction based on this activity statistics. The TERT partially agreed with the explanation and draft revised estimate. Since incorrect activity data were used and emissions from flaring in oil refineries were not included the TERT decided not to accept the revised estimate. The TERT made a draft calculation for flaring in oil refineries and added that to the estimate made by Romania, from which the TERT concluded that the under-estimate is likely below the threshold of significance. The TERT recommends that Romania provides an emission for all NECD pollutants for the next submission, including both flaring in oil and gas extraction and flaring in oil refineries, taking into account the correct activity statistics as documented in the 2016 EMEP/EEA Guidebook. During the country visit 2-3 November 2017 the TERT provided some additional advice on this sector (see annex II below).	no	have calculated the missing pollutants for the time series 2005-2015, and new calculated for 2000-2004 and 2016 (Tier 1 approach). For the moment we do not have data for a Tier 2 approach and we will investigate the possibility of collecting more appropriate data from the gas industry operators; section 3.22
RO-2A1-2017-0001	No	2A1 Cement Production, PM2.5, 2005-2015	For category 2A1 Cement Production and pollutant PM2.5 for 2005 - 2015, the TERT noted that incorrect activity data were used with the 2016 EMEP/EEA Guidebook Tier 1 approach (cement production was used instead of clinker production). This resulted in an over-estimate of PM2.5 emissions which is below the threshold of significance. In response to a question raised during the review, Romania provided a revised estimate for the years 2005-2015. The TERT agreed with the revised estimate provided by Romania. The TERT recommends that Romania include the revised estimate in its next submission for all years in the time series.	RE	recalculated; section 4.1
RO-2A2-2017-0001	No	2A2 Lime Production, PM2.5, 2005-2015	For category 2A2 Lime Production and pollutant PM2.5 for years 2005 - 2015, the TERT noted that the activity data used as the basis for the emission calculation were different to the AD reported to UNFCCC in the CRF. In response to a question raised during the review, Romania explained that they have found a mistake in the calculation as the activity data used was the sum of quicklime and slaked lime, which implies double counting. Romania suggested to use slaked lime as the primary activity statistics. The TERT agreed with the solution provided by Romania, noting that Romania should take care that some of the quicklime may not be processed into slaked lime, in which case this part should be added to the activity data for slaked lime to avoid an underestimation. The TERT noted that the issue is below the threshold of significance for technical	no	recalculated; section 4.2

			correction. The TERT recommends that Romania improves these estimates as indicated above for its next submission.		
RO-2A3-2017-0001	No	2A3 Glass Production, PM2.5, 2005-2015	For category 2A3 Glass Production, pollutant PM2.5 for all years the TERT noted that emissions were not estimated. The TERT noted that the underestimate is below the threshold of significance. However, in response to a question raised during the review, Romania provided a revised estimate for the years 2005-2015 and stated that it will be included in the next submission. The TERT agreed with the revised estimate provided by the Romania.	RE	calculated Tier 1; section 4.3; planned improvement Tier 2
RO-2A5a-2017-0001	No	2A5a Quarrying and mining of minerals other than coal, PM2.5, 2005-2015	For category 2A5a Quarrying and Mining of Minerals Other than Coal and pollutant PM2.5 for all years, the TERT noted that there is an under-estimation which is likely below the threshold of significance. The under-estimate is because emissions from this category have been reported as 'NA' (Not Applicable) while a methodology is available in the 2016 EMEP/EEA Guidebook. In response to a question raised during the review, Romania explained that indeed this source has not been estimated. The TERT recommends that Romania estimates PM2.5 emissions from this source for the next submission. In order to apply the default method in the 2016 EMEP/EEA Guidebook, activity data need to be collected including sand, stone and clay minerals, as well as metal ores mined.	no	NE notation key; planned improvement; section 4.4
