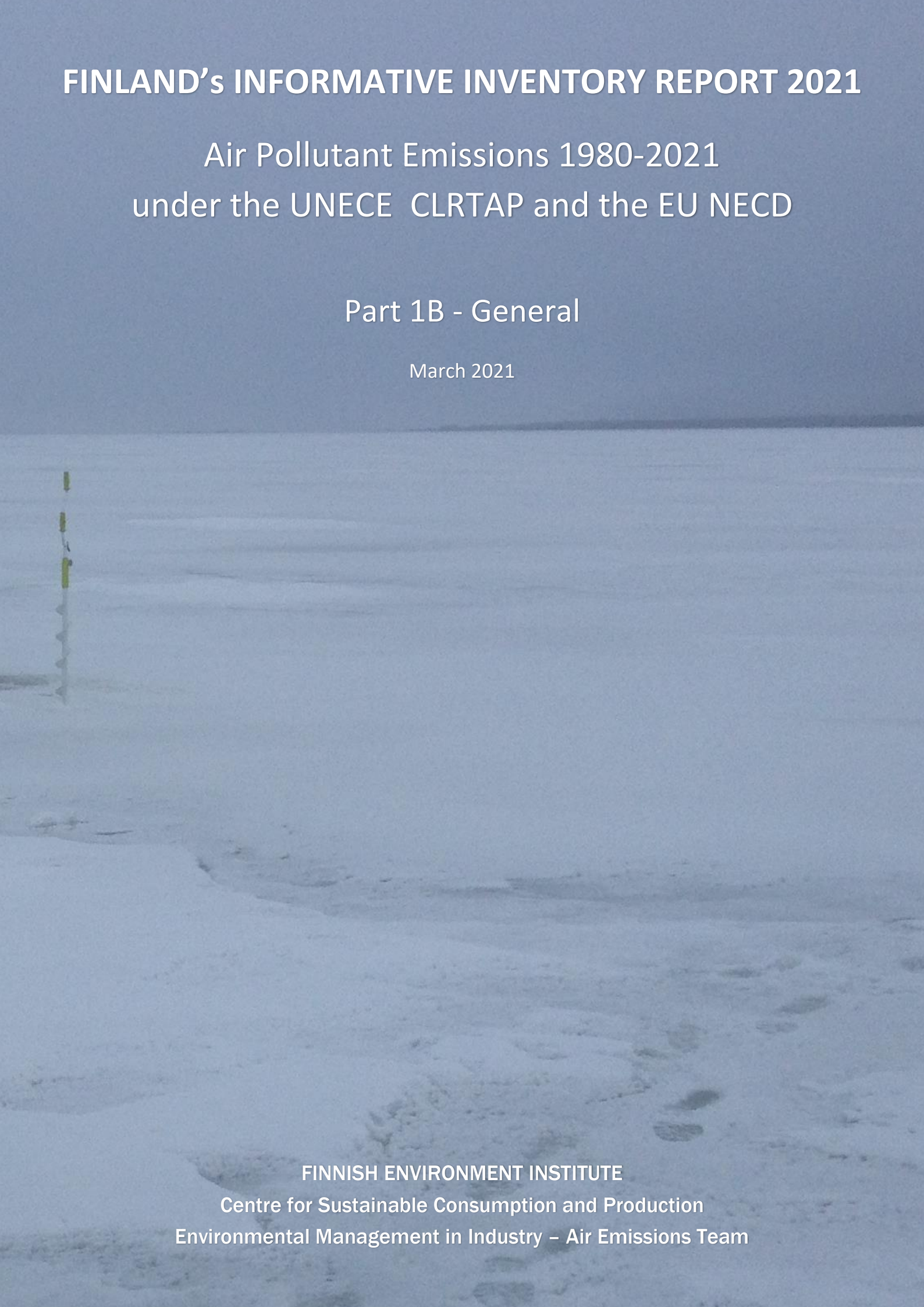
FINLAND's INFORMATIVE INVENTORY REPORT 2021

Air Pollutant Emissions 1980-2021
under the UNECE CLRTAP and the EU NECD

Part 1B - General

March 2021



FINNISH ENVIRONMENT INSTITUTE
Centre for Sustainable Consumption and Production
Environmental Management in Industry – Air Emissions Team

PART 1B - GENERAL

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8 RECALCULATIONS AND IMPROVEMENTS

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February 2021	KS

8.1 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were not included in the base year but have been added since for sources that were included in the base year and are no longer applicable.

As was no obligation to document this information in the early years of reporting air pollutant emission inventories, but 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 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 1990's 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 as explained in details in Chapter 2.3.2 in Part 1A – General of the IIR. 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.

Recalculations submitted in 2018-2019

For details of the large-scale recalculations see 2018 and 2019 IIRs.

15 Feb 2018 Finland submitted the old time series for the years 1990-2015 and new data for 2016. This was because the energy sector data was not finalized by the deadline of the NFR tables.

15 Mar 2018 Finland submitted the first recalculated time series, however, it would not have been mature for submission due to lack of checks that could not be done in the window between the late finalization of the energy sector data and the 4 weeks time frame for

resubmissions.

13 Apr 2018 Finland submitted a recalculated time series that had undergone several QA/QC procedures, however, still having remaining reallocation issues. Due to the UNECE CLRTAP S3 Review and the EU NECD Technical Review, both in June 2018, the data needed to be available.

15 Feb 2019 Finland submitted the recalculated time series which included further harmonized emissions allocations in the time series, however, also some errors were discovered after the submission deadline

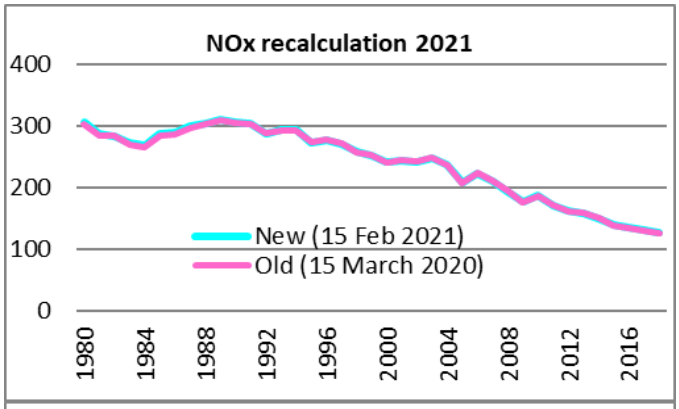
15 Mar 2019 Finland submitted additional corrections to the submission of 15 Feb 2019.

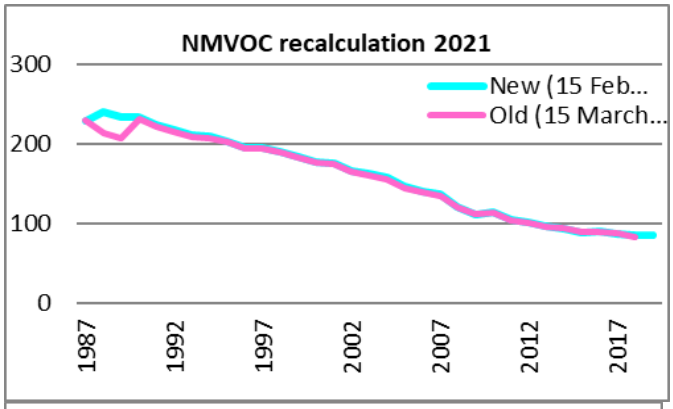
13 Mar 2020 Finland submitted corrections to the submission of 13 Feb 2020 (errors and omissions) due to time constraint caused by unexpected data flows: (1) renewal of the contents of the YLVA database with deletion of technical details used in the energy sector inventory and pre-scheduled initiation of the new energy sector calculation model, (2) errors identified in the agriculture sector calculation model formulas, (3) omission of recalculated values from the submission (agriculture HCB), (4) missing values not captured into the submission 13 February 2020. The impacts of the recalculations are presented in Chapter 8.2.

