FINLAND's INFORMATIVE INVENTORY REPORT 2026

Air Pollutant Emissions 1980-2024
under the UNECE CLRTAP and the EU NECD

Part 1B - General

March 2026

FINNISH ENVIRONMENT INSTITUTE

Climate solutions unit

Air pollution group

PART 1

GENERAL B

PART 1B - GENERAL

REFERENCES

8 RECALCULATIONS AND IMPROVEMENTS

Changes in chapter	
March 2026	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included in the base year but have been added since as well as for sources that were included in the base year and are no longer applicable.

Threre 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 recalcualtions 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 sparce 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) dueto 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.

13 Mar 2026   Finland submitted minor recalculations that were due to correction of erroneous emission data reported for categories 1A3biv and 2D3b in the submission of 13 Feb 2026.

8.1.2 Impacts of recalculations in the 2026 submission

Recalculations to the 2026 submission are explained in detail in the respective IIR chapters (Parts 2-6 of the IIR). The most significant recalculations to the 2026 submission were:

- Implementation of Copert model to the Finnish greenhouse gas and air pollutant emission inventories to estimate the emissions from road transport. Copert replaced the previously used national road transport emission calculation model Lipasto/LIISA. Following the implementation of a new calculation model to the inventories, major recalculations were performed for many air pollutants in the NFR categories 1A3bi-v. All the recalculations are described in more detail in the sector specific chapter of the IIR (Part 3 Transport).

Other recalculations conducted to the 2026 submission have only a minor impact and they are described in the sector specific IIR chapters (Parts 2-6 of the IIR). Below is an overview of the impacts of the recalculations to the 2026 submission in Figure 8.1 and Table 8.1.

NOx (kt) recalculation 2026

Old (14 Feb 2025) — New (13 Mar 2026)

NMVOC (kt) recalculation 2026
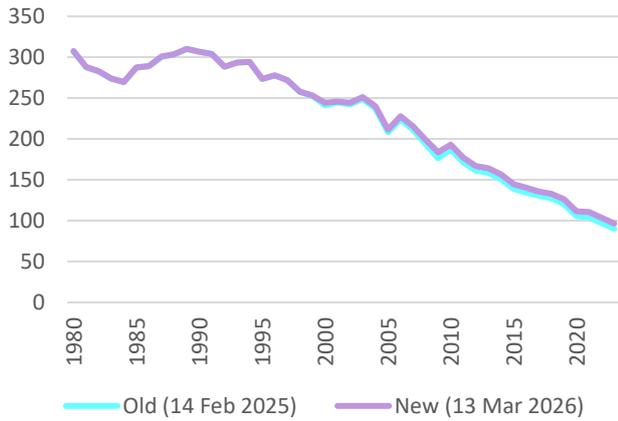
Old (14 Feb 2025) — New (13 Mar 2026)

SO2 (kt) recalculation 2026
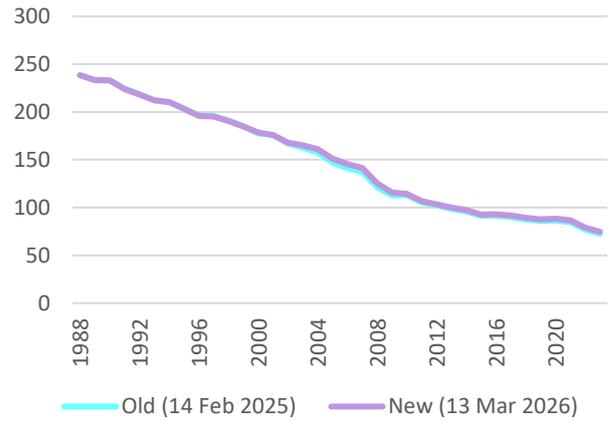
Old (14 Feb 2025) — New (13 Mar 2026)

NH3 (kt) recalculation 2026

Old (14 Feb 2025) — New (13 Mar 2026)

CO (kt) recalculation 2026

Old (14 Feb 2025) — New (13 Mar 2026)

PM2.5 (kt) recalculation 2026

PM10 (kt) recalculation 2026

TSP (kt) recalculation 2026

BC (kt) recalculation 2026
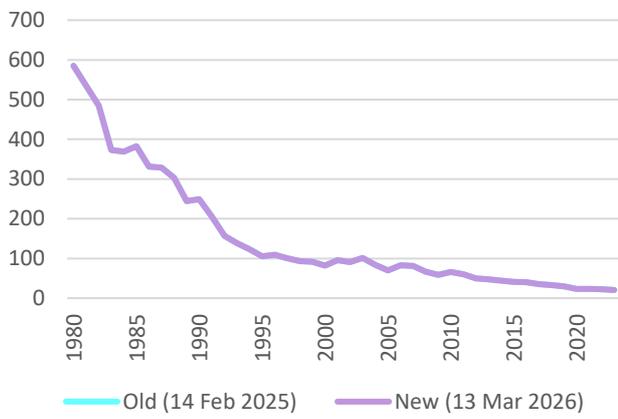
Pb (t) recalculation 2026
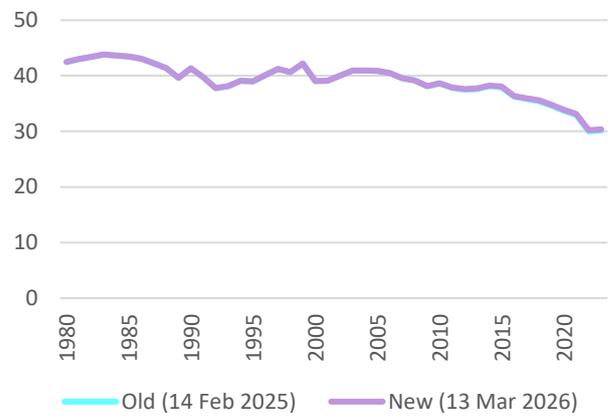
Cd (t) recalculation 2026

Hg (t) recalculation 2026
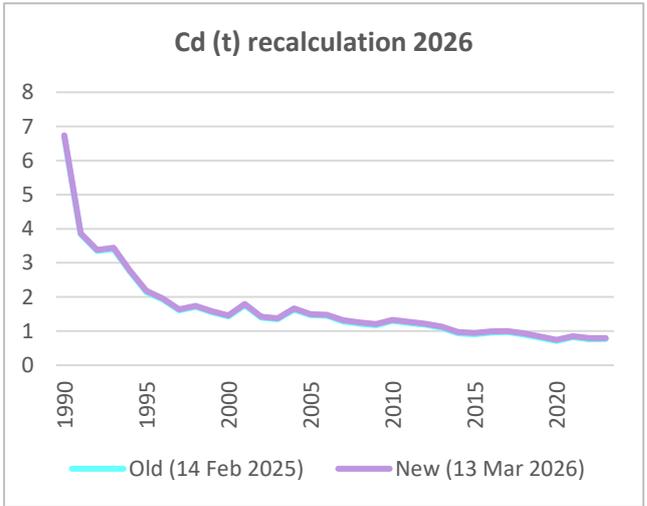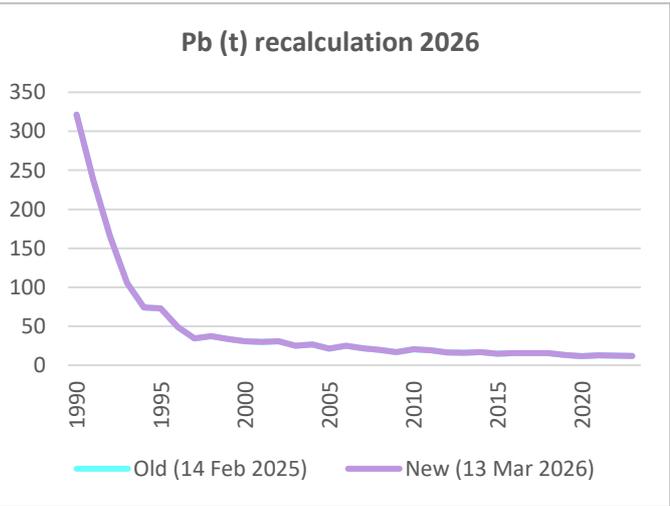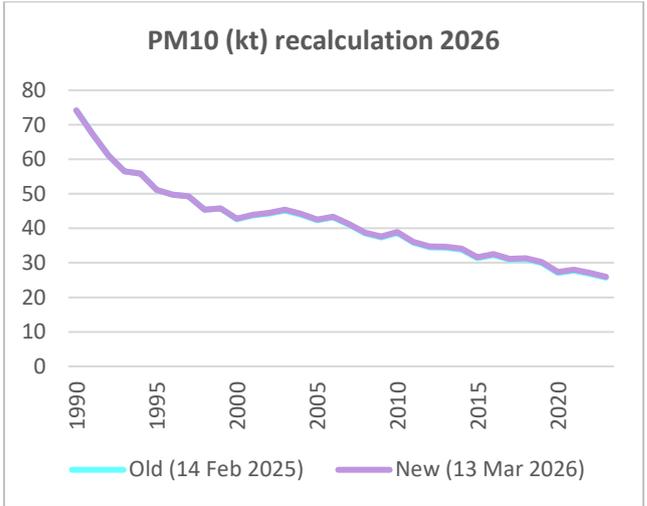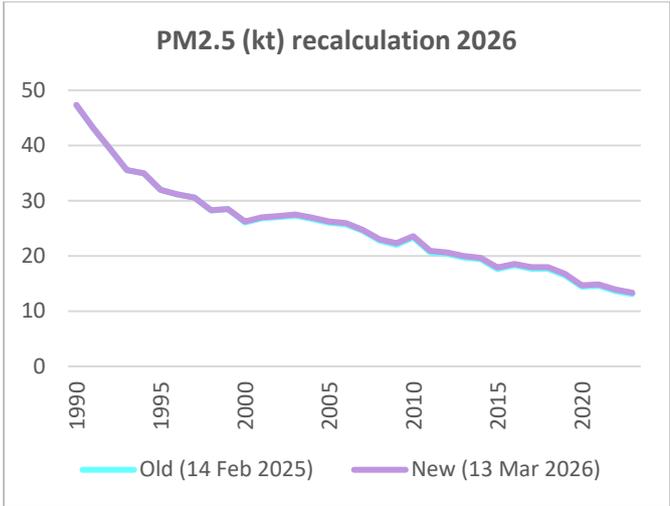
Old (14 Feb 2025) — New (13 Mar 2026)

As (t) recalculation 2026

Old (14 Feb 2025) — New (13 Mar 2026)

Cr (t) recalculation 2026
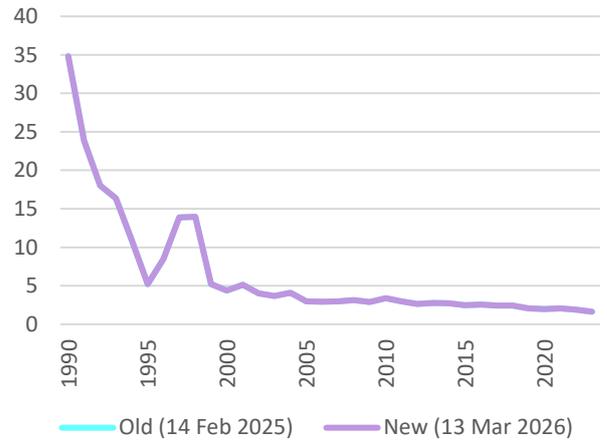
Old (14 Feb 2025) — New (13 Mar 2026)

Cu (t) recalculation 2026
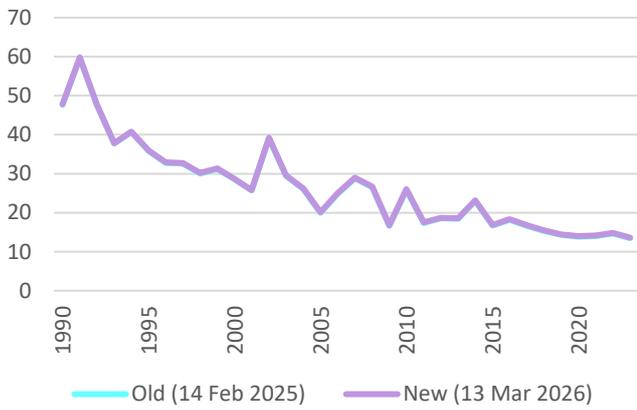
Old (14 Feb 2025) — New (13 Mar 2026)

Ni (t) recalculation 2026

Old (14 Feb 2025) — New (13 Mar 2026)

Zn (t) recalculation 2026
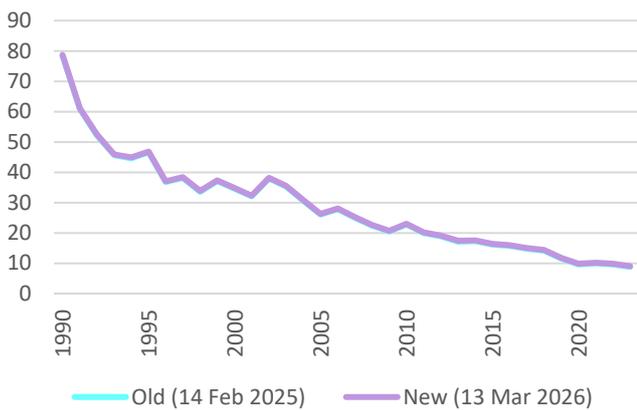
Old (14 Feb 2025) — New (13 Mar 2026)

Figure 8.1 Impact of recalculations in the 2026 submission compared to the 2025 submission.