RO-2A5b-2017-0001	No	2A5b Construction and demolition, PM2.5, 2005-2015	For category 2A5b Construction and Demolition, PM2.5 for all years the TERT noted that that there is an under-estimate which is likely to be below the threshold of significance. The underestimate relates to reporting of 'NA' (Not Applicable) for this category despite the availability of a methodology in the 2016 EMEP/EEA Guidebook. In response to a question raised during the review, Romania explained that no activity data are available. The TERT recommends that Romania explores approaches to collecting the data needed to calculate emissions for this source to provide an estimate of the emissions for the next submission. If this is not possible, the TERT recommends changing the notation key from 'NA' to 'NE'.	no	NE notation key; section 4.5
RO-2B2-2017-0001	No	2B2 Nitric Acid Production, NOX, 2000-2015	For category 2B2 Nitric Acid Production, in response to a question raised during the review, Romania explained that current estimates are based on national statistics of total production and that at the time of compilation the technology was unknown throughout the time series. Romania highlighted that for the year 2015, it has recently gathered information that 80 % of the production is based on catalytic reduction technology and that the technology of the remaining 20 % of total production is still unknown (i.e. Tier 1). This information is not yet included in the inventory but Romania intends to explore expanding this approach for its estimates for the year 2015. The TERT noted that the issue is below the threshold of significance for a technical correction. The TERT recommends that Romania continues elaborating its improved estimates by contacting the producers of nitric acid to investigate the levels of abatement applied and any other plant specific data that could help estimate emissions and to apply a consistent method with a varying assumption based on industry data and or expert judgement on the level of abatement for all years in the time series.	no	planned improvement; section 4.7
RO-2B5-2017-0001	No	2B5 Carbide production, PM2.5, 1990-2015	For particle emissions from Carbide Production 2B5 The TERT noted that Romania had not estimated emissions. In response to a question raised during the review Romania explained that production only occurs in 1990-2006. Romania provided some outline estimates to highlight that emissions of TSP/PM2.5 would be below the threshold and stated that these estimates will be included in the next submission. The TERT agreed that the issue is below the threshold of significance. The TERT recommends that Romania continue the	no	calculated; section 4.9

			work on completing the time series 1990-2004 for particle and PM2.5 as well as correcting the notation keys for 2006-2015 to 'NO'.		
RO-2C5-2017-0001	No	2C5 Lead Production, SOX, PM2.5, 2005-2015	For categories 2C5 Lead Production and 2C6 Zinc Production in response to a question raised during the review Romania explained that no SOX process emissions are included as the applied default emission factors from chapter 1A2b Stationary Combustion in Manufacturing Industries and Construction: Iron and Steel only cover fuel emissions. The TERT recommends that for the next submission Romania includes process SOX emissions from lead and zinc productions when updating default emission factors to the 2016 version of the EMEP/EEA Guidebook. Romania also explained that emissions from combustion in lead production was calculated using a Tier 2 methodology (i.e. calculation of emissions from primary and secondary production separately) while process emissions are calculated using Tier 1. The TERT recommends that Romania also applies the Tier 2 methodology for calculations of the process emissions from lead production for the next submission. The TERT noted that the issues are below the threshold of significance for a technical correction.	no	Tier 2 implemented; section 4.15