8.2 Impact of recalculations in the 2021 submission

Recalculations to the 2021 submission are explained in detail in the respective IIR chapters (Parts 2-6). Below is an overview of the impacts of the recalculations to the 2020 submission in Figure 8.1 and Table 8.1. Most of the recalculations are due to update of statistical data and in some cases application of new emission factors, the largest changes being due to:

- PAH-4, NMVOC, CO, Zn and Cu (all years, especially 1990-1999): corrections for the wood use statistics explained in IIR Part 2 under Small scale wood combustion
- Pb and As: corrections to methods and data explained in IIR Part 4/NFR 2C3


NOx recalculation 2021
400
300
200
100
0
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
New (15 Feb 2021)
Old (15 March 2020)


NMVOC recalculation 2021
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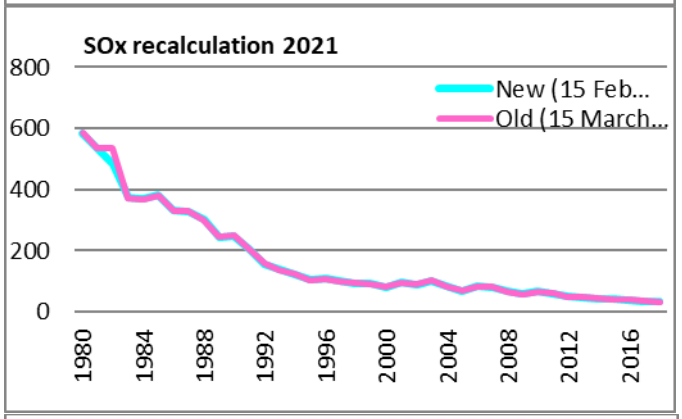
200
100
0
1987
1992
1997
2002
2007
2012
2017
New (15 Feb...
Old (15 March...


SOx recalculation 2021
800
600
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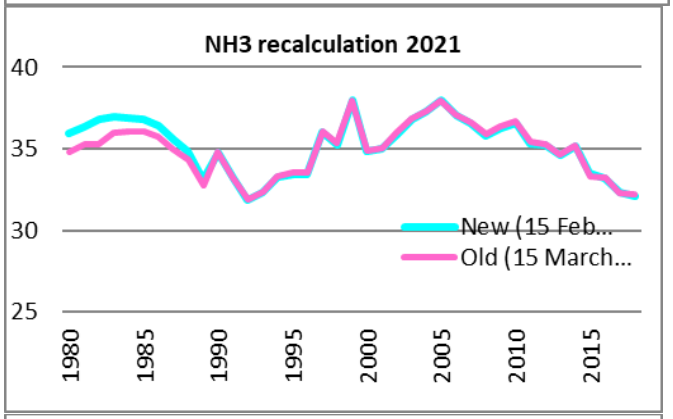
200
0
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
New (15 Feb...
Old (15 March...


NH3 recalculation 2021
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35
30
25
1980
1985
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1995
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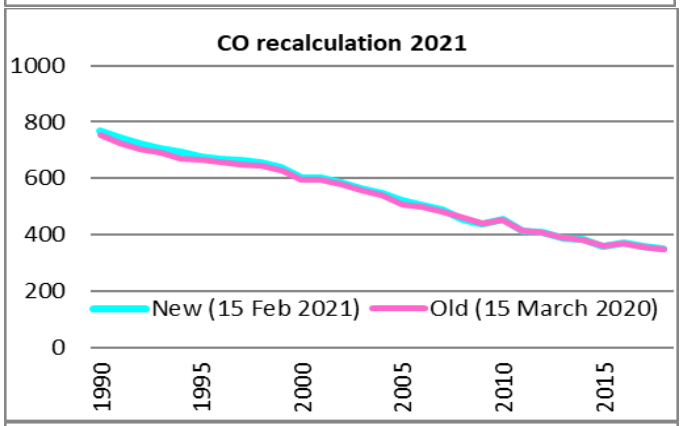
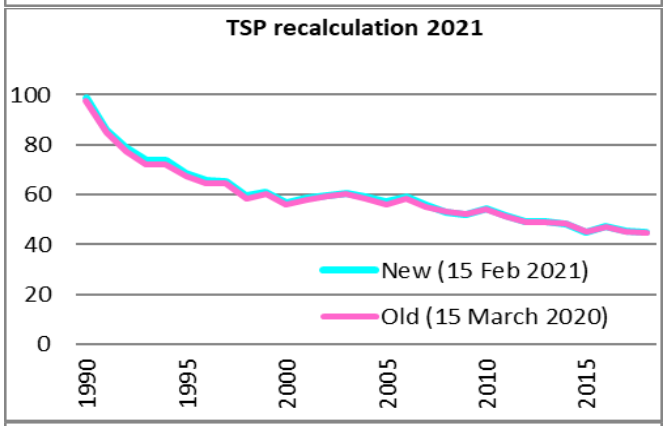
2010
2015
New (15 Feb...
Old (15 March...


CO recalculation 2021
1000
800
600
400
200
0
1990
1995
2000
2005
2010
2015
New (15 Feb 2021)
Old (15 March 2020)


TSP recalculation 2021
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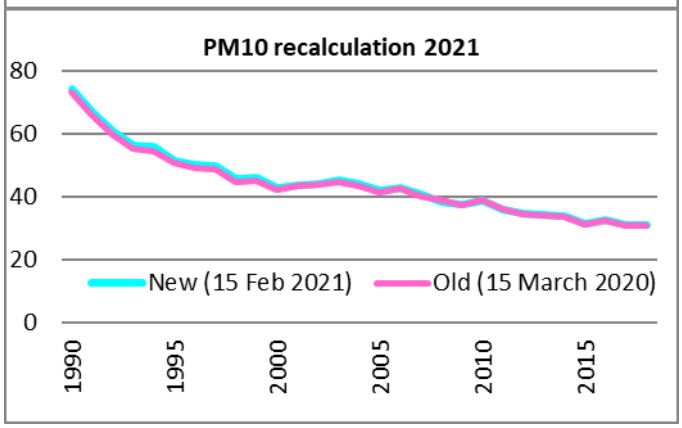
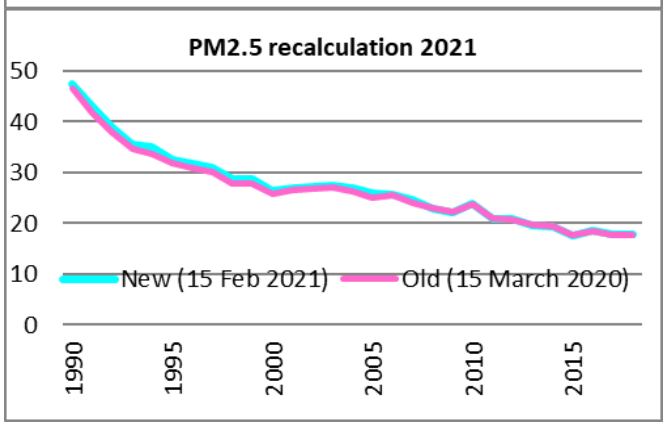
80
60
40
20
0
1990
1995
2000
2005
2010
2015
New (15 Feb 2021)
Old (15 March 2020)


PM10 recalculation 2021
80
60
40
20
0
1990
1995
2000
2005
2010
2015
New (15 Feb 2021)
Old (15 March 2020)


