

FINLAND'S INFORMATIVE INVENTORY REPORT 2025

Air Pollutant Emissions 1980-2023
under the UNECE CLRTAP and the EU NECD

Part 1B - General

March 2025

FINNISH ENVIRONMENT INSTITUTE

Climate solutions unit

Air pollution group

PART 1

GENERAL B

PART 1B - GENERAL

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International aviation cruise (civil)

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Multilateral operations

Transport (fuel used)

Other not included in national total of the entire territory

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REFERENCES

8 RECALCULATIONS AND IMPROVEMENTS

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March 2025	TF

8.1 Recalculations

8.1.1 Summary of recalculations, explanations and justifications

Requested information

According to the Reporting Guidelines this chapter should include information relevant for assessment of compliance with each Protocol including a description of sources that were not included in the base year but have been added since as well as for sources that were included in the base year and are no longer applicable.

There was no obligation to document this information in the early years of reporting air pollutant emission inventories in the 1990s and the reporting guidelines have much developed since, therefore it has not been possible to present the requested information for the early years.

In the IIR sub-chapters “**Source specific recalculations**” of each Sector Chapter, information on annually conducted recalculations is presented for those years when the documentation item already existed.

Recalculations prior to the 2018 submission

The first full recalculation of the time series 1980-2016 was carried out to the submission in 2018. The recalculation of the energy sector time series from the 1990s was initiated in 2002, however, completed first to the 2018 submission. Due to the pending energy sector recalculations, it was not possible to fully recalculate interconnected data due to the complex structure of the inventory. However, individual emission figures and notation keys were corrected in the NFR tables when errors were found, in addition to sources where the activity data did not interfere with data reported by the plants. The ammonia emissions time-series was an exception, and was recalculated because sparse ammonia sources are related to data reported by the operators. The allocation of emissions under consistent reporting categories in the time series was not realized until the full recalculation to the 13 April 2018 resubmission. No impact assessments of the partial recalculations until 2018 were performed due to resource limitations and the fact that the impact on the non-recalculated time series would anyway be highly uncertain.

Resubmissions in 2018-2022

- 15 Feb 2018 Finland submitted the old time series for the years 1990-2015 and new data for 2016. This was because the energy sector data was not finalized by the deadline of the NFR tables.
- 15 Mar 2018 Finland submitted the first recalculated time series, however, it would not have been mature for submission due to lack of checks that could not be done in the window between the late finalization of the energy sector data and the 4 weeks time frame for resubmissions.
- 13 Apr 2018 Finland submitted a recalculated time series that had undergone several QA/QC procedures, however, still having remaining reallocation issues. Due to the UNECE CLRTAP S3 Review and the EU NECD Technical Review, both in June 2018, the data needed to be available.

- 15 Feb 2019 Finland submitted the recalculated time series which included further harmonized emissions allocations in the time series, however, also some errors were discovered after the submission deadline
- 15 Mar 2019 Finland submitted additional corrections to the submission of 15 Feb 2019.
- 13 Mar 2020 Finland submitted corrections to the submission of 13 Feb 2020 (errors and omissions) due to time constraint caused by unexpected data flows: (1) renewal of the contents of the YLVA database with deletion of technical details used in the energy sector inventory and pre-scheduled initiation of the new energy sector calculation model, (2) errors identified in the agriculture sector calculation model formulas, (3) omission of recalculated values from the submission (agriculture HCB), (4) missing values not captured into the submission 13 February 2020.
- 15 Mar 2022 Finland submitted corrections due to errors in NH₃ from 5B2 and some AD changes. In addition, the 2019 adjustment values for 2019 were accidentally included for the year 2020 and were removed.
- 10 Feb 2022 Finland submitted minor recalculations that were due to update of statistical data and in some cases application of new emission factors, or due to new information from the plants.

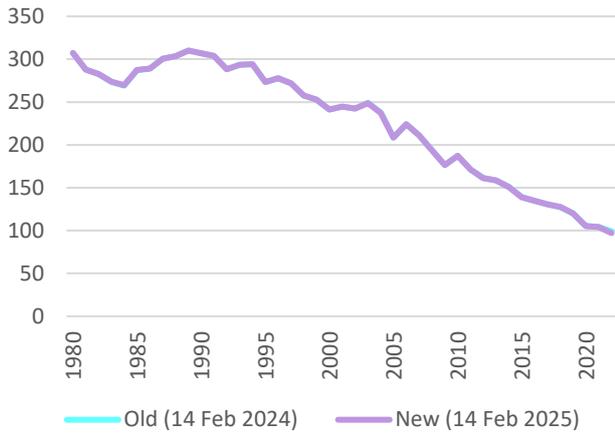
8.1.2 Impacts of recalculations in the 2025 submission

Recalculations to the 2025 submission are explained in detail in the respective IIR chapters (Parts 2-6 of the IIR). The most significant recalculations to the 2025 submission were:

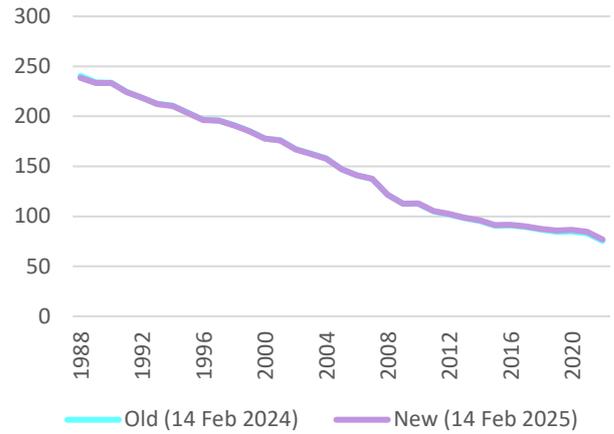
- Update of the share wood used in modern sauna stoves when estimating emissions from small scale wood combustion. The previous estimates overestimated their market penetration. Most significant effect to the national total emissions to PAH-4, where the annual total emissions increased up to 8 percent.
- Updates to the agriculture NH₃ emission estimation (described in detail in the IIR Part 5 Agriculture)
- Update of the PCDD/F emission factor in NFR 1B1b (coke production), which resulted in up to almost 20% annual emission reduction in national total emissions
- Correction PCB emission factor in small scale wood combustion
- Update of EMEP/EEA Guidebook 2023 emission factors in transport sector

Below is an overview of the impacts of the recalculations to the 2025 submission in Figure 8.1 and Table 8.1.

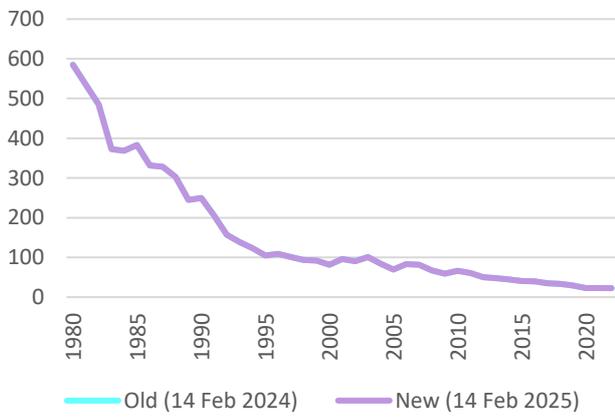
NOx (kt) recalculation 2025



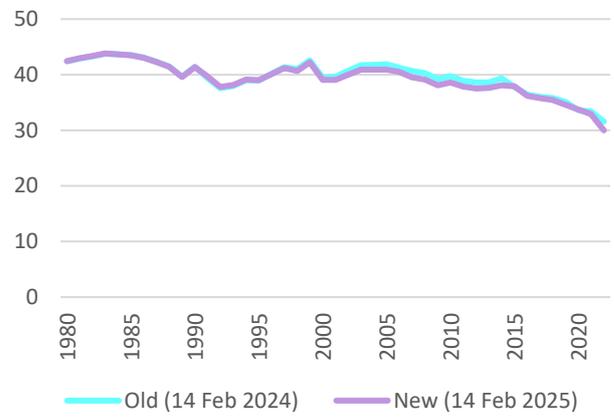
NM VOC (kt) recalculation 2025



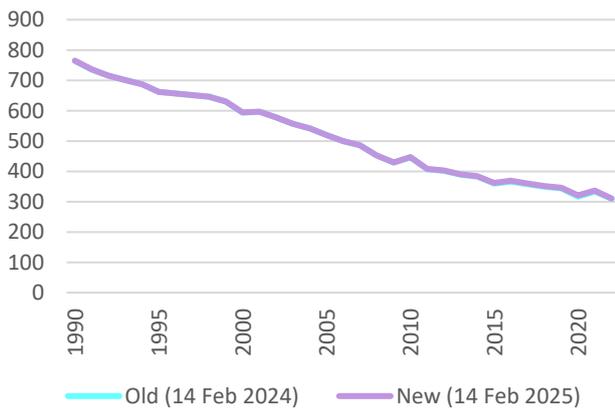
SO2 (kt) recalculation 2025



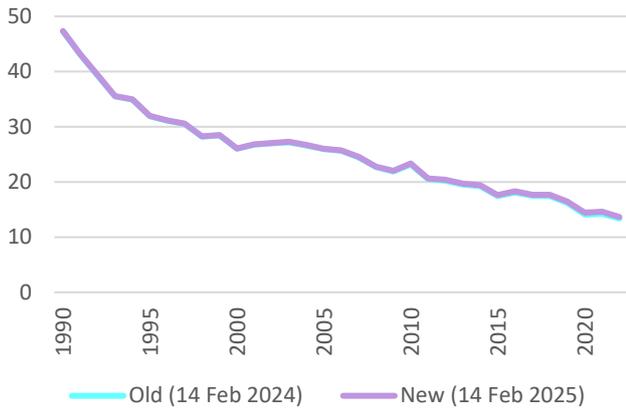
NH3 (kt) recalculation 2025



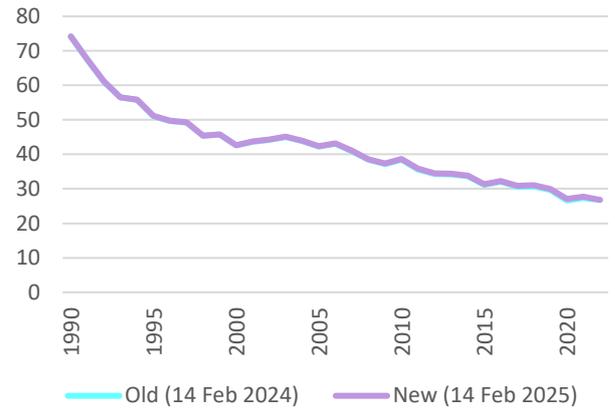
CO (kt) recalculation 2025



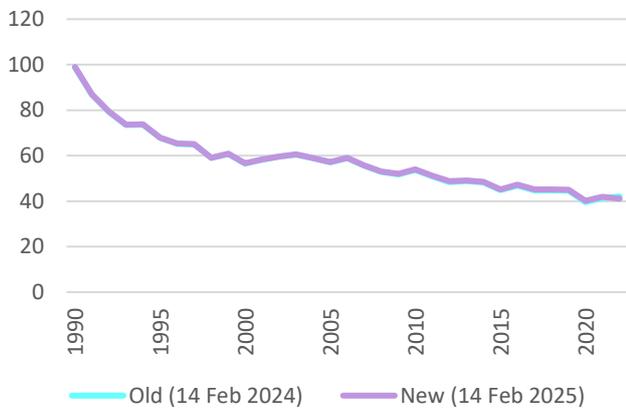
PM2.5 (kt) recalculation 2025



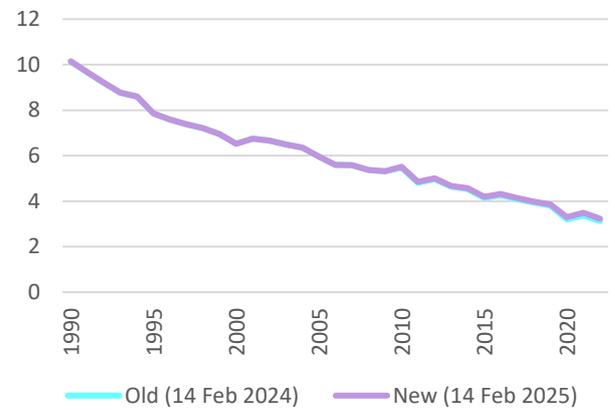
PM10 (kt) recalculation 2025



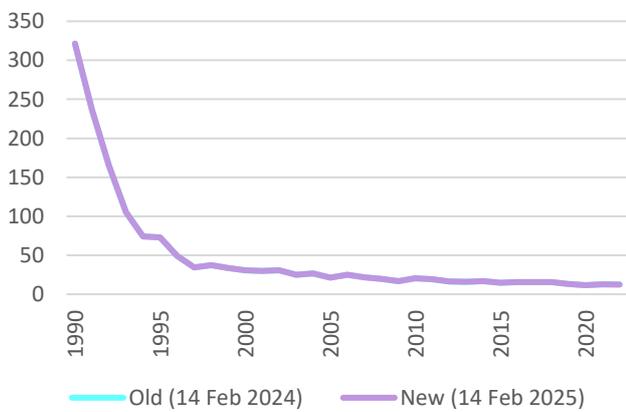
TSP (kt) recalculation 2025



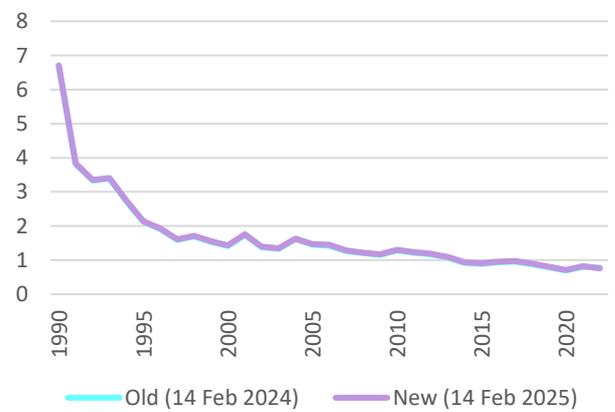
BC (kt) recalculation 2025

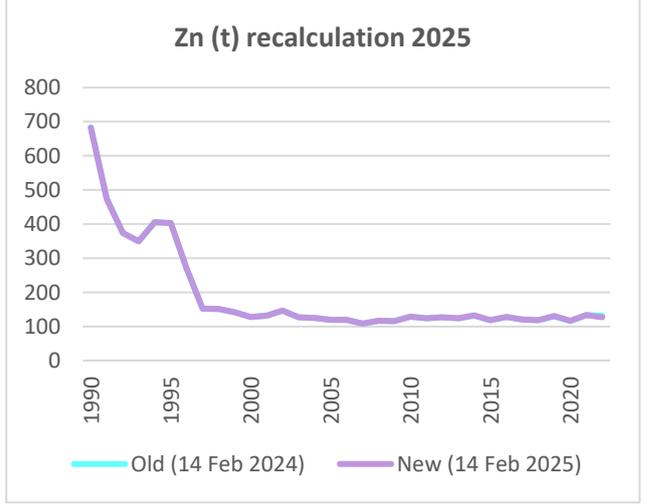
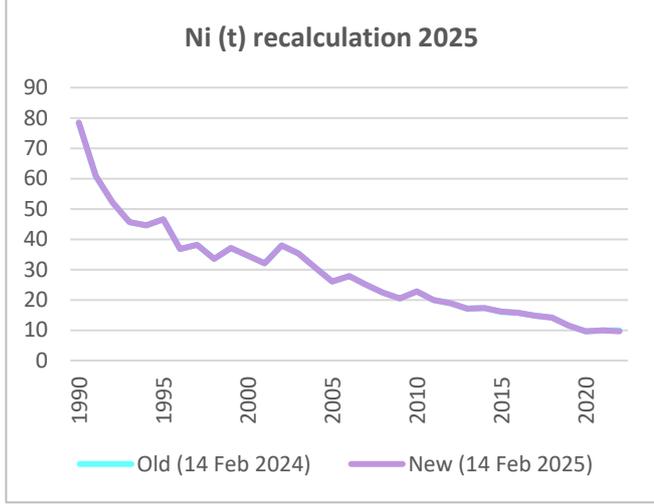
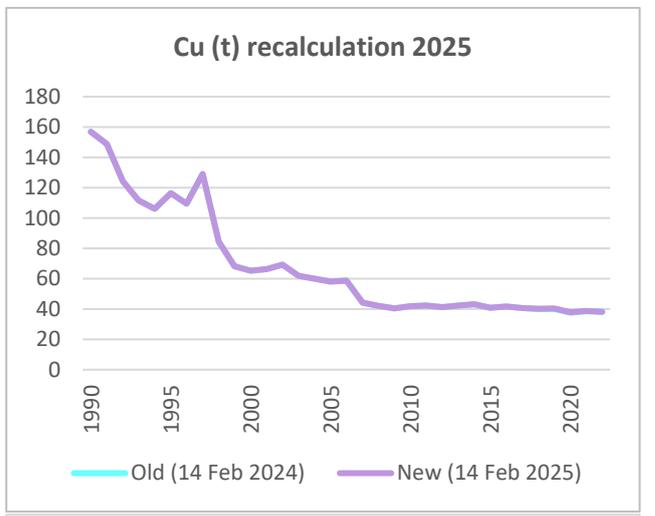
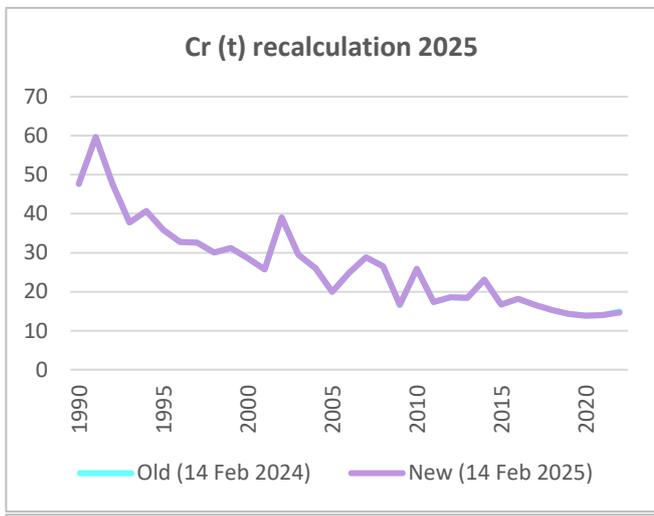
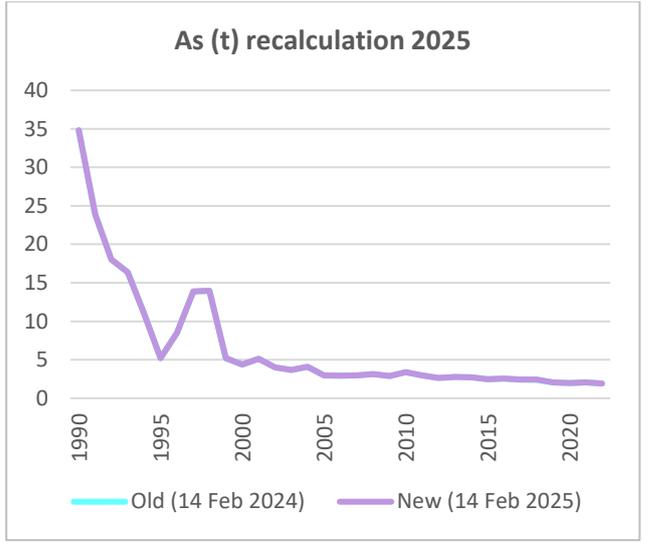
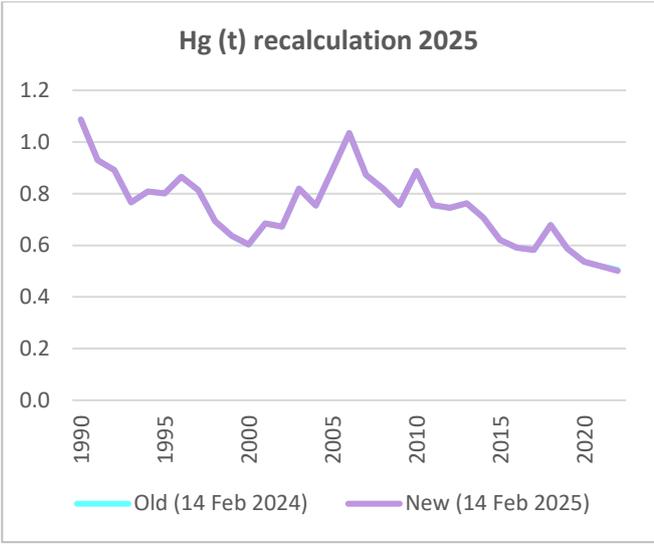


Pb (t) recalculation 2025



Cd (t) recalculation 2025





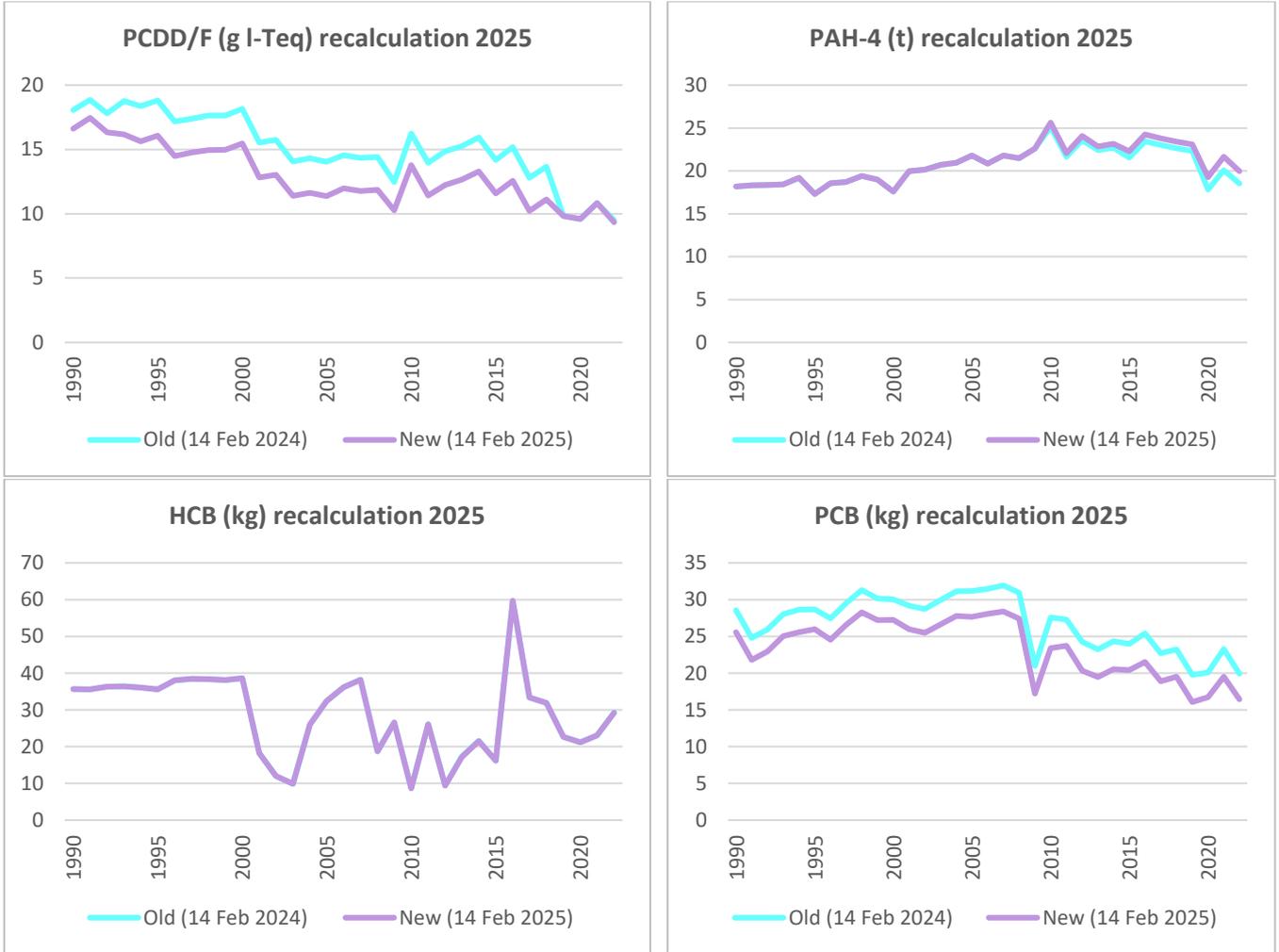


Figure 8.1 Impact of recalculations in the 2025 submission compared to the 2024 submission.