Table 8.1 Impact of recalculations in the 2026 submission compared to the 2025 submission.

NOx

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
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
13 March 2026	307.560	288.016	282.886	273.785	269.645	287.511	289.320	300.757	303.714	310.211	306.880	304.015	288.426	293.631	294.357
Difference	0.283	0.274	0.256	0.252	0.224	0.208	0.193	0.175	0.158	0.138	0.133	0.127	0.120	0.117	0.113
%	0.1 %	0.1 %	0.1 %	0.1 %	0.1 %	0.1 %	0.1 %	0.1 %	0.1 %	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 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
13 March 2026	273.367	277.778	271.902	257.787	253.039	244.403	245.909	244.257	251.277	239.980	211.263	227.812	215.366	198.893	183.842
Difference	0.111	0.117	0.121	0.115	0.112	3.130	1.297	1.791	2.358	2.658	2.946	3.836	4.336	5.196	7.451
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	1.3 %	0.5 %	0.7 %	0.9 %	1.1 %	1.4 %	1.7 %	2.1 %	2.7 %	4.2 %

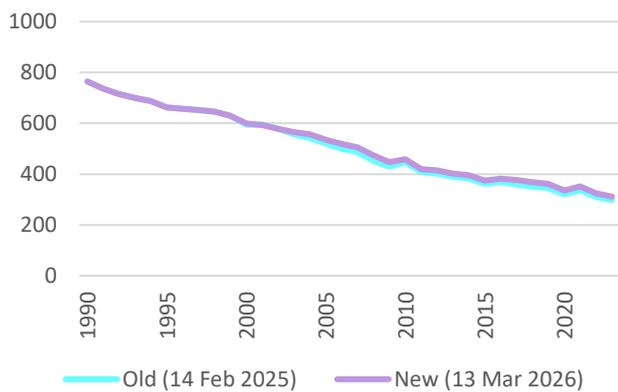|	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
14 February 2025	187.125	171.256	161.331	158.511	150.837	138.747	134.636	130.637	127.603	120.358	105.492	104.218	97.044	90.300	
13 March 2026	192.879	177.003	167.080	164.288	156.627	144.561	140.488	135.850	132.871	126.369	111.520	110.542	103.657	96.605	
Difference	5.754	5.747	5.749	5.777	5.790	5.814	5.852	5.213	5.268	6.011	6.028	6.324	6.613	6.305	
%	3.1 %	3.4 %	3.6 %	3.6 %	3.8 %	4.2 %	4.3 %	4.0 %	4.1 %	5.0 %	5.7 %	6.1 %	6.8 %	7.0 %	

SO$_2$

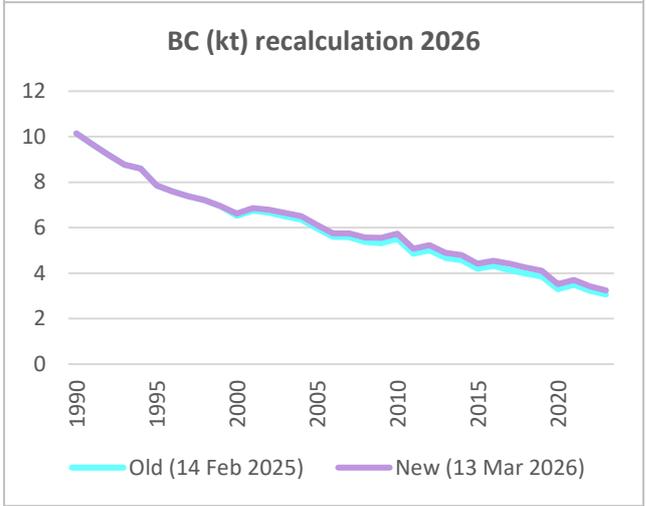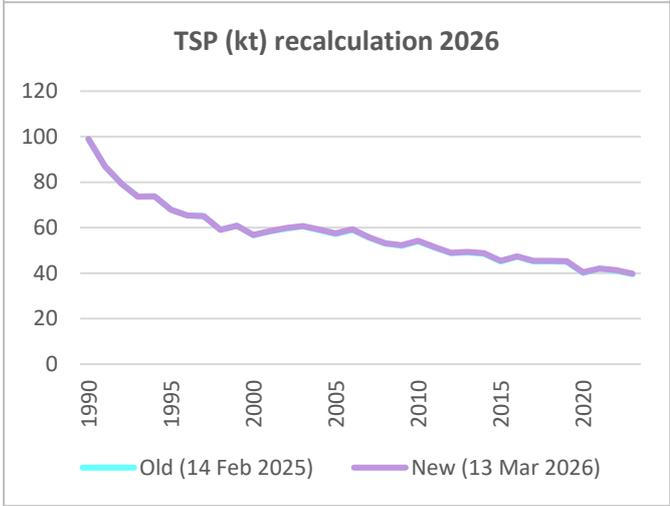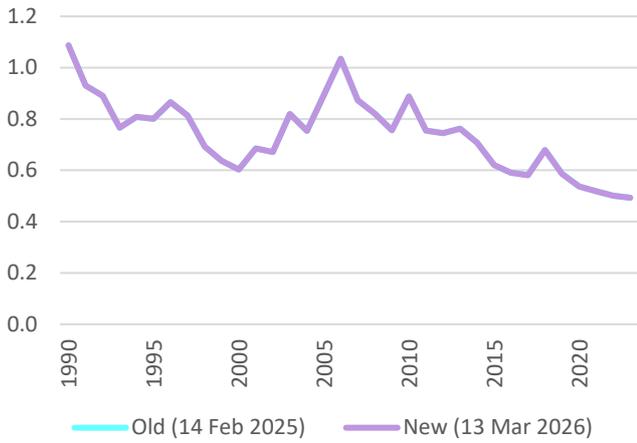|	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
14 February 2025	585.029	534.931	484.785	372.765	368.704	382.708	331.549	328.697	302.705	244.651	249.475	205.845	156.829	138.414	123.269
13 March 2026	585.029	534.931	484.785	372.765	368.704	382.708	331.549	328.697	302.705	244.651	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 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
13 March 2026	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 %

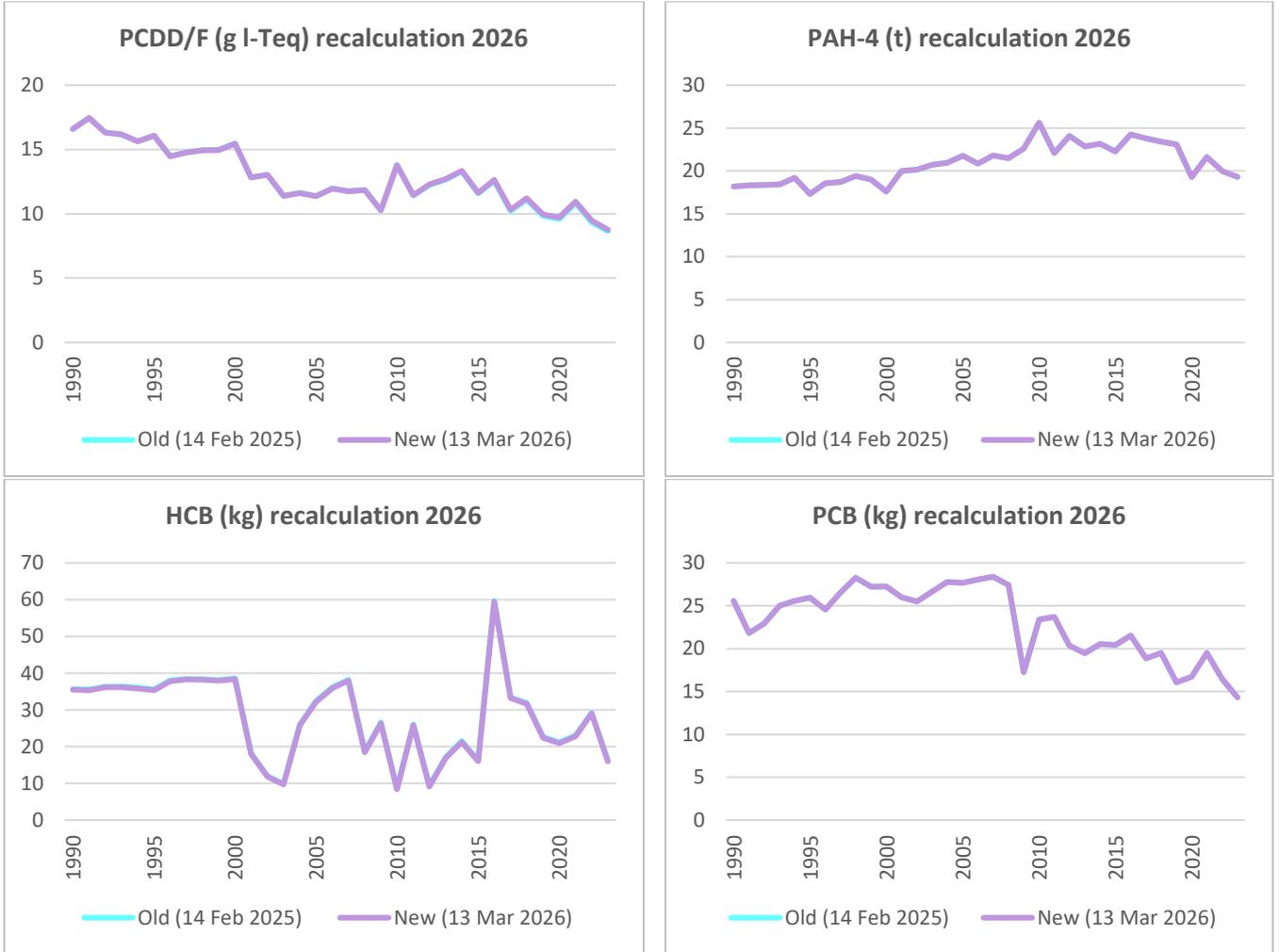|	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
14 February 2025	66.157	60.283	50.018	47.710	44.277	40.850	39.838	35.046	33.148	29.615	23.230	23.112	22.461	20.536	
13 March 2026	66.157	60.283	50.018	47.710	44.277	40.850	39.838	35.042	33.142	29.611	23.227	23.110	22.459	20.534	
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.004	-0.006	-0.004	-0.003	-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 %	

NH$_3$

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
14 February 2025	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
13 March 2026	42.485	43.000	43.396	43.827	43.663	43.476	43.055	42.279	41.422	39.612	41.347	39.715	37.791	38.148	39.106

Difference	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	-0.001	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 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
13 March 2026	39.000	40.118	41.212	40.664	42.222	39.059	39.111	40.027	40.922	40.921	40.904	40.497	39.541	39.143	38.099
Difference	0.000	0.011	0.014	0.013	0.012	0.000	0.015	0.025	0.010	0.005	0.001	0.002	-0.005	-0.010	0.002
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.1 %	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**	**2023**
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	30.160
13 March 2026	38.625	37.887	37.589	37.735	38.225	38.051	36.362	35.962	35.600	34.774	33.895	33.140	30.196	30.382
Difference	0.001	0.038	0.088	0.110	0.113	0.128	0.134	0.136	0.154	0.172	0.172	0.194	0.201	0.222
%	0.0 %	0.1 %	0.2 %	0.3 %	0.3 %	0.3 %	0.4 %	0.4 %	0.4 %	0.5 %	0.5 %	0.6 %	0.7 %	0.7 %

NMVOC

	1988	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
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
13 March 2026	238.444	233.160	233.070	223.953	218.269	212.069	210.088	203.131	195.939	195.353	190.438	184.727	178.490	175.658	167.881
Difference	0.000	0.000	-0.292	-0.277	-0.270	-0.271	-0.285	-0.309	-0.320	-0.346	-0.375	-0.394	0.878	-0.077	0.853
%	0.0 %	0.0 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.2 %	-0.2 %	-0.2 %	-0.2 %	-0.2 %	0.5 %	0.0 %	0.5 %

	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
14 February 2025	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
13 March 2026	165.058	161.228	151.007	145.355	141.478	125.340	115.684	114.285	106.561	103.484	100.069	97.361	92.621	93.009	91.645
Difference	2.516	3.545	4.005	4.412	4.032	3.873	2.961	1.336	1.202	1.222	1.484	1.344	1.373	1.439	1.649
%	1.5 %	2.2 %	2.7 %	3.1 %	2.9 %	3.2 %	2.6 %	1.2 %	1.1 %	1.2 %	1.5 %	1.4 %	1.5 %	1.6 %	1.8 %

	2018	**2019**	**2020**	**2021**	**2022**	**2023**
14 February 2025	87.420	85.840	86.462	84.585	76.856	72.510
13 March 2026	89.256	87.780	88.413	86.554	78.834	74.650
Difference	1.836	1.940	1.951	1.969	1.978	2.140
%	2.1 %	2.3 %	2.3 %	2.3 %	2.6 %	3.0 %

CO

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
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
13 March 2026	764.634	736.024	715.295	700.402	686.691	661.906	656.912	651.503	646.378	629.954	598.781	592.770	578.209	565.818	556.255
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.900	-3.393	0.595	9.309	14.219
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.8 %	-0.6 %	0.1 %	1.7 %	2.6 %

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
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
13 March 2026	535.633	518.956	505.156	473.062	446.996	458.758	419.718	414.219	401.642	395.724	374.431	381.472	376.353	367.771	361.637