RO-2C7a-2017-0001	No	2C7a Copper Production, SOX, PM2.5, 2005-2015	Romania states that only secondary copper production occurs in Romania and that SOX, NOX and CO emissions from fuel combustion is included under NFR 1A2b with no process SOX emissions. If this is correct, then process SOX emissions are not currently included in the Romanian emission estimates as the TERT notes with reference to the 2016 EMEP/EEA Guidebook chapter 2.C.7.a (page 12) that, "emissions of NOX and CO are assumed to originate mainly from combustion and are discussed in chapter 1.A.2.b. All other emissions are assumed to originate primarily from the process". The TERT estimates process SOX emissions to be below 0.01 % of Romania's National Total SOX emissions and hence below the threshold of significance. Emission factor for process SOX emissions from secondary copper production is new in the 2016 EMEP/EEA Guidebook and should be included in the Romanian inventory when updating from GB 2013 to 2016 EMEP/EEA Guidebook. Romania has also stated that Tier 1 emission factors from 2013 EMEP/EEA Guidebook are currently used for estimating particle emissions in NFR 2C7a Copper Production. As the TERT understand from the Romanian answer, it will not be a problem to upgrade to Tier 2 EFs as all Romanian copper production is known to be secondary production. Finally, The TERT notes that Romania has stated that no copper production (primary or secondary) occurs in Romania for the years 2009-2015, if this is correct then the notation key 'NO' should be used for these years for all pollutants.	no	SOx calculated; planned improvement; section 4.17
RO-2D-2017-0001	No	2D Non-Energy Products from Fuels and Solvent Uses, SOX, NOX, NH3, NMVOC, PM2.5, 1990-2015	For 2D Non-Energy Products from Fuels and Solvent Uses, SOX, NOX, NH3, NMVOC, PM2.5, 1990-2015 the TERT noted that the used EFs are not presented transparently in the IIR and are not referenced to any source (e.g. defaults or country specific references). In response to a question raised during the review, the Romania provided a data sheet with AD and EFs for 2D3 Solvent Use categories that provided the transparency needed. The TERT recommends that Romania include this information in its next IIR submission. During the country visit 2-3 November 2017, the TERT helped Romania with accessing and understanding a number of sources of statistics for this category. The visit helped to highlight how Romania could increase transparency, comparability and facilitate the updating of the IIR. This included tables with used EFs and AD with clear references to the data sources; e.g. reports, guidebooks or web pages. The TERT also explained the transparency improvement by including a short and concise explanation of methodology, e.g. describing data flow and data handling. A short description of planned improvements and improvements since last inventory should also be included.	no	section 4.18-4.26

RO-2D3a-2017-0001	Yes	2D3a Domestic solvent use including fungicides, NMVOC, 1990-2015	For key category 2D3a (Domestic Solvent Use Including Fungicides; NMVOC; whole time-series) the TERT noted that Romania had an IEF of 2.7 kg NMVOC/capita, corresponding to the Tier 1 value from the 2013 EMEP/EEA Guidebook. In response to a question raised during the review, Romania provided revised emission estimates using the 2016 EMEP/EEA Guidebook EF 2.462 kg NMVOC/capita. The TERT agreed with the revised estimate provided by Romania. The TERT noted that the changes in emissions were below the threshold of significance. During the country visit 2-3 November 2017, the TERT suggested that Romania use Table 3.5 of the guidebook as inspiration for a prioritised list for a Tier 2 estimate for 2D3a. When improved AD are found for a sub-category a corresponding Tier 2 EF, based on used amount of product or solvent can be used. For the remaining sub-categories population based Tier 1 EFs in Table 3.5 can be used. The TERT recommends that Romania include the revised estimate in its next submission and further investigates the possibilities for obtaining AD on product groups from Eurostat and national databases in order to make a product and/or solvent based Tier 2 assessment.	RE	recalculated; section 4.18; planned improvement