Table 8.1 Impact of recalculations in the 2025 submission compared to the 2024 submission.

NOx															
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
14 February 2024	307.267	287.726	282.611	273.499	269.378	287.256	289.061	300.504	303.491	309.996	306.768	303.880	288.303	293.513	294.250
14 February 2025	307.277	287.742	282.630	273.533	269.421	287.303	289.127	300.582	303.556	310.073	306.747	303.888	288.306	293.514	294.244
Difference	0.010	0.016	0.019	0.034	0.043	0.047	0.066	0.078	0.065	0.077	-0.021	0.008	0.003	0.001	-0.006
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
14 February 2024	273.262	277.673	271.804	257.707	252.959	241.308	244.655	242.519	248.981	237.389	208.395	224.041	211.144	193.822	176.518
14 February 2025	273.256	277.661	271.781	257.672	252.927	241.273	244.612	242.466	248.919	237.322	208.317	223.976	211.030	193.697	176.391
Difference	-0.006	-0.012	-0.023	-0.035	-0.032	-0.035	-0.043	-0.053	-0.062	-0.067	-0.078	-0.065	-0.114	-0.125	-0.127
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	-0.1 %	-0.1 %	-0.1 %
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022		
14 February 2024	187.267	171.403	161.491	158.648	150.985	139.104	134.724	130.542	127.278	120.094	105.343	104.127	99.292		
14 February 2025	187.125	171.256	161.331	158.511	150.837	138.747	134.636	130.637	127.603	120.358	105.492	104.218	97.044		
Difference	-0.142	-0.147	-0.160	-0.137	-0.148	-0.357	-0.088	0.095	0.325	0.264	0.149	0.091	-2.248		
%	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.3 %	-0.1 %	0.1 %	0.3 %	0.2 %	0.1 %	0.1 %	-2.3 %		
SO₂															
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
14 February 2024	585.029	534.931	484.785	372.765	368.704	382.708	331.549	328.697	302.705	244.651	249.475	205.845	156.829	138.414	123.269
14 February 2025	585.029	534.931	484.785	372.765	368.704	382.708	331.549	328.697	302.705	244.651	249.475	205.845	156.829	138.414	123.269
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
14 February 2024	105.201	109.221	100.807	93.529	91.944	81.876	95.898	90.475	101.194	83.594	69.607	82.974	81.235	66.902	58.963
14 February 2025	105.201	109.221	100.807	93.529	91.944	81.876	95.898	90.475	101.194	83.594	69.607	82.974	81.235	66.902	58.963
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022		
14 February 2024	66.157	60.283	50.018	47.710	44.277	40.850	39.838	35.046	33.144	29.613	23.228	23.109	22.692		
14 February 2025	66.157	60.283	50.018	47.710	44.277	40.850	39.838	35.046	33.148	29.615	23.230	23.112	22.461		
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.002	0.002	0.003	-0.231		
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	-1.0 %		
NH₃															
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
10 February 2023	42.402	42.923	43.339	43.783	43.693	43.554	43.113	42.317	41.482	39.664	41.402	39.401	37.557	37.966	39.036
14 February 2024	42.484	42.999	43.395	43.826	43.662	43.475	43.054	42.278	41.421	39.610	41.346	39.716	37.791	38.148	39.106

Difference	0.082	0.076	0.056	0.043	-0.031	-0.079	-0.059	-0.039	-0.061	-0.054	-0.056	0.315	0.234	0.182	0.070
%	0.2 %	0.2 %	0.1 %	0.1 %	-0.1 %	-0.2 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	0.8 %	0.6 %	0.5 %	0.2 %
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
14 February 2024	38.942	40.178	41.348	41.015	42.583	39.496	39.663	40.700	41.691	41.759	41.865	41.254	40.700	40.286	39.183
14 February 2025	39.000	40.107	41.198	40.651	42.210	39.059	39.096	40.002	40.912	40.916	40.903	40.495	39.546	39.153	38.097
Difference	0.058	-0.071	-0.150	-0.364	-0.373	-0.437	-0.567	-0.698	-0.779	-0.843	-0.962	-0.759	-1.154	-1.133	-1.086
%	0.1 %	-0.2 %	-0.4 %	-0.9 %	-0.9 %	-1.1 %	-1.4 %	-1.7 %	-1.9 %	-2.0 %	-2.3 %	-1.8 %	-2.8 %	-2.8 %	-2.8 %
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022		
14 February 2024	39.764	38.910	38.614	38.633	39.368	37.817	36.411	36.032	35.777	35.116	33.598	33.393	31.583		
14 February 2025	38.624	37.849	37.501	37.625	38.112	37.923	36.228	35.826	35.446	34.602	33.723	32.946	29.995		
Difference	-1.140	-1.061	-1.113	-1.008	-1.256	0.106	-0.183	-0.206	-0.331	-0.514	0.125	-0.447	-1.588		
%	-2.9 %	-2.7 %	-2.9 %	-2.6 %	-3.2 %	0.3 %	-0.5 %	-0.6 %	-0.9 %	-1.5 %	0.4 %	-1.3 %	-5.0 %		

NM VOC

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
14 February 2024	240.494	233.833	233.663	224.489	218.770	212.579	210.622	203.678	196.503	195.951	191.068	185.390	177.884	176.010	167.299
14 February 2025	238.444	233.160	233.362	224.230	218.539	212.340	210.373	203.440	196.259	195.699	190.813	185.121	177.612	175.735	167.028
Difference	-2.050	-0.673	-0.301	-0.259	-0.231	-0.239	-0.249	-0.238	-0.244	-0.252	-0.255	-0.269	-0.272	-0.275	-0.271
%	-0.9 %	-0.3 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.2 %	-0.2 %	-0.2 %
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
10 February 2023	162.790	157.911	147.170	141.049	137.477	121.446	112.615	112.507	104.883	101.884	98.383	95.440	90.640	90.859	89.240
14 February 2024	162.542	157.683	147.002	140.943	137.446	121.467	112.723	112.949	105.359	102.262	98.585	96.017	91.248	91.570	89.996
Difference	-0.248	-0.228	-0.168	-0.106	-0.031	0.021	0.108	0.442	0.476	0.378	0.202	0.577	0.608	0.711	0.756
%	-0.2 %	-0.1 %	-0.1 %	-0.1 %	0.0 %	0.0 %	0.1 %	0.4 %	0.5 %	0.4 %	0.2 %	0.6 %	0.7 %	0.8 %	0.8 %
	2018	2019	2020	2021	2022										
10 February 2023	86.640	84.654	84.832	82.892	75.464										
14 February 2024	87.420	85.840	86.462	84.585	76.856										
Difference	0.780	1.186	1.630	1.693	1.392										
%	0.9 %	1.4 %	1.9 %	2.0 %	1.8 %										

CO

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	764.457	735.842	715.135	700.247	686.537	661.765	656.805	651.390	646.260	629.839	593.765	596.047	577.497	556.342	541.870
14 February 2025	764.634	736.024	715.295	700.402	686.691	661.906	656.912	651.503	646.378	629.954	593.881	596.163	577.614	556.509	542.036
Difference	0.177	0.182	0.160	0.155	0.154	0.141	0.107	0.113	0.118	0.115	0.116	0.116	0.117	0.167	0.166
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
14 February 2024	519.417	499.247	486.034	452.015	428.960	446.004	407.361	401.564	388.655	382.571	359.420	366.263	357.066	348.589	343.290
14 February 2025	519.585	499.454	486.234	452.087	429.160	447.140	408.356	402.635	389.709	383.610	362.114	368.751	359.457	351.040	345.525

Difference	0.441	0.424	0.011
%	1.7 %	1.6 %	0.0 %

PM_{2.5}

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
14 February 2024	47.262	43.067	39.280	35.501	34.908	31.918	31.120	30.500	28.227	28.428	25.991	26.761	26.999	27.188	26.613	
14 February 2025	47.346	43.153	39.356	35.573	34.980	31.983	31.169	30.552	28.283	28.482	26.046	26.817	27.055	27.269	26.694	
Difference	0.084	0.086	0.076	0.072	0.072	0.065	0.049	0.052	0.056	0.054	0.055	0.056	0.056	0.081	0.081	
%	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.3 %	0.3 %	
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
14 February 2024	25.944	25.633	24.456	22.731	21.918	23.184	20.490	20.213	19.535	19.224	17.432	18.074	17.490	17.453	16.241	
14 February 2025	26.026	25.734	24.554	22.771	22.022	23.353	20.645	20.377	19.712	19.389	17.642	18.289	17.703	17.667	16.441	
Difference	0.082	0.101	0.098	0.040	0.104	0.169	0.155	0.164	0.177	0.165	0.210	0.215	0.213	0.214	0.200	
%	0.3 %	0.4 %	0.4 %	0.2 %	0.5 %	0.7 %	0.8 %	0.8 %	0.9 %	0.9 %	1.2 %	1.2 %	1.2 %	1.2 %	1.2 %	
	2020	2021	2022													
14 February 2024	14.093	14.223	13.384													
14 February 2025	14.431	14.595	13.657													
Difference	0.338	0.372	0.273													
%	2.4 %	2.6 %	2.0 %													

BC

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
14 February 2024	10.145	9.658	9.208	8.763	8.594	7.858	7.590	7.373	7.212	6.948	6.517	6.746	6.663	6.497	6.350	
14 February 2025	10.145	9.659	9.209	8.763	8.594	7.858	7.590	7.373	7.213	6.948	6.518	6.746	6.663	6.497	6.350	
Difference	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
14 February 2024	5.958	5.588	5.578	5.366	5.318	5.475	4.813	4.967	4.638	4.534	4.138	4.263	4.083	3.934	3.805	
14 February 2025	5.958	5.588	5.577	5.365	5.316	5.513	4.844	5.001	4.669	4.565	4.186	4.315	4.134	3.984	3.854	
Difference	0.000	0.000	-0.001	-0.001	-0.002	0.038	0.031	0.034	0.031	0.031	0.048	0.052	0.051	0.050	0.049	
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.7 %	0.6 %	0.7 %	0.7 %	0.7 %	1.2 %	1.2 %	1.2 %	1.3 %	1.3 %	
	2020	2021	2022													
14 February 2024	3.188	3.370	3.121													
14 February 2025	3.292	3.486	3.228													
Difference	0.104	0.116	0.107													
%	3.3 %	3.4 %	3.4 %													

Pb

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	321.435	237.157	165.145	105.144	73.966	72.690	49.223	34.333	37.244	33.676	30.662	29.800	30.738	24.926	26.496

14 February 2025	321.435	237.157	165.145	105.144	73.966	72.690	49.223	34.333	37.244	33.676	30.662	29.800	30.738	24.926	26.496
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
14 February 2024	21.490	24.866	21.854	19.821	16.759	20.373	19.232	16.339	16.010	16.647	14.694	15.710	15.650	15.433	13.218
14 February 2025	21.490	24.866	21.854	19.821	16.759	20.373	19.232	16.339	16.010	16.647	14.695	15.710	15.650	15.433	13.218
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
	2020	2021	2022												
14 February 2024	11.626	12.557	12.516												
14 February 2025	11.632	12.558	12.198												
Difference	0.006	0.001	-0.318												
%	0.1 %	0.0 %	-2.5 %												

Cd

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	6.686	3.811	3.327	3.387	2.720	2.127	1.910	1.590	1.694	1.535	1.412	1.745	1.375	1.328	1.615
14 February 2025	6.706	3.833	3.347	3.408	2.741	2.146	1.926	1.607	1.711	1.551	1.428	1.762	1.391	1.344	1.632
Difference	0.020	0.022	0.020	0.021	0.021	0.019	0.016	0.017	0.017	0.016	0.016	0.017	0.016	0.016	0.017
%	0.3 %	0.6 %	0.6 %	0.6 %	0.8 %	0.9 %	0.8 %	1.1 %	1.0 %	1.0 %	1.1 %	1.0 %	1.2 %	1.2 %	1.1 %
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
14 February 2024	1.451	1.426	1.266	1.206	1.154	1.283	1.219	1.170	1.080	0.919	0.889	0.940	0.955	0.881	0.789
14 February 2025	1.468	1.447	1.287	1.215	1.174	1.298	1.234	1.185	1.099	0.936	0.907	0.956	0.971	0.898	0.804
Difference	0.017	0.021	0.021	0.009	0.020	0.015	0.015	0.015	0.019	0.017	0.018	0.016	0.016	0.017	0.015
%	1.2 %	1.5 %	1.7 %	0.7 %	1.7 %	1.2 %	1.2 %	1.3 %	1.8 %	1.8 %	2.0 %	1.7 %	1.7 %	1.9 %	1.9 %
	2020	2021	2022												
14 February 2024	0.696	0.803	0.779												
14 February 2025	0.711	0.820	0.760												
Difference	0.015	0.017	-0.019												
%	2.2 %	2.1 %	-2.4 %												

Hg

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	1.087	0.930	0.891	0.766	0.808	0.801	0.865	0.813	0.693	0.636	0.603	0.685	0.672	0.819	0.754
14 February 2025	1.087	0.930	0.891	0.766	0.808	0.801	0.865	0.813	0.693	0.636	0.603	0.685	0.672	0.819	0.754
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
14 February 2024	0.892	1.035	0.873	0.821	0.756	0.888	0.755	0.745	0.762	0.707	0.621	0.591	0.582	0.679	0.587

14 February 2025	0.892	1.035	0.873	0.821	0.756	0.888	0.755	0.745	0.762	0.707	0.621	0.591	0.582	0.679	0.587
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %

2020 2021 2022

14 February 2024	0.537	0.519	0.505
14 February 2025	0.537	0.519	0.501
Difference	0.000	0.000	-0.004
%	0.0 %	0.0 %	-0.8 %

As

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	34.817	23.860	18.045	16.386	10.996	5.222	8.499	13.863	13.983	5.207	4.362	5.122	3.991	3.669	4.113
14 February 2025	34.817	23.860	18.045	16.386	10.996	5.222	8.499	13.863	13.983	5.207	4.362	5.122	3.991	3.669	4.113
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

14 February 2024	2.946	2.960	3.136	2.893	3.400	2.982	2.643	2.756	2.709	2.457	2.578	2.446	2.408	2.058	2.946
14 February 2025	2.946	2.960	3.136	2.893	3.400	2.982	2.643	2.756	2.709	2.457	2.578	2.446	2.415	2.065	2.946
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.007	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.3 %	0.3 %	0.0 %

2020 2021 2022

14 February 2024	1.992	2.047	1.920
14 February 2025	1.996	2.050	1.915
Difference	0.004	0.003	-0.005
%	0.2 %	0.1 %	-0.3 %

Cr

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	47.670	59.686	47.625	37.722	40.668	35.827	32.754	32.628	30.070	31.226	28.564	25.694	39.075	29.455	26.034
14 February 2025	47.670	59.686	47.625	37.722	40.668	35.827	32.754	32.628	30.070	31.226	28.564	25.694	39.075	29.455	26.034
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

14 February 2024	20.009	24.922	28.825	26.509	16.662	25.885	17.371	18.559	18.434	23.065	16.716	18.172	16.652	15.343	14.286
14 February 2025	20.009	24.922	28.825	26.509	16.662	25.885	17.371	18.559	18.434	23.065	16.716	18.172	16.652	15.348	14.292
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.006
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %

2020 2021 2022

14 February 2024	13.844	14.005	14.905
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14 February 2025	13.855	14.010	14.664
Difference	0.011	0.005	-0.241
%	0.1 %	0.0 %	-1.6 %

Cu

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
14 February 2024	156.894	148.871	124.284	111.540	106.193	116.486	109.525	129.014	84.474	68.125	65.333	66.240	69.278	61.899	59.982	
14 February 2025	156.915	148.893	124.304	111.560	106.215	116.505	109.541	129.031	84.491	68.142	65.350	66.257	69.295	61.916	59.999	
Difference	0.021	0.022	0.020	0.020	0.022	0.019	0.016	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
14 February 2024	58.052	58.646	44.147	42.043	40.415	41.965	42.401	41.202	42.379	43.075	40.744	41.642	40.635	40.070	40.077	
14 February 2025	58.069	58.666	44.167	42.051	40.435	41.980	42.416	41.217	42.398	43.091	40.761	41.658	40.651	40.265	40.325	
Difference	0.017	0.020	0.020	0.008	0.020	0.015	0.015	0.015	0.019	0.016	0.017	0.016	0.016	0.195	0.248	
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.5 %	0.6 %	
	2020	2021	2022													
14 February 2024	37.552	38.551	38.391													
14 February 2025	37.884	38.779	38.150													
Difference	0.332	0.228	-0.241													
%	0.9 %	0.6 %	-0.6 %													

Ni

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
14 February 2024	78.439	60.885	52.204	45.625	44.610	46.583	36.798	38.116	33.563	37.110	34.572	32.065	37.917	35.279	30.565	
14 February 2025	78.449	60.896	52.214	45.636	44.621	46.593	36.805	38.124	33.571	37.119	34.580	32.073	37.925	35.287	30.574	
Difference	0.010	0.011	0.010	0.011	0.011	0.010	0.007	0.008	0.008	0.009	0.008	0.008	0.008	0.008	0.009	
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
14 February 2024	26.061	27.825	24.972	22.348	20.474	22.782	19.909	18.869	17.147	17.318	16.104	15.716	14.781	14.149	11.538	
14 February 2025	26.069	27.835	24.982	22.352	20.485	22.789	19.916	18.877	17.157	17.327	16.113	15.724	14.790	14.157	11.546	
Difference	0.008	0.010	0.010	0.004	0.011	0.007	0.007	0.008	0.010	0.009	0.009	0.008	0.009	0.008	0.008	
%	0.0 %	0.0 %	0.0 %	0.0 %	0.1 %	0.0 %	0.0 %	0.0 %	0.1 %	0.1 %	0.1 %	0.1 %	0.1 %	0.1 %	0.1 %	
	2020	2021	2022													
14 February 2024	9.635	9.911	9.917													
14 February 2025	9.644	9.919	9.643													
Difference	0.009	0.008	-0.274													
%	0.1 %	0.1 %	-2.8 %													

Zn

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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14 February 2024	682.839	472.798	374.228	349.383	405.625	402.986	269.817	151.710	150.857	141.454	127.631	131.327	146.873	127.091	124.792
14 February 2025	682.850	472.809	374.238	349.394	405.636	402.995	269.824	151.719	150.866	141.462	127.639	131.335	146.881	127.100	124.800
Difference	0.011	0.011	0.010	0.011	0.011	0.009	0.007	0.009	0.009	0.008	0.008	0.008	0.008	0.009	0.008
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
14 February 2024	119.307	119.065	108.395	116.691	115.833	128.582	124.113	126.809	124.407	131.938	118.616	127.346	119.961	118.490	130.014
14 February 2025	119.316	119.075	108.405	116.695	115.843	128.589	124.120	126.817	124.417	131.946	118.625	127.354	119.969	118.552	130.108
Difference	0.009	0.010	0.010	0.004	0.010	0.007	0.007	0.008	0.010	0.008	0.009	0.008	0.008	0.062	0.094
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.1 %	0.1 %
	2020	2021	2022												
14 February 2024	116.030	133.684	131.533												
14 February 2025	116.190	133.703	126.706												
Difference	0.160	0.019	-4.827												
%	0.1 %	0.0 %	-3.7 %												

PCDD/F

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	18.051	18.856	17.803	18.768	18.372	18.810	17.177	17.386	17.651	17.640	18.158	15.529	15.745	14.055	14.309
14 February 2025	16.604	17.456	16.323	16.171	15.633	16.077	14.473	14.774	14.941	14.966	15.454	12.829	13.036	11.395	11.624
Difference	-1.447	-1.400	-1.480	-2.597	-2.739	-2.733	-2.704	-2.612	-2.710	-2.674	-2.704	-2.700	-2.709	-2.660	-2.685
%	-8.0 %	-7.4 %	-8.3 %	-13.8 %	-14.9 %	-14.5 %	-15.7 %	-15.0 %	-15.4 %	-15.2 %	-14.9 %	-17.4 %	-17.2 %	-18.9 %	-18.8 %
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
14 February 2024	14.033	14.554	14.334	14.414	12.466	16.234	13.962	14.858	15.260	15.933	14.174	15.179	12.790	13.660	9.830
14 February 2025	11.378	11.970	11.764	11.858	10.274	13.777	11.429	12.242	12.653	13.295	11.573	12.558	10.223	11.103	9.830
Difference	-2.655	-2.584	-2.570	-2.556	-2.192	-2.457	-2.533	-2.616	-2.607	-2.638	-2.601	-2.621	-2.567	-2.557	0.000
%	-18.9 %	-17.8 %	-17.9 %	-17.7 %	-17.6 %	-15.1 %	-18.1 %	-17.6 %	-17.1 %	-16.6 %	-18.4 %	-17.3 %	-20.1 %	-18.7 %	0.0 %
	2020	2021	2022												
14 February 2024	9.588	10.841	9.497												
14 February 2025	9.588	10.841	9.344												
Difference	0.000	0.000	-0.153												
%	0.0 %	0.0 %	-1.6 %												

PAH-4

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	18.174	18.330	18.357	18.426	19.210	17.303	18.565	18.704	19.415	18.994	17.596	19.987	20.148	20.701	20.968
14 February 2025	18.176	18.333	18.359	18.430	19.211	17.304	18.565	18.703	19.412	18.991	17.593	19.983	20.146	20.699	20.966
Difference	0.002	0.003	0.002	0.004	0.001	0.001	0.000	-0.001	-0.003	-0.003	-0.003	-0.004	-0.002	-0.002	-0.002
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019