Difference	16.048	19.502	18.922	20.975	17.836	11.618	11.362	11.584	11.933	12.114	12.317	12.721	16.896	16.731	16.112
%	3.1 %	3.9 %	3.9 %	4.6 %	4.2 %	2.6 %	2.8 %	2.9 %	3.1 %	3.2 %	3.4 %	3.4 %	4.7 %	4.8 %	4.7 %

	2020	2021	2022	2023
14 February 2025	320.305	336.711	310.271	298.374
13 March 2026	335.646	351.228	324.222	311.691
Difference	15.341	14.517	13.951	13.317
%	4.8 %	4.3 %	4.5 %	4.5 %

TSP

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2025	98.975	86.980	79.358	73.614	73.784	67.943	65.349	65.023	59.046	60.846	56.592	58.282	59.625	60.522	58.935
13 March 2026	98.975	86.980	79.358	73.614	73.784	67.943	65.349	65.023	59.046	60.846	56.766	58.452	59.813	60.739	59.149
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.174	0.170	0.188	0.217	0.214
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.3 %	0.3 %	0.3 %	0.4 %	0.4 %

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
14 February 2025	57.239	59.065	55.647	52.932	51.984	53.990	51.155	48.722	49.137	48.510	45.203	47.187	45.123	45.098	44.988
13 March 2026	57.433	59.256	55.848	53.170	52.262	54.242	51.404	48.972	49.390	48.763	45.458	47.443	45.418	45.383	45.278
Difference	0.194	0.191	0.201	0.238	0.278	0.252	0.249	0.250	0.253	0.253	0.255	0.256	0.295	0.285	0.290
%	0.3 %	0.3 %	0.4 %	0.4 %	0.5 %	0.5 %	0.5 %	0.5 %	0.5 %	0.5 %	0.6 %	0.5 %	0.7 %	0.6 %	0.6 %

	2020	2021	2022	2023
14 February 2025	40.157	41.846	41.066	39.531
13 March 2026	40.418	42.093	41.317	39.772
Difference	0.261	0.247	0.251	0.241
%	0.6 %	0.6 %	0.6 %	0.6 %

PM$_{10}$

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 February 2025	74.187	67.466	61.175	56.549	55.867	51.166	49.764	49.278	45.446	45.817	42.663	43.742	44.307	45.171	43.970
13 March 2026	74.187	67.466	61.175	56.549	55.867	51.166	49.764	49.278	45.446	45.817	42.836	43.912	44.495	45.388	44.184
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.173	0.170	0.188	0.217	0.214
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.4 %	0.4 %	0.4 %	0.5 %	0.5 %

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
14 February 2025	42.328	43.194	41.012	38.532	37.322	38.639	35.833	34.504	34.393	33.869	31.375	32.304	30.882	31.026	29.933
13 March 2026	42.522	43.386	41.212	38.769	37.599	38.890	36.082	34.755	34.645	34.122	31.630	32.561	31.177	31.311	30.224
Difference	0.194	0.192	0.200	0.237	0.277	0.251	0.249	0.251	0.252	0.253	0.255	0.257	0.295	0.285	0.291
%	0.5 %	0.4 %	0.5 %	0.6 %	0.7 %	0.6 %	0.7 %	0.7 %	0.7 %	0.7 %	0.8 %	0.8 %	1.0 %	0.9 %	1.0 %

	2020	2021	2022	2023
14 February 2025	27.056	27.768	26.789	25.728
13 March 2026	27.316	28.015	27.039	25.962

Difference	0.260	0.247	0.250	0.234
%	1.0 %	0.9 %	0.9 %	0.9 %

PM2.5

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	47.346	43.153	39.356	35.573	34.980	31.983	31.169	30.552	28.283	28.482	26.220	26.988	27.243	27.486	26.908
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.174	0.171	0.188	0.217	0.214
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.7 %	0.6 %	0.7 %	0.8 %	0.8 %

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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
13 March 2026	26.220	25.926	24.754	23.008	22.300	23.605	20.895	20.627	19.964	19.642	17.896	18.545	17.997	17.952	16.731
Difference	0.194	0.192	0.200	0.237	0.278	0.252	0.250	0.250	0.252	0.253	0.254	0.256	0.294	0.285	0.290
%	0.7 %	0.7 %	0.8 %	1.0 %	1.3 %	1.1 %	1.2 %	1.2 %	1.3 %	1.3 %	1.4 %	1.4 %	1.7 %	1.6 %	1.8 %

	2020	2021	2022	2023
14 February 2025	14.431	14.595	13.657	13.108
13 March 2026	14.690	14.845	13.907	13.339
Difference	0.259	0.250	0.250	0.231
%	1.8 %	1.7 %	1.8 %	1.8 %

BC

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	10.145	9.659	9.209	8.763	8.594	7.858	7.590	7.373	7.213	6.948	6.619	6.855	6.790	6.648	6.508
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.101	0.109	0.127	0.151	0.158
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	1.5 %	1.6 %	1.9 %	2.3 %	2.5 %

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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
13 March 2026	6.115	5.752	5.755	5.569	5.549	5.741	5.072	5.228	4.897	4.793	4.414	4.544	4.415	4.248	4.106
Difference	0.157	0.164	0.178	0.204	0.233	0.228	0.228	0.227	0.228	0.228	0.228	0.229	0.281	0.264	0.252
%	2.6 %	2.9 %	3.2 %	3.8 %	4.4 %	4.1 %	4.7 %	4.5 %	4.9 %	5.0 %	5.4 %	5.3 %	6.8 %	6.6 %	6.5 %

	2020	2021	2022	2023
14 February 2025	3.292	3.486	3.228	3.063
13 March 2026	3.514	3.694	3.426	3.241
Difference	0.222	0.208	0.198	0.178
%	6.7 %	6.0 %	6.1 %	5.8 %

Pb

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
13 March 2026	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 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	13.220
13 March 2026	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	13.221
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	0.001
%	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	2023											
14 February 2025	11.632	12.558	12.198	12.089											
13 March 2026	11.632	12.558	12.198	12.090											
Difference	0.000	0.000	0.000	0.001											
%	0.0 %	0.0 %	0.0 %	0.0 %											

Cd

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	6.740	3.866	3.380	3.440	2.773	2.178	1.957	1.639	1.743	1.584	1.460	1.794	1.424	1.377	1.666
Difference	0.034	0.033	0.033	0.032	0.032	0.032	0.031	0.032	0.032	0.033	0.032	0.032	0.033	0.033	0.034
%	0.5 %	0.9 %	1.0 %	0.9 %	1.2 %	1.5 %	1.6 %	2.0 %	1.9 %	2.1 %	2.2 %	1.8 %	2.4 %	2.5 %	2.1 %
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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
13 March 2026	1.502	1.482	1.322	1.250	1.209	1.333	1.269	1.220	1.133	0.971	0.941	0.990	1.006	0.932	0.838
Difference	0.034	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.034	0.035	0.034	0.034	0.035	0.034	0.034
%	2.3 %	2.4 %	2.7 %	2.9 %	3.0 %	2.7 %	2.8 %	3.0 %	3.1 %	3.7 %	3.7 %	3.6 %	3.6 %	3.8 %	4.2 %
	2020	2021	2022	2023											
14 February 2025	0.711	0.820	0.760	0.767											
13 March 2026	0.744	0.854	0.793	0.799											
Difference	0.033	0.034	0.033	0.032											
%	4.6 %	4.1 %	4.3 %	4.2 %											

Hg

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	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 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

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
13 March 2026	0.892	1.035	0.873	0.821	0.756	0.888	0.755	0.745	0.762	0.707	0.621	0.591	0.581	0.679	0.586
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	-0.001	0.000	-0.001
%	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	-0.2 %	0.0 %	-0.2 %

	2020	2021	2022	2023
14 February 2025	0.537	0.519	0.501	0.493
13 March 2026	0.537	0.518	0.501	0.493
Difference	0.000	-0.001	0.000	0.000
%	0.0 %	-0.2 %	0.0 %	0.0 %

As

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	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 2025	2.992	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
13 March 2026	2.992	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
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	2023
14 February 2025	1.996	2.050	1.915	1.632
13 March 2026	1.996	2.050	1.915	1.632
Difference	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %

Cr

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	47.814	59.828	47.766	37.857	40.806	35.963	32.887	32.764	30.207	31.363	28.698	25.830	39.214	29.596	26.178
Difference	0.144	0.142	0.141	0.135	0.138	0.136	0.133	0.136	0.137	0.137	0.134	0.136	0.139	0.141	0.144
%	0.3 %	0.2 %	0.3 %	0.4 %	0.3 %	0.4 %	0.4 %	0.4 %	0.5 %	0.4 %	0.5 %	0.5 %	0.4 %	0.5 %	0.6 %

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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
13 March 2026	20.154	25.069	28.975	26.657	16.810	26.034	17.519	18.705	18.581	23.211	16.861	18.317	16.796	15.492	14.438
Difference	0.145	0.147	0.150	0.148	0.148	0.149	0.148	0.146	0.147	0.146	0.145	0.145	0.144	0.144	0.146
%	0.7 %	0.6 %	0.5 %	0.6 %	0.9 %	0.6 %	0.9 %	0.8 %	0.8 %	0.6 %	0.9 %	0.8 %	0.9 %	0.9 %	1.0 %

	2020	2021	2022	2023
14 February 2025	13.855	14.010	14.664	13.473

13 March 2026	13.996	14.148	14.800	13.608
Difference	0.141	0.138	0.136	0.135
%	1.0 %	1.0 %	0.9 %	1.0 %

Cu

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	162.696	154.605	129.997	116.996	111.761	121.972	114.887	134.525	89.975	73.646	70.753	71.735	74.888	67.595	65.822
Difference	5.781	5.712	5.693	5.436	5.546	5.467	5.346	5.494	5.484	5.504	5.403	5.478	5.593	5.679	5.823
%	3.7 %	3.8 %	4.6 %	4.9 %	5.2 %	4.7 %	4.9 %	4.3 %	6.5 %	8.1 %	8.3 %	8.3 %	8.1 %	9.2 %	9.7 %

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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
13 March 2026	63.944	64.600	50.232	48.039	46.424	48.023	48.414	47.167	48.341	49.031	46.623	47.538	46.526	46.165	46.227
Difference	5.875	5.934	6.065	5.988	5.989	6.043	5.998	5.950	5.943	5.940	5.862	5.880	5.875	5.900	5.902
%	10.1 %	10.1 %	13.7 %	14.2 %	14.8 %	14.4 %	14.1 %	14.4 %	14.0 %	13.8 %	14.4 %	14.1 %	14.5 %	14.7 %	14.6 %

	2020	2021	2022	2023
14 February 2025	37.884	38.779	38.150	37.478
13 March 2026	43.585	44.421	43.689	42.941
Difference	5.701	5.642	5.539	5.463
%	15.0 %	14.5 %	14.5 %	14.6 %

Ni

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	78.685	61.128	52.446	45.857	44.847	46.816	37.024	38.348	33.795	37.343	34.801	32.296	38.153	35.519	30.811
Difference	0.236	0.232	0.232	0.221	0.226	0.223	0.219	0.224	0.224	0.224	0.221	0.223	0.228	0.232	0.237
%	0.3 %	0.4 %	0.4 %	0.5 %	0.5 %	0.5 %	0.6 %	0.6 %	0.7 %	0.6 %	0.6 %	0.7 %	0.6 %	0.7 %	0.8 %

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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
13 March 2026	26.309	28.078	25.230	22.597	20.730	23.036	20.162	19.121	17.400	17.570	16.353	15.965	15.030	14.399	11.788
Difference	0.240	0.243	0.248	0.245	0.245	0.247	0.246	0.244	0.243	0.243	0.240	0.241	0.240	0.242	0.242
%	0.9 %	0.9 %	1.0 %	1.1 %	1.2 %	1.1 %	1.2 %	1.3 %	1.4 %	1.4 %	1.5 %	1.5 %	1.6 %	1.7 %	2.1 %

	2020	2021	2022	2023
14 February 2025	9.644	9.919	9.643	8.793
13 March 2026	9.878	10.151	9.870	9.016
Difference	0.234	0.232	0.227	0.223
%	2.4 %	2.3 %	2.4 %	2.5 %

Zn

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	686.187	476.106	377.524	352.531	408.837	406.151	272.910	154.890	154.031	144.639	130.758	134.498	150.110	130.379	128.163
Difference	3.337	3.297	3.286	3.137	3.201	3.156	3.086	3.171	3.165	3.177	3.119	3.163	3.229	3.279	3.363
%	0.5 %	0.7 %	0.9 %	0.9 %	0.8 %	0.8 %	1.1 %	2.1 %	2.1 %	2.2 %	2.4 %	2.4 %	2.2 %	2.6 %	2.7 %
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
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
13 March 2026	122.709	122.503	111.909	120.155	119.305	132.082	127.588	130.258	127.854	135.381	122.015	130.755	123.367	121.964	133.522
Difference	3.393	3.428	3.504	3.460	3.462	3.493	3.468	3.441	3.437	3.435	3.390	3.401	3.398	3.412	3.414
%	2.8 %	2.9 %	3.2 %	3.0 %	3.0 %	2.7 %	2.8 %	2.7 %	2.8 %	2.6 %	2.9 %	2.7 %	2.8 %	2.9 %	2.6 %
	2020	**2021**	**2022**	**2023**											
14 February 2025	116.190	133.703	126.706	119.511											
13 March 2026	119.490	136.965	129.911	122.671											
Difference	3.300	3.262	3.205	3.160											
%	2.8 %	2.4 %	2.5 %	2.6 %											