PM2.5 recalculation 2021
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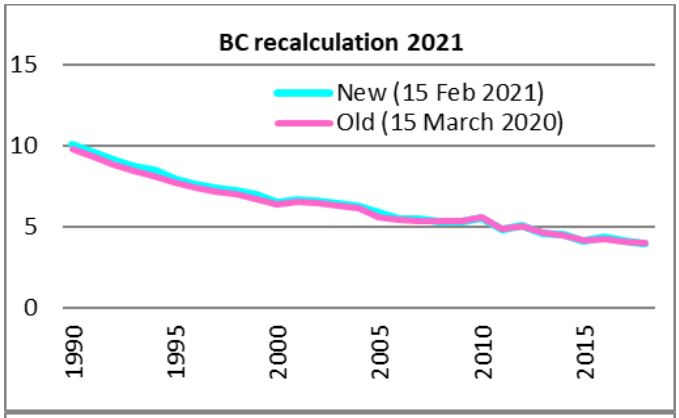
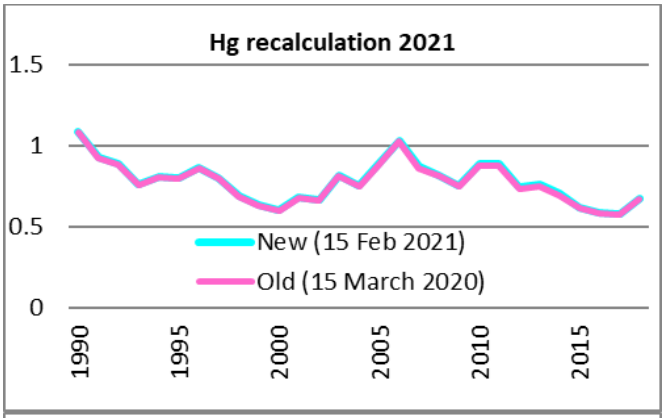
40
30
20
10
0
1990
1995
2000
2005
2010
2015
New (15 Feb 2021)
Old (15 March 2020)


BC recalculation 2021
New (15 Feb 2021)
Old (15 March 2020)
15
10
5
0
1990
1995
2000
2005
2010
2015


Hg recalculation 2021
New (15 Feb 2021)
Old (15 March 2020)
1.5
1
0.5
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1990
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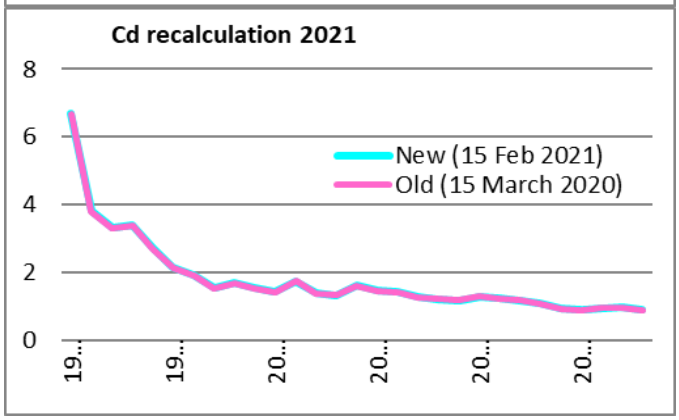
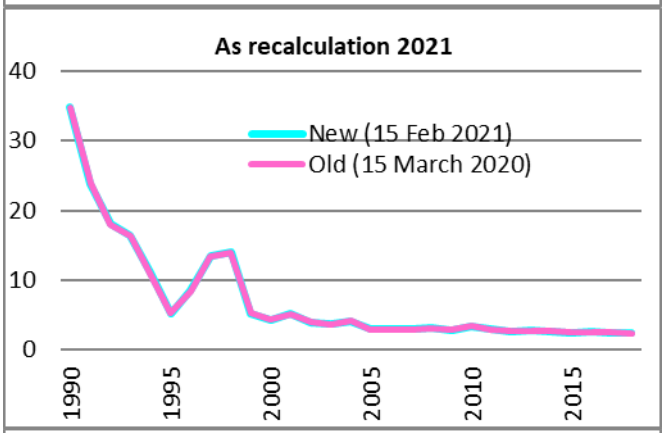
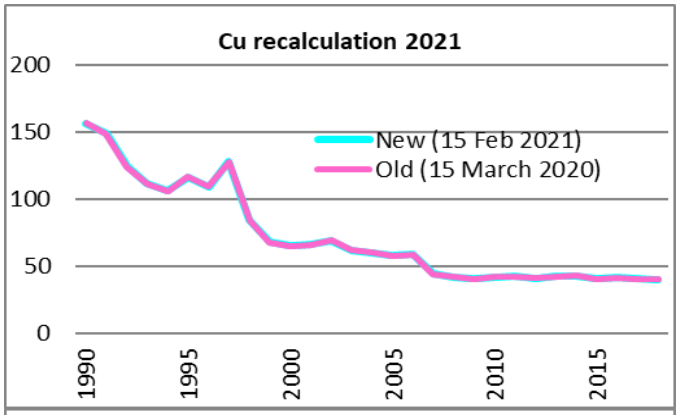
2000
2005
2010
2015


Cd recalculation 2021
New (15 Feb 2021)
Old (15 March 2020)
8
6
4
2
0
19...
19...
20...
20...
20...
20...


As recalculation 2021
New (15 Feb 2021)
Old (15 March 2020)
40
30
20
10
0
1990
1995
2000
2005
2010
2015


Cu recalculation 2021
New (15 Feb 2021)
Old (15 March 2020)
200
150
100
50
0
1990
1995
2000
2005
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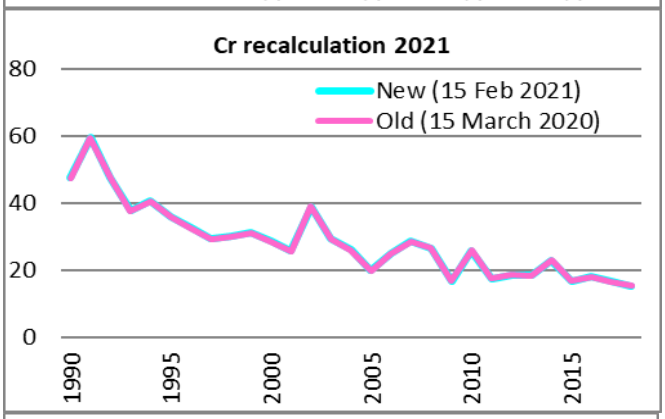
2015


Cr recalculation 2021
New (15 Feb 2021)
Old (15 March 2020)
80
60
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1990
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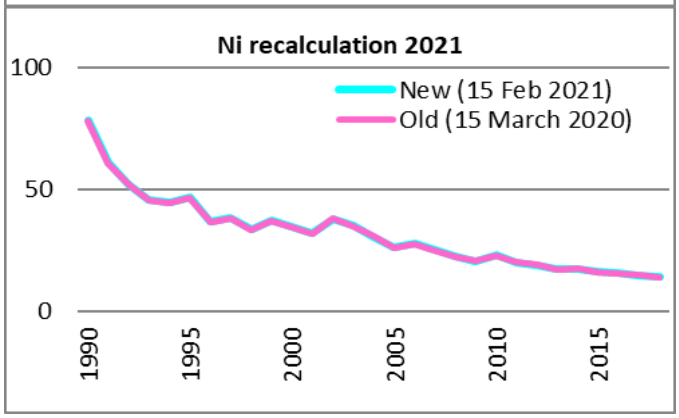
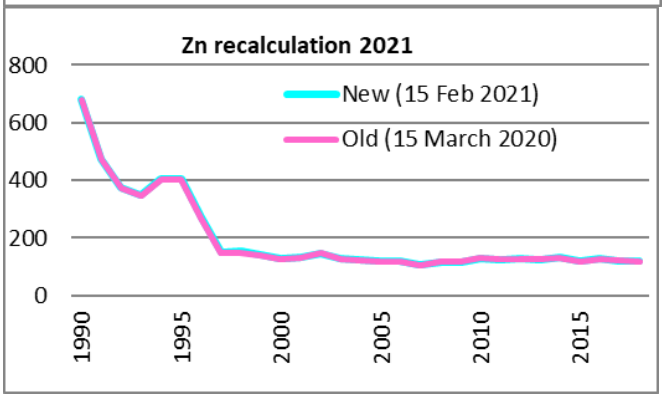
2015