14 February 2024	21.778	20.853	21.783	21.462	22.597	25.124	21.654	23.590	22.409	22.713	21.536	23.456	23.011	22.623	22.314
14 February 2025	21.779	20.855	21.785	21.468	22.610	25.624	22.088	24.065	22.859	23.173	22.270	24.259	23.808	23.404	23.087
Difference	0.001	0.002	0.002	0.006	0.013	0.500	0.434	0.475	0.450	0.460	0.734	0.803	0.797	0.781	0.773
%	0.0 %	0.0 %	0.0 %	0.0 %	0.1 %	2.0 %	2.0 %	2.0 %	2.0 %	2.0 %	3.4 %	3.4 %	3.5 %	3.5 %	3.5 %

2020 2021 2022

14 February 2024	17.837	20.060	18.531
14 February 2025	19.253	21.641	19.967
Difference	1.416	1.581	1.436
%	7.9 %	7.9 %	7.7 %

HCB

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	35.677	35.567	36.361	36.379	36.054	35.572	38.003	38.458	38.377	38.126	38.596	18.186	12.024	9.912	26.039
14 February 2025	35.677	35.567	36.361	36.379	36.054	35.572	38.003	38.458	38.377	38.126	38.596	18.186	12.024	9.912	26.039
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

14 February 2024	32.374	36.122	38.182	18.691	26.568	8.749	26.113	9.464	17.307	21.623	16.206	59.696	33.405	31.883	22.627
14 February 2025	32.374	36.122	38.182	18.691	26.568	8.631	26.113	9.347	17.165	21.510	16.206	59.696	33.405	31.884	22.631
Difference	0.000	0.000	0.000	0.000	0.000	-0.118	0.000	-0.117	-0.142	-0.113	0.000	0.000	0.000	0.001	0.004
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	-1.3 %	0.0 %	-1.2 %	-0.8 %	-0.5 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %

2020 2021 2022

14 February 2024	21.156	23.045	29.245
14 February 2025	21.165	23.056	29.213
Difference	0.009	0.011	-0.032
%	0.0 %	0.0 %	-0.1 %

PCB

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2024	28.558	24.790	25.924	28.007	28.654	28.672	27.456	29.481	31.315	30.165	30.037	29.154	28.730	29.964	31.126
14 February 2025	25.579	21.804	22.933	25.018	25.563	25.962	24.543	26.556	28.282	27.204	27.256	25.971	25.501	26.648	27.768
Difference	-2.979	-2.986	-2.991	-2.989	-3.091	-2.710	-2.913	-2.925	-3.033	-2.961	-2.781	-3.183	-3.229	-3.316	-3.358
%	-10.4 %	-12.0 %	-11.5 %	-10.7 %	-10.8 %	-9.5 %	-10.6 %	-9.9 %	-9.7 %	-9.8 %	-9.3 %	-10.9 %	-11.2 %	-11.1 %	-10.8 %

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

14 February 2024	31.190	31.466	31.937	30.932	20.970	27.566	27.290	24.257	23.249	24.343	23.957	25.418	22.688	23.256	19.759
14 February 2025	27.664	28.052	28.387	27.414	17.234	23.399	23.723	20.321	19.471	20.551	20.405	21.537	18.877	19.502	16.065
Difference	-3.526	-3.414	-3.550	-3.518	-3.736	-4.167	-3.567	-3.936	-3.778	-3.792	-3.552	-3.881	-3.811	-3.754	-3.694
%	-11.3 %	-10.8 %	-11.1 %	-11.4 %	-17.8 %	-15.1 %	-13.1 %	-16.2 %	-16.3 %	-15.6 %	-14.8 %	-15.3 %	-16.8 %	-16.1 %	-18.7 %

2020 2021 2022

14 February 2024	20.091	23.284	19.922
14 February 2025	16.724	19.504	16.426
Difference	-3.367	-3.780	-3.496
%	-16.8 %	-16.2 %	-17.5 %

8.2 Improvements and Reviews

Changes in chapter	
March 2024	TF

Inventory improvement programme at Finnish Environment Institute

Identification of further development needs in the Finnish air pollutant inventory is carried out on a continuous basis according to annual work programmes although larger scale improvements are possible only when the necessary resources for the improvement projects are available.

In the past years the inventory improvement programme was strongly linked with the national emission data production methods provided to the operators in their reporting to emission registers such as the PRTR. Finnish Environment Institute maintains information on emission estimation methodologies and emission factors on a website (<https://www.ymparisto.fi/fi/saasteettomuus-ja-ymparistoriskit/ilmansuojelu/ilman-epapuhtauksien-paastot-suomessa/paastotiedon-tuottaminen-ja-ilmoittaminen-paastorekistereihin/paastorekisterit>) (in Finnish). These methods should be applied in the PRTR reporting by the plant operators whenever no plant specific data is available. This procedure has been developed to ensure consistency between the data reported by the plants and the emission inventory.

The programme has thus far included studies in the energy production sector (boilers >50 MW), industrial processes (pulp and paper, iron and steel), agriculture and waste sectors and resulted in updating or developing of several emission factors. The studies involve also examination of the applicability of the default methods presented in the Guidebook for the national conditions.

National emission factors are derived from data reported by the plants when these are based on site-specific measurements and other site-specific data. In the later years, the obligation to use the latest version of the Guidebook emission factors has been more dominant. In the coming years, emphasis will be given to check and further develop national emission factors based on data reported by the plants and replace the Guidebook EFs with these where feasible.

The results of the uncertainty analysis are used to prioritise the improvements.

Review, Improvement and Harmonization of the Nordic Air Emission Inventories in the Nordic Air Emission Experts Group

Changes in chapter	
March 2025	TF

Since 2004 the Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) have carried out several projects on reviewing, improving and harmonizing the national air pollutant emission inventories. The work has been funded by the Nordic Council of Ministers. The target of the cooperation is to share knowledge and resources and to increase the quality of the Nordic CLRTAP air emission inventories with respect to accuracy, comparability, transparency and completeness. Until now, POP, NMVOC, particle and partly also heavy metal emission inventories in the Nordic countries have improved. Several improvements to the national inventories have been made in all Nordic countries due to the results of the work, for instance in NMVOC and particle emission inventories.

In addition to the overall review (2004), the following specific sectors have been under work:

- particulate emissions from small scale wood combustion and road transport (2006)
- emissions from the use of products (2006-2011)

- NMVOC inventories from the domestic product use sector (2010)
- SLCP emissions (2014-2017)
- POP and heavy metals from all sectors (2016-2018).
- POP and heavy metals and particles (2019-2024)

Improvements in the Finnish Inventory due to the Inventory Review Processes

UNECE CLRTAP In-Depth Review of Inventories, Stage 3 Review Report 2024

Changes in chapter	
February 2025	TF

The improvements made to the 2025 inventory submission in response to the UNECE CLRTAP In-Depth Review of Inventories (Stage 3) in 2024 are presented in Table 8.2.

Table 8.2. Improvements made in response to UNECE CLRTAP Stage 3 Review in 2024.

NOTE – Responses to earlier CLRTAP Reviews can be found in the earlier versions of the IIR.

ID	Pollutants	NFR category	Key Category	Type	TAC ₁ C ₂ C ₃
Finland-2024-2D3a-1	NMVOG	2D3a	Yes	R	T
<p>Observation</p> <p>The ERT noted that Finland does not report the activity data in the NFR submission for category 2D3a Domestic solvent use including fungicides. In response to a question from the ERT, Finland states that the calculation model contains three different sub-models: (1) Household product use, (2) Pharmaceutical, adhesive and filling agents and (3) Use of disinfectants, and NMVOG emissions are calculated based on different types of activity data, such as sales from different products, population, or data provided by chemical agency. The ERT notes the complexity of the activity data, however, NA is not accurate.</p> <p>Recommendation</p> <p>The ERT recommends that Finland include, within the Annex I reporting template, activity data for NFR category 2D3a, instead of reporting the Notation Key 'NA'. The ERT recommends that this can either be presented as solvent content of products, or population, such that comparisons can be made with other countries.</p> <p><i>Actions up to March 2025</i></p> <p>All activity data used by Finland for NFR category 2D3a cannot be expressed in just one unit (solvent content of products or population). In addition, part of the activity data is confidential. Therefore, Finland will continue to report 'NA' in the Annex I table. We do not see that reporting only part of the activity data in the Annex I table would be reasonable. However, the transparency and comprehension of presenting the activity data in the IIR Part 4 IPPU (chapter 4.5) was increased to the 2025 submission.</p>					

EU Technical Review under the NECD in 2024

Changes in chapter	
February 2025	TF

The improvements made to the 2025 inventory submission in response to the EU Technical Review under the NECD in 2024 are presented in Table 8.3.

Table 8.3 Improvements in response to the 2024 EU Technical Review under the NECD (Final Review Report)

NOTE1 – Responses to NECD Projections Review are provided under the Projections Chapter below.

NOTE2 – Responses to earlier NECD Reviews can be found in the earlier versions of the IIR.

2024 Review Report Table 4: All findings for NO_x, NMVOC, SO₂, NH₃, PM_{2.5} and PM₁₀, including those made during the 2024 NECD inventory review and those not implemented from previous reviews.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2023	RE, TC, or UPTC in 2024
2024 (1)	FI-1A2d-2024-0001	No	1A2d Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print, NH ₃ , 1990-2022	NA	No
<p>Recommendation</p> <p>For category 1A2d Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print, NH₃ and all years the TERT notes that there is use of notation key 'NA' (not applicable), but a Tier 1 emission factor is available in the 2019 and 2023 EMEP/EEA Guidebook for biomass and substantial biomass activity is reported across the time series in 1A2d. In response to a question raised during the review, Finland explained that (as described in the IIR) the 2023 EMEP/EEA Guidebook Tier 1 is not suitable for 1A2d, and the original reference has a poor-quality rating. Finland includes NH₃ emissions in 1A4a/c based on a national emission factor and in category 1A1 where SCR/SNCR is used. Finland considers that the 1A2d energy plant technologies are aligned with 1A1 technologies and operate without SCR/SNCR.</p> <p>The TERT recommends that Finland modify the use of nation key to 'NE' (not estimated) to align with EMEP/EEA Guidebook 1A1a Tier 1 tables and review with operators/regulators to identify when SNCR/SCR is implemented.</p> <p><i>Actions up to March 2025</i></p> <p><i>To the 2025 submission, the notation key for NH₃ emissions in categories 1A2a-f was revised from 'NA' to 'NE' in line with the recommendation. However, Finland still considers that 'NA' would be more correct. More detailed description of the use notation keys in this case is included in chapter 2B in IIR Part 2 energy (p. 34).</i></p>					
Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2023	RE, TC, or UPTC in 2024
2024 (1)	FI-5B1-2024-0001	No	5B1 Biological treatment of waste - Composting, NH ₃ , 2005, 2019, 2020, 2021, 2022	NA	No

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2023	RE, TC, or UPTC in 2024
<p>Recommendation</p> <p>For category 5B1 Biological treatment of waste: Composting, NH₃, years 2005, 2019, 2020, 2021 and 2022, the TERT notes on page 10 of the Finland IIR, Part 6: Waste and Other, the emission factors of 0.24 kg/Mg from the 2023 EMEP/EEA Guidebook is used. However, the emission factors show a deviation of 18% in 2021. This over-estimate or under-estimate does not have an impact on total emissions that is above the threshold of significance. In response to a question, Finland explained the there is an error in the IIR table 6.8 for the year 2021 but that the data in the NFR-tables is correct. This will be updated in the 2025 submission of the IIR.</p> <p>The TERT recommends that Finland correct the NH₃ emission for year 2021 in table 6.8 in the 2025 submission.</p> <p><i>Actions up to March 2025</i></p> <p><i>In the 2025 submission, the table 6.8 was removed from the IIR (Part 6 Waste and Other sources). It was considered that it is unnecessary to repeat the same NH₃ emission data in the IIR that is reported in the NFR tables.</i></p>					

9 PROJECTIONS

Changes in chapter	
Update of text March 2025	TF, MS
Update of projections	Every 1-2 years

9.1 Projections for 2025, 2030, 2040, 2050

With existing measures (WM) projections

Finland is currently in the process of updating its Energy and climate strategy. It has become an established practice that each government draws up an energy and climate strategy. The new energy and climate strategy is expected to be completed in the spring of 2025. The energy and climate strategy takes into account and coordinates the Government Programme's energy and climate policies, the long- and medium-term climate change policy plans referred to in the Climate Change Act, and the EU's energy and climate targets for 2030. Different background studies are prepared to support the strategy. In the Finnish air pollutant emission projections, an extensive background study that was published in the spring 2024 (abbreviated as PEIKKO¹) has been utilized.

As with the original National Air Pollution Control Programme 2030 (Ministry of the Environment, 2019²), the First Update Report of the programme³ (published in May 2023) concludes that the With Existing Measures scenario, Finland will be able to meet the air pollution emission reductions for 2030. Based on that, an air pollutant emission scenario, called WM, is presented in this chapter.

Base years

The base years for the projections depend on the sector as follows:

Energy	2022
Transport	a specific base year does not play a significant role in transportation projections
IPPU & Waste	2022
Agriculture	the projections are based on animal number forecasts, a specific base year not relevant

In the 2025 projections submission, the year 2022 has been used as a base year and reported in the Annex IV reporting table. However, especially in transport and agriculture projections, a specific base year does not play a significant role. In addition, the projections in some IPPU categories are simplified running averages or scaled in line with capita projections.

Projections for 2025, 2030, 2040 and 2050

Emission projections for 2025, 2030, 2040 and 2050 submitted in 2025 cover nitrogen oxides, sulphur oxides, non-methane volatile organic compounds, ammonia, fine particles (PM_{2.5}) and black carbon.

For all the sectors, emission scenarios are available up to 2050. The current projected emission values are presented in Table 9.1. According to the projections, Finland will continue to meet all emission

¹ Baseline scenarios for energy and climate policy package towards zero emissions (PEIKKO). Available at: <http://urn.fi/URN:ISBN:978-952-383-219-0>

² Ministry of the Environment. 2019. National Air Pollution Control Programme 2030. Publications of the Ministry of Environment 2019:7

³ Ministry of the Environment. 2023. First update of the national air pollution control programme 2030. Publications of the Ministry of the Environment 2023:24.

reduction targets set for any of these pollutants under the 2012 amendment to the 1999 Gothenburg Protocol to the CLRTAP and the EU National Emission reduction Commitments Directive (2016/2284).

Table 9.1. Projected national total emissions for 2025, 2030, 2040, 2050 as reported on 15 March 2025.

Pollutant	Unit	WM projections				
		2022*	2025	2030	2040	2050
SO _x	kt	23	20	14	13	12
NO _x	kt	97	85	67	56	49
NM VOC	kt	77	73	67	62	55
NH ₃	kt	30	30	29	27	24
PM _{2.5}	kt	14	12	10	9	7
BC	kt	3.2	2.8	2.2	1.7	1.2

*Base year for the emission projections in 2025 submission.

QA/QC measures and sensitivity analysis

In general, the same sectoral QA/QC activities that are carried out for the historical emissions, and described in the sectoral chapters in the IIR, are also carried out for the projected emissions. For instance, in the case of activity data, these include the cross-checking of possible anomalies. In addition, especially in agriculture, the same activity data is also used by Natural Resources Institute Finland in the production of ghg-emission projections. They also carry out QA/QC activities for the activity data and the results of these activities are available for the air pollutant emission projections. Regarding the sensitivity analysis, no specific sensitivity analyses have been carried out. In many cases, some specific sensitivity analyses have not been considered necessary. E.g. in the energy sector, according to the projections, all the 2030 targets will be met and the technological development and the increasing share of non-combustible renewables will decrease the emissions in the future. The EMEP/EEA Emission Inventory Guidebook 2023 provides only a short introduction to the sensitivity analysis and no detailed methodological guidance are provided. In addition, the use of sensitivity analyses is not a shall requirement in the reporting guidelines. However, the appropriateness of the sensitivity analyses will be examined for the future submissions.

9.2 Projections for Energy

Changes in chapter	
Update of text March 2025	MS, TF
Update of projections	Every 1-2 years

The following text describes how projections for energy production facilities, industrial processes and households were calculated in the 2025 submission. Finland is currently in the process of updating its Energy and climate strategy, and a new baseline scenario for the primary energy consumptions was finalized in the first months of 2025. However, updates in the national air pollution model were done in December 2024 and are based on the previous version of the baseline. The previous version was published in late 2024 in a separate project, called Baseline scenarios for energy and climate policy package towards zero emissions (PEIKKO⁴). Primary energy consumption data resulting from the PEIKKO project was received specifically from VTT (Technical Research Centre of Finland) to be used for modelling of air pollutant emissions.

⁴ Baseline scenarios for energy and climate policy package towards zero emissions (PEIKKO). Available at: <http://urn.fi/URN:ISBN:978-952-383-219-0>

The projections have been calculated at the Finnish Environment Institute. Primary energy consumption data resulting from the PEIKKO project was received specifically from VTT (Technical Research Centre of Finland) to be used for modelling of air pollutant emissions. Using this input data, the Finnish Regional Emissions scenario (FRES) model (Karvosenoja 2008) was used to calculate emission projections for combustion plants and residential combustion. It covers the emissions of sulfur dioxide (SO₂), nitrogen oxides (NO_x) non-methane volatile organic compounds (NMVOCs) (from residential combustion only) and primary particulate matter (TSP, PM₁₀, PM_{2.5}, PM₁ and PM_{0.1}). Primary PM includes the fractionation to main chemical species (black and organic carbon, sulfate, main heavy metals and mineral matter). For NH₃ and NMVOC emissions from the energy sector (with the exception of NMVOC emissions from residential combustion), projections are expert estimates based on historical emissions. Only ammonia slips from SCR/SNCR are considered as ammonia emissions. No ammonia emissions are expected from biomass combustion with the technologies used in Finnish heat and power production.

FRES is a scenario model, where a new reference years can be added as necessary , and target years are selected according to specific needs and available activity data. For the purpose of this report a new base year of 2022 was added, and target years of 2030 and 2050 were calculated. The two target years were then used to estimate emissions for the years 2025 and 2040, assuming linear progression. The FRES model is not completely aligned with the NFR reporting scheme in all aspects, however, and thus it has been used to estimate relative changes in emissions. These relative changes were then implied to emissions reported for 2022 in the NFR.

The FRES model or any other national source does not include estimations for future changes in process industry emissions that are not caused by to fuel combustion. The projected change in the most important subsectors (iron and steel, pulp and paper, food and beverages as well as chemical industry) is thus estimated using the GAINS model (Amann et. al. 2011). The scenario *ECLIPSE_V6b_CLE_base* for Finland was used to calculate relative changes in emissions from 2022 to each target year. These relative changes were then implied to emissions reported for 2022 in the NFR.

Model parameters

The emissions are calculated from the parameters of activity levels, emission factors and emission control technology removal efficiencies and utilization rates (Figure 9.1). The energy consumption and industrial production scenarios produced in the PEIKKO study are used as input to the model (Annex IV B-WM). In the FRES model the activity unit for combustion processes is annual primary energy use (e.g. PJ a⁻¹). Emission sources are treated as point sources (~450 combustion plants and ~130 process industry plants) or area sources (residential combustion and small or less active combustion plants).

For some combustion plants the emissions and fuel use data are reported in the national YLVA database so that plant-specific emission factors can be calculated. If the data is not available, emission factors will be implemented based on legislation (current or upcoming, depending on the year) for the type of plant in question. The statutes affecting the emission limits of combustion plants are:

- The Industrial Emissions Directive, and the BAT conclusions concerning energy production and different industrial sectors, Medium Combustion Plant Directive
- Environmental Protection Act (527/2014)
- Government Decree on Limiting Emissions from Large Combustion Plants (936/2014)
- Government Decree on Environmental Protection Requirements for Medium-sized Energy Production Units (1065/2017)
- Government Decree on Waste Incineration (151/2013)

Based on these a table has been compiled, where emission factors are given for each fuel type and plant size category, taking into account the date of the start of the operation of the plant (available at request).

Small-scale residential combustion is the biggest source of PM and NMVOC emissions in Finland. The emission calculation scheme for residential (wood) combustion is described in Savolahti et al. (2016)⁵. It includes 5 categories for small-scale central heating boilers and 9 categories for stoves or fireplaces. All of them have separate emission factors based mostly on national measurements, and annual activities based on questionnaires. We have also tried to take into account the suboptimal combustion practices of some stove users. Based on emission factors from literature and info from chimney sweeps, we have used a coefficient for “poor combustion”, resulting in an increase of the average emission factors. Future emissions in the projection are determined by activity changes, natural development of the appliance stock and the Ecodesign directive (2015/1195 and 2015/1189 for residential combustion). The prevalence of wood combustion has been increasing during the last decades but was relatively stable from 2008 to 2017 (estimate based on questionnaires). Mostly due to improvements in energy efficiency, the previously increasing trend is expected to start to decline in the future. In 2022, wood consumption in residential, agricultural, commercial and industrial buildings was 60 PJ. In the WM scenario, this is expected to decline to 50 PJ in 2030 and 36 PJ in 2050. Ecodesign will not have a major impact until 2030, since it mainly targets appliances with a very long service life (e.g. ~35 years for masonry heaters) and does not cover sauna stoves, which are very common in Finland. However, the natural development of the appliance stock towards cleaner stoves and boilers is expected to notably decrease the average emission factors of the sector already by 2030, and thus decrease the emissions. Due to these two factors, emissions (mostly PM and NMVOC) from the residential sector are expected to decrease significantly in the projection.

For ammonia from residential combustion, the projections are expert estimates based on historical emissions and estimated fuel use for future years.

⁵ Savolahti M., Karvosenoja N., Tissari J., Kupiainen K., Sippula O. & Jokiniemi J. 2016. Black carbon and fine particle emissions in Finnish residential wood combustion: Emission projections, reduction measures and the impact of combustion practices. *Atmospheric Environment* 140 (2016) 495-505. <https://doi.org/10.1016/j.atmosenv.2016.06.023>

9.3 Projections for Transport

Changes in chapter	
Update of text March 2025	AL, TF
Update of projections	Every 1-2 years

Projections for road and rail transport as well as aviation and working machines are produced using VTT's LIPASTO system, which has a time series for the years 1980-2050.

Road transport

In road transport, the projections are based on the authorities' (The Finnish Transport Infrastructure Agency) forecast of vehicle kilometrage until 2060⁶. The vehicle kilometrage forecast is affected by several factors: most importantly, forecasted development of economy, population growth and cost of driving. A major change in methodology has increased the passenger kilometrage: the relatively inexpensive driving of battery electric vehicles is assumed to increase the total passenger vehicle kilometrage. In the ELIISA model⁷, average annual kilometrages for vehicles are adjusted so that the national kilometrage forecast is achieved with the same size of vehicle fleet as used in the national kilometrage projections. Thus, the composition of the fleet (vehicle types and motive powers) is linked to the projected kilometrage development – as the composition of the fleet varies, the total kilometrage varies also and may not fully match to the national projections. Kilometrage projections include also the impacts of other local policies, which have an assumed impact on kilometrage such as governmental support for public transport and the investment program for walking and bicycling infrastructure (for more details, see attachment 1a in Lauhkonen & Markkanen 2023⁸). Projection includes also a new estimate for the impact of the ETS2 for road transport starting from 2028 onwards⁹.