PCDD/F

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	16.594	17.447	16.314	16.162	15.625	16.069	14.467	14.767	14.935	14.960	15.448	12.823	13.029	11.387	11.616
Difference	-0.010	-0.009	-0.009	-0.009	-0.008	-0.008	-0.006	-0.007	-0.006	-0.006	-0.006	-0.006	-0.007	-0.008	-0.008
%	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	-0.1 %	-0.1 %	-0.1 %
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
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
13 March 2026	11.370	11.963	11.757	11.850	10.267	13.771	11.443	12.281	12.696	13.344	11.619	12.625	10.321	11.213	9.946
Difference	-0.008	-0.007	-0.007	-0.008	-0.007	-0.006	0.014	0.039	0.043	0.049	0.046	0.067	0.098	0.110	0.116
%	-0.1 %	-0.1 %	-0.1 %	-0.1 %	-0.1 %	0.0 %	0.1 %	0.3 %	0.3 %	0.4 %	0.4 %	0.5 %	1.0 %	1.0 %	1.2 %
	2020	**2021**	**2022**	**2023**											
14 February 2025	9.588	10.841	9.344	8.651											
13 March 2026	9.705	10.962	9.471	8.766											
Difference	0.117	0.121	0.127	0.115											
%	1.2 %	1.1 %	1.4 %	1.3 %											

PAH-4

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
13 March 2026	18.176	18.333	18.359	18.430	19.211	17.304	18.565	18.703	19.412	18.991	17.597	19.990	20.153	20.696	20.961
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.007	0.007	-0.003	-0.005
%	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 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
13 March 2026	21.776	20.852	21.779	21.463	22.614	25.621	22.085	24.062	22.856	23.170	22.266	24.255	23.803	23.396	23.085
Difference	-0.003	-0.003	-0.006	-0.005	0.004	-0.003	-0.003	-0.003	-0.003	-0.003	-0.004	-0.004	-0.005	-0.008	-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 %

	2020	**2021**	**2022**	**2023**
14 February 2025	19.253	21.641	19.967	19.315
13 March 2026	19.256	21.636	19.969	19.314
Difference	0.003	-0.005	0.002	-0.001
%	0.0 %	0.0 %	0.0 %	0.0 %

HCB

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
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
13 March 2026	35.471	35.367	36.162	36.189	35.858	35.378	37.811	38.257	38.173	37.919	38.391	17.978	11.811	9.696	25.816
Difference	-0.206	-0.200	-0.199	-0.190	-0.196	-0.194	-0.192	-0.201	-0.204	-0.207	-0.205	-0.208	-0.213	-0.216	-0.223
%	-0.6 %	-0.6 %	-0.5 %	-0.5 %	-0.5 %	-0.5 %	-0.5 %	-0.5 %	-0.5 %	-0.5 %	-0.5 %	-1.1 %	-1.8 %	-2.2 %	-0.9 %

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
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
13 March 2026	32.151	35.896	37.948	18.461	26.345	8.400	25.881	9.119	16.937	21.284	15.982	59.468	33.176	31.651	22.404
Difference	-0.223	-0.226	-0.234	-0.230	-0.223	-0.231	-0.232	-0.228	-0.228	-0.226	-0.224	-0.228	-0.229	-0.233	-0.227
%	-0.7 %	-0.6 %	-0.6 %	-1.2 %	-0.8 %	-2.7 %	-0.9 %	-2.4 %	-1.3 %	-1.1 %	-1.4 %	-0.4 %	-0.7 %	-0.7 %	-1.0 %

	2020	**2021**	**2022**	**2023**
14 February 2025	21.165	23.056	29.213	16.240
13 March 2026	20.950	22.835	29.003	16.035
Difference	-0.215	-0.221	-0.210	-0.205
%	-1.0 %	-1.0 %	-0.7 %	-1.3 %

PCB

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
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
13 March 2026	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	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 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
13 March 2026	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	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**	**2023**

14 February 2025	16.724	19.504	16.426	14.315
13 March 2026	16.724	19.504	16.426	14.315
Difference	0.000	0.000	0.000	0.000
%	0.0 %	0.0 %	0.0 %	0.0 %

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 2025

The improvements made to the 2026 inventory submission in response to the UNECE CLRTAP In-Depth Review of Inventories (Stage 3) in 2025 are presented in Table 8.2.

Table 8.2. Improvements made in response to UNECE CLRTAP Stage 3 Review in 2025.
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$_3$
FI-2025-1A2gviii, 1B2aiv, 1A1b, 1A2a, 1A2b, 1A2c, 1A2d, 1A2e, 1A2f, and 1B1b	NOx, SOx, PM2.5	1A2gviii, 1B2aiv, 1A1b, 1A2a, 1A2b, 1A2c, 1A2d, 1A2e, 1A2f, and 1B1b	Yes	R	C$_1$, C$_3$

Observation
The ERT noted that the projected SOx and PM2.5 emission estimates for category 1A2gviii for the year 2025 do not appear to be consistent with the historical data. A significant increase was observed: 1888% for SOx (WM) and 900% for PM2.5 (WM) between the last reported historical year (2023) and the projected emissions for 2025, which appears to be very high. A change of 200% in PM2.5 emissions for category 1B2aiv (WM), and a change of 841% in NOx emissions (WM) for 1A2gviii was observed between the last reported historical year (2023) and the projected emissions for 2025. These changes appear to be very high. No explanation or background information regarding these observations was found in the IIR. The ERT further noted that for the following NFR categories: 1A1b, 1A2a, 1A2b, 1A2c, 1A2d, 1A2e, 1A2f, and 1B1b, the notation key 'IE' is used for projected emissions of NOx and SOx.
In response to the question from the ERT, Finland stated that, the 2025 NOx, SOx and PM2.5 projected emission estimates in category 1A2gviii in annex IV include also emissions from categories 1A1b, 1A1c, 1A2a, 1A2b, 1A2c, 1A2d, 1A2e, 1A2f and 1B1b. This explains the significant increase in the emissions in category 1A2gviii. In Annex IV, notation 'IE' is reported for NOx, SOx and PM2.5 emissions in 2025 in categories 1A1b, 1A1c, 1A2a, 1A2b, 1A2c, 1A2d, 1A2e, 1A2f and 1B1b. In the emission inventory (Annex I), the emissions are estimated and reported for each source category, whereas in annex IV aggregation of emissions has been made and notation key 'IE' reported for the aforementioned categories. Finland further stated, that the projected PM2.5 emissions in category 1B2aiv were frozen to the base year 2022 level. This category is a negligible source of PM2.5 emissions. The simplified methodology was used due to lack of better information. In the emission inventory, there is significant interannual variation in PM2.5 emissions from category 1B2aiv. The 2023 emissions were considerably smaller compared to 2022. The share of PM2.5 emissions from 1B2aiv from the national total PM2.5 emissions were only 0.002% in 2022 and 0.001% in 2023.

Recommendation
The ERT recommends Finland to include the information provided during the review concerning emissions reported under NFR category 1A2gviii its next submission.

Actions up to March 2026
The issue will be addressed to in the next air pollutant emission projection submission in 2027.

ID	Pollutants	NFR category	Key Category	Type	TAC$_1$C$_2$C$_3$
FI-2025-1A3ei-1	NOx, NMVOC	1A3ei	No	R	T, C$_3$

Observation

The ERT noted that the projected NOx and NMVOC emission estimates for NFR category 1A3ei for the year 2025 do not appear to be consistent with the historical estimates. A change of 5497% and 2402% between the last reported historical year 2023 and projected 2025 emissions was observed for NOx and NMVOC emissions respectively. In response to a question from the ERT, Finland stated that the projections for this category were not estimated using the VTT's LIPASTO system, but instead followed a methodology applied in the energy, IPPU, and waste sectors, using year n–3 as the base year, as recommended in the 2023 NECD Projections review. Finland also noted that NOx and NMVOC emissions from this category are negligible in terms of the national total, and that the emissions for the projection years were frozen at the base year level due to strong interannual variability and lack of better information. The methodological description for this category was inadvertently omitted from the 2025 IIR and will be included in the next submission.

Recommendation

The ERT recommends that Finland include a transparent explanation of the methodology used for this category in the next IIR, including the rationale for applying the n–3 base year approach. This would improve transparency and allow for better assessment of consistency of projected data.

Actions up to March 2026
The issue will be addressed to in the next air pollutant emission projection submission in 2027.

ID	Pollutants	NFR category	Key Category	Type	TAC$_1$C$_2$C$_3$
FI-2025-2	Activity data	Sector 2	NA	R	T

Observation

The ERT noted that the Annex IV and IIR 2025 do not include projected activity data for the IPPU sector. In response to a question from the ERT, Finland stated that the current projection methodologies in the IPPU sector are not based on the use of activity data and emission factors to produce the emission estimates. Therefore, when no specific activity data was used in the calculations, it was neither reported in the Annex IV nor IIR. However, if the future projections submissions will include the use of specific activity data to produce some IPPU emission projection estimates, the AD will be reported in Annex IV and the IIR.

Recommendation

The ERT recommends Finland to include an explanation of the methodologies applied to estimate projected emission data in IPPU sector. Further, the ERT recommends, that in case projected emissions would be based on activity data and emission factors, these are reported in the IIR and the corresponding NFR templates.

Actions up to March 2026
The issue will be addressed to in the next air pollutant emission projection submission in 2027.

ID	Pollutants	NFR category	Key Category	Type	TAC$_1$C$_2$C$_3$
FI-2025-3		3			T

Observation

The ERT noted that the IIR does not include a transparent enough description of adopted and planned policies and measures included in the projections for the sector agriculture. In response to a question raised by the ERT, Finland stated that there is an action plan report available on ammonia reduction measures and that they will include a reference to the report as well as a list of the most significant measures in the next IIR.

ID	Pollutants	NFR category	Key Category	Type	TAC₁C₂C₃
FI-2025-3		3			T

Recommendation
The ERT recommends to include a transparent description of adopted and planned policies and measures for the sector agriculture in the next submission of the IIR that accompanies a projected emission dataset.

Actions up to March 2026
The issue will be addressed to in the next air pollutant emission projection submission in 2027.

EU Technical Review under the NECD in 2025

The improvements made to the 2026 inventory submission in response to the EU Technical Review under the NECD in 2025 are presented in Table 8.3.

Table 8.3 Improvements in response to the 2025 EU Technical Review under the NECD (Final Review Report)

NOTE1 – Responses to NECD Projections Review are provided under the Projections Chapter 9.7 below.
NOTE2 – Responses to earlier NECD Reviews can be found in the earlier versions of the IIR.

2025 Review Report Table 4: All findings for NOx, NMVOC, SO$_2$, NH$_3$, PM$_{2.5}$ and PM$_{10}$, including those made during the 2025 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 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-1A1-2025-0001	No	1A1 Energy Production, 1B2c Venting and Flaring (oil, gas, combined oil and gas), 1B2aiv, Fugitive emissions oil: Refining and storage, SO2, NOX, BaP, PAHs, PCBs, HCB, Cd, Hg, Pb, PCDD/F, CO, BC, 1990-2023	N/A	No

Recommendation

For 1B2c Venting and Flaring (oil, gas, combined oil and gas), all years, the TERT notes that there is a lack of transparency regarding the reporting of notation key 'IE' (included elsewhere) in the NFR table. This does not relate to an over- or under-estimate of emissions. The IIR part 1A General table 1.10 includes the following information regarding use of notation keys: 1B2aiv - NOX, SO2, NH3, CO, heavy metals, PCDD/PCDF: See IIR Part2 Energy on page 66, and 1B2c - NOX, NMVOC, SO2, particles, CO, heavy metals: 1A1a. In response to a question raised during the review, Finland explained that for 1B2aiv - NOX, SO2, NH3, CO, heavy metals and for 1A1b, and 1B2c 'emissions from venting and flaring in refineries are generally included in category 1B2aiv'.

The TERT recommends that Finland improve the transparency of the use of notation keys for sectors 1B2c, Venting and Flaring (oil, gas, combined oil and gas), and 1B2aiv, Fugitive emissions oil: Refining and storage, in the 2026 submission.

Actions up to March 2026

The description of the use of notation keys in categories 1B2c and 1B2aiv was revised in in the respective chapters of the IIR (Part 2 Energy) in yje 2026 submission to increase the transparency.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-1A3bii-2025-0001	No	1A3bii Road Transport: Light Duty Vehicles, NOX, 2005, 2023	N/A	No

Recommendation

For category 1A3bii Road Transport: Light Duty Vehicles, pollutant NOX, and for years 2005 and 2023, an observation has been created by the automated checks related to a high Implied Emission Factor (IEF) when compared to other Member States. For example, in 2023, the IEF of Finland for liquid fuels is 0.55 t/TJ, while all other countries are below 0.35 t/TJ. For the same issue during the 2023 review and in response to a relevant question for year 2005, Finland answered that this was due to the old diesel light duty vehicles fleet. Since this observation keeps arising from the automated checks, the TERT addressed a similar question to Finland during this year's review. In response to this question, Finland provided detailed explanations regarding the LIISA model used for emission calculations, emission factors, and fleet/activity data (i.e., synthesis of the vehicle fleet, splits per Euro standard, speed-dependent emission factors, etc.). In addition, Finland provided a very detailed document explaining why a similar situation is not observed in cars and trucks and what is the difference compared to light commercial vehicles. The TERT understands, accepts, and thanks Finland for these detailed explanations; hence, this observation is closed as resolved.