Ni recalculation 2021
New (15 Feb 2021)
Old (15 March 2020)
100
50
0
1990
1995
2000
2005
2010
2015


Zn recalculation 2021
New (15 Feb 2021)
Old (15 March 2020)
800
600
400
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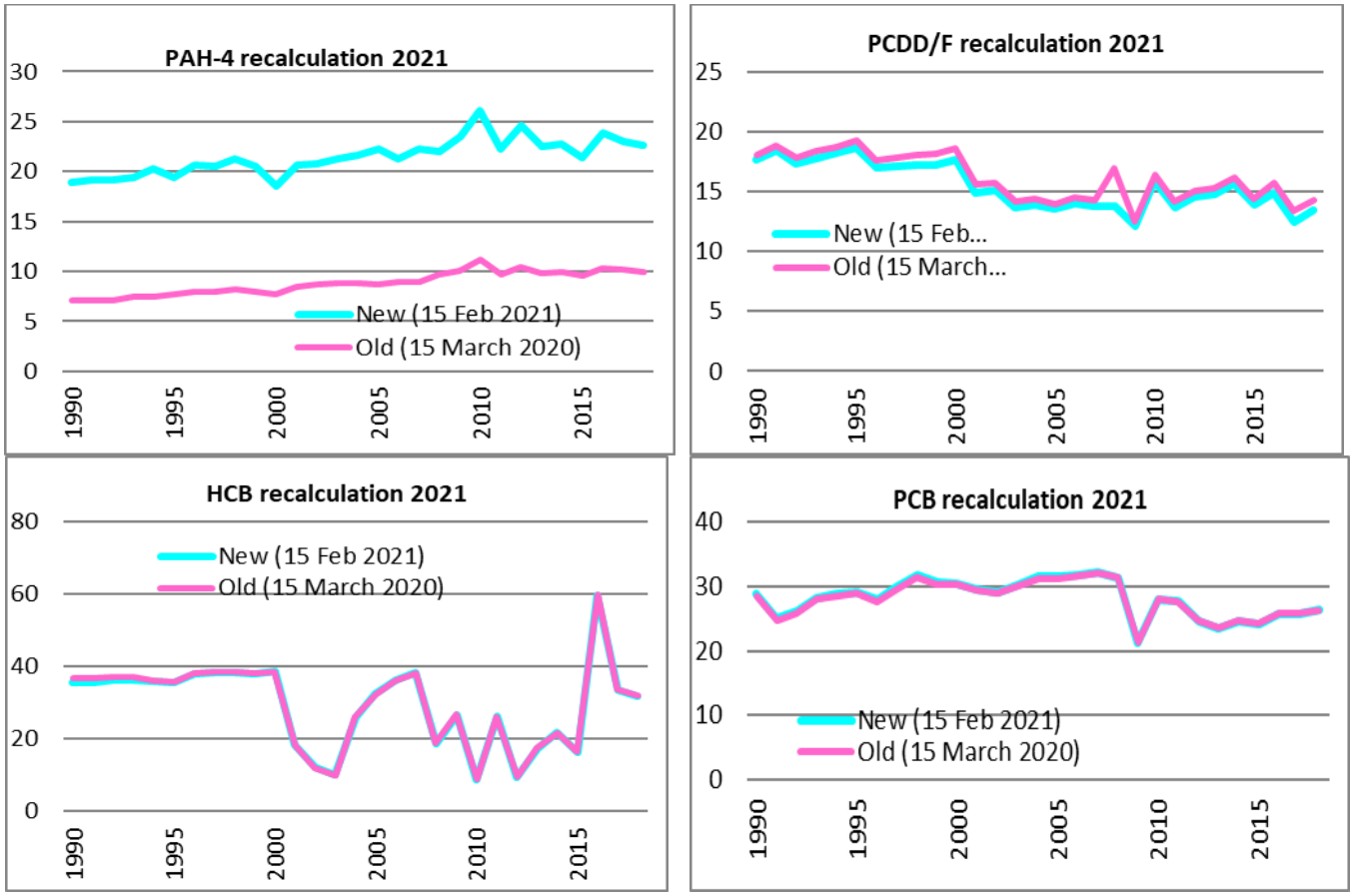


Figure 8.1 Impact of recalculations in 2021 submission to 2020 submission

Table 8.1 Impacts of 2021 recalculations to emissions

Nox																				
	1980	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
15 Feb 2021	307.182	286.884	282.262	273.176	269.054	286.991	288.711	300.116	303.080	309.551	306.359	303.483	287.916	293.134	293.859	273.114	277.454	271.585	257.440	252.746
15 March 2020	307.182	286.884	282.262	273.176	269.054	286.991	288.711	300.116	303.080	309.551	305.996	303.110	287.542	292.767	293.373	272.871	277.138	271.280	257.131	252.418
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.363	0.373	0.374	0.367	0.486	0.243	0.316	0.305	0.309	0.328
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	
15 Feb 2021	241.062	244.344	242.180	248.635	237.073	208.102	223.729	210.841	193.525	176.439	187.294	171.303	161.521	158.398	150.714	138.782	134.600	130.222	126.721	
15 March 2020	240.912	244.193	242.097	248.494	236.889	207.691	223.604	210.562	193.639	176.449	187.237	171.274	161.406	158.289	150.596	138.594	134.375	130.061	126.595	
Difference	0.150	0.151	0.083	0.141	0.183	0.411	0.125	0.279	-0.115	-0.010	0.057	0.029	0.115	0.109	0.118	0.188	0.225	0.161	0.126	
%	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.1	-0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	
SOx																				
	1980	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
15 Feb 2021	584.393	534.327	484.234	372.240	368.242	382.271	331.171	328.281	302.271	244.256	248.820	205.522	156.202	137.604	122.681	104.555	109.085	100.679	93.411	91.842
15 March 2020	584.393	534.327	484.234	372.240	368.242	382.271	331.171	328.281	302.271	244.256	248.795	205.497	156.177	137.580	122.648	104.539	109.065	100.660	93.392	91.822
Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.025	0.025	0.024	0.033	0.016	0.020	0.019	0.019	
%	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	0.0	0.0	0.0	0.0	
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	
15 Feb 2021	81.812	95.775	90.387	101.105	83.529	69.551	82.914	81.170	66.838	58.912	66.108	60.224	49.961	47.612	44.251	40.827	39.813	35.021	33.125	
15 March 2020	81.803	95.765	90.382	101.095	83.517	69.526	82.908	81.154	66.847	58.917	66.108	60.227	49.956	47.612	44.251	40.829	39.809	35.021	33.127	
Difference	0.009	0.010	0.006	0.010	0.011	0.025	0.007	0.016	-0.009	-0.005	0.000	-0.003	0.005	0.000	0.000	-0.002	0.005	0.000	-0.003	
%	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	0.0	0.0	0.0	0.0	
NH3																				
	1980	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
15 Feb 2021	35.928	36.332	36.798	36.944	36.866	36.795	36.397	35.581	34.814	33.137	34.738	33.190	31.857	32.285	33.266	33.425	33.425	35.987	35.259	37.943
15 March 2020	36.185	36.589	37.054	37.201	37.123	37.052	36.654	35.838	35.071	33.394	34.785	33.245	31.914	32.336	33.288	33.508	34.531	36.039	35.311	37.979
Difference	-0.257	-0.257	-0.257	-0.257	-0.257	-0.257	-0.257	-0.257	-0.257	-0.257	-0.047	-0.055	-0.057	-0.051	-0.022	-0.084	-1.107	-0.052	-0.052	
%	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.8	-0.1	-0.2	-0.2	-0.2	-0.1	-0.2	-3.2	-0.1	-0.1	
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	
15 Feb 2021	34.815	35.012	35.854	36.809	37.270	37.996	37.028	36.600	35.757	36.265	36.596	35.345	35.247	34.592	35.150	33.533	33.192	32.331	32.121	
15 March 2020	34.889	35.043	35.941	36.876	37.316	37.972	37.084	36.605	35.863	36.339	36.645	35.395	35.244	34.626	35.177	33.315	33.195	32.318	32.189	
Difference	-0.074	-0.031	-0.087	-0.067	-0.046	0.025	-0.056	-0.005	-0.107	-0.074	-0.049	-0.050	0.003	-0.035	-0.027	0.218	-0.002	0.014	-0.068	
%	-0.2	-0.1	-0.2	-0.2	-0.1	0.1	-0.2	0.0	-0.3	-0.2	-0.1	-0.1	0.0	-0.1	-0.1	0.7	0.0	0.0	-0.2	