Sales forecasts cover both new vehicles and imported used vehicles: imported vehicles add also a significant amount of vehicles to Finland's vehicle fleet. Scrappage rate is a function of end-of-life-age of vehicles: it is based on actual changes in the fleet. The model considers the penetration of the Euro classes based on statistical data. Assumptions of fuel efficiency development of passenger cars and vans are in line with the CO₂ emission regulation by EU¹⁰, which implies the end of sales for new combustion engine vehicles by 2035. For buses, the model assumes fuel efficiency development according to the EC proposal for new heavy duty vehicles¹¹. For trucks, fuel efficiency development follows a recent expert evaluation of the emergence of electric and fuel cell trucks in Finland⁸. Vast increases in electric and fuel cell vehicle registrations are introduced to the model to simulate the implementation of EU's updated CO₂ emission regulation.

The modelled fleet is divided into different sub-types: eight main types including passenger cars (with and without catalytic converter), vans, buses, rigid and articulated trucks, mopeds, motorcycles and quadricycles. These, in turn, are divided into seven propulsion groups: gasoline, diesel, E85 (ethanol-petrol vehicles), ED95 (ethanol-diesel vehicles), methane, electricity (including plug-in hybrids) and hydrogen. Each of these have their own forecasts of shares of annual sales and imports and fuel

⁶ Moilanen, P., Lapp, T., Niinikoski, M., Blomqvist, P. & Rinta-Piirto, J.. 2022. National transport forecasts (in Finnish). Traficom Research Reports 6/2022. Available at: <https://www.traficom.fi/sites/default/files/media/publication/VLE%202022.pdf>

⁷ Markkanen, J., Lauhkonen, A., & Niemi, A. (2023). Scenarios for greenhouse gas emissions and energy consumption of road transport in Finland: Exploring the impact of existing policies. VTT Technical Research Centre of Finland. VTT Technology No. 413 <https://doi.org/10.32040/2242-122X.2023.T413>

⁸ Lauhkonen, AI & Markkanen, J. 2023. Tieliikenteen ajoneuvokanta- ja päästöennusteen päivitys 2023 (in Finnish). Available at: https://www.traficom.fi/sites/default/files/media/publication/Tieliikenne_PaastoPaivitys_2023.pdf

⁹ Baseline scenarios for energy and climate policy package towards zero emissions (PEIKKO). Available at: <http://urn.fi/URN:ISBN:978-952-383-219-0>

¹⁰ Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO₂ emission performance standards for new passenger cars and for new light commercial vehicles

¹¹ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Regulation (EU) 2019/1242 as regards strengthening the CO₂ emission performance standards for new heavy-duty vehicles and integrating reporting obligations, and repealing Regulation (EU) 2018/956 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2023:88:FIN>

efficiency development. In addition, regarding consumed fuels, the proportions of fossil and renewable fuel components are considered. The use of biofuels will increase from 10 % in 2020 (by energy content, of annual liquid and gaseous fuel sales) up to 34 % in 2030 due to the biofuel obligation in Finland¹² with a temporary decreases in 2022 and 2023 (12 % and 13.5 %, respectively). Biogas and P2X-fuels are included in the obligation since 2022, although P2X fuels are not separately modelled.

The fleet turnover rate of passenger vehicles will be 4.4 % in 2025, 4.5 % in 2030, 4.6 % in 2040 and 4.6 % in 2050. The corresponding figures for vans are: 4.9 %, 4.9 %, 4.8 % and 4.6 %, and for trucks: 4.0 %, 3.8 %, 3.9 % and 3.7 %. A special feature in Finland are the very heavy trucks (gigatrucks), which reduce the number of trucks with trailer. The increase in the number and kilometrage of motorcycles, mopeds and quadricycles is expected to stabilise in the coming years. The vehicle fleet development is based on an expert estimate on the current sales trends of available powertrains and the availability of new vehicles in the European market as well as on CO₂-limits of new vehicles as set in EU-legislation. The development in the forecast is dominated by increase of battery electric vehicles, which replace conventional gasoline and diesel vehicles in all vehicle categories except in trucks, for which CNG/LNG-powered vehicles replace conventional vehicles. The demand for electric vehicles remains high as the total share of battery-powered (plug-ins included) cars exceeded 50 % of all new car sales in 2023.

Ammonia

In transport, most NH₃ emissions originate from passenger cars equipped with catalytic converters. Improvements in technology have substantially reduced NH₃ emissions from passenger cars after 2005 and the development is continuing in the projections. On the other hand, the introduction of the urea additive in heavy vehicles since Euro V significantly increases their ammonia emissions. However, since heavy-duty NH₃ emissions are one-tenth of NH₃ emissions from passenger cars, emissions from passenger cars dominate and overall emissions are decreasing in the projections.

PM2.5 and BC

Car exhaust emissions of particulate matter (PM2.5) and black carbon (BC) have fallen to less than a quarter since the year 2000 and the development is continuing in the projections. However, emissions from tyre and brake wear and road abrasion are increasing. According to the forecast, the vehicle kilometrage for passenger cars especially, increases from 2020 until 2050. One key reason for this is relatively inexpensive driving of battery electric vehicles.

NM VOC

NM VOC emissions are decreasing due to the renewal of vehicle fleet. A significant share of these emissions is caused by mopeds and motorcycles. The increase in the number and kilometrage of motorcycles and mopeds is expected to stabilise in the coming years and the vehicle fleet renewal towards greater share of newer Euro-classes is continuing in the projections. Currently there is no detailed information on the development of NM VOC emissions in the coming years.

Sensitivity analysis for road transport scenarios

Sensitivity analyses have been carried out using the ELIISA calculation model in the PEIKKO project. The sensitivity analyses examined the biodistribution obligation levels of fuels for 2024–2027. The obligation levels were adjusted to 13.5% for 2024, 16.5% for 2025, 19.5% for 2026, and 22.5% for 2027. Analyses showed an increase in GHG emissions, with a cumulative rise of 4.8 Mt CO₂ eq. by 2027. The 2030 emission levels remain unchanged as the 2030 distribution obligation was not altered. For air pollutants, this did not have an effect since current emission factors used in the modeling do not take into account changes in the bio share of fuels. No other sensitivity analyses have been conducted in the recent years.

¹² Finnish Act on biofuels 20.12.2022/1134. Available at: <https://www.finlex.fi/fi/laki/alkup/2022/20221134>

Railways

The forecast for rail transport is based on the expert estimation of the development of diesel train transport volume (gross tonne kilometres). This development follows the national transport forecasts⁶ on transported tonnes. The proportion of diesel trains has decreased significantly in recent years and they are mainly used in non-electrified, smaller rail sections. In 2021, the total rail transport volume was 40.2 million tonnes, with 15.8 million tonnes between Finland and Russia. In 2022, transport activity reduced substantially especially in diesel-powered freight transport mainly due to the economic sanctions against Russia. In 2023 freight transport decreased by 11% while passenger transport activity increased by 3%. Total rail transport activity fell by 6% between 2022 and 2023.

The decline of the transports between Finland and Russia is expected to reduce total volumes significantly. By 2030, the total volume is estimated to be 30.7 million tonnes, with minimal changes anticipated thereafter due to stable forecasts of forest industry commodities. Pulp production and transports of raw wood are expected to remain steady after current plant investments. The share of raw wood transport is projected to exceed 50%, and forest industry companies will account for about 75% of total rail transport.¹³ No other major changes to the development are expected.

National navigation

In maritime transport, the calculation of the MEERI model is mainly based on the number of port calls at Finnish ports. The forecasts therefore have focused on experts' (The Finnish Transport Infrastructure Agency's) estimation of the development of port calls. These estimates have been updated based on Traficom's (Finnish Transport and Communications Agency) national transport forecasts⁶ (2022).

By 2035, the total volume of maritime exports is expected to decline before growing again. Imports will rise significantly in the near future due to replacing Russian railway imports with maritime transport. In 2021, Finnish ports handled 94.1 million tonnes of international maritime cargo, with imports at 43.1 million tonnes and exports at 42.8 million tonnes. By 2060, exports are projected to reach 45.3 million tonnes, primarily driven by general cargo, chemical products, and pulp and paper mass, despite a decrease in petroleum product exports. Imports are projected to reach 51.8 million tonnes, with significant growth in general cargo, ores, and LNG, while crude oil imports will decline⁶.

Emission factor forecasts are based on expert estimation on the development of different Tier emission levels in ships and the use of different fuels (HFO, HFO with scrubbers, MDO/MGO, diesel, LPG). For icebreakers, where emissions are dependent on highly changing yearly ice conditions, forecasts are based on a 10-year average. In work vessels, ferry boats, fishing vessels and leisure boats the situation has been stabilised and no changes are expected⁶.

Working machines

For working machines, the forecasts are based on a recent analysis of alternative powertrains and their market penetration in Finland¹⁴. Evolution of fleet (50 different machine types) is affected by, the penetration of emission standards (Stage levels) for ICE-powertrains and the market penetration of electric work machines in Finland. Mechanisation of the work has reached its maximum and the sales of new machines is mainly replacing scrapped machines and the number of most of the machine types is stabilised. Increased efficiency of machines, work and emission restrictions and increasing electrification of machines will reduce emissions in projections.

¹⁴ Markkanen, J., & Lauhkonen, A. (2021). Työkoneiden päästöjen perusennuste ja sähköistymisen vaikutus päästöihin (in Finnish). VTT Technical Research Centre of Finland. VTT Asiakasraportti No. VTT-CR-00245-21. Available at: <https://cris.vtt.fi/en/publications/ty%C3%B6koneiden-p%C3%A4st%C3%A4st%C3%B6jen-perusennuste-ja-s%C3%A4hk%C3%B6istymisen-vaikutus-p%C3%A4st%C3%A4st%C3%B6ihin>

Aviation

There is currently no specific model to calculate aviation emission projections. The emissions from aviation are minor and are not considered to impact the projected trends of any pollutant. In the 2025 projection submission, 2022 emissions have been frozen for all pollutants for the projection years. The aviation emission projections will be under development for the next projection submission.

Base year in transport projections

The LIPASTO models do not use an exact base year for projections. In addition to the national forecast trajectories for activity (e.g. tonnes transported, vehicle kilometrage) and statistical data and assumptions for inventory year, the estimated future development of activity are affected to varying degrees (depending on the model) by data from preceding years also.

For example, when assessing the future development of port calls in maritime transport, an average of the past 5 years' port call numbers (instead of only last inventory year) has been used as a starting point due to fluctuations and uncertainties regarding the port call data.

Another example is the forecast calculation for the number of working machines. The fleet of working machines is divided into groups aged 1 to 30 years, and for each age category, a certain number of machines are removed from the fleet based on pre-determined age-specific removal rate. Additionally, each year a certain number of new machines (age 1 year) are added to the fleet based on statistical data or other estimates. Hence, historical trends, along with new annual sales estimates, influence the total number of machines in the forecast years.

Currently, the base year does not play a significant role in transportation projections calculations. Instead, the national forecast trajectories for activity upon which the projections are based are a key part of projection calculations.

9.4 Projections for IPPU and Waste

Changes in chapter	
Update of text March 2025	MS, TF
Update of projections	Every 1-2 years

Projections for the IPPU sector were updated based on best available information depending on the activity sector as described below in Table 9.2.

Table 9.2. Methods and assumptions used in IPPU and Waste sector projections.

Sector		Method
2A1	Cement production	NOx from 2A1 and 2A3, SOx from 2A1, 2A2 and 2A3 and PM2.5/BC from 2A1 are included in the energy sector projections as is the case also are in the inventory of historic years. NMVOC from 2A1 and 2A3 are estimated to be constant at the base year 2022 level. These are minor sources of NMVOC and no specific projection has been prepared.
2A2	Lime production	
2A3	Glass production	
2A5a	Quarrying and mining of minerals other than coal	
2A5b	Construction and demolition	
2A5c	Storage, handling and transport of mineral products	
2B2	Nitric acid production	Chemical industry is a minor source of NOx. The projection has been made using relative changes in the GAINS model for nitric acid production emissions in Finland (all NOx emissions grouped under category 2B10a).
2B6	Titanium dioxide production	2B10a SOx projection has been made using relative changes in the GAINS model for chemical industry.
2B10a	Chemical industry: Other	2B10a NMVOC and NH3 emissions projections are estimated based on the running average of the last three years (latest year being the base year 2022).
2B10b	Storage, handling and transport of chemical products	PM2.5/BC from 2B10a and NMVOC/PM2.5 from 2B10b are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared). From 2023 onwards, Titanium dioxide production is Not Occurring in Finland.
2C1	Iron and steel production	2C1 includes emissions from 2C1 and 2C2. NMVOC, SOx, PM2.5 and BC projections are based on the relative changes of respective iron and steel industry emissions in the GAINS model.
2C2	Ferroalloys production	NH3 emissions from 2C1 are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).
2C3	Aluminium production	These are all minor sources of emissions and no specific projection has been prepared. All emissions are estimated to be constant at the base year 2022 level.
2C6	Zinc production	
2C7a	Copper production	
2C7b	Nickel production	
2C7c	Other metal production	

Sector		Method
2C7d	Storage, handling and transport of metal products	
2D3a	Domestic solvent use including fungicides	NMVOC projections are calculated using capita forecasts as a surrogate.
2D3b	Road paving with asphalt	<p>NMVOC and NH3 projections are based on the running average of last three years (latest year being the base year 2022). No forecast is available for the development of the sector.</p> <p>All other emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).</p>
2D3c	Asphalt roofing	
2D3d	Coating applications	
2D3e	Degreasing	
2D3f	Dry cleaning	
2D3g	Chemical products	
2D3h	Printing	
2D3i	Other solvent use	
2G	Other product use	2G is a minor sources of emissions and no specific projection has been prepared. All emissions are estimated to be constant at the base year 2022 level.
2H1	Pulp and paper industry	<p>NMVOC, SOx, PM2.5 and BC projections are based on the relative changes of respective pulp and paper industry emissions in the GAINS model.</p> <p>NH3 emission projections are based on the running average of last three years (latest year being the base year 2022).</p>
2H2	Food and beverages industry	<p>NMVOC projection is based on the relative changes of respective food and beverages industry emissions in the GAINS model.</p> <p>PM2.5 emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).</p>
2I	Wood processing	<p>NMVOC emission projection is based on the running average of last three years (latest year being the base year 2022). No forecast is available for the development of the sector.</p> <p>PM2.5 emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).</p>
2L	Other production, consumption, storage, transportation or handling of bulk products	All emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).
5A	Biological treatment of waste – Solid waste disposal on land	<p>NMVOC emissions are minor and are projected based on capita forecasts.</p> <p>PM2.5 emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).</p>
5B1	Biological treatment of waste – Composting	A minor source of NH3 emissions, estimated to be constant at the base year 2022 level.
5B2	Biological treatment of waste – Anaerobic digestion at biogas facilities	The forecast for NH3 is estimated based on principles explained below for the agriculture sector projections.
5C1bv	Cremation	

Sector		Method
		NOx , SOx and NMVOC projections from cremation are included in the energy sector projections as they also are in the inventory of historic years. PM2.5 and BC emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).
5D1	Domestic wastewater handling	NMVOC emissions are minor and are projected using capita forecasts as surrogate. NH3 projection is estimated using capita forecasts for the projected years as surrogate.
5D2	Industrial wastewater handling	NMVOC emissions are minor and are calculated as running 3-year average (latest year being the base year 2022).
5E	Other waste	PM2.5 and BC emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).

Population forecasts, GDP, GDP/capita and GDP growth forecasts used in the preparation of the IPPU and Waste sector projections are presented in Table 9.3. The figures in orange italics are calculated from the latest data available (2024¹⁵) with GDP growth forecast in relation to population forecasts.

In the projections the structural changes in the Finnish economy are taken into account, especially the latest years decreasing trends due to covid and the Ukrainian war, that impact negatively the IPPU activities in Finland. In addition, for the past decades, the emission levels in Finland have decreased even when the activity levels have increased, due to implementation of BAT technologies.

Table 9.3 Population forecasts, GDP, GDP/capita, GCP forecasts and GDP growth forecasts (figures in orange are calculated from historical values using GDP forecasts as surrogate)

Year	Population (mill.) (Statistics Finland)	GDP (Statistics Finland)	GDP/capita (Statistics Finland)	GDP growth forecast
1980	4.8	33660	7030	
1990	5.0	90964	18198	
2000	5.2	136386	26324	
2005	5.3	164666	31332	
2010	5.4	188147	35002	
2013	5.5	203497	37330	
2015	5.5	210192	38305	
2018	5.5	231905	42028	
2020	5.5	236387	42717	
2021	5.5	248764	44837	
2022	5.6	266135	47832	
2023	5.6	272782	48678	
2024	5.6	<i>272509</i>	<i>48313</i>	<i>-0.1</i>
2025	5.7	<i>274689</i>	<i>48444</i>	<i>0.8</i>
2030	5.8	<i>279634</i>	<i>48297</i>	<i>1.8</i>
2040	6.0	<i>282150</i>	<i>47032</i>	<i>0.9</i>
2050	6.2	<i>283843</i>	<i>45951</i>	<i>0.6</i>
2060	6.3	<i>285546</i>	<i>45045</i>	<i>0.6</i>
2070	6.5	<i>286974</i>	<i>44149</i>	<i>0.5</i>

¹⁵ Publications by Statistics Finland [Tilastokeskus - \(stat.fi\)](https://tilastokeskus.fi), [Bruttokansantuote ja -tulo sekä tarjonta ja kysyntä, vuosittain muuttujina Taloustoimi, Vuosi ja Tiedot. PxWeb \(stat.fi\)](https://www.bruttokansantuote.fi), Bank of Finland <https://www.eurojatalous.fi/fi/2025/artikkelit/tyoikaisen-vaeston-supistuminen-ja-heikko-tuottavuus-painavat-suomen-pitkan-ajan-kasvunakymaa/>

9.5 Projections for Agriculture

Changes in chapter	
Update of text March 2025	JG, TF
Update of projections	Every 1-2 years

Projections for agriculture are based on the Finnish Agricultural Emission Calculation System available up to 2050. The projected emissions are calculated using the same Tier methodologies as are used in the historical inventory. The animal numbers and the use of mineral fertilizers are forecasts by Natural Resources Institute Finland (Luke). The forecasts are based on the Dynamic Regional Sector Model of Finnish Agriculture, Dremfia, except for fur animals and reindeer, for which the numbers are estimated from existing statistics assuming that there will not be major changes in the coming years. (Lehtonen, 2023¹⁶).

In terms of emissions from the field operations (3De, 3Dc) and sewage sludge applied to soils (3Da2b), emission projections are based on historical emissions. More specifically, they are average emissions calculated from the emissions between 2014 and 2023. For activity data of anaerobically digested other organic waste and energy crops, values of 2023 have been used. For activity data of composted other organic waste and energy crops, as well as for unprocessed organic wastes, average values from the past 10 years (2014-2023) have been used. For activity data of crop residues, values of the base year (2022) have been used.

The Dremfia model has been utilized in several research projects to produce various agricultural development pathways for the future and assess their climate impacts. The latest project has been the PEIKKO-project, where the future development of greenhouse gas emissions and removals in Finland under current energy and climate policy measures have been assessed, taking into account the heightened geopolitical situation and its recent consequences. The development of animal numbers and use of mineral fertilisers of the **PEIKKO WEM-low** -scenario for agriculture has been utilized when the emission projections for agriculture have been produced.

The PEIKKO WEM-scenarios for agriculture are (Lehtonen, 2023):

- WEM-Baseline: conservative development, no change in human diets.
- WEM-High: Investments in clean technologies and new products are progressing faster than in the WEM-Baseline scenario. Dietary changes are occurring: meat and dairy products -33%, more grains and legumes for food 2020-2050.
- WEM-Low: Weak economic development. Slower technological development compared to the WEM-High scenario. Slow dietary change between 2020-2050: red meat -33%, milk -20%, poultry +20%. Slower development of biogas production than in WEM-high.

Activity data for agricultural emission projections

- *Animal numbers and inorganic nitrogen use* data used in the emission projections are shown in the table 9.4 (see text above).
- *Nitrogen excretion rate estimations* are based on the recent development and are shown in the table 9.5. As described in the Agriculture-chapter of the IIR, the whole excretion time series for all pig categories and horses have been updated, affecting also the excretion rates used in the emission projections calculation.
- Estimated evolution of *manure management practices* is described in the tables 9.6 - 9.17. There have been some changes compared to the previous reporting, based on the most recent manure management data.

¹⁶ Lehtonen, H. 2023. Personal communication 20.12.2023. Natural Resources Institute Finland (Luke)

- *Efficiencies of the emission abatement measures* (as well as the unabated emission factors used) can be found from the Agriculture-chapter of the IIR. There have been no changes compared to the previous reporting.
- *Other activity data*: see text above.

As mentioned above, the development of animal numbers and the use of mineral fertilizers are projected up to 2050 in Natural Resources Institute Finland (Luke) based on the Dynamic Regional Sector Model of Finnish Agriculture, Dremfia. This model is based on agricultural economics principles, is well validated in terms of production and land use 1995-2020, and has been frequently used in analysing agricultural and agri-environmental policies (Lehtonen & Niemi 2018, Lehtonen & Niskanen 2016, Lehtonen & Rankinen 2015). However, the development of the numbers of fur animals, lambs, goats and reindeers, which have a small economic role and a small contribution to e.g. greenhouse gases and ammonia, are estimated from existing statistics assuming that there will not be major changes in the coming years. These assumptions and principles have been used when projecting development of agriculture and greenhouse gases in Finland in recent years (see e.g. Aakkula et al. 2019, Koljonen et al. 2020, Lehtonen & Rämö 2020).

The DREMFA sector model has produced several times projections of animal numbers which fit very well the post -development 1995-2020. In fact, the animal number projections in the references above, shows decreasing numbers of bovine animals and pigs, but non-decreasing numbers of poultry animals for years after 2020. This is because of the increasing milk yield of dairy cows which imply reduced numbers of other bovine animals. Pig numbers have been decreasing since ten years due to gradually decreasing domestic demand of pig meat and reduced profitability of production while consumers have substituted poultry meat for pork and thus the number of poultry animals have been in the increase. There is a reason to assume, based on healthiness and climate awareness of consumers, that red meat production (beef, pork) in Finland will continue on gradually decreasing trend and thus the numbers of bovine animals and pigs will remain below the current levels in the future.