However, in order to avoid similar repetitions in next years' reviews, the TERT recommends that Finland summarise all these explanations in a separate paragraph/subsection in the IIR with a proper indication/title, e.g. "Additional explanations and details of the light duty vehicles fleet explaining high NOX emissions for some years".

Actions up to March 2026

The explanations referred to in the recommendation were not included in the IIR (Part 3 Transport) in the 2026 submission. A new calculation model (COPERT) has been implemented in the inventory to estimate he emissions from road transport in the 2026 submission. Therefore, the issue is not relevant as such anymore.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-1A4ciii-2025-0001	No	1A4ciii Agriculture/Forestry/Fishing: National Fishing, PM2.5, 2005, 2020-2022	N/A	No

Recommendation

For category 1A4ciii Agriculture/Forestry/Fishing: National Fishing, pollutant PM2.5, years 2005 and 2020 – 2022, an observation has been created related to recalculations that have been applied to PM2.5, but not to PM10. Studying the 2025 IIR, the TERT could not find a relevant explanation, apart from p.59 in section '3.11 Off-road mobile sources', where it is mentioned that 'Recalculation of PM2.5 under 1A4ciii is due to correction of EFs', but there is no further explanation why similar recalculation has not been applied to PM10. In response to a question raised during the review, Finland answered that in the MEERI model, all fishing boats are assumed to use Marine Diesel Oil (MDO); PM2.5 and PM10 emissions are calculated as fractions of TSP; used fractions were previously based on 2019 EMEP/EEA Guidebook (update Oct. 2020), which is not available anymore; since the 2023 EMEP/EEA Guidebook does not provide these values, Finland re-estimated the fractions from the previous public version of the EMEP/EEA Guidebook that has corresponding values available, i.e., version 2016, table 3-2, p.14; now the ratios for MDO are PM10=TSP and PM2.5~0.9 x PM10; there were no changes to PM10 values. The TERT checked the relevant versions of the EMEP/EEA Guidebook and confirmed the statements of Finland. The TERT would like to point out that older versions of the EMEP/EEA Guidebook are all still available on the EEA website including the 2019 version (https://www.eea.europa.eu/en/analysis/publications/emep-eea-Guidebook-2019).

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-1A4ciii-2025-0001	No	1A4ciii Agriculture/Forestry/Fishing: National Fishing, PM2.5, 2005, 2020-2022	N/A	No

The TERT recommends that Finland include these explanations in the IIR of the next submission so as to ensure transparency of the description of the methodology.

Actions up to March 2026

The explanation of the recalculation conducted in the 2025 submission was also included in the chapter 3.11 of the IIR (Part 3 Transport) where the recalculations of the category 1A4ciii are described.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-2-2025-0001	No	2 Industry, NMVOC, 1990-2023	N/A	No

Recommendation

For 2D3a Domestic Solvent Use including Fungicides, NMVOCs, for all years, the TERT notes that Finland, in the IIR, provide detailed information on emission factors and NMVOC speciation for a range of consumer products, however it is not necessarily clear to the reader what Finland's full methodology is. In response to a question raised during the review, Finland provided the TERT with detailed calculations that displayed, for a number of product types, the associated emission factor, and NMVOC speciation. Through correspondence with Finland, the TERT noted that there are certain instances where Finland over-estimate emissions for some product types. The TERT notes that the issue is below the threshold of significance for a technical correction.

The TERT recommends that Finland review the detailed calculations and assumptions for products where emissions are estimated in NFR 2D3a, Domestic Solvent Use including Fungicides, to ensure that there are no instances of overestimating emissions for a product type, such as where the emission is greater than overall quantity of product. The TERT further recommends Finland to review the documentation provided within the IIR to ensure the text is transparent in setting out relevant input data, assumptions and calculations, possibly by including the calculation within a formula in addition to within prose.

Actions up to March 2026

The calculation of NMVOC emissions for the category 2D3a was reviewed to the 2026 submission. Following the review, the errors discovered in the calculation of NMVOC emissions from household product use were corrected and the the emissions were recalculated for the whole time series. In addition, the description of the calculation methodologies in the IIR (pp. 66-69 of the IIR Part 4 IPPU) was updated to increase the transparency.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-2-2025-0002	No	2 Industry, N/A, 1990-2023	N/A	No

Recommendation

For category 2 Industry, all years, the TERT notes that there is a lack of transparency regarding the completeness of reporting of activity data for IPPU sectors. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Finland explained that a number of NFR categories are estimated based on emission reporting by facilities, and thus it is not representative to report activity data for the majority of NFR 2 categories.

The TERT recommends that Finland, where feasible and as far as possible, estimate the activity data for all NFR 2 Industry sectors to allow for the calculation of IEFs, enabling comparability checks to be made with other Member States.

Actions up to March 2026

Finland continues to apply the same princicples as previously when reporting the activity data for NFR 2 categories. The issue is described in more detail in chapter 4.1 of the IIR (pp. 5-6 in IIR Part 4 IPPU). In addition, in cases where emission are calculated by the inventory team and the activity data is not confidential, the activity data of the NFR 2 categories are presented in the sector specific IPPU chapters of the IIR.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-2A3-2025-0004	No	2A3 Glass Production, NH3, 2005	N/A	No

Recommendation

For category 2A3 Glass Production, pollutant NH3, year 2005, the TERT notes that there is a lack of transparency regarding notably large emission estimates compared to the rest of the time series. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Finland explained that the text in the IIR had not been updated, and that the NH3 emissions between 2000 and 2006 were reported by operators as opposed to utilising the data in Table 4.8 of the IPPU chapter as is implied.

The TERT recommends that Finland carry out their intention of improving the accuracy of the methodological description in the IIR regarding NH3 emissions from NFR 2A3, Glass Production, particularly around notable time series changes, in this case 2005.

Actions up to March 2026

The description in the IIR regarding NH_3 emissions from category 2A3 has been updated in the 2026 submission (p. 15 of the IIR Part 4 IPPU).

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-2A5b-2025-0001	No	2A5b Construction and Demolition, PM2.5, PM10, 1990-2023	N/A	No

Recommendation

For 2A5b Construction and Demolition, pollutants PM2.5, PM10, for all years, the TERT notes that there is a lack of transparency regarding completeness of activity considered in the estimation of emissions from road construction. Table 4.14 in the IPPU chapter of the IIR suggests that only the construction of major roads is taken into account. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Finland explained that the heading of Table 4.14 in the IIR had not been updated, and that the calculation of total road length considers highways, class I and II mains roads, regional roads, connecting roads, collector roads, slips roads, ring-type crossing, and ferry routes.

The TERT recommends that Finland, in the 2026 submission, updates the IIR to clarify that the estimation of emissions from road construction considers the full range of road types.

Actions up to March 2026

The description in the IIR regarding activity considered in the estimation of emissions from road construction has been updated in the 2026 submission (p. 21 of the IIR Part 4 IPPU).

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-3-2025-0001	No	3 Agriculture, 3B Manure Management, 3Da2a Animal Manure Applied to Soils, NH3, 1990-2023	N/A	No

Recommendation

For categories 3B Manure Management and 3Da2a Animal Manure Applied to Soils, pollutant NH3, years 1990-2023, the TERT notes that there is a lack of transparency regarding the penetration rates of abatement techniques over the entire reporting period for all types of housing systems for all livestock categories, as well as for manure management (all types) and manure application techniques. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Finland provided a comprehensive dataset and explained the data sources used to develop the penetration rates for abatement techniques for the categories 3B Manure management and 3Da2a Animal Manure Applied to Soils.

The TERT recommends that Finland improve transparency by providing further clarification on the penetration rates of the abatement techniques for the entire reporting period for all types of housing systems of all livestock categories, manure management (all types) and manure application techniques.

Actions up to March 2026

A comprehensive manure management data set, including the penetration rates of abatement measures, covering the whole time series 1980-2024 was included as an annex to the IIR (Part 5 Agriculture) in the 2026 submission.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-3Da2a-2025-0001	No	3Da2a Animal Manure Applied to Soils, NH3, 2020-2022	N/A	No

Recommendation

For category 3Da2a Animal Manure Applied to Soils, pollutant NH3, years 2020 to 2022, the TERT notes a lack of transparency regarding the reasons for the recalculations conducted in the 2025 submission. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Finland explained that new data on manure management practices became available for the 2025 reporting, which led to updates in the data for the years 2012 to 2022 and resulted in revised emissions for all relevant categories (FI-3Da2a-2025-0002 and FI-3Da3-2025-0001).

The TERT recommends that Finland improve transparency by providing explanations regarding the reasons for the recalculations, as well as by supplying reference sources and explaining how consistency in manure management data (housing, storing, pasturing, manure application practices) was ensured across the entire reporting period.

Actions up to March 2026

All the recalculations performed in the agriculture sector in the 2026 submission, including their reasons, are described in the sector specific chapters of the Agriculture IIR (Part 5 of the Finnish IIR). Details of the manure management data used in the inventory are also described in the sector specific chapters of the Agriculture IIR.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-3Da2a-2025-0002	No	3Da2a Animal Manure Applied to Soils, NMVOC, 2020-2022	N/A	No

Recommendation

For category 3Da2a Animal Manure Applied to Soils, pollutant NMVOC, years 2020 to 2022, the TERT notes a lack of transparency regarding the reasons for the recalculations conducted in the 2025 submission. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Finland explained that new data on manure management practices became available for the 2025 reporting, which led to updates in the data for the years 2012 to 2022 and resulted in revised emissions for all relevant categories (FI-3Da2a-2025-0001 and FI-3Da3-2025-0001).

The TERT recommends that Finland improve transparency by providing explanations regarding the reasons for the recalculations, as well as by supplying reference sources and explaining how consistency in manure management data (housing, storing, pasturing, manure application practices) was ensured across the entire reporting period.

Actions up to March 2026

All the recalculations performed in the agriculture sector in the 2026 submission, including their reasons, are described in the sector specific chapters of the Agriculture IIR (Part 5 of the Finnish IIR). Details of the manure management data used in the inventory are also described in the sector specific chapters of the Agriculture IIR.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-3Da3-2025-0001	No	3Da3 Urine and Dung Deposited by Grazing Animals, NH3, 2020-2022	N/A	No

Recommendation
For category 3Da3 Urine and Dung Deposed by Grazing Animals, pollutant NH3, years 2020-2022, the TERT notes a lack of transparency regarding the reasons for the recalculations conducted in the 2025 submission. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Finland explained that new data on manure management practices became available for the 2025 reporting, which led to updates in the data for the years 2012 to 2022 and resulted in revised emissions for all relevant categories (FI-3Da2a-2025-0001 and FI-3Da2a-2025-0002).   **The TERT recommends that Finland improve transparency by providing explanations regarding the reasons for the recalculations, as well as by supplying reference sources and explaining how consistency in manure management data (housing, storing, pasturing, manure application practices) was ensured across the entire reporting period.**   *Actions up to March 2026*   *All the recalculations performed in the agriculture sector in the 2026 submission, including their reasons, are described in the sector specific chapters of the Agriculture IIR (Part 5 of the Finnish IIR). Details of the manure management data used in the inventory are also described in the sector specific chapters of the Agriculture IIR.*

2025 Review Report Table 6: All findings for heavy metals and POPs, including those made during the 2025 NECD inventory review and those not implemented from the 2021 NECD inventory review.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-1A1b-2025-0001	Yes	1A1b Petroleum Refining, 1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-Metallic Minerals, Pb, 1990-2023	N/A	No

Recommendation
For categories 1A1b Petroleum Refining and 1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-Metallic Minerals, pollutant Pb, years 1990 to 2023, the TERT notes that there is a lack of transparency regarding abatement techniques. The TERT notes that in the IIR, part 2, page 35 there is a lack of information on abatement techniques for certain plants in the YLVA database. With reference to NECD review questions 1A1b-2019-0001 and 1A2f-2019-0001, Finland explains in the IIR that a "more comprehensive update on the missing abatement techniques will be carried out and following this, the necessary recalculations of heavy metal emissions in different categories will be made in the future submissions", and that "the current over-estimations of Pb emissions in categories 1A1b and 1A2f have not yet been revised in the inventory". This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Finland explained that due to limited resources, the comprehensive updating of the abatement techniques data has not yet been finalised, and that Finland will try to prioritise finalising the work and make the necessary recalculations to the future submissions.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-1A1b-2025-0001	Yes	1A1b Petroleum Refining, 1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-Metallic Minerals, Pb, 1990-2023	N/A	No

The TERT recommends that Finland make effort to find resources to assess and update the missing abatement techniques, and include this issue and an estimated timeline for finalisation of the work under the planned improvements in the IIR in the next submission.

Actions up to March 2026

For the 2026 submission, it was yet not possible to estimate a specific timeline for finalisation of the work.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-2A3-2025-0003	Yes	2A3 Glass Production, Cd, Hg, Pb, 2015-2023	N/A	No

Recommendation

For category 2A3 Glass Production, pollutants Pb, Cd, Hg, years 2015-2023, the TERT notes that there is a lack of transparency regarding the extent to which heavy metal emissions from glass production are estimated, as Finland report emissions for the pollutants up to 2014, then subsequently report the notation key 'NA', implying that the process does not lead to the emission of priority heavy metals. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Finland explained that according to the one remaining facility's environmental permit, heavy metal emissions - measured every third year - have been below the limit of detection.

The TERT recommends that Finland report, for improved transparency, emissions of Pb, Cd and Hg as 'NE' as opposed to 'NA' for the years where emissions are not measured due to falling below the limit for detection. The TERT further recommends Finland include documentation on the use of this notation key in their IIR in the 2026 submission.