NMVOC

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	239.760	233.187	233.010	223.274	217.210	211.029	210.127	203.166	195.662	195.531	190.660	184.284
15 March 2020	239.760	233.187	231.105	221.368	215.305	209.181	207.628	201.945	194.094	194.079	189.170	182.698
Difference	0.000	0.000	1.906	1.906	1.905	1.848	2.498	1.221	1.567	1.452	1.489	1.587
%	0.0	0.0	0.8	0.9	0.9	0.9	1.2	0.6	0.8	0.7	0.8	0.9

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	177.971	175.095	166.179	161.914	157.317	146.203	140.156	136.429	120.304	111.318	113.409	103.931	101.574	96.248	93.666	88.895	89.833	87.351	85.436
15 March 2020	177.224	174.271	165.742	161.169	156.429	144.312	139.675	135.257	121.071	111.760	113.488	104.284	101.330	96.595	93.990	89.318	89.811	87.709	85.317
Difference	0.746	0.824	0.437	0.744	0.888	1.891	0.480	1.173	-0.767	-0.442	-0.078	-0.353	0.245	-0.347	-0.324	-0.423	0.022	-0.359	0.119
%	0.4	0.5	0.3	0.5	0.6	1.3	0.3	0.9	-0.6	-0.4	-0.1	-0.3	0.2	-0.4	-0.3	-0.5	0.0	-0.4	0.1

CO

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	769.777	741.224	720.529	705.659	692.180	675.306	669.802	663.097	657.539	639.485
15 March 2020	754.061	725.506	704.823	690.416	671.575	665.247	656.916	651.150	645.280	626.440
Difference	15.716	15.718	15.706	15.242	20.605	10.058	12.887	11.947	12.259	13.044
%	2.1	2.2	2.2	2.2	3.1	1.5	2.0	1.8	1.9	2.1

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	601.187	601.362	582.837	561.807	547.407	523.843	503.511	490.443	456.762	437.061	453.841	411.764	409.328	389.186	382.934	359.582	370.747	358.946	350.062
15 March 2020	595.302	595.202	579.402	555.887	541.352	509.153	499.688	481.157	462.530	440.186	454.001	413.888	406.821	389.328	383.258	361.136	368.148	359.076	350.531
Difference	5.885	6.160	3.435	5.920	6.055	14.689	3.823	9.286	-5.767	-3.124	-0.160	-2.124	2.507	-0.141	-0.324	-1.554	2.599	-0.130	-0.469
%	1.0	1.0	0.6	1.1	1.1	2.9	0.8	1.9	-1.2	-0.7	0.0	-0.5	0.6	0.0	-0.1	-0.4	0.7	0.0	-0.1

TSP

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	98.905	86.225	78.832	73.584	73.724	68.435	65.812	65.420	59.391	61.114
15 March 2020	97.923	85.242	77.850	72.631	72.435	67.806	65.006	64.674	58.624	60.299
Difference	0.982	0.983	0.982	0.953	1.289	0.629	0.806	0.747	0.766	0.815
%	1.0	1.2	1.3	1.3	1.8	0.9	1.2	1.2	1.3	1.4

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	56.854	58.460	59.631	60.673	59.094	57.228	59.004	55.605	52.944	52.090	54.366	51.296	49.071	49.007	48.377	45.123	47.395	45.153	45.056
15 March 2020	56.485	58.072	59.416	60.300	58.647	56.313	58.762	55.024	53.295	52.275	54.409	51.412	48.895	48.997	48.378	45.168	47.228	45.138	45.069
Difference	0.369	0.388	0.216	0.373	0.446	0.915	0.241	0.580	-0.352	-0.184	-0.043	-0.116	0.176	0.010	-0.001	-0.045	0.167	0.015	-0.014
%	0.7	0.7	0.4	0.6	0.8	1.6	0.4	1.1	-0.7	-0.4	-0.1	-0.2	0.4	0.0	0.0	-0.1	0.4	0.0	0.0

PM10

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	74.179	66.897	60.777	56.547	55.837	51.663	50.230	49.689	45.800	46.087
15 March 2020	73.236	65.953	59.834	55.632	54.600	51.060	49.457	48.972	45.064	45.304
Difference	0.943	0.944	0.943	0.915	1.237	0.604	0.773	0.717	0.736	0.782
%	1.3	1.4	1.6	1.6	2.3	1.2	1.6	1.5	1.6	1.7

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	42.931	43.919	44.350	45.328	44.131	42.323	43.147	40.984	38.561	37.475	39.052	36.024	34.894	34.333	33.814	31.375	32.579	30.990	31.101
15 March 2020	42.577	43.547	44.143	44.970	43.703	41.445	42.917	40.428	38.901	37.655	39.090	36.141	34.733	34.332	33.825	31.448	32.423	30.987	31.116
Difference	0.354	0.372	0.207	0.358	0.428	0.878	0.231	0.556	-0.340	-0.180	-0.038	-0.117	0.161	0.001	-0.010	-0.073	0.157	0.002	-0.015
%	0.8	0.9	0.5	0.8	1.0	2.1	0.5	1.4	-0.9	-0.5	-0.1	-0.3	0.5	0.0	0.0	-0.2	0.5	0.0	0.0

PM2.5

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	47.397	42.778	38.966	35.600	35.021	32.502	31.647	30.958	28.647	28.761
15 March 2020	46.443	41.823	38.012	34.673	33.782	31.876	30.857	30.223	27.894	27.961
Difference	0.954	0.955	0.954	0.927	1.239	0.626	0.790	0.735	0.753	0.800
%	2.1	2.3	2.5	2.7	3.7	2.0	2.6	2.4	2.7	2.9

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	26.326	26.995	27.135	27.430	26.857	26.026	25.706	24.546	22.819	22.211	23.796	20.874	20.803	19.699	19.384	17.690	18.603	17.853	17.808
15 March 2020	25.945	26.599	26.898	27.050	26.409	25.141	25.447	23.971	23.123	22.360	23.792	20.963	20.621	19.673	19.368	17.746	18.426	17.826	17.798
Difference	0.381	0.396	0.236	0.381	0.448	0.885	0.259	0.575	-0.305	-0.149	0.004	-0.089	0.183	0.026	0.017	-0.056	0.178	0.027	0.010
%	1.5	1.5	0.9	1.4	1.7	3.5	1.0	2.4	-1.3	-0.7	0.0	-0.4	0.9	0.1	0.1	-0.3	1.0	0.2	0.1

BC

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	10.100	9.602	9.152	8.718	8.548	7.957	7.668	7.421	7.247	6.961
15 March 2020	9.834	9.332	8.882	8.457	8.195	7.784	7.447	7.216	7.036	6.737
Difference	0.267	0.270	0.269	0.261	0.353	0.173	0.221	0.205	0.210	0.224
%	2.7	2.9	3.0	3.1	4.3	2.2	3.0	2.8	3.0	3.3