RO-2G-2017-0001	No	2G Other product use, SOX, NOX, NH3, NMVOC, PM2.5, 1990-2015	For category 2G (Other Product Use; all pollutants; whole time series) the TERT noted that Romania does not include the potential Key Categories Tobacco and Fireworks. In response to a question raised during the review, Romania provided AD and revised emission estimates for years 2005 to 2015 for Tobacco. For fireworks import/export data on Eurostat were found but no production data from the national statistics. The revised estimates showed changes that were below the threshold of significance. The TERT agreed with the revised estimate provided by Romania. During the country visit 2-3 November 2017, the TERT provided advice on accessing the data from Eurostat. The TERT recommends that Romania include the revised estimate in its next submission and further investigates the possibilities for obtaining production data for fireworks from Eurostat and national databases.	RE	calculated; section 4.27
RO-3B-2017-0002	Yes	3B Manure Management, NH3, 2005-2015	The TERT noted that NH3 emission from NFR 3B1a dairy cattle, NFR 3B3 Swine, 3B4gi laying hens and NFR 3B2 sheep is a key source (2015) and thus a Tier 2 calculation should be used where possible. In response to a question raised during the review, Romania provided a revised estimate for NH3 emission from dairy cattle, non-dairy cattle, fattening pigs, sows, sheep and laying hens for year 2005, 2010 and 2015, based on Excel spreadsheet calculation given in EMEP/EEA Guidebook 3.B Manure management – Appendix B. Romania stated that the revised estimate will be included in the next submission. The revised NH3 estimate is not above threshold of significance for technical correction for year 2015 and 2010, but it is above threshold for year 2005. The TERT agreed with the revised estimate provided by Romania. The TERT recommends that Romania include the revised estimate in its next submission. Following the visit of 2-3 November 2017, the TERT noted that Romania plan to implement the NH3 Tier2 approach for key categories; Dairy, swine, laying hens and sheep, based on the Excel spreadsheet "3b manure management – appendix B". The TERT provided some advice on developing this approach.	RE	recalculated Tier 2 and splitted in 3B, 3Da2a, 3Da3 section 5.1,5.2,5.4, 5.7,5.8
RO-3B-2017-0003	No	3B Manure Management, NOX, 2005-2015	TERT noted that the NOX emission 2005-2015 from NFR 3B Manure Management is calculated based on Tier 1 EF in 2013 EMEP/EEA Guidebook, but no conversion to NO2 was provided. In response to a question raised during the review, Romania provided a revised estimate for years 2005-2015 based on NO2 EF in 2016 EMEP/EEA Guidebook 3B (Table 3.3). TERT checked the revised estimate and found small differences for laying hens and broilers, and unfortunately TERT was not able to resolve the differences between the revised estimate and the original estimates. The TERT noted that the issue is below the threshold of significance for a technical correction. During the country visit 2-3 November 2017 Romania indicated that it plans to update to EMEP/EEA	no	recalculated, section 5.1-5.8

			Guidebook 2016 and use updated NO2 EF for 3B and updated PM2.5 EF for swine and poultry. The TERT provided some advice on developing this approach. The TERT recommends that Romania review and include a transparent estimate in its next submission using country specific data and or the data in the EMEP/EEA Guidebook referenced above.		
RO-3B-2017-0004	Yes	3B Manure Management, NMVOC, 2005-2015	TERT noted that the following livestock categories are key source for NMVOC emission 2015; NFR 3B1a Manure Management - Dairy Cattle, NFR 3B3 Manure Management - Swine and 3B4gi Manure Management - Laying Hens, which indicate a use of Tier 2 approach. In response to a question raised during the review, Romania explained that further analysis is required in order to assess Tier2 activity data availability. The TERT recommend Romania to include information on the allocation of feeding with and without silage to improve the transparency of NMVOC calculation. The TERT appreciates Romania's efforts to further improvement of the emission inventory and recommends Romania to use the values for MJ (gross feed intake in megajoule) and VS (volatile solid excreted) in CRF Table 3.As1 and Table 3B(a)s1. Also, information for ratio NH3 emission in housing, storage and application is needed and if no national data is available, default values in 2016 EMEP/EEA Guidebook 3B Table 3.9 can be used. Following the TERT's visit 2-3 November 2017, Romania plan to estimate NMVOC emissions based on Tier2 approach for keys categories; dairy cattle, swine and laying hens. The TERT provided some advice on developing this approach. The TERT encourages to highlight its intention in "planned improvements" in IIR, if the NMVOC emission is not estimated for next submission.	no	planned improvement Tier 2