Actions up to March 2026

Finland considers the notation key 'NA' to be appropriate in this case and, therefore, no changes were made to the notation keys in the 2026 submission.

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-2D3b-2025-0001	No	2D3b Road Paving with Asphalt, PCDD/F, 1990-2023	N/A	No

Recommendation

For category 2D3b Road Paving with Asphalt, pollutants PCDD/F, for all years, the TERT notes that Finland use UNEP Toolkit, 1999, as the source of emission factors. However, it is noted that there is a more recent version of the UNEP Toolkit available online. In response to a question raised during the review, Finland stated that they will review the PCDD/F emission factor in the most recent

Review year of initial recommendation (number of years it has been recommended)	Observation	Key Category	NFR, Pollutant(s), Year(s)	RE, TC in 2024	RE, TC, or UPTC in 2025
2025 (1)	FI-2D3b-2025-0001	No	2D3b Road Paving with Asphalt, PCDD/F, 1990-2023	N/A	No

version of the UNEP toolkit and, if necessary, update the emission factor used in the national inventory. The TERT notes that the issue is below the threshold of significance for a technical correction.

The TERT recommends that Finland review the most up to date version of the UNEP toolkit and update emission factors where appropriate within the 2026 submission, documenting recalculations and data sources within the IIR.

Actions up to March 2026

The PCDD/F emission factor was revised in the category 2D3b and the emissions were recalculated for the whole time series. The new emission factor was taken from the lates available version of the UNEP toolkit as described in respective chapter of the IIR (pp. 72-75 of the IIR Part 4 IPPU).

9 PROJECTIONS

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 etrategy 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 PEIKKO[1]) has been utilized.

As with the original National Air Pollution Control Programme 2030 (Ministry of the Environment, 2019[2]), the First Update Report of the programme[3] (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

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[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 se 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
NMVOC	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 (PEIKKO[4]). 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.

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[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 (NOx) non-methane volatile organic compounds (NMVOCs) (from residential combustion only) and primary particulate matter (TSP, PM10, PM2.5, PM1 and PM0.1). 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 questionaries). 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.

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[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

Area sources   **Point sources**   **Emission control technologies**

Country level

For each source sector k:
- activity A
- unabated emission factor EF
- control technology implementation rate X
- emission height

Annual area emission for year t:

$$EM^a_t = \sum_{k,t} X_{k,m,t} \cdot (1-\eta_m) \cdot A_{k,t} \cdot EF_k$$

Country emission (Mg a⁻¹)

Municipality level

For each municipality m and
25 aggregated sectors k':
- allocation surrogate M

$$EM^a_{m,t} = \sum_{k'} EM^a_{k',t} \cdot M_{k',m}$$

Municipality emission (Mg a⁻¹)

1 x 1 km2 level

For each 1 x 1 km2 grid cell g and
4 aggregated sectors k'':
- allocation surrogate G

$$EM^a_{g,m,t} = \sum_{k''} EM^a_{k'',m,t} \cdot G_{g,k''}$$

1 x 1 km2 emission (Mg a⁻¹)

Point source level

For each plant l:

Plant parameters:
- capacity
- combustion technology
- control technology
- unabated emission factor EF
- control technology

Operation parameters:
- primary and secondary fuels
- operation hours OH
- activity A = C * OH

Stack parameters:
- diameter
- height
- geographical location
- flue gas volume
- flue gas temperature

Annual point source emission for year t:

$$EM^P_t = \sum_l (1-\eta_m) \cdot A_{l,t} \cdot EF_l$$

Plant emission (Mg a⁻¹)

Emission control technologies

For each control technology m:

Technical parameters
- emission removal efficiency η
- electricity consumption
- sorbent consumption
- labor need
- by-product production

Cost parameters
- investment I
- fixed operation and maintenance OM^{fix}
- variable operation and maintenance OM^{var}
  (prices of electricity, sorbents, labor, by-product disposal etc.)
- investment lifetime lt and interest rate ir

Annualized investment cost:

$$I^{an}_m = \frac{(1-ir)^{lt} \cdot ir}{(1+ir)^{lt} - 1} \cdot I_m$$

Emission reduction unit cost:

$$c = \frac{\frac{I^{an} + OM^{fix}}{P} + OM^{var}}{EF \cdot \eta}$$

Unit cost (€ Mg⁻¹)

Annual emission control cost (€ a⁻¹)

FRES model boundary

1 hour level

Temporal allocation with variable sector aggregation:

1 x 1 km2 / plant emission (Mg h⁻¹)

Figure 9.1. Structure of the FRES model.

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 2060[6]. 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 model[7], 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 2023[8]). Projection includes also a new estimate for the impact of the ETS2 for road transport starting from 2028 onwards[9].

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 CO_2 emission regulation by EU[10], 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 vehicles[11]. For trucks, fuel efficiency development follows a recent expert evaluation of the emergence of electric and fuel cell trucks in Finland[8]. Vast increases in electric and fuel cell vehicle registrations are introduced to the model to simulate the implementation of EU's updated CO_2 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

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[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, Al & 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 CO_2 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 Finland[12] 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 CO_2-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 NH_3 emissions originate from passenger cars equipped with catalytic converters. Improvements in technology have substantially reduced NH_3 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 NH_3 emissions are one-tenth of NH_3 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.

NMVOC
NMVOC 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 NMVOC 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.

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[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 forecasts[6] 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 forecasts[6] (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 decline[6].

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 expected[6].

Working machines

For working machines, the forecasts are based on a recent analysis of alternative powertrains and their market penetration in Finland[14]. Evolution of fleet (50 different machine types) is affected by, the penetration of emission standars (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.

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[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%A4%C3%A4st%C3%B6jen-perusennuste-ja-s%C3%A4hk%C3%B6istymisen-vaikutus-p%C3%A4%C3%A4

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). 2B10a SOx projection has been made using relative changes in the GAINS model for chemical industry. 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). 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.
2B6	Titanium dioxide production	
2B10a	Chemical industry: Other	
2B10b	Storage, handling and transport of chemical products	
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. NH3 emissions from 2C1 are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).
2C2	Ferroalloys production	
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	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. All other emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).
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	NMVOC, SOx, PM2.5 and BC projections are based on the relative changes of respective pulp and paper industry emissions in the GAINS model. NH3 emission projections are based on the running average of last three years (latest year being the base year 2022).
2H2	Food and beverages industry	NMVOC projection is based on the relative changes of respective food and beverages industry emissions in the GAINS model. PM2.5 emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).
2I	Wood processing	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. PM2.5 emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).
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	NMVOC emissions are minor and are projected based on capita forecasts. PM2.5 emissions are estimated to be constant at the base year 2022 level (minor sources and no specific projection has been prepared).
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 (2024[15]) 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	*272509*	*48313*	*-0.1*
2025	5.7	*274689*	*48444*	*0.8*
2030	5.8	*279634*	*48297*	*1.8*
2040	6.0	*282150*	*47032*	*0.9*
2050	6.2	*283843*	*45951*	*0.6*
2060	6.3	*285546*	*45045*	*0.6*
2070	6.5	*286974*	*44149*	*0.5*

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[15] Publications by Statistics Finland Tilastokeskus - (stat.fi), Bruttokansantuote ja -tulo sekä tarjonta ja kysyntä, vuosittain muuttujina Taloustoimi, Vuosi ja Tiedot. PxWeb (stat.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, 2023[16]).

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 (2014-203) 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 DREMFIA 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
	Broiler breeder hen	Broiler	Laying hen pullet	Cockerel	Laying hen	Other poultry	Turkey	Goat	Sheep	Use of inorganic N-fert. as N (tonnes)
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
Manure management				
Treated as slurry (%)	0	0	0	-
Treated as deep litter (%)	96	13	0	-
Treated as solid manure (%), of which	4	87	100	-
urine not separated (FYM, %)	100	100	100	-
urine separated (%)	0	0	0	-
Grazing				
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 2020-2050	Boars 2020-2050	Weaned pigs 2020-2050
	2020	2030	2040	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	10	7	7	7	5	5	3
urine not separated (FYM, %)	21	19	19	19	43	19	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
Animal shelter (% of manure)												
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	-	-	-	-	-	-	-	-	-	-	-	-
Manure storage (% of manure)												
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 9.11. Detailed information on deep litter management in animal shelters and manure storages 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
Animal shelter (% of manure)																				
Improved cleaning of surfaces	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flushing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Increased manure removal frequency	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rapid urine separation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or chemical air scrubbers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cooling of manure channels	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Drying of manure on manure belt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-leaking drinking system	-	-	-	-	-	-	-	-	90	100	100	100	-	-	-	-	-	-	-	-
Manure storage (% of manure)																				
No measures	57	52	48	45	36	29	29	29	45	42	44	45	54	50	47	45	49	50	47	45
Solid manure covering	43	48	52	55	64	71	71	71	55	58	56	55	46	50	53	55	51	50	53	55
Filling of storage from the bottom	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional information																				
Percentage of deep litter stored after removal from animal shelter	20	20	20	20	20	20	20	20	80	80	80	80	20	20	20	20	20	20	20	20

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
Animal shelter (% of manure)																								
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manure storage (% of manure)																								
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
Animal shelter (% of manure)																
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manure storage (% of manure)																
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
Type of surface for application												
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
Application on arable land												
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
Application on plant covered land												
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
Application on stubble												
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	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
Type of surface for application															
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
Application on arable land															
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
Application on plant covered land															
Broadcast spreading	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 9.16. Detailed information on solid manure (FYM) 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	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>Type of surface for application</u>																		
Arable land	80	68	68	88	88	88	88	88	88	68	68	68	76	76	76	95	95	95
Plant covered land	32	32	32	12	12	12	12	12	12	32	32	32	24	24	24	5	5	5
Stubble	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<u>Application on arable land</u>																		
No incorporation	1	1	1	1	0	0	2	1	1	0	0	0	1	0	0	6	0	0
Incorp. with ploughing < 4 h	12	12	12	9	9	9	17	18	18	10	9	9	10	9	9	11	14	14
Incorp. with ploughing < 12 h	17	17	17	15	16	16	10	9	9	17	18	18	17	18	18	10	13	13
Incorp. with ploughing 12-24 h	32	33	33	17	15	15	11	7	7	33	35	35	33	35	35	36	30	30
Incorp. with harrowing < 4 h	12	12	12	26	29	29	27	30	30	10	9	9	9	9	9	11	14	14
Incorp. with harrowing < 12 h	10	12	12	13	13	13	17	19	19	8	9	9	10	9	9	11	14	14
Incorp. with harrowing 12-24 h	15	13	13	18	20	20	16	16	16	21	20	20	19	20	20	14	15	15
<u>Application on plant covered land</u>																		
Broadcast spreading	100	100	100	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
Type of surface for application																
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	-	-	-	-	-	-	-	-
Application on arable land																
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
Application on plant covered land																
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	-	-	-	-	-	-	-	-
Application on stubble																
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.

NMVOC

NMVOC 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 2025 review of projections