Note on 3F, Field burning and other agriculture projections: Field burning is forbidden starting from 1.1.2021

Table 9.4. Animal numbers and use of inorganic nitrogen fertilisers in 2015-2023 and as prediction for 2025-2050

	Cattle					Fur Animals			Horses and ponies		Pigs			
	Bull >1 yr	Calf <1 yr	Dairy cow	Heifer >1 yr	Suckler cow	Fox and racoon	Mink and fitch	Reindeer	Horse	Pony	Boar (50- kg)	Fattening pig (50-kg)	Sow (with piglets)	Weaned pig (20-50 kg)
Finland 2017	110 767	297 334	274 954	150 269	59 854	2 282 000	1 448 000	193 142	64 000	10 400	1 400	446 900	99 100	248 500
Finland 2018	105 770	298 882	271 429	146 100	60 096	2 092 000	1 368 000	184 958	64 000	10 400	1 400	425 000	95 200	246 200
Finland 2019	104 485	288 066	262 292	142 430	60 349	2 060 000	1 042 000	188 190	63 900	10 400	1 300	438 600	92 200	257 700
Finland 2020	98 187	290 199	259 579	136 445	61 975	1 413 000	768 000	194 972	64 000	10 000	1 100	450 600	88 700	263 700
Finland 2021	101 472	288 872	253 527	136 469	63 698	1 266 000	778 000	182 454	64 000	10 000	1 000	405 400	93 000	255 900
Finland 2022	102 217	281 339	248 008	137 280	65 151	773 000	538 000	185 356	59 000	13 000	810	379 840	85 000	230 300
Finland 2023	100 220	280 466	241 949	133 333	64 683	689 000	516 000	179 503	59 500	12 000	750	372 910	82 520	226 900
Finland 2025	98 215	270 446	233 467	131 965	64 606	1 000 000	700 000	190 000	59 000	12 000	1 172	355 668	79 670	206 036
Finland 2030	95 892	264 049	229 833	128 843	64 119	1 000 000	700 000	190 000	59 000	12 000	1 049	318 559	71 357	184 539
Finland 2035	92 292	254 135	217 137	124 006	65 778	1 000 000	700 000	190 000	59 000	12 000	990	300 678	67 352	174 181
Finland 2040	87 788	241 734	206 942	117 954	62 167	1 000 000	700 000	190 000	59 000	12 000	930	282 301	63 235	163 535
Finland 2045	79 532	219 001	184 953	106 862	58 849	1 000 000	700 000	190 000	59 000	12 000	824	250 125	56 028	144 896
Finland 2050	73 438	202 218	159 840	98 673	65 279	1 000 000	700 000	190 000	59 000	12 000	814	247 150	55 362	143 172

	Poultry					Goat and sheep		Inorg. N Use of inorganic N-fert. as N (tonnes)		
	Broiler breeder hen	Broiler	Laying hen pullet	Cockerel	Laying hen	Other poultry	Turkey		Goat	Sheep
Finland 2017	472 976	8 046 698	508 874	22 335	3 745 944	47 213	291 579	5 278	155 926	138 948
Finland 2018	424 296	8 780 903	607 630	17 426	3 984 824	26 135	299 093	5 437	154 999	138 385
Finland 2019	394 715	9 111 743	647 260	16 405	3 900 385	26 758	262 646	5 925	144 876	146 798
Finland 2020	396 097	8 507 327	566 326	17 958	3 811 547	9 639	267 986	6 034	140 171	139 316
Finland 2021	478 782	8 499 274	796 124	21 549	3 728 997	11 187	296 020	5 931	131 086	145 807
Finland 2022	597 651	8 900 737	664 534	24 183	3 865 831	8 696	294 206	6 304	132 084	101 831
Finland 2023	607 133	8 716 719	568 603	30 083	3 994 765	15 027	283 712	5 807	122 060	101 831
Finland 2025	599 755	10 031 093	459 603	18 486	3 014 195	20 000	341 677	6 300	132 100	132 633
Finland 2030	618 645	10 347 033	444 503	17 879	2 915 164	20 000	352 438	6 300	132 100	130 765
Finland 2035	620 298	10 374 673	429 028	17 257	2 813 677	20 000	353 380	6 300	132 100	132 248
Finland 2040	625 810	10 466 865	413 258	16 622	2 710 253	20 000	356 520	6 300	132 100	133 042
Finland 2045	626 293	10 474 944	414 149	16 658	2 716 099	20 000	356 795	6 300	132 100	132 063
Finland 2050	626 627	10 480 535	452 706	18 209	2 968 962	20 000	356 985	6 300	132 100	124 248

Table 9.5 Nitrogen excretion rates (kg N/animal place/year) in 2017-2023 and as prediction for 2025-2050

		Dairy cow	Heifer >1 yr	Calve <1 yr	Suckler cow	Bull >1 yr	Sow	Boar	Fattening pig	Weaned pig	Horse	Pony	Sheep	Goat
Finland	2017	134.892	58.341	36.065	66.891	68.550	22.209	21.422	16.643	3.392	44.161	24.20	7.653	10.700
Finland	2018	136.367	58.326	36.326	66.852	69.428	23.169	21.821	16.381	3.365	44.128	24.14	7.815	10.700
Finland	2019	140.101	59.907	37.311	67.778	70.672	20.620	21.271	15.408	2.998	44.179	24.18	7.951	10.700
Finland	2020	144.608	61.692	38.408	69.714	72.069	22.946	20.812	17.466	3.326	44.154	24.10	7.945	10.700
Finland	2021	144.957	62.761	38.804	69.836	71.364	23.016	20.976	15.508	3.367	44.154	24.12	7.841	10.700
Finland	2022	143.364	62.286	38.240	69.826	70.351	22.444	20.964	15.207	3.342	43.997	24.31	7.930	10.700
Finland	2023	143.884	60.044	37.152	68.113	70.040	22.444	20.966	15.207	3.342	43.974	24.31	7.904	10.700
Finland	2025	144.000	63.000	40.000	70.000	70.500	22.444	20.966	15.207	3.342	43.974	24.309	7.700	10.700
Finland	2030	150.000	65.000	40.000	71.000	70.500	22.444	20.966	15.207	3.342	43.974	24.309	7.700	10.700
Finland	2035	155.000	66.000	40.000	72.000	70.500	22.444	20.966	15.207	3.342	43.974	24.309	7.700	10.700
Finland	2040	160.000	66.000	40.000	73.000	70.500	22.444	20.966	15.207	3.342	43.974	24.309	7.700	10.700
Finland	2045	160.000	66.000	40.000	74.000	70.500	22.444	20.966	15.207	3.342	43.974	24.309	7.700	10.700
Finland	2050	160.000	66.000	40.000	74.000	70.500	22.444	20.966	15.207	3.342	43.974	24.309	7.700	10.700

		Broiler	Broiler hen	Laying hen	Laying hen pullet	Cockerel	Turkey	Other poultry	Fox and racoon	Mink and fitch	Reindeer
Finland	2017	0.478	0.992	0.601	0.389	0.969	1.663	0.636	3.000	1.305	10.700
Finland	2018	0.478	0.992	0.601	0.389	0.969	1.640	0.636	3.000	1.305	10.700
Finland	2019	0.478	0.992	0.583	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2020	0.479	0.992	0.593	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2021	0.479	0.992	0.574	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2022	0.478	0.992	0.522	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2023	0.479	0.992	0.522	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2025	0.478	0.992	0.590	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2030	0.478	0.992	0.590	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2035	0.478	0.992	0.590	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2040	0.478	0.992	0.590	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2045	0.478	0.992	0.590	0.388	0.969	1.695	0.636	3.000	1.305	10.700
Finland	2050	0.478	0.992	0.590	0.388	0.969	1.695	0.636	3.000	1.305	10.700

Manure management data for 2020 and as a prediction for 2025, 2030 and 2040 (In most cases, the values used for 2050 are the same as those used for 2040).

All values: % of manure unless otherwise stated.

Table 9.6. General information on cattle manure management and grazing in Finland in 2020 and as a prediction for 2030, 2040 and 2050.

	Dairy cows				Suckler cows				Heifers				Bulls				Calves <1 yr			
	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050
<u>Manure management</u>																				
Treated as slurry (%)	79	82	82	82	3	3	3	3	51	51	51	51	61	63	63	63	27	25	25	25
Treated as deep litter (%)	2	2	2	2	46	50	50	50	20	22	22	22	8	7	7	7	26	29	29	29
Treated as solid manure (%), of which	19	16	16	16	51	47	47	47	29	27	27	27	30	30	30	30	47	47	47	47
urine not separated (FYM, %)	23	23	23	23	90	90	90	90	69	72	72	72	95	97	97	97	79	83	83	83
urine separated (%)	77	77	77	77	10	10	10	10	31	28	28	28	5	3	3	3	21	17	17	17
<u>Grazing</u>																				
Grazing period (days)	119	121	121	121	154	150	150	150	140	141	141	141	205	216	216	216	135	137	137	137
Grazed animals (%)	55	50	50	50	97	98	98	98	58	54	54	54	4	3	3	3	21	19	19	19
Animals inside in nights (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Time inside at night (h)	12	12	12	12	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3
Manure excreted on pasture (%)	9	8	8	8	39	39	39	39	21	20	20	20	2	1	1	1	7	6	6	6

Table 9.7. General information on manure management and grazing of sheep, goats, horses, ponies, fur animals and reindeer in Finland in 2020 and as a prediction for 2030, 2040 and 2050.

	Sheep & Goat 2020-2050	Horses & Ponies 2020-2050	Fur animals 2020-2050	Reindeer 2020-2050
<u>Manure management</u>				
Treated as slurry (%)	0	0	0	-
Treated as deep litter (%)	96	13	0	-
Treated as solid manure (%), of which urine not separated (FYM, %)	4 100	87 100	100 100	- -
urine separated (%)	0	0	0	-
<u>Grazing</u>				
Grazing period (days)	139	180	-	365
Grazed animals (%)	98	97	-	100
Animals inside in nights (%)	100	100	-	0
Time inside at night (h)	1	6	-	0
Manure excreted on pasture (%)	36	36	-	100

Table 9.8. Percentages (%) of management methods for pig manure in Finland in 2020 and as a prediction for 2030, 2040 and 2050.

	Sows				Fattening pigs	Boars	Weaned pigs
	2020	2030	2040	2050	2020-2050	2020-2050	2020-2050
Treated as slurry (%)	84	86	86	86	95	95	96
Treated as deep litter (%)	6	8	8	8	0	1	1
Treated as solid manure (%), of which urine not separated (FYM, %)	10 21	7 19	7 19	7 19	5 43	5 19	3 0
urine separated (%)	79	81	81	81	57	81	100

Table 9.9. Percentages (%) of management methods for poultry manure in Finland in 2020 and as a prediction for 2025, 2030 and 2040.

	Laying hens				Broilers	Laying hen pullets				Cockerels	Broiler hens	Turkeys	Other poultry
	2020	2030	2040	2050	2020 – 2050	2020	2030	2040	2050	2020-2050	2020 - 2050	2020 - 2050	2020- 2050
Slurry	3	1	1	1	0	0	0	0	0	0	0	0	0
Deep litter	16	15	15	15	100	40	40	40	40	50	100	100	40
Solid manure	81	85	85	85	0	60	60	60	60	50	0	0	60

Table 9.10. Detailed information on slurry management in animal shelters and manure storages in Finland in 2020 and as a prediction for 2030, 2040 and 2050. Unit: percentage of total slurry per animal species.

Abatement measures	Slurry											
	Cattle				Pigs				Poultry			
	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050
<u>Animal shelter (% of manure)</u>												
Improved cleaning of surfaces	14	15	15	15	18	20	20	20	0	0	0	0
Flushing	8	10	10	10	8	10	10	10	0	0	0	0
Increased manure removal frequency	13	15	15	15	13	15	15	15	0	0	0	0
Rapid urine separation	-	-	-	-	-	-	-	-	-	-	-	-
Biological or chemical air scrubbers	0	0	0	0	0	0	0	0	0	0	0	0
Cooling of manure channels	2	3	3	3	33	40	40	40	-	-	-	-
Drying of manure on manure belt	-	-	-	-	-	-	-	-	-	-	-	-
Non-leaking drinking system	-	-	-	-	-	-	-	-	-	-	-	-
<u>Manure storage (% of manure)</u>												
No measures	0	0	0	0	48	40	29	18	48	40	29	18
Tight roof (concrete)	1	1	2	2	2	2	2	2	2	2	2	2
Semi-tight roof (floating covers)	15	17	15	13	26	30	35	40	26	30	35	40
Natural crust	67	61	55	50	0	0	0	0	0	0	0	0
Tent, roof	17	21	28	35	25	28	34	40	25	28	34	40
Filling of storage from the bottom	91	91	91	91	79	81	81	81	79	81	81	81

Table 9.12. Detailed information on solid manure (FYM) management in animal shelters and manure storages in Finland in 2020 and as a prediction for 2030, 2040 and 2050. Unit: percentage of total solid manure per animal species.

Abatement measures	Solid manure (FYM)																							
	Cattle				Pigs				Poultry				Sheep + Goat				Horses				Fur animals			
	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050
<u>Animal shelter</u> <u>(% of manure)</u>																								
Improved cleaning of surfaces	14	15	15	15	14	15	15	15	1	0	0	0	1	1	1	1	15	15	15	15	0	0	0	0
Flushing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
Increased manure removal frequency	13	15	15	15	12	15	15	15	81	95	95	95	0	0	0	0	-	-	-	-	0	0	0	0
Rapid urine separation	4	5	5	5	5	5	5	5	-	-	-	-	0	0	0	0	-	-	-	-	0	0	0	0
Biological or chemical air scrubbers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	0	0	0	0
Cooling of manure channels	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Drying of manure on manure belt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-leaking drinking system	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<u>Manure storage</u> <u>(% of manure)</u>																								
Solid manure covering	34	40	51	60	35	41	51	60	57	61	61	60	39	45	53	60	44	45	53	60	0	0	0	0
Filling of storage from the bottom	18	15	15	15	60	63	63	63	6	8	8	8	6	8	8	8	6	8	8	8	0	0	0	0

Table 9.13. Detailed information on separately collected urine and dung management in animal shelters and manure storages in Finland in 2020 and as a prediction for 2030, 2040 and 2050. Unit: percentage of total urine and dung per animal species.

Abatement measures	Urine								Dung							
	Cattle				Pigs				Cattle				Pigs			
	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050
<u>Animal shelter (% of manure)</u>																
Improved cleaning of surfaces	14	15	15	15	14	15	15	15	14	15	15	15	14	15	15	15
Flushing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Increased manure removal frequency	-	-	-	-	-	-	-	-	4	4	4	4	2	2	2	2
Rapid urine separation	4	5	5	5	4	5	5	5	-	-	-	-	-	-	-	-
Biological or chemical air scrubbers	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Cooling of manure channels	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Drying of manure on manure belt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-leaking drinking system	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<u>Manure storage (% of manure)</u>																
Tight roof (concrete)	67	82	81	80	39	53	62	70	-	-	-	-	-	-	-	-
Natural crust	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tent, roof, floating cover	16	6	8	10	27	14	12	10	-	-	-	-	-	-	-	-
Solid manure covering	-	-	-	-	-	-	-	-	34	40	51	60	35	41	51	60
Filling of storage from the bottom	-	-	-	-	-	-	-	-	20	15	15	15	60	63	63	63

Table 9.14. Detailed information on slurry application in Finland in 2020 and as a prediction for 2030, 2040 and 2050. Unit: percentage of total slurry per animal species.

Abatement measures	Slurry											
	Cattle				Pigs				Poultry			
	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050
<u>Type of surface for application</u>												
Arable land	28	28	28	28	56	59	59	59	56	59	59	59
Plant covered land	54	57	57	57	20	18	18	18	20	18	18	18
Stubble	18	16	16	16	24	23	23	23	24	23	23	23
<u>Application on arable land</u>												
Injection	58	66	68	70	53	63	67	70	51	63	67	70
Band spreading	8	6	8	10	24	22	23	25	26	22	23	25
Broadcast spreading	33	28	24	20	24	15	10	5	23	15	10	5
Of manure spread on soil surface:												
No incorporation	9	7	7	7	2	0	0	0	2	0	0	0
Incorp. with ploughing < 4 h	5	4	4	4	12	11	11	11	12	11	11	11
Incorp. with ploughing < 12 h	5	4	4	4	5	4	4	4	5	4	4	4
Incorp. with ploughing 12-24 h	5	2	2	2	10	9	9	9	10	9	9	9
Incorp. with harrowing < 4 h	17	18	18	18	27	28	28	28	27	28	28	28
Incorp. with harrowing < 12 h	23	25	25	25	33	39	39	39	33	39	39	39
Incorp. with harrowing 12-24 h	36	40	40	40	10	9	9	9	10	9	9	9
<u>Application on plant covered land</u>												
Injection	71	81	83	85	52	60	63	65	51	60	63	65
Band spreading	9	6	5	5	33	32	31	30	37	32	31	30
Broadcast spreading	19	13	12	10	14	8	6	5	12	8	6	5
<u>Application on stubble</u>												
Injection	62	70	70	70	41	50	60	70	37	50	60	70
Band spreading	9	6	8	10	26	27	26	25	31	27	26	25
Broadcast spreading	28	24	22	20	32	23	14	5	33	23	14	5
Of manure spread on soil surface:												
No incorporation	7	6	6	6	2	0	0	0	2	0	0	0
Incorp. with ploughing < 4 h	15	15	15	15	10	10	10	10	10	10	10	10
Incorp. with ploughing < 12 h	22	24	24	24	16	15	15	15	16	15	15	15
Incorp. with ploughing 12-24 h	36	38	38	38	11	9	9	9	11	9	9	9
Incorp. with harrowing < 4 h	5	3	3	3	22	24	24	24	22	24	24	24
Incorp. with harrowing < 12 h	8	7	7	7	20	22	22	22	20	22	22	22
Incorp. with harrowing 12-24 h	7	6	6	6	18	19	19	19	18	19	19	19

Table 9.15. Detailed information on deep litter application in Finland in 2020 and as a prediction for 2030, 2040 and 2050. Unit: percentage of total deep litter per animal species.

Abatement measures	Deep litter														
	Cattle			Pigs			Poultry			Sheep + Goat			Horses		
	2020	2030	2040, 2050	2020	2030	2040, 2050	2020	2030	2040, 2050	2020	2030	2040, 2050	2020	2030	2040, 2050
<u>Type of surface for application</u>															
Arable land	68	68	68	88	88	88	88	88	88	68	68	68	76	76	76
Plant covered land	32	32	32	12	12	12	12	12	12	32	32	32	24	24	24
Stubble	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<u>Application on arable land</u>															
No incorporation	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0
Incorp. with ploughing < 4 h	15	15	15	14	14	14	14	14	14	15	15	15	14	14	14
Incorp. with ploughing < 12 h	16	16	16	13	13	13	13	13	13	16	16	16	17	17	17
Incorp. with ploughing 12-24 h	28	28	28	30	30	30	30	30	30	28	28	28	27	27	27
Incorp. with harrowing < 4 h	15	15	15	14	14	14	14	14	14	15	15	15	11	11	11
Incorp. with harrowing < 12 h	3	3	3	14	14	14	14	14	14	3	3	3	14	14	14
Incorp. with harrowing 12-24 h	23	23	23	15	15	15	15	15	15	23	23	23	17	17	17
<u>Application on plant covered land</u>															
Broadcast spreading	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 9.17. Detailed information on separately collected urine and dung application in Finland in 2020 and as a prediction for 2030, 2040 and 2050. Unit: percentage of total solid manure per animal species.

Abatement measures	Urine								Dung							
	Cattle				Pigs				Cattle				Pigs			
	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050	2020	2030	2040	2050
<u>Type of surface for application</u>																
Arable land	13	12	12	12	33	35	35	35	80	84	84	84	83	82	82	82
Plant covered land	73	76	76	76	26	26	26	26	20	16	16	16	17	18	18	18
Stubble	14	13	13	13	42	39	39	39	-	-	-	-	-	-	-	-
<u>Application on arable land</u>																
Injection	14	17	29	40	36	43	47	50	-	-	-	-	-	-	-	-
Band spreading	7	11	21	30	7	8	20	30	-	-	-	-	-	-	-	-
Broadcast spreading	79	72	50	30	56	49	34	20	-	-	-	-	-	-	-	-
Of manure spread on soil surface:																
No incorporation	17	17	17	17	3	4	4	4	1	1	1	1	1	0	0	0
Incorp. with ploughing < 4 h	18	20	20	20	1	0	0	0	12	12	12	12	9	9	9	9
Incorp. with ploughing < 12 h	8	8	8	8	11	10	10	10	17	17	17	17	15	16	16	16
Incorp. with ploughing 12-24 h	18	17	17	17	6	4	4	4	32	33	33	33	17	15	15	15
Incorp. with harrowing < 4 h	18	20	20	20	41	45	45	45	12	12	12	12	26	29	29	29
Incorp. with harrowing < 12 h	17	18	18	18	18	19	19	19	10	12	12	12	13	13	13	13
Incorp. with harrowing 12-24 h	16	15	15	15	35	37	37	37	15	13	13	13	18	20	20	20
<u>Application on plant covered land</u>																
Injection	24	31	46	60	59	71	79	85	-	-	-	-	-	-	-	-
Band spreading	9	7	8	10	7	3	7	10	-	-	-	-	-	-	-	-
Broadcast spreading	67	62	45	30	34	26	15	5	-	-	-	-	-	-	-	-
<u>Application on stubble</u>																
Injection	23	25	33	40	10	15	34	50	-	-	-	-	-	-	-	-
Band spreading	6	9	20	30	4	8	20	30	-	-	-	-	-	-	-	-
Broadcast spreading	71	66	47	30	86	77	47	20	-	-	-	-	-	-	-	-
Of manure spread on soil surface:																
No incorporation	25	26	26	26	4	4	4	4	-	-	-	-	-	-	-	-
Incorp. with ploughing < 4 hrs	3	0	0	0	2	0	0	0	-	-	-	-	-	-	-	-
Incorp. with ploughing < 12 h	18	20	20	20	5	4	4	4	-	-	-	-	-	-	-	-
Incorp. with ploughing 12-24 h	44	48	48	48	55	62	62	62	-	-	-	-	-	-	-	-
Incorp. with harrowing < 4 h	1	0	0	0	4	0	0	0	-	-	-	-	-	-	-	-
Incorp. with harrowing < 12 h	1	1	1	1	14	14	14	14	-	-	-	-	-	-	-	-
Incorp. with harrowing 12-24 h	8	5	5	5	16	16	16	16	-	-	-	-	-	-	-	-

9.6 Emission reductions based on existing measures and measures that have been adopted in the legislation

Sulphur emissions

Sulphur dioxide emissions originate mainly from energy production and industrial processes. Emissions from industry decreased already between 2005-2010 in line with the limits presented in the LCPD (2001/80/EY), although the uses of both coal and peat in 2010 were higher than in 2005. Between 2010 and 2020 emissions from energy production decreased due to decreasing combustion of coal, peat and HFO and the limitations in the IED. During 2020s combustion of coal will further decrease.

Emissions from industrial processes follow the projected increase of production volumes, while a slight decrease is projected to the emission factors for metal industry and refineries due to technical improvements of processes.

Nitrogen oxides

The main sources for NO_x are road transport, off-road machinery and energy production. Emissions from the transport sector are projected to decrease due to EU legislation although transport volumes increase. The main contributor to decreases will be the implementation of new EURO standards.