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	6.500	6.674	6.580	6.440	6.295	5.900	5.528	5.512	5.315	5.315	5.599	4.873	5.089	4.633	4.527	4.152	4.351	4.128	3.980
15 March 2020	6.401	6.569	6.522	6.339	6.174	5.648	5.462	5.353	5.410	5.369	5.600	4.906	5.043	4.633	4.530	4.175	4.305	4.126	4.014
Difference	0.100	0.105	0.058	0.101	0.121	0.251	0.066	0.159	-0.095	-0.055	0.000	-0.033	0.046	0.000	-0.003	-0.023	0.046	0.002	-0.034
%	1.6	1.6	0.9	1.6	2.0	4.5	1.2	3.0	-1.8	-1.0	0.0	-0.7	0.9	0.0	-0.1	-0.5	1.1	0.0	-0.8

Pb

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	321.435	237.157	165.145	105.144	73.966	72.717	49.247	31.871	37.262	33.689
15 March 2020	321.370	237.094	165.083	105.084	73.889	72.675	49.195	31.823	37.213	34.796
Difference	0.065	0.063	0.062	0.060	0.077	0.043	0.052	0.048	0.049	-1.107
%	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	-3.2

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	30.671	29.800	30.738	24.926	26.495	21.490	24.866	21.854	19.823	16.771	20.398	19.245	16.363	16.010	16.646	14.690	15.720	15.656	15.428
15 March 2020	30.642	30.405	30.719	24.900	26.466	21.439	24.853	21.817	19.841	16.780	20.393	19.250	16.347	15.994	16.638	14.687	15.697	15.642	15.410
Difference	0.030	-0.605	0.018	0.026	0.029	0.050	0.013	0.037	-0.018	-0.008	0.005	-0.004	0.016	0.016	0.008	0.003	0.022	0.015	0.018
%	0.1	-2.0	0.1	0.1	0.1	0.2	0.1	0.2	-0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1

Cd

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	6.685	3.811	3.326	3.387	2.720	2.135	1.917	1.539	1.699	1.538
15 March 2020	6.670	3.796	3.311	3.372	2.700	2.125	1.905	1.528	1.688	1.526
Difference	0.015	0.015	0.015	0.015	0.020	0.010	0.012	0.011	0.012	0.012
%	0.2	0.4	0.5	0.4	0.7	0.5	0.6	0.7	0.7	0.8

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	1.414	1.745	1.375	1.327	1.615	1.451	1.426	1.266	1.207	1.157	1.290	1.223	1.177	1.079	0.919	0.888	0.943	0.955	0.881
15 March 2020	1.408	1.739	1.371	1.322	1.608	1.456	1.422	1.257	1.212	1.160	1.290	1.225	1.174	1.079	0.919	0.890	0.941	0.956	0.883
Difference	0.006	0.006	0.003	0.006	0.007	-0.005	0.004	0.009	-0.006	-0.003	0.000	-0.002	0.003	0.000	0.000	-0.002	0.001	-0.001	-0.002
%	0.4	0.3	0.2	0.4	0.4	-0.3	0.3	0.7	-0.5	-0.3	0.0	-0.2	0.2	0.0	0.0	-0.3	0.2	-0.1	-0.2

Hg

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	1.086	0.929	0.891	0.765	0.808	0.802	0.866	0.803	0.693	0.636
15 March 2020	1.084	0.927	0.888	0.763	0.804	0.800	0.863	0.800	0.690	0.633
Difference	0.003	0.003	0.003	0.002	0.004	0.002	0.003	0.003	0.003	0.004
%	0.2	0.3	0.3	0.3	0.5	0.3	0.4	0.4	0.5	0.6

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	0.604	0.684	0.672	0.819	0.753	0.891	1.034	0.873	0.821	0.756	0.889	0.889	0.746	0.762	0.707	0.621	0.591	0.582	0.679
15 March 2020	0.602	0.682	0.670	0.817	0.751	0.887	1.032	0.870	0.820	0.756	0.886	0.753	0.744	0.760	0.705	0.620	0.589	0.580	0.677
Difference	0.002	0.002	0.002	0.002	0.002	0.004	0.003	0.003	0.001	0.001	0.002	0.135	0.002	0.001	0.002	0.001	0.002	0.002	0.002
%	0.3	0.3	0.3	0.3	0.3	0.4	0.2	0.4	0.1	0.1	0.3	17.9	0.2	0.2	0.2	0.2	0.4	0.3	0.3

As																			
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**									
15 Feb 2021	34.816	23.859	18.044	16.386	10.996	5.225	8.501	13.456	13.984	5.208									
15 March 2020	34.811	23.854	18.039	16.381	10.989	5.221	8.497	13.453	13.980	5.318									
Difference	0.005	0.005	0.005	0.005	0.007	0.003	0.004	0.004	0.004	-0.111									
%	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	-2.1									
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
15 Feb 2021	4.362	5.121	3.991	3.668	4.112	2.992	2.945	2.959	3.136	2.894	3.402	2.983	2.645	2.755	2.709	2.456	2.579	2.446	2.415
15 March 2020	4.360	5.183	3.990	3.666	4.110	2.987	2.944	2.956	3.138	2.895	3.402	2.983	2.644	2.755	2.709	2.457	2.578	2.445	2.415
Difference	0.002	-0.061	0.001	0.002	0.002	0.005	0.001	0.003	-0.002	-0.001	0.000	-0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.000
%	0.0	-1.2	0.0	0.1	0.1	0.2	0.0	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr	13.980																		
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**									
15 Feb 2021	47.670	59.685	47.624	37.721	40.668	35.921	32.838	29.556	30.133	31.271									
15 March 2020	47.495	59.510	47.449	37.551	40.438	35.809	32.694	29.423	29.996	31.126									
Difference	0.175	0.175	0.175	0.170	0.230	0.112	0.143	0.133	0.137	0.145									
%	0.4	0.3	0.4	0.5	0.6	0.3	0.4	0.5	0.5	0.5									
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
15 Feb 2021	28.595	25.694	39.075	29.455	26.034	20.008	24.921	28.824	26.515	16.704	25.971	17.417	18.644	18.434	23.063	16.701	18.206	16.654	15.343
15 March 2020	28.528	25.624	39.036	29.388	25.953	19.837	24.877	28.716	26.580	16.739	25.971	17.440	18.612	18.434	23.065	16.716	18.172	16.649	15.344
Difference	0.066	0.070	0.039	0.067	0.080	0.171	0.045	0.109	-0.066	-0.035	-0.001	-0.023	0.032	0.000	-0.002	-0.015	0.033	0.005	0.000
%	0.2	0.3	0.1	0.2	0.3	0.9	0.2	0.4	-0.2	-0.2	0.0	-0.1	0.2	0.0	0.0	-0.1	0.2	0.0	0.0
Cu																			
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**									
15 Feb 2021	156.893	148.869	124.283	111.539	106.193	116.501	109.538	127.925	84.484	68.132									
15 March 2020	156.863	148.839	124.253	111.510	106.153	116.482	109.514	127.903	84.461	68.107									
Difference	0.030	0.030	0.030	0.029	0.039	0.019	0.025	0.023	0.023	0.025									
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0									
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
15 Feb 2021	65.338	66.239	69.277	61.898	59.981	58.051	58.644	44.146	42.043	40.421	41.980	42.409	41.216	42.378	43.074	40.741	41.647	40.633	40.156
15 March 2020	65.327	66.228	69.271	61.887	59.967	58.022	58.637	44.127	42.054	40.427	41.980	42.413	41.210	42.378	43.074	40.744	41.641	40.632	40.173
Difference	0.011	0.012	0.007	0.012	0.014	0.029	0.008	0.019	-0.011	-0.006	0.000	-0.004	0.005	0.000	0.000	-0.003	0.006	0.002	-0.017
%	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	0.0	0.0	0.0	0.0	0.0	0.0