In Table 9.18 below recommendations presented in the Review Report of the 2025 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 2025 projections review.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
FI-0A-2025-0002	2025	0A National total (based on fuel sold)	SO2, NOx, NH3, PM2.5, NMVOC, BC, GHGs	2025, 2030, 2040, 2050	WM	No	The TRT noted with reference to the IIR that there is a lack of transparency regarding whether the activity data used for calculating the reported emission projections are consistent with the activity data used for calculating Greenhouse Gas (GHG) emissions projections. In response to a question raised during the review, Finland provided detailed explanations for each main category (Energy, Transport, IPPU, Agriculture and Waste) and transparently outlined where data are or are not fully consistent with the activity data used in the GHG projections reporting. **The TRT recommends that Finland work on improving the consistency in the data used for both the GHG and the air pollutant projections, and include the detailed explanations (as provided to the TRT during the projections review) in the IIR for the next submission.**	The issue will be addressed to in the next air pollutant emission projection submission in 2027.
FI-1A1a-2025-0002	2025	1A1a Public electricity and heat production	NMVOC	2025, 2030	WM	Yes	For category 1A1a Public electricity and heat production, pollutant NMVOC, the TRT noted that that there is a lack of transparency regarding why projected emissions of NMVOC in 2025 and 2030 are higher than in the base year when other reported pollutant emissions decline (NOX, SO2 and PM2.5) and activity for most fuels in the Annex IV submission indicates reduced fuel use compared to the base year.	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
							n response to a question raised during the review, Finland explained that emissions of NMVOC are associated with use of biomass and waste fuels and emission projections were developed from projected combined activity for these fuels in categories 1A1a and 1A2gviii Stationary combustion in manufacturing industries and construction: Other and an allocation made to 1A1a. **The TRT notes that this issue does not relate to an over- or under-estimate and recommends that Finland review the methodology and considers how NMVOC emissions are allocated between categories 1A1a and 1A2gviii and provides a detailed explanation of the methodology and allocation in the IIR for the next submission.**	
FI-1A1b-2025-0001	2025	1A1b Petroleum refining	SO2, NOx, PM2.5, NMVOC	2025, 2030, 2040, 2050	WM	No	For category 1A1b Petroleum refining and projected emissions of SO2 (and NOX, NMVOC and PM2.5) the TRT noted that there is a lack of transparency regarding why the notation key ''IE' (Included Elsewhere) is used in the Annex IV submission. Chapter 9.2 of the IIR sets out the methodology for Energy sector but does not explain aggregation of categories or use of notation keys. Emissions are reported in category 1A1b in the historical inventory and 1A1b is a key category for SO2. n response to a question raised during the review, Finland explained that emissions for 1A1b are aggregated with 1A2gviii Stationary combustion in manufacturing industries and construction: Other, as the projections modelling tools used by Finland do not allow more detailed modelling currently. Finland also commented that aggregation is allowed under the Reporting Guidelines (article 40 of the Guidelines for Reporting Emissions and Projections Data	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
							under the Convention on Long-range Transboundary Air Pollution). **The TRT notes that this issue does not relate to an over- or under-estimate and recommends that Finland develop an approach for projections to minimise aggregation of categories and, where aggregation is unavoidable, explains the use of notation key 'IE' to identify the category where emissions are allocated and, includes the rationale for reporting aggregated emissions, in the IIR for the next submission.**	
FI-1A2-2025-0001	2025	1A2 Manufacturing Industries and Construction (Combustion in industry including Mobile)	SO2, NOx, PM2.5, NMVOC, NH3	2025, 2030, 2040, 2050	WM	No	For category 1A2 Manufacturing Industries and Construction (Combustion in industry including Mobile), for all pollutants (NOX, NMVOC, SO2, NH3 and PM2.5), the TRT noted that there is a lack of transparency regarding why the notation key ''IE' (Included Elsewhere) is used in the Annex IV submission for categories 1A2a, 1A2b, 1A2c, 1A2d, 1A2e, 1A2f. Emissions are reported in these categories in the historical inventory and 1A2b and 1A2d are key categories for SO2. In response to a question raised during the review, Finland explained that a description of the use of notation keys and the aggregation of categories in the emission projection reporting was missing in the IIR and that categories were aggregated because activity data was only available at an aggregated level. Finland also commented that aggregation is allowed under the Reporting Guidelines (article 40 of the Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution). **The TRT notes that this issue does not relate to an over- or under-estimate and recommends that Finland develop an**	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
							approach for projections to minimise aggregation of categories and, where aggregation is unavoidable, explain the use of the notation key 'IE' to identify the category where emissions are allocated and include a rationale for reporting aggregated emissions, in the IIR for the next submission.	
FI-1A4ai-2025-0002	2025	1A4ai Commercial/Institutional: Stationary	SO2, NOx, NMVOC and PM2.5	2025, 2030, 2040, 2050	WM, WAM	No	For category 1A4ai Commercial/Institutional: Stationary and projected emissions of SO2 (and NOX, NMVOC and PM2.5) for the With Measures (WM) scenario, the TRT noted that there is a lack of transparency regarding the reason(s) for significant emission reductions in 2025 and 2030. The notation key ''IE' (Included Elsewhere) is used in the Annex IV submission for activity data for 1A4ai (and 1A4ci Agriculture/Forestry/Fishing: Stationary). Chapter 9.2 of the IIR sets out the methodology for Energy sector but does not explain use of notation keys. Category 1A4ai is a key category for SO2 in the historical inventory. In response to a question raised during the review, Finland explained that, apart from wood combustion, the model used for developing emission projections aggregates categories within category 1A4. Finland also reported errors in the emission projections relating to omission of bio-oils and peat activity from certain categories. **The TRT notes that this issue relates to an under-estimate and recommends that the QA/QC processes are developed further to minimise instances of missing activity in the next submission. The TRT also recommends that Finland develop an approach for projections to minimise aggregation of categories and, where aggregation is unavoidable, explain**	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
							the use of the notation key 'IE' to identify the category where emissions are allocated and include a rationale for reporting aggregated emissions, in the IIR for the next submission.	
FI-1A5a-2025-0001	2025	1A5a Other stationary (including military)	SO2, NOX, PM2.5	2025, 2030, 2040, 205	WM	Yes	For category 1A5a Other stationary (including military) and projected emissions of SO2, NOX, and PM2.5 (and NMVOC) for the With Measures (WM) scenario that there is a lack of transparency regarding activity data in 2025 and 2030. The notation key ''IE' (Included Elsewhere) is used in the Annex IV submission for activity data for 1A5a (and 1A5b). Chapter 9.2 of the IIR sets out the methodology for Energy sector but does not explain use of notation keys. Category 1A5a is a key category for SO2, NOX and PM2.5 in the historical inventory. In response to a question raised during the review, Finland explained that there is no activity data in projections for category 1A5a and a simplified approach is adopted for emission projections. **The TRT notes that this issue does not relate to an over- or under-estimate and recommends that Finland explain use of notation keys for activity data and the methodology applied for emission estimates in the IIR for the next submission.**	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
FI-1B1b-2025-0001	2025	1B1b Fugitive emission from solid fuels: Solid fuel transformation	SO2	2025, 2030, 2040, 2050	WM	Yes	For category 1B1b Fugitive Emission from Solid Fuels: Solid Fuel Transformation and projected emissions of SO2 (and other pollutants) for the With Measures (WM) scenario, the TRT noted that there is a lack of transparency regarding why the notation key ''IE' (Included Elsewhere) is used in the Annex IV submission for emissions and 'NA' (Not Applicable) for activity data. Chapter 9.2 of the IIR sets out the methodology for Energy sector but does not explain aggregation of categories or use of notation keys. Emissions are reported in category 1B1b in the historical inventory and 1B1b is a key category for SO2 in the historical inventory. In response to a question raised during the review, Finland explained that emissions from category 1B1b were included in the category 1A2gviii Stationary combustion in manufacturing industries and construction: Other. The activity data available for industrial sources was only available in aggregated level. **The TRT notes that this issue does not relate to an over- or under-estimate and recommends that Finland develop an approach for projections to minimise aggregation of categories and, where aggregation is unavoidable, explains the use of the notation key 'IE' to identify the category where emissions are allocated and, includes a rationale for reporting aggregated emissions, in the IIR for the next submission.**	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
FI-2C2-2025-0001	2025	2C2 Ferroalloys production	SO2, PM2.5, NMVOC	2025, 2030, 2040, 2050	WM	No	For NFR 2C2 Ferroalloys production, NMVOC, SO2 and PM2.5, the TRT noted that emissions were reported for historical years but then reported as 'IE' (Included Elsewhere) for projections. In response to a question raised during the review, Finland confirmed that emissions from 2C2 were reported in 2C1 Iron and Steel Production for the projections, and explained that separate emission projections will be provided for categories 2C1 and 2C2 for the next submission. **The TRT notes that this issue does not relate to an over- or under-estimate and recommends that Finland report emissions from 2C1 and 2C2 separately in the next submission.**	The issue will be addressed to in the next air pollutant emission projection submission in 2027.
FI-3D-2025-0001	2025	3D Plant production and agricultural soils	NH3, PM2.5, NMVOC	2025, 2030, 2040, 2050	WM	Yes	For 3D Crop production and agricultural soils, NH3, NMVOC and PM2.5, all projected years, the TRT noted that there is a lack of transparency regarding some aspects of projected activity data in the IIR. Whilst the information on manure management and application in section 9.5 of the IIR is excellent, and Annex IV submission contains the aggregate activity data projections on quantity of inorganic N applied and total area of cropland, the TRT cannot find any information on i) the projected shares of inorganic fertiliser applied by type (e.g. fraction of urea, ammonium nitrate etc.), ii) abatement measures applied for inorganic fertiliser application (if any), or iii) the projected shares of different crop types in total area (which affects emissions from 3Dc and 3De). In response to a question raised during the review, Finland explained that: i) for the projected shares of inorganic	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
							fertiliser applied by type, the mean value of the shares from the years 2010–2020 is applied for all projected years; ii) Regarding abatement measures for inorganic fertiliser application, the emission reduction method applied in the calculation for mineral nitrogen fertilisers is placement application. The assumption is that fertilisers used on grasslands are surface-applied, while for other crops, fertilisers are applied as placement fertilisation at sowing. The assumption for all years (including emission projections) is that 35% of the fertiliser is surface-applied and 65% is applied using placement techniques; iii) No change in crop type distribution is assumed for the projected years. **The TRT notes that this issue does not relate to an over- or under-estimate and recommends that Finland include this quantitative information on projections assumptions in the next IIR submission, and investigate the possibility of more accurately projecting fertiliser use and crop type distribution.**	
FI-5-2025-0001	2025	5 Waste	NH3	2025, 2030, 2040, 2050	WM	No	For category 5B2 Biological Treatment of Waste - Anaerobic Digestion At Biogas Facilities, pollutant NH3 and for all projected years, the TRT noted that there is a lack of transparency regarding what drives the upward projected emissions trend. In response to a question raised during the review, Finland explained that the assumptions related to biogas production in the projections are detailed in separate publications, and these same assumptions are used in the national GHG emission projections. **The TRT notes that this issue does not relate to an over- or under-estimate and recommends that Finland document**	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Recommendation	Response
							the assumptions, including any expert judgments used to estimate emission projections in the IIR for the next submission.	

Table 9.19 - Review Report Table 4-3 Encouragements from the 2025 projections review.

Observation	Original review year	NFR	Pollutant	Projection's year(s)	Scenario	KC	Encouragement	Response
FI-0A-2025-0001	2025	0A National total (based on fuel sold)	NH3, NMVOC	2025, 2030, 2040, 2050	WM	No	The TRT noted that the value zero (0) or a blank cell is reported for one or more categories (1A5a Other Stationary, 3B4a Manure Management - Buffalo, 3B4f Manure Management - Mules & Assess) for the year(s) and pollutant(s): NH3 (2025, 2030); NMVOC (2025, 2030). In response to a question raised during the review, Finland stated that the quality control and assurance procedures in the next projection submission will be increased to avoid the zero values or blank cells in the reporting table. **The TRT notes that this issue does not relate to an over- or under-estimate and encourages Finland to use the appropriate notation keys for category and pollutant combinations where no emissions arise in the next submission.**	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

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. This was raised during the 2023 projections review. It was not clear to the TRT whether the expected evolution of abatement measures for housing and manure storage (e.g. the expected increase in fraction of slurry stores with a tent or roof) are taken from the PEIKKO-project cited in section 9.5 of the IIR, or from the sources mentioned in the Q&A during the 2023 projections review (as they are not listed in the IIR). In response to a question raised during the review, Finland confirmed that the projections of these parameters are based on the two sources mentioned during the 2023 projections review, namely: 1) the assumption of increased usage of Best Available Techniques (BAT) in livestock production, and 2) the implementation of the Action Plan to Reduce Ammonia Emissions from Agriculture in Finland for the years 2021–2027 (https://julkaisut.valtioneuvosto.fi/handle/10024/163564). **The TRT notes that this issue does not relate to an over- or under-estimate and encourages Finland to include these two sources in relation to the expected evolution of abatement measures for housing and manure storage (or another reference if the assumptions are updated to be based on a different source) in the IIR for the next submission.**	The issue will be addressed to in the next air pollutant emission projection submission in 2027.

10 GRIDDED EMISSIONS AND LPS

10.1 Gridded data

Backgound

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 sparcely 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 classifiactions 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 in their vicinity and especially in the Southern part of Finland. Inside municipalities, population is more and more moving from sparcely 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 sparcely populated areas continue to loose their inhabitants.

Sources included

The reporting of gridded data includes the following pollutants: NO_x (as NO_2), NMVOC, SO_x (as SO_2), NH_3, $PM_{2.5}$, PM_{10}, 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
NOx	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
SOx	t	12457.4	16699.1	3667.4	52.8	5.0	46.8	84.4	64.1	42.2			7.9
NH3	t	3.7	659.9	1172.6	3.2	234.1	838.1	1.0		6.3	475.1	18324.0	10471.5
PM2.5	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
PM10	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

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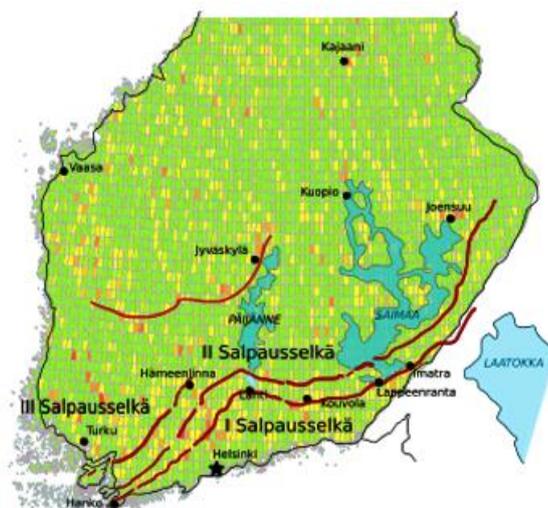
Figure 10.2 – CLC2006 marked land extraction areas in EMEP grid (background) and their correlation with the Salpausselkä ridge system (foreground)

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	ObjectID	Municipality	Passengers
32	Vantaa	15278994	111	Kruunupyy	68991
190	Oulu	877080	88	Kemi	57681
204	Pirkkala	466671	65	Jyväskylä	50570
234	Rovaniemi	427367	207	Pori	26229
284	Turku	324687	11	Enontekiö	20169
296	Vaasa	319315	246	Savonlinna	12215
252	Siilinjärvi	261151	59	Joroinen	6759
97	Kittilä	237222	109	Kouvola	500
49	Inari	146314			
146	Liperi	131291			
31	Helsinki	100000			
ObjectID	Municipality	Passengers			
133	Lappeenranta	98300			
119	Kuusamo	74583			
71	Kajaani	74558			

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 parametres. 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)
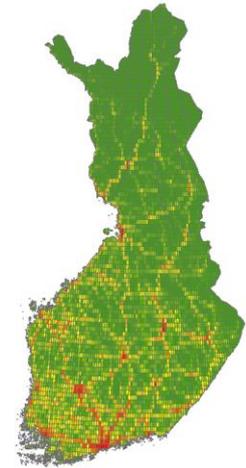
Figure 10.3 illustrates the resulting map after applying the methodology.