NO_x emissions from energy production decreased only slightly between 2005-2010 when the uses of peat, coal and biomass were restored to the normal level from their exceptional levels in 2005 when the lock-out in forest industries and the extraordinary good water situation in production of hydroelectric power decreased the demand of fuels.

The IED restricts emissions from the use of coal and biomass. The use of coal and peat also decrease notably towards 2030, although biomass use is expected to increase.

Emissions from industrial processes depend on the development of production volumes and in small scale combustion on the amount of wood combusted. Impacts to emission levels from small technical improvements in both the process industry and small-scale combustion are included in the projections.

Particles

Important particulate matter sources are residential wood combustion, traffic, industry and peat production. Particulate emissions are expected to decrease due to the renewal of the combustion equipment stock.

In transport, exhaust gas emissions decrease due to the increasing number of new EURO standard vehicles. Although direct particulate emissions in exhaust gases almost decrease, traffic dust will still remain an issue. PM emissions from traffic are a significant contributor to health impacts because the emissions occur at the height of inhalation and concentrate in high density population areas.

Emissions from peat production, i.e. operations related to extraction of peat, vary annually due to peat production volumes which depend on weather (for instance between 2005–2012 from 2.7 to 5.5 kt. During the latest years, peat production volumes in Finland have decreased significantly. This development is expected to continue.

The increasingly stringent emission regulation in combustion plants decrease emissions only slightly, since biomass consumption is expected to increase significantly

For industrial processes, no changes have been made in the projected emission factors over the years and the emissions follow development of production volumes.

Ammonia

The main ammonia source is agriculture where manure management drives the emissions. Small emissions are generated in transport, waste handling and industrial processes.

NMVO

NMVO emissions have been decreased between 2005 – 2010 and further thereafter. The most important source is transport where emission reductions are expected due to the new EURO standard vehicles. Half of exhaust gas emissions originate in gasoline vehicles and half from fuel refining, storage and distribution.

Emissions from industry and product use have decreased since the beginning of the 2000s due to implementation of VOC Directives (1999/13/EC and 2004/42/EC), In Finland also the levels of activities in these sectors have decreased.

9.7 NECD 2023 review of projections

In Table 9.18 below recommendations presented in the Review Report of the 2023 NECD Review of Projections are presented with actions made on the right hand side column.

Table 9.18 - Review Report Table 4-2 Recommendations from the 2023 projections review.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
FI-0A-2023-0004	2023	0A National total (based on fuel sold)	SO ₂ , PM _{2.5} , NMVOC, NH ₃ , NO _x	2025, 2030, 2040, 2050	WM	n.a	For IIR Part 1B Chapter 8.2 the TRT noted that that there is a lack of transparency related to QA/QC activities and sensitivity assessment which have been carried out on the projected emissions. In response to a question raised during the review, Finland explained in detail that the same sectoral QA/QC activities that are carried out for the historical emissions, and described in the sectoral chapters in the IIR, are also carried out for the projected emissions. The TRT notes that this issue does not relate to an over or under-estimate and recommends that Finland adds the detailed text provided to the TRT into the IIR to aid overall transparency.	The description of the QA/QC activities carried out on the projected emissions has been included in chapter 9.1 of the IIR in the 2025 submission.
FI-1A1-2023-0001	2023	1A1 Energy industries (Combustion in power plants & Energy Production)	SO ₂ , NO _x	2025, 2030, 2040, 2050	WM	Yes	For category 1A1 Energy industries and pollutants NO _x and SO _x (and to a lesser extent BC, NH ₃ , NMVOC and PM _{2.5}) the TRT noted that there is a lack of transparency regarding which Base Year has been used. Category 1A1 is a key category for NO _x and SO _x in the historical inventory. In response to a question raised during the review, Finland explained that the base years are not the same for the different sectors. Year 2019 is indicated as the base year for energy, the base year for transport is 2021 and the base year for other sectors is 2020. The TRT notes that this issue does not relate to an over or under-estimate and recommends that Finland harmonise the base years for all the sectors and to use (x-3) [or (x-2)] as the base year - where 'x' is the submission year. The reporting guidance clearly states that the base year for projections should be x-3 (i.e. 2020).	The harmonization of the base years in different sectors has been implemented in the 2025 projection submission. 2022 (x-3) has been used as the base year in all the sectors. However, as described in more detail in chapters 9.1-9.5, a certain base year does not play a significant role in all the sectoral projections.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
FI-1A3a,c,d,e-2023-0001	2023	1A3a,c,d,e Off-road transport	PM2.5, NH3, NOX	2025, 2030, 2040, 2050	WM	No	For categories 1A3a,c,d,e Off-road transport and pollutants PM2.5, NH3, and NOX for the reference year (2020), the TRT noted that emissions in Annex IV and in NFR tables are not the same. In response to a question raised during the review, Finland explained that the values in the projections NFR table (Annex IV) were accidentally changed, and this caused differences in the decimals. The TRT notes that this relates to an over or under-estimate of the projections in all years and recommends that Finland provides consistent emissions in Annex IV and in NFR tables.	In 2025 projection submission, consistent emissions in Annex IV and in NFR tables have been reported.
FI-1A3b-2023-0001	2023	1A3b Road Transport	SO2	2025, 2030, 2040, 2050	WM	No	For categories 1A3bi, 1A3bii, 1A3biii and 1A3biv and pollutant SO2 for the reference year (2020), the TRT noted that emissions in Annex IV and in NFR tables are not the same. In response to a question raised during the review, Finland explained that the values in the projections NFR table (Annex IV) were accidentally changed, and this caused differences in the decimals. The TRT notes that this relates to an over or under-estimate of the projections in all years and recommends that Finland provide consistent emissions in Annex IV and in NFR tables.	In 2025 projection submission, consistent emissions in Annex IV and in NFR tables have been reported.
FI-2D, 2G-2023-0001	2023	2D, 2G Solvent and other product use	NMVOC	2025, 2030, 2040, 2050	WM, WAM	Yes	For NFR 2D,G Solvent and other product use and NMVOC the TRT noted that there may be an over-estimate in the projections. In response to a question raised during the review, Finland explained that there was an issue with the calculations that would require correction in future submission. The TRT notes that this issue relates to an over or under-estimate and recommends that Finland correct the calculations in time for the next projection submission.	The issue has been corrected in the 2025 projection submission.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
FI-3B-2023-0001	2023	3B Animal husbandry and manure management	NMVOC	2025, 2030	WM	No	For 3B Animal husbandry and manure management, NMVOC projections in the years 2025 and 2030 the TRT noted that there was an unusual trend in emissions compared to non-dairy cattle numbers. According to the data reported in Annex IV B, between 2020 and 2025 the number of non-dairy cattle is projected to reduce by around 3.5%, whereas the NMVOC emissions are projected to increase by around 5%. However, between 2025 and 2030 the change in emissions (-6.4%) is more negative than the change in population (-5.2%). This implies a higher emission factor per head in 2025 (7.24kg /head) than either in 2020 (6.64 kg/head) or 2030 (7.15 kg/head). In response to a question raised during the review, Finland explained that an error had been identified in the activity data, specifically in the feed intake gross energy (MJ/animal/day) for bulls in 2021, resulting in NMVOC emission that are too high. This error was not spotted until after their submission. The TRT notes that this issue relates to an over or under-estimate and recommends that this error is corrected in the next submission.	The issue has been corrected in the 2025 projection submission.
FI-3B-2023-0002	2023	3B Animal husbandry and manure management	PM2.5, NMVOC, NH3, NOx	2025	WM	No	For categories 3B4g poultry, 3B4h other animals and 3D Plant production and agricultural soils, and pollutants NH3, NMVOC, NOx and PM2.5 for the year 2020 the TRT noted that the emission value provided in the projections submission does not precisely match the value for 2020 in the historical inventory upon which the projections are based. In most cases the numbers reported in the projections appear to be equal to those in the historical inventory when the latter are rounded to 3 decimal places (e.g., NH3 emissions from 3B4g poultry is 0.9656368 in the historical inventory, and 0.9660 in the projections submission). However, for NOx emissions from 3B4g poultry a difference to 3 decimal places remains even after rounding; the value in the historical inventory is 0.1461001, and that in the projections 0.1469681. In response to a	In the 2025 projection submission, unrounded values have been submitted for all categories.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
							question raised during the review, Finland explained that in the projections reporting template there is an error in cell C38 (NOX from 3B4g). It mistakenly references cell E37, which represents the value for 2025. The correct value for 2020, as reported in the historical inventory, should be 0.1461001. The TRT notes that this issue does not relate to an over or under-estimate in projected emissions, but recommends that in the next projections submission Finland correct this error and also submit unrounded values where possible for all categories.	

Table 9.19 - Review Report Table 4-3 Encouragements from the 2023 projections review.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Encouragement	Response
FI-3B-2023-0003	2023	3B Animal husbandry and manure management	PM2.5, NMVOC, NH3, NOX	2025, 2030, 2040, 2050	WM	No	For 3B Animal husbandry and manure management, PM2.5, NMVOC, NH3, NOX and all projected years, the TRT noted that there is a lack of transparency in the projections chapter of the IIR regarding which policies and measures (PaMs) are taken into account in the With Measures (WM) scenario. In response to a question raised during the review, Finland explained that the WM scenario is based on the same assumptions for development of the agricultural policy and prices as were used in the HIISI project which was established to support the preparation of the update of the Finland's Energy and Climate Strategy – Carbon neutral Finland 2035. Finland also provided a summary of the main drivers included within the HIISI WEM scenario for agriculture for the years 2020-2050 e.g., slight decrease in the use of inorganic fertilisers due to rising fertiliser prices; decline in milk and cattle meat production resulting from increasing production costs, reduced hectare yields	Information on the key policies and measures have been included in the chapter 9.5 of the IIR in submission 2025.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Encouragement	Response
							and a decline in cattle meat price. The TRT notes that a reference to this study is provided in section 8.2.1 of the IIR, but that it would improve transparency to include a summary of the key policies and measures and other drivers directly in the IIR, as was provided by Finland in response to the review question. The TRT notes that this issue does not relate to an over or under-estimate and encourages Finland to include a clear explanation of which PaMs are taken into account in the WM scenario in the IIR submitted along the next projections submission.	
FI-3B-2023-0004	2023	3B Animal husbandry and manure management	PM2.5, NMVOC, NH3, NOX	2025, 2030, 2040, 2050	WM	No	For 3B Animal husbandry and manure management, PM2.5, NOX, NH3 and NMVOC in all years, the TRT noted that the IIR does not state which Tier methodology has been used to calculate projected emissions. In response to a question raised during the review, Finland explained that the projections were calculated using the same Tier methodology (Tier 2/3) as the historical emissions inventory. The TRT notes that this issue does not relate to an over or under-estimate and encourages Finland to clearly state which Tier methodology was used to calculate projections in the IIR submitted with the next projections submission.	Information that the projected emissions are calculated using the same Tier methodologies as are used in the historical inventory, has been included in the chapter 9.5 of the IIR in submission 2025.
FI-5-2023-0001	2023	5 Waste	NOX, SO2	2025, 2030	WM	No	For category 5 Waste and pollutants NOX and SO2 the TRT noted that no emissions are reported for the years 2025, 2030. In response to a question raised during the review, Finland explained that SO2 and NOX emitting sources (incineration/combustion/burning or cremation) are allocated under NFRs 1A1a or 1A2gviii in the Finnish inventory. The TRT notes that this issue does not relate to an over or under-estimate and encourages Finland to use in Annex IV the notation key 'IE' instead of 'NA'.	The notation key 'IE' has been used in 2025 projections submission.

10 GRIDDED EMISSIONS AND LPS

10.1 Gridded data

Changes in chapter	
March 2023	JM, KS , TF
Change in methodology	New grid 2015

Background

The new EMEP grid of 0.1 degrees introduced in the 2014 Reporting Guidelines was implemented in the inventory system in 2015. Finland lies between the northern latitudes of 60° and 70°, where one degree corresponds to approximately to a 7 km *7 km area (Figure 10.1)

The presentation of gridded data in the 1° * 1° format has at the moment been implemented for the land cover of activities only in 2005. It is planned to prepare datasets also for the earlier years as well as for future years when resources are available for this kind of work.

Gridded data in the resolution of 50 km * 50 km according to the earlier versions of the Reporting Guidelines is available also for the earlier reporting years.

Submissions of gridded data are presented in Table 1.12 in IIR Part 1A.



Figure 10.1 Geographical location of Finland (Maps of the World 2016)

Developments in land use

In comparison to other European countries, Finland is still a sparsely populated country with a small urban zone in the Southern part of the country. Only the capital region is a highly urbanized area according to the classifications of EuroStat and OECD.

In addition to the low population density, a specific feature of Finland is the share of rural areas and long distances between inhabitant centres. An exceptional feature compared to other low density countries is that almost all of Finland is populated and the most distant rural areas are rather vital. In an European comparison Finland was one of the top 5 countries in the share of rural areas of total area.

During the last decades more people have moved to the population centres, rural centres of their vicinity and especially in the Southern part of Finland. Inside municipalities, population is more and more moving from sparsely populated areas to villages. Largest growth can be seen in population centres exceeding 100 000 inhabitants and secondly in 1000 - 100 000 population centres. Growth rate has been high also in centres less than 1000 inhabitants, while the sparsely populated areas continue to lose their inhabitants.

Sources included

The reporting of gridded data includes the following pollutants: NO_x (as NO₂), NMVOC, SO_x (as SO₂), NH₃, PM_{2.5}, PM₁₀, BC, CO, Pb, Cd, Hg, PCDD/F, PAH-4, HCB and PCBs. Emission data is collected from the Finnish Air Emission Information System (IPTJ). Emission and location data of installations subject to environmental permit reporting are obtained from YLVA database. Data from regional emission sources (eg. transport and agriculture) are based on calculation and have been geographically distributed on the basis of more detailed national emission data.

The emission source classifications are based on the UN classification of climate and long-range transport agreements and GNFR sectors reported are A_PublicPower, D_Fugitive, B_Industry, C_OtherStationaryComb, I_Offroad, H_Aviation, F_RoadTransport, G_Shipping, E_Solvents, M_Other, J_Waste, K_AgriLivestock and L_AgriOther. (Tables 10.1-10.2)

Table 10.1 – Air pollutant emissions of GNFR categories for the year 2018.

Pollutant	Unit	A_PublicPower	B_Industry	C_OtherStationaryComb	D_Fugitive	E_Solvents	F_RoadTransport	G_Shipping	H_Aviation	I_Offroad	J_Waste	K_AgriLivestock	L_AgriOther
NO _x	t	24357.9	29347.2	10098.6		6.1	30429.7	6472.7	1017.8	15420.5		423.5	9020.9
NMVOC	t	1603.3	15041.4	22130.0	6075.5	9860.3	5111.1	2937.2	140.2	6171.5	88.4	12978.6	3161.7
SO _x	t	12457.4	16699.1	3667.4	52.8	5.0	46.8	84.4	64.1	42.2			7.9
NH ₃	t	3.7	659.9	1172.6	3.2	234.1	838.1	1.0		6.3	475.1	18324.0	10471.5
PM _{2.5}	t	336.3	2770.2	9541.2	1189.5	203.3	1911.7	298.4	7.4	919.6	103.9	166.5	350.0
PM ₁₀	t	1178.1	4140.0	10574.6	1697.0	214.8	7560.0	330.4	7.4	924.8	104.4	571.4	3812.8
BC	t	18.0	75.3	2704.8	0.0	3.7	704.0	61.4	3.7	414.4	9.4		18.8
CO	t	15646.9	33040.7	167383.1		187.1	37153.7	19565.3	1204.9	74447.8			1901.5
Pb	kg	2188.9	9983.0	1573.7	4.0	1113.3	491.7	12.6	36.3	3.7	1.2		1.6
Cd	kg	134.4	458.0	244.2	0.2	19.4	2.2	1.0		8.4	0.7		14.6
Hg	kg	160.0	424.7	42.8	0.0	0.1	25.1	2.7		0.9	18.1		2.9
PCDD/F	g	3.7	4.4	1.6	2.6	0.0	1.0	0.0		0.0	1.1		0.0
PAHs	g	546245.6	366667.6	8318764.0	456176.8	11384.1	225747.3			64521.5	1000.0		10.6

HCB	kg	0.5	31.0	0.3		0.0	0.2	0.0		0.0	0.0		0.0
PCBs	g	319.7	19145.1	3760.3	3098.6		0.2	9.2		1.1	12.1		

The categories contain point sources and non-point sources as illustrated in the table below.

Table 10.2 - The relative shares of emissions from point and non-point sources per aggregate category

Pollutant	Public power and industries*		Other stationary combustion**		Traffic and agriculture***		Products and waste****	
	Point sources	Non-point sources	Point sources	Non-point sources	Point sources	Non-point sources	Point sources	Non-point sources
NOx	98.5 %	1.5 %	0.4 %	99.6 %	0.0 %	100.0 %	0.0 %	100.0 %
NMVOc	50.8 %	49.2 %	0.0 %	100.0 %	0.0 %	100.0 %	21.0 %	79.0 %
SOx	98.1 %	1.9 %	0.3 %	99.7 %	0.0 %	100.0 %	14.1 %	85.9 %
NH3	99.5 %	0.5 %	0.0 %	100.0 %	0.0 %	100.0 %	31.2 %	68.8 %
TSP	58.8 %	41.2 %	0.1 %	99.9 %	0.0 %	100.0 %	20.1 %	79.9 %
PM10	63.3 %	36.7 %	0.0 %	100.0 %	0.0 %	100.0 %	20.2 %	79.8 %
PM2.5	62.7 %	37.3 %	0.0 %	100.0 %	0.0 %	100.0 %	19.0 %	81.0 %
BC	98.6 %	1.4 %	0.0 %	100.0 %	0.0 %	100.0 %	0.0 %	100.0 %
CO	99.2 %	0.8 %	0.0 %	100.0 %	0.0 %	100.0 %	0.0 %	100.0 %
Pb	94.4 %	5.6 %	0.3 %	99.7 %	0.0 %	100.0 %	0.0 %	100.0 %
Cd	98.1 %	1.9 %	0.0 %	100.0 %	0.0 %	100.0 %	0.0 %	100.0 %
Hg	98.2 %	1.8 %	0.2 %	99.8 %	0.0 %	100.0 %	0.0 %	100.0 %
As	84.4 %	15.6 %	0.8 %	99.2 %	0.0 %	100.0 %	0.0 %	100.0 %
Cr	94.9 %	5.1 %	0.1 %	99.9 %	0.0 %	100.0 %	0.0 %	100.0 %
Cu	85.2 %	14.8 %	0.4 %	99.6 %	0.0 %	100.0 %	0.0 %	100.0 %
Ni	94.1 %	5.9 %	0.1 %	99.9 %	0.0 %	100.0 %	0.0 %	100.0 %
Zn	97.1 %	2.9 %	0.0 %	100.0 %	0.0 %	100.0 %	0.0 %	100.0 %
PCCD/F	98.0 %	2.0 %	0.1 %	99.9 %	0.0 %	100.0 %	0.0 %	100.0 %
PAH-4	99.0 %	1.0 %	0.0 %	100.0 %	0.0 %	100.0 %	13.0 %	87.0 %
HCB	99.3 %	0.7 %	0.0 %	100.0 %	0.0 %	100.0 %	0.0 %	100.0 %
PCB	85.3 %	14.7 %	0.0 %	100.0 %	0.0 %	100.0 %	0.0 %	100.0 %

The headers aggregate the GNFR categories as follows:

* Public power and industries: A_PublicPower, D_Fugitive, B_Industry

** Other stationary combustion: C_OtherStationaryComb

*** Traffic and agriculture: I_Offroad, H_Aviation, F_RoadTransport, G_Shipping, K_AgriLivestock, L_AgriOther

**** Products and waste: E_Solvents, M_Other, J_Waste

Point sources are distributed by Tier 3 methodology. IPTJ contains coordinate data as WGS84 for all known point sources. Non-point sources vary between Tier 1 and 2 based on the activity. The table below presents the primary tier and the secondary tier in brackets. The secondary tier applies to the point or non-point emissions of the category which contributes to the lesser half of total emissions (for categories with both emission sources present). (Table 10.3)

Table 10.3 – Tier categorisation of spatial disaggregation of GNFR-categories

GNFR19	A_PublicPower	B_Industry	C_OtherStationaryComb	D_Fugitive	E_Solvents	F_RoadTransp	G_Shipping	H_Aviation	I_Offroad	J_Waste	K_AgriLivestoc	L_AgriOther
Tier	3 (1)	3 (1)	1 (3)	1	1 (3)	2	2	2	2	1 (3)	1	1

Data sources for disaggregation of non-point emission sources

Changes in chapter	
March 2022	JM

The geographical distribution of non-point emission sources, such as transport, households, agriculture and small-scale wood burning utilizes Finnish-wide proxies, which aim to represent each emission source with highest applicable level of accuracy. The spatial data set of the national road and street information system (Digiroad) is used as a medium for traffic emissions. Numerous different data sources have been utilized in allocating the calculated regional emissions to the map. The most commonly used source material is Corine Land Cover (CLC2006), which describes the Finnish land use and land cover in 2006. The material covers built land, agricultural areas, forests, open canals and rocky lands, wetlands and bogs and water areas. The data extracted from CLC2006 is supplemented with SLICES (Separated Land Use & Cover information System) data. Built environment is modelled with the Building and Housing Register (RHR) data. Activities without suitable proxies are distributed according to population density.

Point source sources, such as power plants and industrial operational plants, are shown according to their coordinates. Non-point emission sources such as emissions from transport, consumption and production, agriculture, and small-scale wood burning, cannot be allocated to a single point, but will use the indirect data that best represent each emission source. An activity for which no suitable medium exists is distributed according to population density. The proxies are currently based on land use of 2010 +/- 5 years depending on the availability of the data.

The proxies for non-point emission-sources are linked to the emissions by SNAP categorization. The table below presents the proxies and their corresponding SNAP, NFR and GNFR categorizations as are used in the GRID inventory submission of 2020 and beyond (Table 10.4).