RO-3B-2017-0005	No	3B Manure management, PM2.5, 2005-2015	TERT notes that the PM2.5 emission 2005-2015 from NFR 3B Manure Management is a key category and the estimate is based on a 2016 EMEP/EEA Guidebook Tier 1 approach. In response to the question raised during the review Romania provided a revised estimate for PM2.5 emission from swine, laying hens and broilers, and plan to fully update their methodology in the next submission. TERT agree with the estimate provided by Romania and note that the revised estimate of PM2.5 from 3B is below the threshold of significance. During the country visit 2-3 November 2017 Romania indicated that it plans to update to EMEP/EEA Guidebook 2016 and use updated NO2 EF for 3B and updated PM2.5 EF for swine and poultry. The TERT provided some advice on developing this approach. The TERT recommends that Romania include the revised estimate in its next submission.	RE	recalculated, section 5.1-5.8
RO-3B-2017-0006	Yes	3B Manure management, NOX, NH3, NMVOC, PM2.5, 2005-2015	The TERT noted that the number of cattle in NFR 3B Manure Management 2005-2015 differ compared to the number given in UNFCCC reporting (CRF Table 3.As1). In response to a question raised during the review, Romania provided a revised estimate for number of dairy cattle and non-dairy cattle in order to match the numbers in CRF. The revised number of cattle is included in question RO_3B_2017_0002, where a technical correction is estimated for NH3 emission from dairy cattle, non-dairy cattle and swine 2005, 2010 and 2015. During the country visit 2-3 November 2017, the TERT noted that Romania will continue to improve the consistency between data for NFR and CRF – e.g. the number of cattle. Many of the agricultural activity data for estimation of air pollutants are the same as for greenhouse gas emissions. The TERT provided some advice on developing this approach. The TERT recommends that Romania include the revised estimate for cattle in its next submission.	no	recalculated, section 5.1-5.4
RO-3Da1-2017-0001	No	3Da1 Inorganic N-Fertilisers (includes also urea application), NH3, 2005-2015	The TERT noted that NH3 emissions from NFR 3Da1 inorganic fertiliser are based on activity data from EUROSTAT, which is significant lower compared to the GHG CRF. The TERT also noted that no NOX emission are estimated. In response to a question raised during the review, Romania provided a revised estimate for year 2005, 2010 and 2015 and stated that it will be included in the next submission. The TERT agreed with the revised estimate provided by Romania and noted that	RE	recalculated, section 5.10

			the revised estimate resulted in a change to the estimates that was greater than the threshold of significance. During the country visit 2-3 November 2017 Romania indicated that it plans to estimate the NH3 and NO2 emission from use of N in mineral fertilizers. The N-content in mineral fertilizers have to be consistent with the activity data in CRF (Table 3D and EF). Tier 1 EF is available in GB 2016 3D Table 3.1. The TERT provided some advice on developing this approach. The TERT recommends that Romania to include the revised estimate in its next submission.		
RO-3Da1-2017-0002	No	3Da1 Inorganic N-Fertilisers (includes also urea application), NMVOC, 2005-2015	TERT noted that the NMVOC emission from cultivated crops is estimated and allocated to NFR 3Da1 Inorganic N-Fertilisers. This NMVOC emission is related to the cultivation of the agricultural crops and thus the TERT recommend Romania to reallocate the NMVOC emission from crops NFR 3Da1 to NFR 3De Cultivated Crops for its next submission. During the country visit 2-3 November 2017 Romania indicated that it plans to reallocate NMVOC emission from cultivated crops and the PM2.5, PM10 and TSP from field operations to the correct NFR categories; NFR 3De cultivated crops and NFR 3Dc farm-level agricultural operations. The TERT provided some advice on developing this approach. The TERT recommends that Romania to include the revised estimate in its next submission.	no	reallocated to 3De, section 5.14