Ni

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	78.439	60.885	52.204	45.625	44.610	46.664	36.870	38.176	33.617	37.149
15 March 2020	78.289	60.735	52.054	45.480	44.413	46.568	36.747	38.062	33.500	37.025
Difference	0.150	0.150	0.150	0.146	0.197	0.096	0.123	0.114	0.117	0.124
%	0.2	0.2	0.3	0.3	0.4	0.2	0.3	0.3	0.3	0.3

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	34.599	32.065	37.917	35.279	30.565	26.061	27.825	24.972	22.353	20.511	22.856	19.949	18.943	17.147	17.317	16.091	15.745	14.784	14.149
15 March 2020	34.542	32.005	37.884	35.221	30.496	25.914	27.787	24.879	22.410	20.540	22.856	19.969	18.915	17.147	17.318	16.104	15.716	14.778	14.139
Difference	0.057	0.060	0.033	0.058	0.069	0.146	0.038	0.093	-0.056	-0.030	0.000	-0.020	0.027	0.000	-0.002	-0.013	0.029	0.006	0.010
%	0.2	0.2	0.1	0.2	0.2	0.6	0.1	0.4	-0.3	-0.1	0.0	-0.1	0.1	0.0	0.0	-0.1	0.2	0.0	0.1

Zn

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	682.839	472.798	374.228	349.383	405.625	404.876	271.497	148.399	152.117	142.364
15 March 2020	679.339	469.298	370.728	345.988	401.033	402.636	268.627	145.739	149.387	139.459
Difference	3.500	3.500	3.500	3.395	4.592	2.240	2.870	2.660	2.730	2.905
%	0.5	0.7	0.9	1.0	1.1	0.6	1.1	1.8	1.8	2.1

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	128.261	131.327	146.873	127.091	124.792	119.300	119.065	108.395	116.819	116.680	130.307	125.041	128.516	124.409	131.897	118.309	128.014	120.016	118.656
15 March 2020	126.931	129.934	146.096	125.748	123.182	115.884	118.169	106.225	118.134	117.378	130.318	125.502	127.882	124.407	131.938	118.617	127.347	119.898	118.644
Difference	1.330	1.393	0.777	1.344	1.610	3.416	0.896	2.170	-1.315	-0.698	-0.011	-0.461	0.634	0.002	-0.041	-0.307	0.668	0.117	0.012
%	1.0	1.1	0.5	1.1	1.3	2.9	0.8	2.0	-1.1	-0.6	0.0	-0.4	0.5	0.0	0.0	-0.3	0.5	0.1	0.0

PCDD/F

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	17.626	18.415	17.351	17.820	18.163	18.604	16.983	17.055	17.171	17.253
15 March 2020	18.070	18.816	17.863	18.397	18.723	19.294	17.657	17.837	17.995	18.131
Difference	-0.444	-0.401	-0.512	-0.577	-0.561	-0.689	-0.673	-0.781	-0.825	-0.878
%	-2.5	-2.1	-2.9	-3.1	-3.0	-3.6	-3.8	-4.4	-4.6	-4.8

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	17.681	14.887	15.124	13.707	13.852	13.550	14.050	13.816	13.838	12.104	15.914	13.639	14.582	14.833	15.650	13.935	14.941	12.506	13.415
15 March 2020	18.616	15.616	15.735	14.205	14.363	13.910	14.516	14.271	16.973	12.456	16.419	14.157	15.021	15.311	16.125	14.409	15.731	13.402	14.356
Difference	-0.934	-0.729	-0.611	-0.497	-0.510	-0.359	-0.465	-0.455	-3.135	-0.352									
%	-5.0	-4.7	-3.9	-3.5	-3.6	-2.6	-3.2	-3.2	-18.5	-2.8									

PAH-4

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	18.968	19.121	19.164	19.434	20.265	19.457	20.622	20.574	21.212	20.579
15 March 2020	7.117	7.138	7.156	7.410	7.484	7.676	7.962	8.002	8.257	7.997
Difference	11.851	11.984	12.008	12.024	12.782	11.780	12.660	12.571	12.955	12.582
%	166.5	167.9	167.8	162.3	170.8	153.5	159.0	157.1	156.9	157.3

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	18.565	20.601	20.765	21.314	21.590	22.228	21.295	22.229	21.987	23.470	26.140	22.289	24.651	22.528	22.811	21.380	23.821	23.035	22.623
15 March 2020	7.740	8.508	8.716	8.816	8.857	8.710	8.897	8.991	9.687	10.097	11.129	9.713	10.436	9.841	9.976	9.518	10.317	10.143	9.985
Difference	10.825	12.093	12.049	12.499	12.733	13.518	12.398	13.238	12.299	13.373	15.011	12.576	14.215	12.688	12.835	11.862	13.504	12.892	12.638
%	139.9	142.1	138.2	141.8	143.8	155.2	139.4	147.2	127.0	132.4	134.9	129.5	136.2	128.9	128.7	124.6	130.9	127.1	126.6

HCB

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	35.677	35.567	36.361	36.379	36.054	35.585	38.015	38.468	38.386	38.132
15 March 2020	35.684	35.571	36.370	36.392	36.061	35.613	38.040	38.496	38.412	38.156
Difference	-0.007	-0.004	-0.009	-0.013	-0.007	-0.028	-0.024	-0.028	-0.026	-0.024
%	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	38.601	18.186	12.024	9.912	26.039	32.374	36.122	38.182	18.691	26.574	8.761	26.120	9.476	17.307	21.623	16.203	59.701	33.405	31.883
15 March 2020	38.651	18.243	12.091	9.973	26.096	32.411	36.184	38.220	18.753	26.619	8.926	26.212	9.526	17.357	21.676	16.363	59.962	33.575	32.024
Difference	-0.051	-0.057	-0.067	-0.060	-0.058	-0.036	-0.062	-0.038	-0.062	-0.045	-0.165	-0.092	-0.051	-0.051	-0.054	-0.160	-0.261	-0.170	-0.141
%	-0.1	-0.3	-0.6	-0.6	-0.2	-0.1	-0.2	-0.1	-0.3	-0.2	-1.8	-0.4	-0.5	-0.3	-0.2	-1.0	-0.4	-0.5	-0.4

PCB

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15 Feb 2021	28.850	25.020	26.121	28.265	28.917	29.080	27.858	29.886	31.718	30.545
15 March 2020	28.550	24.720	25.821	27.974	28.523	28.888	27.612	29.658	31.484	30.296
Difference	0.300	0.300	0.300	0.291	0.394	0.192	0.246	0.228	0.234	0.249
%	1.1	1.2	1.2	1.0	1.4	0.7	0.9	0.8	0.7	0.8

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Feb 2021	30.371	29.460	29.069	30.252	31.411	31.467	31.797	32.247	31.235	21.295	27.978	27.618	24.652	23.498	24.587	24.179	25.723	25.770	26.260
15 March 2020	30.257	29.341	29.002	30.137	31.273	31.174	31.721	32.061	31.348	21.354	27.979	27.657	24.597	23.497	24.590	24.302	25.771	25.863	26.346
Difference	0.114	0.119	0.067	0.115	0.138	0.293	0.077	0.186	-0.113	-0.060	-0.001	-0.040	0.054	0.000	-0.003	-0.123	-0.048	-0.093	-0.086
%	0.4	0.4	0.2	0.4	0.4	0.9	0.2	0.6	-0.4	-0.3	0.0	-0.1	0.2	0.0	0.0	-0.5	-0.2	-0.4	-0.3

8.3 Planned improvements

8.3.1 Inventory improvement programme at Finnish Environment Institute

Identification of further development needs in the Finnish UNECE CLRTAP inventory is carried out on a continuous basis according to annual work programmes (Table 1.01). 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 E-PRTR. Finnish Environment Institute maintains information on emission estimation methodologies and emission factors on a website (http://www.ymparisto.fi/fi-FI/Asiointi_luvat_ja_ymparistovaikutusten_arviointi/Luvat_ilmoitukset_ja_rekisterointi/Paastotiedon_ilmoittaminen__paastorekistereihin_PRTR) (in Finnish). These methods should be applied in the E-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. After the full recalculation of the time series 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.