Table 10.4 – List of used proxies per SNAP category in the inventory submission of 2020 of gridded emissions

GNFR19	NFR	NFR Description	SNAP	SNAP Description	Proxy	Source
A_Public Power	1A1a	Public electricity and heat production	010205	District heating - Stationary engines	Industrial areas and services	Corine land cover 2006
B_Industry	2C1	Iron and steel production	040208	Rolling mills	Industrial areas and services	Corine land cover 2006
	2H2	Food and beverages industry	040627	Meat, fish etc. frying / curing	Industrial areas and services	Corine land cover 2006
	2B1	Ammonia production	040403	Ammonia	Industrial areas and services	Corine land cover 2006
	2D3c	Asphalt roofing	040610	Asphalt roofing materials	All buildings - floor area	National building and dwelling register
	2I	Wood processing	040620	Wood processing	Industrial areas and services	Corine land cover 2006
	2C7c	Other metal production	040309z	Other	Industrial areas and services	Corine land cover 2006
	2H2	Food and beverages industry	040606	Wine	Wineries	Public listing
	2A5b	Construction and demolition	040624	Public works and building sites	All buildings - floor area	National building and dwelling register
	2H2	Food and beverages industry	040625	Sugar production	Industrial areas and services	Corine land cover 2006
	2A5c	Storage, handling and transport of mineral products	040900	Storage, handling and transport of mineral products	Industrial areas and services	Corine land cover 2006

2B10a	Chemical industry: Other (Please specify in the IIR)	040407	NPK fertilisers	Industrial areas and services	Corine land cover 2006	
2B10b	Storage, handling and transport of chemical products (Please specify in the IIR)	040415	Storage and handling of inorganic chemical prod. (o)	Mines and industrial areas	Separated Land Use/Land Cover Information System (SLICES)	
2H2	Food and beverages industry	040605	Bread	Industrial areas and services	Corine land cover 2006	
2H2	Food and beverages industry	040607	Beer	Breweries	Public listing	
2A5a	Quarrying and mining of minerals other than coal	040616	Extraction of mineral ores	Mines	Separated Land Use/Land Cover Information System (SLICES)	
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (Please specify in the IIR)	030326	Other	Facilities for energy production	National building and dwelling register	
2A3	Glass production	040613	Glass (decarbonizing)	Industrial areas and services	Corine land cover 2006	
2C7c	Other metal production (Please specify the sources included/excluded in the notes column to the right)	040210	Other	Industrial areas and services	Corine land cover 2006	
2C3	Aluminium production	040301	Aluminium production (electrolysis)	Industrial areas and services	Corine land cover 2006	
2H1	Pulp and paper industry	040602	Paper pulp (kraft process)	Industrial areas and services	Corine land cover 2006	
2L	Other production, consumption, storage, transportation or handling of bulk products	040617	Other (including asbestos products manufacturing)	Industrial areas and services	Corine land cover 2006	
2D3b	Road paving with asphalt	040611	Road paving with Asphalt	Streets under construction	Digiroad	
2C7d	Storage, handling and transport of metal products	040211	Storage, handling and transport of ferrous metal products	Population density	National building and dwelling register	
2A2	Lime production	040614	Lime (decarbonizing)	Industrial areas and services	Corine land cover 2006	
2C1	Iron and steel production	040209	Sinter and pelletizing plant (except comb. 030301)	Industrial areas and services	Corine land cover 2006	
2A1	Cement production	040612	Cement (decarbonizing)	Industrial areas and services	Corine land cover 2006	
C_Other Stationary Comb	1A5a	Other stationary (including military)	020106	Commercial and institutional - Other stationary equipment (n)	Industrial areas and services	Corine land cover 2006
	1A4ci	Agriculture/Forestry/Fis hing: Stationary	020305	Agri./forest/aqua. - Other stationary equipment (n)	Built agricultural land	Separated Land Use/Land Cover

						Information System (SLICES)
	1A4bi	Residential: Stationary	020205	Residential - Other equipment (stoves, fireplaces, cooking)	Buildings with wood as the primary heat source	National building and dwelling register
	1A4ai	Commercial / institutional: Stationary	020103b	Commercial and institutional - Combustion plants < 20 MW (boilers)	Population density	National building and dwelling register
	1A5a	Other stationary (including military)	020103b	Commercial and institutional - Combustion plants < 20 MW (boilers)	Population density	National building and dwelling register
	1A4bi	Residential: Stationary	020202b	Residential - Combustion plants < 20 MW (boilers)	Population density	National building and dwelling register
	1A4ai	Commercial / institutional: Stationary	020106	Commercial and institutional - Other stationary equipment (n)	Industrial areas and services	Corine land cover 2006
	1A4ci	Agriculture/Forestry/Fishing: Stationary	020302b	Agri./forest/aqua. - Combustion plants < 20 MW (boilers)	Population density	National building and dwelling register
D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	050601	Pipelines (q)	Industrial areas and services	Corine land cover 2006
	1B1c	Other fugitive emissions from solid fuels	050121	Peat production	Population density	National building and dwelling register
	1B2av	Distribution of oil products	050502	Transport and depots (except 050503)	Industrial areas and services	Corine land cover 2006
	1B1b	Fugitive emission from solid fuels: Solid fuel transformation	040201	Coke oven (door leakage and extinction)	Industrial areas and services	Corine land cover 2006
	1B2av	Distribution of oil products	050503	Service stations (including refuelling of cars)	Service stations	National building and dwelling register
E_Solvents	2G	Other product use	060601	Use of fireworks	Population density	National building and dwelling register
	2D3e	Degreasing	060204	Other industrial cleaning	All buildings - volume	National building and dwelling register
	2D3g	Chemical products	060314	Other	Population density	National building and dwelling register
	2D3i	Other solvent use	060412	Other (preservation of seeds,...)	Agricultural land in use (overall)	Separated Land Use/Land Cover Information System (SLICES)
	2D3i	Other solvent use	060406	Preservation of wood	All buildings - floor area	National building and dwelling register
	2D3a	Domestic solvent use including fungicides	060408	Domestic solvent use (other than paint application)	Buildings used for permanent residence	National building and dwelling register

	2D3d	Coating applications	060103	Paint application : construction and buildings (except item 060107)	All buildings - floor area	National building and dwelling register
	2D3d	Coating applications	060108	Other industrial paint application	Industrial areas and services	Corine land cover 2006
	2D3g	Chemical products	060310	Asphalt blowing	Population density	National building and dwelling register
	2D3d	Coating applications	060109	Other non-industrial paint application	All buildings - floor area	National building and dwelling register
	2D3h	Printing	060403	Printing industry	Population density	National building and dwelling register
	2D3i	Other solvent use	060404	Fat, edible and non-edible oil extraction	Population density	National building and dwelling register
	2D3g	Chemical products	060313	Leather tanning	Population density	National building and dwelling register
	2D3g	Chemical products	060307	Paints manufacturing	Population density	National building and dwelling register
	2G	Other product use	060602	Use of tobacco	Population density	National building and dwelling register
F_Road Transport	1A3bv	Road transport: Gasoline evaporation	070600	Gasoline evaporation from vehicles	Service stations	National building and dwelling register
	1A3biii	Road transport: Heavy duty vehicles and buses	070300	Heavy duty vehicles > 3.5 t and buses	Streets and roads (weighed with no. vehicles)	Digiroad
	1A3biv	Road transport: Mopeds & motorcycles	070500	Motorcycles > 50 cm3	Streets and roads (weighed with no. vehicles)	Digiroad
	1A3bi	Road transport: Passenger cars	070100	Passenger cars	Streets and roads (weighed with no. vehicles)	Digiroad
	1A3bvii	Road transport: Automobile road abrasion	070800	Road abrasion	Streets and roads (weighed with no. vehicles)	Digiroad
	1A3bii	Road transport: Light duty vehicles	070200	Light duty vehicles < 3.5 t	Streets and roads (weighed with no. vehicles)	Digiroad
	1A3bvi	Road transport: Automobile tyre and brake wear	070700	Automobile tyre and brake wear	Streets and roads (weighed with no. vehicles)	Digiroad
G_Shipping	1A3dii	National navigation (Shipping)	080303	Personal watercraft	Water bodies over 200 hectares and built water environments	Other
	1A3dii	National navigation (Shipping)	080304	Inland goods carrying vessels	Water bodies over 200 hectares and built water environments	Other
	1A3dii	National navigation (Shipping)	080302	Motorboats / workboats	Water bodies over 200 hectares and built water environments	Other
	1A3dii	National navigation (Shipping)	080402	National sea traffic within EMEP area	National ports (incl. onland area occupied)	Corine land cover 2006
H_Aviation	1A3ai(i)	International aviation LTO (Civil)	080502	International airport traffic (LTO cycles - <1000 m)	Airports (weighed with passenger numbers)	Separated Land Use/Land Cover Information System (SLICES)

	1A3aii(i)	Domestic aviation LTO (Civil)	080501	Domestic airport traffic (LTO cycles - <1000 m)	Airports (weighed with passenger numbers)	Separated Land Use/Land Cover Information System (SLICES)
I_Offroad	1A3c	Railways	080200	Railways	Railroads	Railroads
	1A4ciii	Agriculture/Forestry/Fishing: National fishing	080403	National fishing	Water bodies over 200 hectares and built water environments	Other
	1A4aii	Commercial / institutional: Mobile	081000	Other off-road	All buildings - count	National building and dwelling register
	1A5b	Other, Mobile (including military, land based and recreational boats)	080100	Military	Population density	National building and dwelling register
	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	080700	Forestry	New tree stumps from 2009 to 2011	Finnish Forest Institute
	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	080600	Agriculture	Agricultural land in use (overall)	Separated Land Use/Land Cover Information System (SLICES)
	1A2gvii	Mobile Combustion in manufacturing industries and construction: (Please specify in the IIR)	080800	Industry – off road	Industrial areas and services	Corine land cover 2006
	1A4bii	Residential: Household and gardening (mobile)	080900	Household and gardening	Buildings used for permanent residence	National building and dwelling register
J_Waste	5D1	Domestic wastewater handling	091002	Waste water treatment in residential and commercial sect.	Population density	National building and dwelling register
	5C1bv	Cremation	090901	Incineration of corpses	Crematoriums	Public listing
	5A	Biological treatment of waste - Solid waste disposal on land	090401	Managed Waste Disposal on Land	Landfills	Other
	5C1biii	Clinical waste incineration	090207	Incineration of hospital wastes	Population density	National building and dwelling register
	5B1	Biological treatment of waste - Composting	091005	Compost production	Sparse residential areas	Corine land cover 2006
	5E	Other waste (Please specify in IIR)	091101	Unintentional house fires	Population density	National building and dwelling register
	5A	Biological treatment of waste - Solid waste disposal on land	090403	Other	Population density	National building and dwelling register
	5E	Other waste (Please specify in IIR)	091007	Latrines	Sparse residential areas	Corine land cover 2006
	5D2	Industrial wastewater handling	091001	Wastewater treatment in industry	Industrial areas and services	Corine land cover 2006
	5E	Other waste (Please specify in IIR)	091102	Unintentional car fires	Population density	National building and dwelling register
K_Agri Livestock	3B4giii	Manure management - Turkeys	100509a	Turkeys	Farmhouses (Swine and bovine)	National building and dwelling register
	3B1a	Manure management - Dairy cattle	100501	Dairy cows	Farmhouses (Swine and bovine)	National building and dwelling register

	3B3	Manure management - Swine	100504	Sows	Farmhouses (Swine and bovine)	National building and dwelling register
	3B2	Manure management - Sheep	100505	Sheep	Farmhouses (Other animals)	Separated Land Use/Land Cover Information System (SLICES)
	3B4gi	Manure management - Laying hens	100507	Laying hens	Farmhouses (Swine and bovine)	National building and dwelling register
	3Da3	Urine and dung deposited by grazing animals	100517	Urine and dung deposited by grazing animals	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)
	3B4e	Manure management - Horses	100506	Horses	Stables	National building and dwelling register
	3B4gii	Manure management - Broilers	100508	Broilers	Farmhouses (Other animals)	Separated Land Use/Land Cover Information System (SLICES)
	3B4giv	Manure management - Other poultry (please specify in the IIR)	100509z	Other poultry (ducks, geese ,etc.)	Population density	National building and dwelling register
	3B4h	Manure management - Other animals (please specify in the IIR)	100510	Fur animals	Farmhouses (Other animals)	Separated Land Use/Land Cover Information System (SLICES)
	3B4h	Manure management - Other animals (please specify in the IIR)	100516	Reindeer	Population density	National building and dwelling register
	3B1b	Manure management - Non-dairy cattle	100502	Other cattle	Farmhouses (Swine and bovine)	National building and dwelling register
	3B3	Manure management - Swine	100503	Fattening pigs	Farmhouses (Swine and bovine)	National building and dwelling register
	3B4d	Manure management - Goats	100511	Goats	Farmhouses (Other animals)	Separated Land Use/Land Cover Information System (SLICES)
L_AgriOther	3Da1	Inorganic N-fertilizers (includes also urea application)	100104	Market gardening	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)
	3Df	Use of pesticides	100600	Use of pesticides and Limestone	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)
	3Da2b	Sewage sludge applied to soils	100906	Sewage sludge applied to soils	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)
	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	101000	Farm-level storage, handling and transport of agricultural products	Built agricultural land	Separated Land Use/Land Cover Information System (SLICES)
	3Da1	Inorganic N-fertilizers (includes also urea application)	100101	Permanent crops	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)

	3Da2a	Animal manure applied to soils	100905	Animal manure applied to soils	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)
	3F	Field burning of agricultural residues	100300	On-field burning of stubble, straw, etc.	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)
	3Da1	Inorganic N-fertilizers (includes also urea application)	100102	Arable land crops	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)
	3Db	Indirect emissions from managed soils	100208	Indirect emissions from managed soils	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)
	3Da1	Inorganic N-fertilizers (includes also urea application)	100105	Grassland	Fields and fallows	Separated Land Use/Land Cover Information System (SLICES)
O_AviCruise	1A3ai(ii)	International aviation cruise (Civil)	080504	International cruise traffic (>1000 m)	Population density	National building and dwelling register
	1A3aii(ii)	Domestic aviation cruise (Civil)	080503	National cruise traffic (>1000 m)	Population density	National building and dwelling register
P_IntShippi ng	1A3di(i)	International maritime navigation	080404	International sea traffic (international bunkers)	Population density	National building and dwelling register

Corine Land Cover 2006

CORINE Land Cover 2006 (CLC2006) dataset provides information on Finnish land cover and land use. The data is derived from the European CLC 2006 project and it includes raster data with the resolution of 25 x 25 metres. The data is produced by SYKE based on automated interpretation of satellite images and data integration. The standard CLC nomenclature contains 44 categories for land cover of which the following are selected to be used as basis of distribution:

- Class 1110 — Dense residential
- Class 1120 — Sparse residential
- Class 1210 — Industry and Services
- Class 1220 — Transportation
- Class 1230 — Harbour areas
- Class 1310 — Land extraction areas
- Class 1320 — Landfills
- Class 1330 — Construction areas
- Class 1421 — Second houses and non-permanent living

The data is extracted from original source and converted from raster data into point. These points are aggregated into EMEP grid cells, where their total count within a cell acts as the density defining factor for the given cell. The accuracy of the method is dependent on the accuracy of the source material. Using land use as the basis for basis for distribution of diffuse emissions does not take into account the rate of activity within the given area. Some accuracy is also lost during conversion. However, an example analysis made for land extraction areas reveals a correlation with land use and the Salpausselkä ridge system. which is known of possessing a high activity rate for land extraction. (Figure 10.2)

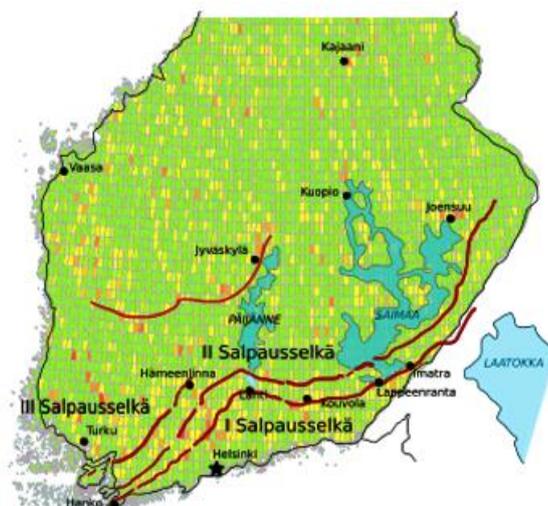


Figure 10.2 – CLC2006 marked land extraction areas in EMEP grid (background) and their correlation with the Salpausselkä ridge system (foreground)

SLICES

Separated Land Use/Land Cover Information System (SLICES) is a land use dataset from a joint operation between National Land Survey of Finland (NLS), Finnish Environment Institute (SYKE) and the Finnish Forest Research Institute (METLA, currently known as the Natural Resources Institute Finland). As a source material it is handled with the same principles as CLC data, as SLICES is a sub-constituent to CLC material. The categorization of data however differs and the following models are extracted based on SLICES data:

- Airports (by land use)
- Storage areas
- Agricultural areas with activity
- Agricultural fallows
- Built agricultural land
- Mines and other mineral extraction
- Extraction of sand, gravel and other land extraction

The emissions of GNFR H_Aviation are distributed to the land used by airports, which are weighed by the statistics of Finavia for the year 2013. Table 10.5 presents the passenger numbers for selected cities.

Table 10.5 – Passenger numbers per airport used to scale aviation emissions

ObjectID	Municipality	Passengers
32	Vantaa	15278994
190	Oulu	877080
204	Pirkkala	466671
234	Rovaniemi	427367
284	Turku	324687
296	Vaasa	319315
252	Siilinjärvi	261151
97	Kittilä	237222
49	Inari	146314
146	Liperi	131291
31	Helsinki	100000
ObjectID	Municipality	Passengers
133	Lappeenranta	98300
119	Kuusamo	74583
71	Kajaani	74558

111	Kruunupyy	68991
88	Kemi	57681
65	Jyväskylä	50570
207	Pori	26229
11	Enontekiö	20169
246	Savonlinna	12215
59	Joroinen	6759
109	Kouvola	500

For some airports no passenger data is available. For these 100 passengers is assumed. These municipalities are Alajärvi, Alavus, Asikkala, Imatra, Jomala, Jämijärvi, Jämsä, Kauhajoki, Kauhava, Keminmaa, Kitee, Kokemäki, Kontiolahti, Kotka, Kuhmo, Kemijärvi, Lieksa, Loppi, Oripää, Pudasjärvi, Raahe, Rautavaara, Salo, Sodankylä, Suomussalmi, Tampere, Vihti, Ylivieska, Eura. Hyvinkää airport is assumed to be used only for non-motorized air vehicles.

Building and Dwelling Register

Building and Dwelling Register (here referred as BDR, fin Rakennus- ja Huoneistorekisteri. RHR) is the national register for buildings and dwellings. The use of the register is limited by several laws. The data of BDR is used only as the basis of analysis. No detailed information or exact counts of buildings or housing in an area can by any means be backtracked based on the published data. Based on BDR data the following models are constructed to be used as basis for distribution:

- Population density
- All buildings – by count
- All buildings – by floor area
- All buildings – by overall volume
- Residential buildings – permanent
- Residential buildings – temporary
- Energy production facilities
- Energy production facilities with wood based fuels as primary heat source
- Commercial buildings with wood based fuels as primary heat source
- Residential buildings with wood based fuels as primary heat source
- Agriculture – Horse stables and other animal shelters
- Agriculture – Piggeries, cattle shelters and henhouses
- Agriculture – grain drying kilns and facilities
- Petrol stations and other automobile service facilities

For models based on all buildings several models were constructed based on count, floor area and the overall volume to be used for different purposes. For example for categories of product use the it can be assumed that the activity rate is more connected to the count of households rather than volumetric parameters. For emissions resulting from heating, the overall volume gives a better estimate as the amount of energy required correlates with building volume. The inventory of 2022 will substitute the previous model with a more detailed model, both of which are based on the data above.

National road and street information system (Digiroad)

Digiroad is the national road- and street information system which contains the centre line geometry data for all known streets. The activity rate is also available for most main roads as vehicles per day. The following activities are extracted for use as proxies:

- Highways
- Roads
- Streets
- Private streets
- All combined

Activity rate is introduced with the following formula:

$$E_{cell} = \frac{E_{total}}{n_{total}} * n_{cell}$$

where

E_{cell} = Emission value in a cell

E_{total} =Sum value of emissions

n_{total} =Vehicles per day (total national)

n_{cell} =Vehicles per day (cell)

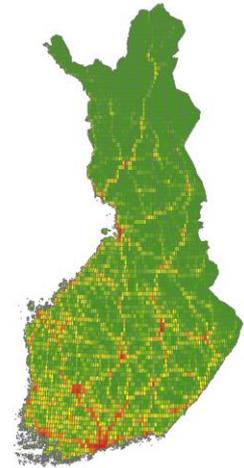


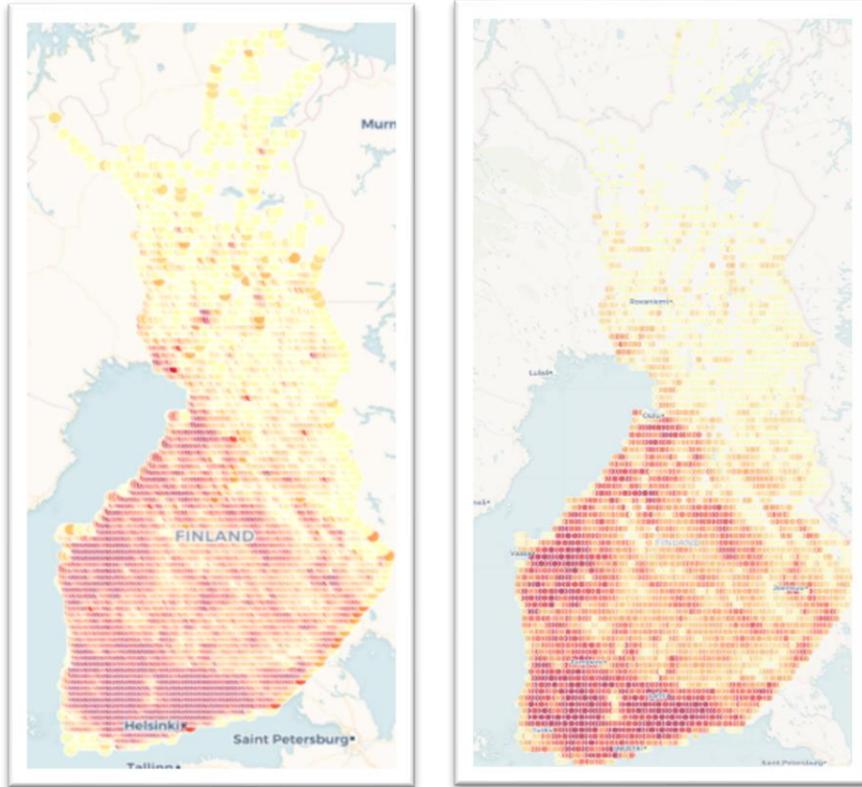
Figure 10.3 illustrates the resulting map after applying the methodology.

Figure 10.3 - PM_{2.5} emissions of 2013 in the national street system

Other sources

In the Finnish emission inventory crematoria, small breweries and wineries are calculated as diffuse sources. It is however possible to collect the location data for most of these based on various public listings. The data extracted in this manner is geocoded based on publicly available addresses and emissions are assigned to the corresponding cells. The method does not take the rate of activity within the locations into account.

For agricultural emissions a pre-existing proxy containing information about field distribution is used. This proxy is used for GNFR L_AgriOther under which Finland reports the following activities: indirect emissions from managed soils, urine and dung deposited by grazing animals, inorganic N-fertilizers, on-field burning of stubble, use of pesticides, animal manure applied to soils, sewage sludge applied to soils and farm-level agricultural operations. Spatially these emissions are estimated by fields and built agricultural land. Agricultural activities concentrate on the south-west of Finland and there is a notable amount of fields in the vicinity of the largest cities. To illustrate further, the images below present an image of the distribution of emissions before and after reconfiguring the proxies for the 2020 submission as a response to observation FI-GRID-L-2020-0001. Figure 10.4 presents the registered fields for Southern Finland (as listed by the Finnish Food Authority).