RO-3Da1-2017-0003	No	3Da1 Inorganic N-Fertilisers (includes also urea application), PM2.5, 2005-2015	The TERT notes that the emission of PM2.5, PM10 and TSP from field operations are estimated and allocated to NFR 3Da1 Inorganic N-Fertilisers. Due to the 2016 EMEP/EEA Guidebook Table 3.1 it´s clarified in a more transparently way than given in 2013 EMEP/EEA Guidebook Table 3-1, that particle emission related to soil cultivation, harvesting, cleaning and drying should be allocated under the NFR 3Dc Farm-Level Agricultural Operations. In order to ensure comparability of the emission across the countries TERT recommend Romania to reallocate the PM emission from 3Da1 to NFR 3Dc in its next submission. During the country visit 2-3 November 2017 Romania indicated that it plans to reallocate NMVOC emission from cultivated crops and the PM2.5, PM10 and TSP from field operations to the correct NFR categories; NFR 3De cultivated crops and NFR 3Dc farm-level agricultural operations. The TERT provided some advice on developing this approach. The TERT recommends that Romania to include the revised estimate in its next submission.	no	reallocated to 3Dc, section 5.13
RO-3Da1-2017-0004	No	3Da1 Inorganic N-Fertilisers (includes also urea application), NOX, 2005-2015	TERT notes that the NOX emission from NFR 3Da1 Inorganic N-Fertilisers is not estimated for 2005-2015 and the notation key 'NE' is used. No information is given in IIR. This under-estimate may have an impact on total emissions that is above the threshold of significance and the TERT ask for further information. In response to a question raised during the review, Romania provided an estimate based on the total amount of N-fertilisers in Eurostat, which increases the 2015 NOX emission by 14.3 kt NOX corresponding to 6% of the total NOX emission. The TERT recommends that Romania include the estimated NOX emission from NFR 3Da1 inorganic fertilisers in the next submission. During the country visit 2-3 November 2017 Romania indicated that it plans to estimate the NH3 and NO2 emission from use of N in mineral fertilizers. The N-content in mineral fertilizers have to be consistent with the activity data in CRF (Table 3D and EF). Tier 1 EF is available in GB 2016 3D Table 3.1. The TERT provided some advice on developing this approach. The TERT recommends that Romania to include the revised estimate in its next submission. TERT recommends that Romania consider to use the amount of N in inorganic fertilizer (activity data) based on CRF Table 3Da1.	no	calculated; section 5.10
RO-3Da2a-2017-0001	No	3Da2a Animal Manure Applied to Soils, NH3, 2005-2015	TERT notes that notation key 'NA' is used for NH3 emission for 2005-2015 from NFR 3Da2a Animal Manure Applied to Soils and NFR 3Da3 Urine and Dung Deposited by Grazing Animals. These emissions are in submission 2017 included in emission from NFR 3B Manure Management. During the review, Romania	no	recalculated Tier 2 and splitted in 3B, 3Da2a, 3Da3,

			explained that no data are available. The TERT recommend that Romania update to NH3 EF in 2016 EMEP/EEA Guidebook Table 3.2 for Tier 1 and Table 3.9 for Tier 2 calculation for livestock categories, which is estimated as key category. Use of 2016 EMEP/EEA Guidebook makes is possible to split NH3 the emission in the three different NFR categories, NFR 3B, NFR 3Da2a and NFR 3Da3 for both Tier 1 and Tier calculation. During the country visit 2-3 November 2017 the TERT noted that Romania continues to improve the calculation of NH3 emission from the livestock production and plan to split the emission in 3B (manure management), 3Da2a (application) and 3Da3 (grazing). For Tier2 approach, it recommends to use the Excel spreadsheet "3b manure management – appendix B" and for Tier1 approach refer to GB 2016 3B Table 3.2. The TERT provided some advice on developing this approach. TERT recommend Romania to allocate the NH3 emission from animal manure in all three NFR categories 3B, NFR 3Da2a and NFR 3Da3.		section 5.11