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).
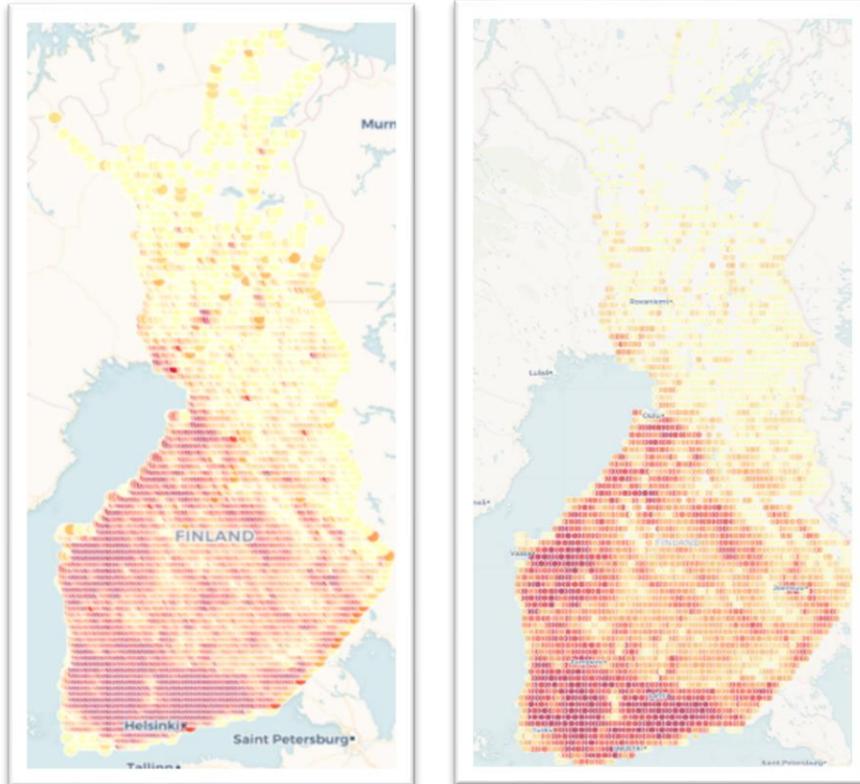
Initial submission   Revised estimate

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://wwwp2.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 D_Fugitive B_Industry	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.
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 H_Aviation F_RoadTransport G_Shipping	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.
E_Solvents M_Other J_Waste	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.
K_AgriLivestock L_AgriOther	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.

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 3.41. 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 Finnish Supervisory Agency 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 most significant differences for the year 2023 are listed below.

Some emissions in the 2023 dataset in the European Environment Agency's (EEA) PRTR database (Industrial Reporting database v13, December 2024) were absent from the LPS data for 2023 reported in submission 2025. These included:

- When the emissions are divided into different stack heights, the emissions do not fall under the LPS reporting:
    - NOx emissions from Facility IDs: 1216, 11179, 100050963
- Incorrect emissions in the PRTR database:

- o NOx emissions from Facility ID 1406: these are emissions are erroneously doubled in the database
  - o PCDD/F emission from Facility ID 3626: these are emissions are erroneously in a incorrect unit in the database and are 1000 times too high
- PRTR data contains emissions data from working machines. In the inventory these emissions are not point source data but calculated as described in the IIR Part 3 Transport. In the PRTR data, these emissions include:
  - o NOx emissions from Facility IDs: 1409, 27238, 100131111
- In some cases the fuel use data has not been available in the inventory eventhough the facility reported emissions are available. These facility reported emissions may also be reported in the PRTR data. In these cases, the emissions data in the inventory are not as a point source data but accounted for via the energy balance difference (described in more detail in the IIR Part Energy). In the PRTR data this issue relates the following emissions:
  - o NOx emissions from Facility IDs: 2873, 100335579
  - o CO emissions from Facility IDs: 1866, 100335579

The most significant differences observed in the emissions in the 2023 dataset in the European Environment Agency's (EEA) PRTR database (Industrial Reporting database v13, December 2024) and inventory LPS data for 2023 reported in submission 2025 relate to these cases:

- NOx emissions from Facility IDs: 1269, 2096, 2157, 100252736
- NMVOC emissions from Facility ID: 11183
- SO2 emissions from Facility ID: 1162
- PCB emissions from Facility ID: 2110
- In all of these cases the emissions in LPS reporting are higher due to inclusion of emissions calculated in the inventory in addition to the emissions reported by the facilities in the YLVA system.

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 SOx, NOx, NMVOCs, NH_3 and $PM_{2.5}$.

Decision 2012/3 of the Executive Body[17] 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, 2012/12[18] and 2014/1[19], 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 Accepted adjustments

Gothenburg Protocol and National Emission reduction Commitments Directive

In the 2025 and 2026 submissions, the NH_3 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 NH_3 emission reduction commitment under the amended Gothenburg Protocol and the EU NECD. In this regard, we refer also to the reported NH_3 emission projections (chapter 9 of the IIR), according to which, Finland will meet its NH_3 emission reduction targets until 2029 and for 2030.

In the 2025 submission, Finland applied for an adjustment to its 2005, 2020 and 2021 NH_3 emissions for:

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[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

- NFR categories 3Da2c, 3Da4, 5B2 and 6A based on circumstance 1 (new emission source) 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 (significantly different emission factors) presented above in chapter 11.1.

The application under the amended Gothenburg Protocol was accepted by the EMEP Steering Body[20] and under the EU NECD by the European Commission.

Table 11.1 shows the exceedance in 2026 submission against the NH_3 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 accepted 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*[21].

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[20] https://unece.org/sites/default/files/2025-12/ECE_EB.AIR_GE.1_2025_2%20E_0.pdf
[21] https://www.ceip.at/fileadmin/inhalte/ceip/00_pdf_other/2022/technical_guidance_for_erc_adjustments_issue1.1.pdf

Table 11.1. Summary of Finland's NH₃ emissions inventory for years 2005, 2020, 2021, 2022, 2023 and 2024 and the accepted adjusted national total emissions for compliance for 2005, 2020 and 2021.

Unadjusted emissions	2005	2020	2021	2022	2023	2024
NH3 national total, kt	40.904	33.895	33.140	30.196	30.382	30.213
ERC, %		20	20	20	20	20
National total target, kt		32.723	32.723	32.723	32.723	32.723
Emission reduction, %		**-17.1**	**-19.0**	**-26.2**	**-25.7**	**-26.1**
ERC exceedance, kt		1.172	0.417	-	-	-

Approved adjustment	2005	2020	2021
NFR 3B1a	1.710	0.765	0.637
NFR 3B1b	1.442	1.237	1.287
NFR 3B2	0.045	0.071	0.066
NFR 3B3	-0.173	-0.239	-0.159
NFR 3B4d	0.005	0.004	0.004
NFR 3B4e	0.185	0.207	0.209
NFR 3B4gi	0.621	0.644	0.611
NFR 3B4gii	0.636	1.488	1.514
NFR 3B4giii	0.134	0.131	0.145
NFR 3B4giv	0.135	0.071	0.099
NFR 3B4h	-0.317	-0.296	-0.270
NFR 3Da1	-2.492	-1.978	-2.085
NFR 3Da2a	-2.564	-3.127	-3.083
NFR 3Da2c	-0.429	-0.482	-0.458
NFR 3Da3	-0.565	-0.478	-0.468
NFR 3Da4	-0.193	-0.295	-0.303
NFR 5B2	-0.013	-0.180	-0.203
NFR 6A	-0.408	-0.560	-0.577
Total effect of adjustment	-2.238	-3.017	-3.034
Adjusted NH3 national total, kt	38.665	30.878	30.106
ERC, %		20	20
Adjusted national total target, kt		30.932	30.932
Adjustment emission reduction, %		**-20.1**	**-22.1**
ERC compliance margin, kt		0.054	0.826

Finland submitted the previously approved adjustment application (Annex IIa to the ECE/EB.Air/130) on 13 February 2026. The Declaration on consistent reporting of approved adjustments with description of the minor recalculations on ammonia emissions in the 2026 submission was submitted on 15 March 2026. No new adjustment applications were made in the 2026 submission.

Detailed methodological descriptions for estimating the NH₃ emissions in 2026 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;

NH_3 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 NH_3 emissions from these source categories. NH_3 emissions from none of these source categories were included in Finland's 2012 submission.

In the Finnish inventory NH_3 emissions from these source catgories 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 NFR 3B, manure application NFR 3Da2a, grazing NFR 3Da3) was based on national emission factors and methods. For technical reasons, the Finnish adjustment application presents implied emission factors (IEFs), which by themselves are not sufficient to describe how the emission/volatilization factors (unabated emission factors) used in the emission calculations and their changes affect the calculated emissions. This issue is addressed in the Annex 1 to the chapter 11 of the IIR (IIR_Chapter_11_Annex1_Finland_Ammonia_Adjustment_data.xlsx), which contains data used for calculating emissions from manure (manure management, grazing, manure application, yards) for the years 2005, 2020, and 2021 using both the previous (adjusted) and current (unadjusted) calculation systems for the adjustment application. The activity data (manure management information, nitrogen excretion, animal numbers) are the same in both systems used for the adjustment application, but in addition to differences in emission factors, the calculation methodologies themselves also differ.

The current calculation system follows the EMEP/EEA 2023 Guidebook methodologies. Like the previous system, it includes emission abatement techniques, their shares, and efficiencies, as well as temperature correction factors.

The previous calculation system was conceptually similar to the current one but had several significant differences:

1. The calculations did not fully follow the Guidebook in use at the time; for example, in the case of manure management (housing and storing), emissions were based on total nitrogen rather than TAN.
2. Unabated emission factors were taken from international literature.
3. Nitrogen transformation processes (immobilisation, mineralisation) were not considered in the calculations. The current system accounts for these.
4. Emissions from yards were not included in the previous calculation system. The current system also includes yards.
5. In addition to ammonia, only N_2O emissions were considered. The current system also includes N_2 and NO_x emissions.

In the Annex 1 to the chapter 11 of the IIR (IIR_Chapter_11_Annex1_Finland_Ammonia_Adjustment_data.xlsx), the sheet Example contains an example of the emission calculation of Dairy cows for 2020 in the current calculation system. The example contains the main elements of the actual calculation system and also how the IEF is formed (Summary section).

For ammonia emissions from inorganic nitrogen fertilisers (NFR 3Da1), the original calculation in the 2012 submission was based on the EMEP/CORINAIR Emission Inventory Guidebook 2007. The unadjusted (current) calculation method follows EMEP/EEA 2023 Guidebook and includes the effect of placement fertilisation as an emission abatement measure:

- 65% of the total applied inorganic nitrogen (all fertiliser types) is applied to arable land, and the remaining 35% to grassland.
- For nitrogen applied to arable land, the emission factor (EF) from GB 2023 is used. Additionally, the effect of placement fertilisation (typical method in Finland) is considered, and an abatement factor of -100% is applied.
- For nitrogen applied to grassland, the EF from GB 2023 is used as such, with no abatement factor applied.

In the adjusted (previous) calculation method:

- 65% of the total applied inorganic nitrogen is applied to arable land, and 35% to grassland (all fertiliser types except AN solutions, see below).
- For nitrogen applied to arable land, the arable land EF from GB 2007 is used, along with a factor of 17/14 to convert NH_3-N to NH_3. A -50% abatement factor is applied to account for placement fertilisation.
- For nitrogen applied to grassland, the grassland EF from GB 2007 is used, also with a 17/14 conversion factor. No abatement factor is applied.

A revision of activity data for "Inorganic N-fertilisers – on grassland – Ammonium solutions (AN)" and "Inorganic N-fertilisers – on arable land – Ammonium solutions (AN)" is also included. The difference between the adjusted and unadjusted activity data stems from how AN solutions were allocated in the previous method: all mineral fertiliser types except AN solutions were split 65% to arable land and 35% to grassland. AN solutions were assumed to be applied only on arable land. In the current method, all fertiliser types (including AN solutions) are distributed equally: 65% to arable land and 35% to grassland. In summary: the total amount of AN solutions remains the same in both the adjusted (previous) and unadjusted (current) methods, but the distribution between arable land and grassland differs.

The original agricultural emission calculation emission factors and methodology used in 2012 submission are fully described in the report by Grönroos et al. (2009)[22]. Note that the unabated emission factors ("Evaporates without abatement measures") of the previous calculation system were taken from international literature. The detailed description, including the literature review on the basis of which the unabated emission factors were produced, is provided in Grönroos et al. (2009).

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 13 February 2026. As described above, IEFs (Implied Emission Factors) are presented under emission factors in Table1.

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.

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 NH_3 emissions for 2020 and 2021 into compliance. All of the changes are considered to be "significant" in the context of attaining compliance with emission reduction commitments.

Annex 1 to Chapter 11 of the IIR

IIR_Chapter_11_Annex1_Finland_Ammonia_Adjustment_data.xlsx is available in the reporting folder **B. Informative Inventory Report – IIR 2026**.

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[22] https://helda.helsinki.fi/items/72cc6642-0c9b-4def-884b-f2e71cfe0278

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 Multilaterial 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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