Initial submission Revised estimate



Registered fields in the registry of Finnish food authority

Figure 10.4. Maps above: Distribution of emissions before and after reconfiguring the proxies for the 2020 submission as a response to observation FI-GRID-L-2020-0001. Map below: Registered fields for Southern Finland (as listed by the Finnish Food Authority) marked in pink colour.

Public viewing tool for spatial distribution of emissions

A viewing tool of the spatial distribution of emissions within the inventory can be found at: <https://www.p2.ymparisto.fi/paastotkartalla/?lang=en>. The viewing tool aggregates GNFR sectors as presented in Table 10.6.

Table 10.6 – Description of the aggregation of GNFR classes for public viewing.

GNFR	Aggregate class	Description of sources
A_PublicPower	Public power and industries	Energy production and industrial processes covers emissions from electricity production and district heating, manufacturing and handling of fuels as well as from industrial processes and industrial boilers. Emissions which can not be allocated to geographical locations are evenly distributed on the map on industrial areas.
D_Fugitive		
B_Industry		
C_OtherStationaryComb	Other stationary combustion	Other stationary combustion includes such small scale furnaces and heat sources. Most of these are heat sources for housing, but also included are sauna stoves, fireplaces and stoves using wood or biomass as the primary fuel. The category also includes emissions from known fuel consumption that can not be allocated to a known facility.
I_Offroad	Transport	Transport category includes emissions from road and rail transport, navigation, aviation, non-road and working machinery. Regarding road transport emissions from tyre, brake wear and road abrasion as well as gasoline evaporation are included. The mapping has been carried out using data on road network, starting points of navigation and aviation without route data.
H_Aviation		
F_RoadTransport		
G_Shipping		
E_Solvents	Products and waste	Product use and waste includes use of products and solvents in industry and households. Emissions from landfill, composting and wastewater treatment are included, as well as e.g. house and car fires.
M_Other		
J_Waste		
K_AgriLivestock	Agriculture	The emissions from agriculture consists of such activities as animal husbandry and manure management, fertilizing and the use of pesticides. Also field burning of agricultural residues and other field operations are listed under agricultural emissions.
L_AgriOther		

Methodological issues

Changes in chapter	
March 2021	JM

Overview of the calculation of emissions

Gridded emissions contain all of the emissions of the air emission inventory including point sources and non-point sources. The national emission values are distributed to the cells with the following generalized equation.

$$E_{cell} = \frac{E_{total}}{n_{total}} * n_{cell}$$

Where

- E_{cell} = Emission value in a cell
- E_{total} = Total emission value
- n_{total} = Rate of activity, national total
- n_{cell} = Rate of activity in a cell

The methodology is constructed by the instructions of *Spatial mapping of emissions* of EMEP/EEA Guidebook 2013. As of the latest methodology of Guidebook 2019, the following steps are included in the methodology:

- Key category analysis to identify the most important sources is used.
- Existing spatial datasets are preferred.
- GIS tools are used to improve the proxies.
- Proxy data that is judged to most closely represent the spatial emissions patterns and intensity, and which is applicable with available resources, is selected.
- Spatial datasets that are complete are preferred.
- New data is available rarely. The currently gridded data uses spatial proxies which are set to describe land use of the year 2010.
- Issues relating to non-disclosure may be encountered but have not been observed to date.
- Aggregation is done in the EMEP 0.1 x 0.1 degree longitude/latitude grid but the methodology of creating proxies is applicable to higher levels of detail when needed

Disaggregating diffuse emissions.

The methodology to create proxies follows the basic principles as presented in the Guidebook 2019 where applicable, with modifications based on source content. Point sources are gridded based on chapter 3.4.1. Area sources are gridded based on chapter 3.4.2, however in many cases the material is first converted into points of certain density within the area. This commonly takes place with rasterized data sources that do not allow spatial analysis with the available toolset. Line sources are gridded according to chapter 3.4.3. Converting spatial projections is done where needed.

Uncertainty and time series' consistency

No evaluation of uncertainty has been done for gridded data. The methodology is prone to uncertainty especially in the temporal scale, as spatial disaggregation is done only for the target year 2010.

Source-specific QA/QC and verification

Normal statistical quality checking related to assessment of magnitude and trends has been carried out. Visual inspection for all GNFR sectors.

Source-specific recalculations including changes made in response to the review process

2020

- Update of methodology and inclusion of new inspection tools.
- Correction of geographical allocation issues: FI-GRID-L-2020-0001, FI-GRID-C-2020-0001, FI-GRID-B-2020-0001
- Update of coordinates to selected power plants (in response to FI-GRID-A-2020-0001)

2021

- Rewritten documentation of gridded emissions (in response to *Notes on reporting of air pollutant emissions from Large Point sources and emissions gridded data under the NECD*)
- Improved accuracy in facility coordinates
- Facility locations unified with LPS

2022

- The proxy data used for small scale wood combustion have been updated to more detailed data regarding the location of different building types (Finnish Regional Emission Scenario, FRES).

Source-specific planned improvements

None.

10.2 LPS data, sources, geographical coordinates and emissions

Changes in chapter	
March 2025	TF
Change in method	none

According to the CLRTAP Reporting Guidelines, large point sources (LPS) are defined as facilities whose combined emissions, within the limited identifiable area of the site premises, exceed the pollutant emission thresholds identified in table 1 of the reporting guidelines. In the Finnish inventory, LPS facilities are identified as facilities that have at least one PRTR installation at their site premises. All emissions from all installations of these facilities, that are located at their site premises and exceed the pollutant emission thresholds identified in the reporting guidelines, are included in the LPS reporting data.

The emission data from LPS facilities are either reported by the facilities according to the environmental monitoring requirements in their environmental permits, and available from the YLVA system, or calculated at SYKE. Always when facility reported emission data are available, it is used in the reporting. All the reported LPS emission data is also included in the national inventory.

The emission data reported by Finland under the PRTR regulation is extracted from the YLVA system. This emission data is also included in the national inventory and LPS emission data. The differences in the emission data of individual facilities reported under the PRTR and LPS reporting are usually due to the inclusion of all installations from the site premises of the facilities to the LPS reporting. The PRTR reporting comprise only PRTR installations. Furthermore, in some cases, the LPS reporting data may also contain emissions calculated at SYKE in addition to the emissions reported by the facility to the YLVA system. Sometimes, erroneous emission data of PRTR installations is detected from the YLVA system (e.g. emissions reported in a wrong unit). When detected, these are corrected to the inventory data extracted from YLVA. The facility supervisors from the Centres for Economic Development, Transport and the Environment are informed of these data. If these data are not corrected to the PRTR reporting, this causes also differences between inventory/LPS data and PRTR data.

PRTR reporting includes ammonia emissions from a large number of agricultural operators. In the Finnish inventory, these facility reported emissions are not taken into account in the inventory reporting (and hence LPS reporting), since all the ammonia emissions in the inventory are calculated in a separate calculation model for agricultural emissions.

Note that the inventory is built up from boiler/process level data and default LPS emissions are calculated as part of the inventory, however, replaced by the reported data in the YLVA system, whenever these data are available and their correctness is checked.

The incorrect coordinates detected in the 2020 NECD review have been corrected to the latest LPS data sets.

The differences between the latest PRTR and LPS reporting data sets are described in the IIR. The differences for the year 2020 are listed below. The list will be completed with a description of the differences in more recent years' data sets in submission 2026.

Some emissions reported by the facilities for 2020 in the European Environment Agency's (EEA) PRTR database (Industrial Reporting database v5, December 2021) were absent from the LPS data for 2020 reported in submission 2022. These included:

- NO_x emissions reported by PRTR National IDs 3238 and 11179, SO_x emissions reported by the PRTR National ID 100239774 and PM₁₀ emissions reported by PRTR National ID 1913. In

these cases the 2020 emissions are below the reporting threshold from LPS when the emissions are split between the different stack heights in the LPS reporting.

- NO_x emissions reported by PRTR National ID 100131111. The emission data in the reported in the PRTR database for this facility includes emissions also from the fuel use in off-road working machines. In the air pollutant emission inventory, all emissions from off-road working machines are calculated in the LIPASTO (explained in a more detailed level in the IIR/Part 3 – Transport) calculation system. To avoid double counting, none of the emissions of working machines reported by the facilities themselves are taken into account.
- PCDD/F emissions reported by PRTR National ID 1172. These emissions are incorrect in the PRTR database. The emissions are 1000 times too high in the database. The emissions have been corrected to the air pollutant emission inventory and the correct emissions are below the reporting threshold from LPS.
- PCDD/F emissions reported by PRTR National ID 3653. The emissions reported by the facility for the first time for 2020 in the PRTR database will be investigated thoroughly with the facility during 2022. Based on this work the possible inclusion of these emissions will be decided for submission 2023.

Data on Finnish LPSs has been submitted annually under the CLRTAP and since 2002 under the NECD.

Uncertainty and time series' consistency

No separate evaluation of uncertainty has been done for LPS data. However, all LPS data are included in the inventory data, for which an uncertainty analysis has been carried out.

Source-specific QA/QC and verification

Normal statistical quality checking related to assessment of magnitude and trends has been carried out.

Source-specific recalculations including changes made in response to the review process

2012

- The definition of the set of Finnish Large Point Sources (LPS) was revised to correspond to the definition of PRTR installations. as defined in the revised UNECE Reporting Guidelines (ECE/EB.AIR/97).
- During the preparation of the 2012 submission, it was observed that the conversion of nationally used coordinates into the coordinates in the CLRTAP reporting did not work as believed. A new method to convert the coordinates was introduced.

2017-2018

- The geographical coordinates used in national reporting for point sources is EUREF-FIN and there was a need to carry out a conversion between the level and geographical coordinates. The additional functionality challenges were resolved to the 2019 submission.

2021

- Rewritten documentation
- Correction of some coordinates
- VAHTI-based coordinates updated to more accurate YLVA coordinates.
- Facility locations unified with gridded data.

2022

- Inclusion of a description of the differences between the latest PRTR and LPS reporting data sets.

Source-specific planned improvements

None.

11 ADJUSTMENTS

11.1 Adjustment mechanisms under the Gothenburg Protocol and EU National Emission reduction Commitments Directive

The 2012 amendment to the 1999 Gothenburg Protocol to the CLRTAP and the EU National Emission reduction Commitments Directive (2016/2284) set emission reduction commitments (ERCs) for Finland from 2020 onwards for SO_x, NO_x, NMVOCs, NH₃ and PM_{2.5}.

Decision 2012/3 of the Executive Body¹⁷ stated that adjustments may be made under specific circumstances to the national emission inventories for the purpose of comparing the inventories with emission reduction commitments.

According to the Article V of the EU NEC Directive (2016/2284), Member States may establish adjusted annual national emission inventories where non-compliance with their national emission reduction commitments would result from applying improved emission inventory methods updated in accordance with scientific knowledge.

As defined in the EMEP Executive Body Decisions 2012/3, 2012/12¹⁸ and 2014/1¹⁹, circumstances under which an adjustment may be applied fall into three categories where:

1. Emission source categories are identified that were not accounted for at the time when emission reduction commitments were set.
2. Emission factors used to determine emissions levels for particular source categories for the year in which emissions reduction commitments are to be attained are significantly different than the emission factors applied to these categories when emission reduction commitments were set.
3. The methodologies used for determining emissions from specific source categories have undergone significant changes between the time when emission reduction commitments were set and the year they are to be attained.

The reference version of the EMEP/EEA Guidebook that is used to determine the scientific knowledge and understanding when the emission reduction commitments were set is 2009 for the commitments specified in the amended Gothenburg Protocol and EU NECD.

11.2 Application for adjustments

Gothenburg Protocol and National Emission reduction Commitments Directive

In the 2025 submission, the NH₃ emission reduction from the year 2005 to 2020 and 2021 is not in line with emission reduction commitment set under the 2012 amendment to the 1999 Gothenburg Protocol to the CLRTAP and the EU National Emission reduction Commitments Directive (2016/2284). From 2022 onwards Finland is in compliance with the NH₃ emission reduction commitment under the amended Gothenburg Protocol and the EU NECD. In this regard, we refer also to the reported NH₃ emission projections (chapter 9 of the IIR), according to which, Finland will meet its NH₃ emission reduction targets until 2029 and for 2030.

¹⁷ https://www.ceip.at/fileadmin/inhalte/ceip/4_adjustments/decisions/ece_eb.air_111_add.1_eng_decision_3.pdf

¹⁸ https://www.ceip.at/fileadmin/inhalte/ceip/4_adjustments/decisions/decision_2012_12.pdf

¹⁹ https://www.ceip.at/fileadmin/inhalte/ceip/4_adjustments/decisions/decision_2014_1.pdf

In the 2025 submission, Finland has applied for an adjustment to its 2020 and 2021 NH₃ emissions for:

- NFR categories 3Da2c, 3Da4, 5B2 and 6A based on circumstance 1 presented above in chapter 11.1 and
- NFR categories 3B1a, 3B1b, 3B2, 3B3, 3B4d, 3B4e, 3B4gi, 3B4gii, 3B4giii, 3B4giv, 3B4h, 3Da1, 3Da2a and 3Da3 based on circumstance 2 presented above in chapter 11.1.

Table 11.1 shows the exceedance against the NH₃ national emission reduction commitment as set in the amended Gothenburg Protocol and the EU NECD for the years 2020 and 2021, and to what extent the proposed adjustment to the emission inventory eliminates the exceedance and brings Finland into compliance for 2020 and 2021. In table 11.1, the calculations used to quantify the adjustment have been performed according to the *Technical Guidance for Emissions Inventory Adjustments under the Amended Gothenburg Protocol: Inventory adjustments in the context of Emission Reduction Commitments*²⁰.

Table 11.1. Summary of Finland's NH₃ emissions inventory for years 2005, 2020, 2021, 2022, 2023 and the proposed adjusted national total emissions for compliance for 2020 and 2021.

Unadjusted emissions	2005	2020	2021	2022	2023
NH ₃ national total, kt	40.903	33.723	32.946	29.995	30.160
ERC, %		20	20	20	20
National total target, kt		32.722	32.722	32.722	32.722
Emission reduction, %		-17.6	-19.5	-26.7	-26.3
ERC exceedance, kt		1.000	0.223	-	-

Proposed adjustment	2005	2020	2021
NFR 3B1a - EF revision	1.710	0.765	0.637
NFR 3B1b - EF revision	1.442	1.237	1.287
NFR 3B2 - EF revision	0.045	0.071	0.066
NFR 3B3 - EF revision	-0.173	-0.239	-0.159
NFR 3B4d - EF revision	0.005	0.004	0.004
NFR 3B4e - EF revision	0.185	0.207	0.209
NFR 3B4gi - EF revision	0.621	0.644	0.611
NFR 3B4gii - EF revision	0.636	1.488	1.514
NFR 3B4giii - EF revision	0.134	0.131	0.145
NFR 3B4giv - EF revision	0.135	0.071	0.099
NFR 3B4h - EF revision	-0.317	-0.296	-0.270
NFR 3Da1 - EF revision	-2.492	-1.978	-2.085
NFR 3Da2a - EF revision	-2.564	-3.127	-3.083
NFR 3Da2c - New source	-0.428	-0.482	-0.457
NFR 3Da3 - EF revision	-0.565	-0.478	-0.468
NFR 3Da4 - New source	-0.193	-0.295	-0.303
NFR 5B2 - New source	-0.013	-0.180	-0.203
NFR 6A - New source	-0.408	-0.560	-0.577
Total effect of adjustment	-2.238	-3.017	-3.033
Adjusted NH ₃ national total, kt	38.665	30.705	29.912
ERC, %		20	20
Adjusted national total target, kt		30.932	30.932
Adjustment emission reduction, %		-20.6	-22.6
ERC compliance margin, kt		0.227	1.019

Note: Annex IIa to the ECE/EB.Air/130 was originally submitted on 14 February 2025. However, a re-submission of the Annex IIa to the ECE/EB.Air/130 was made on 15 March

²⁰ https://www.ceip.at/fileadmin/inhalte/ceip/00_pdf_other/2022/technical_guidance_for_erc_adjustments_issue1.1.pdf

2025. The re-submission contains the final adjustment application Annex IIa to the ECE/EB.Air/130.

Detailed methodological descriptions for estimating the NH₃ emissions in 2025 submission are provided in the sector specific IIR chapters Part 5 Agriculture (for categories 3B and 3D) and Part 6 Waste and Other sources (for categories 5B2 and 6A). The summary of the methodologies used for each category:

- NFR 3B Manure management: In general, the calculation system follows the principles of the Tier 2 method described in the EMEP/EEA Guidebook 2023. However, it has some features, which move it towards the Tier 3 method, such as the greater number of animal and manure categories than listed under Tier 2, and the inclusion of the emission abatement measures.
- NFR 3Da1 Inorganic N-fertilizers: EMEP/EEA Guidebook 2023, Tier 2. Impact of abatement measures (placement fertilisation) is included in the emission calculation.
- NFR 3Da2a Animal manure applied to soils: see above NFR 3B Manure management.
- NFR 3Da2c Other organic fertilisers applied to soils: EMEP/EEA Guidebook 2023, Tier 1.
- NFR 3Da3 Urine and dung deposited by grazing animals: EMEP/EEA Guidebook 2023, Tier 2.
- NFR 3Da4 Crop residues applied to soils: EMEP/EEA Guidebook 2023, Tier 2.
- NFR 5B2 Biological treatment of waste - Anaerobic digestion at biogas facilities: EMEP/EEA Guidebook 2023, Tier 2
- NFR 6A Other (Pets – cats and dogs): EMEP/EEA Guidebook 2023, Tier 1

The supporting documentation required by Parties applying for an adjustment is defined in Decision 2012/12 of the Executive Body and in Annex IV Part 4 of EU NEC Directive (2016/2284).

For new emission source categories the supporting documentation include:

- Evidence that the new emission source category is acknowledged in scientific literature and/or the EMEP/EEA air pollutant emission inventory guidebook;
- Evidence that this source category was not included in the relevant historic national emission inventory at the time when the emission reduction commitment was set;
- Evidence that emissions from a new source category contribute to a Party being unable to meet its reduction commitments, supported by a detailed description of the methodology, data and emission factors used to arrive at this conclusion;

NH₃ emissions from NFRs 3Da2c (Other organic fertilisers applied to soils), 3Da4 (Crop residues applied to soils), 5B2 (Biological treatment of waste - Anaerobic digestion at biogas facilities) and 6A (Other (Pets – cats and dogs)) are all new sources compared to when the Emission Reduction Commitments were set. In the 2009 version of the Guidebook (EEA, 2009), no methodologies or default emission factors were available for NH₃ emissions from these source categories. NH₃ emissions from none of these source categories were included in Finland's 2012 submission.

In the Finnish inventory NH₃ emissions from these source categories were included in the following submissions:

- NFR 3Da2c Other organic fertilisers applied to soils: 2022 submission
- NFR 3Da4 Crop residues applied to soils: 2025 submission
- NFR 5B2 Biological treatment of waste - Anaerobic digestion at biogas facilities: 2022 submission
- NFR 6A Other (Pets – cats and dogs): 2024 submission

For significantly different emission factors used for determining emissions from specific source categories the supporting documentation include:

- A description of the original emission factors, including a detailed description of the scientific basis upon which the emission factor was derived;
- Evidence that the original emission factors were used for determining the emission reductions at the time when they were set;
- A description of the updated emission factors, including detailed information on the scientific basis upon which the emission factor was derived;
- A comparison of emission estimates made using the original and the updated emission factors, demonstrating that the change in emission factors contributes to a Party/MS being unable to meet its reduction commitments; and
- The rationale for deciding whether the changes in emission factors are significant;

The original agricultural emission calculation model used in agricultural ammonia emission reporting in the 2012 submission for manure-related emissions (manure management, manure application, grazing) was based on national emission factors and methods. They were principally similar to the EMEP/EEA Guidebook but had the following main differences:

- Emission calculations for manure management were based on total nitrogen in manure, not TAN, whereas emission calculations for manure spreading and grazing were based on TAN.
- The unabated emission factors (volatilization factors) used in the emission calculations were based on data collected from the literature, not the Guidebook.

As is the case today, emission reduction measures were already included in the calculation of manure-related ammonia emissions at that time.

For ammonia emissions from inorganic nitrogen fertilisers, the original calculation in the 2012 submission was based on the EMEP/CORINAIR Emission Inventory Guidebook 2007.

The original agricultural emission calculation emission factors and method used in 2012 submission are fully described in the report by Grönroos et al. (2009)²¹.

The original and the current emission factors and the quantified impact on the emissions estimates of the change are presented in detail in the Table1 of Annex IIa to the ECE/EB.Air/130 submitted on 15 March 2025. In the Table1, IEFs (Implied Emission Factors) are presented under emission factors because the unabated emission factor (volatilisation factor) alone does not provide sufficient information on the formation of calculated emissions.

In Finland's emission inventory, the IEF is influenced not only by the volatilisation factor but also by the coverage of emission reduction measures and their efficiency, animal-specific nitrogen excretion data, and, in Finland's case, temperature correction factors. Since it is not possible to present all these factors in the Table1 of Annex IIa to the ECE/EB.Air/130, the IEFs are presented instead.

Additionally, the emission factors for inorganic nitrogen fertilisers presented in the Table1 of Annex IIa to the ECE/EB.Air/130 are not entirely taken directly from the Guidebook, as the NH₃-N factors

²¹ <https://helda.helsinki.fi/items/72cc6642-0c9b-4def-884b-f2e71cfe0278>

in the 2007 Guidebook have been converted to NH₃ factors. Furthermore, the emission factors for nitrogen applied to arable land have been multiplied by a factor of 0.5, reflecting the emission-reducing effect of placement fertilisation.

The total effect of all the changes to emission factors and new sources included in the ammonia emission inventory contribute to moving Finland's national total NH₃ emissions for 2020 and 2021 into compliance. All of changes are therefore considered to be "significant" in the context of attaining compliance with emission reduction commitments.

12 MEMO ITEMS

Changes in chapter	
Update of text	March 2020 KS
Change in methodology	

Overall description and methodologies

1 A 3 ai(ii) International aviation cruise

See IIR Part 2 Energy under Aviation.

1 A 3 aii(ii) Domestic aviation cruise

See IIR Part 2 Energy under Aviation.

1 A 3 dii(i) International maritime navigation

See IIR Part 2 Energy under Navigation.

1 A 5 c Multilateral operations

Included under 1A5 (IE)

1 A 3 Transport (fuel used)

Not applicable (NA). The inventory is based on fuels sold.

6 B Other not included in national total of the entire territory

Not occurring (NO) in Finland.

11 A Volcanoes

There are no volcanoes in Finland.

11 B Forest fires

Not estimated (NE).

11 C Other natural emissions

Not applicable (NA).

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