RO-3Da2a-2017-0002	No	3Da2a Animal Manure Applied to Soils, NOX, 2005-2015	The TERT noted that no NOX emission is estimated from NFR 3Da2a Animal Manure Applied to Soils for 2005-2015. In response to a question raised during the review, Romania indicated that no data are available regarding livestock manure applied to soils and a further analysis is necessary in order to estimate emissions from this category. The TERT made an estimate based on EF NOX Tier 1 (2016 EMEP/EEA Guidebook 3D Table 3.1) and the activity data (amount of N in manure) registered in Romania CRF Table 3.D. During the country visit 2-3-November 2017, the TERT provided some advice on developing this approach. The TERT noted that the issue is below the threshold of significance. TERT recommends that Romania include an estimate in its next submission.	no	planned improvement
RO-3Da2b-2017-0001	No	3Da2b Sewage Sludge Applied to Soils, NOX, NH3, 2005-2015	The TERT notes that 'NA' is used to report NH3 and NOX emission from NFR 3Da2b Sewage Sludge Applied to Soils and for NFR 3Da2c Other Organic Fertilisers Applied to Soils for years 2005, 2010 and 2015. In response to a question raised during the review, Romania explained that activity data for the amount of compost is available (refer to NFR 5B1 Biological Treatment of Waste - Composting), but no information on N content in the compost. The TERT is aware of the lack of data for N content and recommend that Romania explores data gathered by other member states IIR and research. Romania plan to do some further investigations regarding whether sewage sludge is applied on agricultural soils and if this activity takes place, a Tier 1 default is available based on number of capita (2016 EMEP/EEA Guidebook 3D Table 3.1). The NH3 and NOX emissions from NFR 3Da2b and 3Da2c is typically a relatively small emission source and likely to be below the threshold of significance. During the country visit 2-3 November 2017 Romania indicated that it will investigate the possibility to include NH3 and NO2 emission from sewage sludge (NFR 3Da2b) and other organic fertilizers (NFR 3Da2c) applied to soils. It is suggested to cooperate with colleagues working with greenhouse gas emission.	no	further investigations
RO-3F-2017-0001	No	3F Field burning of agricultural residues, SOX, NOX, NH3, NMVOC, PM2.5, 2005-2015	TERT noted that no emission is estimated for NFR category 3F Field Burning of Agricultural Residues 2005-2015 but that in Romania's CRF 2015 emissions from field burning of agricultural residues is reported for CH4 and N2O. A Tier 1 approach is available in 2016 EMEP/EEA Guidebook 3F Table 3-1. In response to a question raised during the review, Romania provided an estimate for years 2005-2015 for emission for all compounds mentioned in 2016 EMEP/EEA Guidebook 3F Table 3-1 from field burning of agricultural residues from wheat and maize. The TERT agreed with the revised estimate provided by Romania. The TERT appreciate Romania's effort to improve the inventory and recommends that Romania include the emission from field burning of the remaining crop types (rye, barley and other) with its revised estimates in its next submission. During the country visit 2-3 November 2017 the TERT noted that Romania should check the activity data registered in CRF Table 3F to insure constancy.	RE	calculated; section 5.15

RO-5A-2017-0001	No	5A Biological treatment of waste - Solid waste disposal on land, NMVOC, 2005;2010;2015	For 5A Biological Treatment of Waste - Solid Waste Disposal on Land, NMVOC, 2005;2010;2015, emissions the TERT noted that the NMVOC IEF was different from the default EF provided in the 2016 EMEP/EEA Guidebook. In response to a question raised during the review, Romania provided some detailed explanation on the methodology used to estimate NMVOC emissions from 5A and proposed a revised estimate. The TERT agreed with the revised estimate and noted that the impact of the revised estimate is below the threshold of significance. However, the TERT would like Romania to pay attention to the 2013 EMEP/EEA Guidebook reference: "US Environmental Protection Agency (US EPA) evaluates that 98.7 % of the landfill gas is methane and 1.3 % are other VOCs". Obviously, CH4 doesn't correspond to 98,7% of "landfill gas" (at a maximum 30 to 40% and the rest mainly composed of CO2 and other gases, including NMVOC) but actually corresponds to 98,7% of "VOC". However, even if the sentence is quite confusing, Romania has done the proper interpretation and the correct estimate.	RE	recalculated section 6.1
RO-5A-2017-0002	No	5A Biological treatment of waste - Solid waste disposal on land, PM2.5, 2005;2010;2015	For PM2.5 emissions from 5A Biological Treatment of Waste - Solid Waste Disposal on Land the TERT noted that emissions are not reported although default EF are provided in the 2016 EMEP/EEA Guidebook. In response to a question raised during the review, Romania provided a revised estimate (together with RO-5A-2017-0001). The TERT agreed with the result of the calculation and noted that PM2.5 emissions are below the threshold of significance as expected. However, the TERT would like to note that the method applied is not correct as the AD (waste statistics) required for the estimation of PM2.5 needs to include the amount of mineral waste handled (construction and demolition, ash etc.) while the AD for estimating NMVOC is only MSW. The TERT notes that as EF are presented in the same table, the 2016 EMEP/EEA Guidebook there is common confusion on this with MS and the use of MSW only is acceptable. The TERT recommends Romania to include the calculation of PM2.5 from 5A in its next submission and to where possible use the correct AD which includes the amount of mineral waste handled (construction and demolition, ash etc.) as well as the amount of MSW.	RE	recalculated section 6.1
RO-5C1bv-2017-0001	No	5C1bv Cremation, SOX, NOX, NMVOC, PM2.5, 2005;2010;2015	For 5C1bv Cremation, in response to a question raised during the review, Romania indicated to the TERT that it does not currently estimate emissions. Romania highlighted a lack of information on activity data. The TERT agreed with Romania that emissions for this category would be below the threshold of significance. The TERT noted that Romania have already initiated collection of information. The TERT recommends that Romania estimates emissions from cremation and include it, with a transparent description of methods, data sources and assumptions used, in its next submission for the complete time series.	no	further research and information is needed
RO-5D3-2017-0001	Yes	5D3 Other Wastewater Handling, NH3, 2005;2010;2015	For 5D Wastewater Handling the TERT noted that NH3 emissions from latrines are very high (9% of national total, which is quite unusual in EU). Romania assumes that 100% of the rural population uses latrines. In response to a question raised during the review, Romania explained that the Romanian statistical office does not have very specific information on the proportion of latrines. Following questions from the TERT, Romania provided a revised estimate with modified assumptions that a fraction of rural population is using septic tanks and the rest is using latrines. The TERT agreed with the revised estimate provided by Romania. The TERT recommends that Romania investigate further the fraction of population using latrines and to include the revised estimate in its next submission. In addition, the TERT recommends Romania to report these emissions under 5D1 Domestic Wastewater Handling.	RE	calculated section 6.6

RO-5E-2017-0001	No	5E Other Waste, SOX, NOX, NMVOC, PM2.5, 2005;2010;2015	For 5E Other Waste the TERT noted that Romania did not estimate PM2.5 emissions although default EF is provided in the 2016 EMEP/EEA Guidebook. In response to a question raised during the review Romania proposed to estimate these emissions but some national statistics were missing. The TERT has made a rough estimate and noted that the issue is below the threshold of significance for a technical correction and recommends that Romania includes emissions from building and car fires in its next submission. The split between types of building could be for instance derived from other similar Member States. For your information, the split used for the rough estimate is the following: 40% of detached houses, 5% of non-detached houses, 33% of apartments and 22% of industrial building. These values correspond to an average of data reported by Croatia, Denmark, Slovakia and Sweden.	no	further research and information is needed

Program of improvement is focused on the many tasks like gathering additional activity data to include new emission sources, correlation with other reporting, improvement of QA/QC actions.

8. I.I.R. REFERENCES

- EIONET CDR – CLRTAP Emission Inventories of ROMANIA
- EMEP/EEA 2016 Air Pollution Inventory Guidebook
- Romanian Ministerial Order No. 3.299/2012 for the approval of the methodology for compiling and reporting of air emissions inventories.