The overall scheme of the inventory improvement programme is presented in Chapter 14 in Table 1.01.

Information of the Nordic cooperation in harmonization and improvement of air pollutant emission inventories in the Nordic countries is presented in Chapter 8.5.2

Sector-specific improvements that have already been implemented due to the QA/QC work and the inventory improvement programme are presented in Table 1.02 and those still remaining in Table 1.03

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

Changes in chapter	
March 2021	KS

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 Councilof 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 (2019-2023)

8.4 Improvements in the Finnish Inventory due to the Inventory Review Processes

8.4.1 CLRTAP S3 Review and EU Technical Review under the NECD in 2018

The improvements made to the inventory in response to the 2018 S3 review under the CLRTAP and to the EU Technical Review under the NECD in 2018 are presented in Table 1.03.

Table 8.2 Improvements in response to the 2021 EU Technical Review under the NECD (Final Review Report), actions made in the column to the right

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

Table 4: All recommendations including those additionally made during the NECD Review 2020 and those not implemented from previous reviews, for NOX, NMVOC, SO2, NH3, PM2.5

Initial recommendation, year, number of years	KC	NFR, Pollutant(s), Year(s)	RE or TC in	Response
FI-3B-2020-0001	Yes	**Recommendation** For 3B Manure Management for NH_3 emissions, the TERT noted that there is a lack of transparency regarding the implementation of abatement techniques, as no information is provided in the IIR regarding how these percentages have been estimated. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Finland explained that before 2013, data on manure management and emission abatement techniques was mainly based on expert opinions and on some statistical data. Then, in 2013, a survey was conducted on manure management, changes in legislation and in the Agri-environmental support system were taken into account, and new statistical data on slurry injection was available in 2015-2018. Finally, Finland indicated that a new survey on manure management practices is being prepared at the Natural Research Institute Finland and is likely to be launched in 2021. **The TERT recommends that Finland includes the explanations provided during the review in its IIR for the next submission.**	No	The explanation is included in IIR Part 5 p. 30.
FI-3B-2020-0002	Yes	**Recommendation** For 3B Manure Management for NH_3 emissions, the TERT noted that no information was provided regarding anaerobic digestion, while in the waste chapter, it is mentioned that there are 13 farm-scale biogas plants. In response to a question raised during the review Finland explained that according to the Natural Resources Institute Finland (Luke), quantity of anaerobically digested livestock manure is currently around 160,000 tons/year, which represents about 1% of the total amount of livestock manure (excluding manure excreted on pasture). Finland indicated that the amount of anaerobically digested manure is so small that it has not been seen essential to make major changes to the agricultural emission calculation system. The TERT noted that the issue should be below the threshold of significance for a technical correction. The TERT understands that anaerobic digestion is currently not that important in Finland, but it might grow over time. **The TERT recommends that Finland further explores the possibility to distinguish anaerobic digestion of manure in its calculation, or provide justifications for not estimating, or describe the steps taken and the schedule of implementation in the 2021 IIR submission.**	No	The explanation on including anaerobic digestion of manure in the calculation system during 2021 is provided in IIR Part 5 p. 27.
FI-3B1a-2020-0001	Yes	**Recommendation** For 3B1a Manure Management - Dairy Cattle and NH_3 emissions, the TERT noted that there is a lack of transparency regarding the N excretion rates over time. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Finland provided the updated N excretion data. **The TERT recommends that Finland includes the new time series for all animal categories for N excretion in its IIR in the next submission.**		Nitrogen excretion time series for all animal categories is included in IIR Part 5 p. 31-32.

Initial recommendation, year, number of years	KC	NFR, Pollutant(s), Year(s)	RE or TC in	Response
FI-3B3-2020-0001	Yes	**Recommendation** For 3B3 Manure Management – Swine for NH_3 emissions, the TERT noted that Finland uses an average EF for all pig categories (per manure type). In response to a question raised during the review Finland explained that the EF used for slurry system (0.31) is an average value of the EF for sows and EF for fattening pigs from the 2019 EMEP/EEA Guidebook. For solid manure system (except deep litter system), the EF for sows (0.24; 2019 Guidebook) is used for sows and for fattening pigs. For deep litter system, the EF for pig solid manure storage (0.29; 2019 Guidebook) is used for housing of sows and fattening pigs. However, the TERT noted that the 2019 EMEP/EEA Guidebook provides EF per swine category (sows/fattening pigs), with different values depending on the swine category during housing. The TERT noted that the issue is below the threshold of significance for a technical correction. **The TERT recommends that Finland uses the EFs per swine category and include the information regarding the EFs used in its IIR for next submission.**		The calculation model will be modified during 2021 so that the use of swine category specific EFs are possible to use. The explanation and the currently used EFs are provided in IIR Part 5 p. 22-27.
FI-3Da1-2020-0001	Yes	**Recommendation** For 3Da1 Inorganic N-fertilizers (includes also urea application) and NH3 emissions for all years, the TERT noted that there is a lack of transparency regarding the implementation of abatement techniques, as no information is provided in the IIR regarding the percentage (65%) of the mineral fertilizer spread using placement fertilisation. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Finland explained that the proportion of placement fertilisation is based on the ratio between non-grasses and the total actively cultivated agricultural land. For grasses, mineral fertilisers are typically applied by broadcast spreading technique, and for other crops the placement fertilisation technique is used. **The TERT recommends that Finland includes the information and data provided during the review to explain how the percentage of placement fertilisation has been estimated and to show the progress of this technique over time.**		The explanation is provided in IIR Part 5 p. 52-53
FI-3Da2a-2020-0002	Yes	**Recommendation** For 3Da2a Animal Manure Applied to Soils for NH3 and NOXNOX emissions, the TERT noted that there is a lack of transparency regarding the activity data used, as no value is reported in the NFR tables or in the IIR. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Finland provided the activity data for 2018. **The TERT recommends that Finland reports the amount of total N from manure applied to fields in the NFR tables and include a table with the distinction per animal category as provided during the review in its IIR for the next submission.**		Total N from manure applied divided by animal categories is included in IIR Part 5 p. 57.

Initial recommendation, year, number of years	KC	NFR, Pollutant(s), Year(s)	RE or TC in	Response
FI-3Da2c-2020-0001	No	**Recommendation** For 3Da2c Other Organic Fertilisers applied to soils for NH3 and NOXNOX emissions, the TERT noted that there is a lack of transparency regarding the use of the notation key 'NO' while some activity data are provided in the NFR 5B1 Biological treatment of waste – Composting. In response to a question raised during the review, Finland explained that other organic fertilisers applied to fields, such as composted household waste and industrial waste, are not considered as the amounts applied to fields are considered small. Furthermore, they are mainly used in landscaping, not on fields. **The TERT recommends that Finland includes the explanation provided during the review in its IIR for the next submission and consider changing the notation key to 'NE', if this is occurring to some extent.**		The explanation provided to the 2020 TERT is ncluded in IIR Part 5 p. 61
FI-3Da3-2020-0001	Yes	**Recommendation** For 3Da3 Urine and Dung Deposited by Grazing Animals for NH3 emissions, the TERT noted a drop in emissions between 2014 and 2015 (-12%) which was not the case in the previous submission. In response to a question raised during the review Finland explained that the reason for the drop is an error in the number of reindeer for that year. The TERT noted that the issue is below the threshold of significance for a technical correction. **The TERT recommends that Finland corrects the calculation of NH3 emissions from 3Da3 for the year 2015 in the next submission.**		The number of reindeer for 2015 is corrected to the 2021 submission and explained in IIR Part 5 p. 49.
FI-5B2-2019-0001	No	**Assessment of the implementation of the initial recommendation** For 5B2 Biological Treatment of Waste - Anaerobic digestion at Biogas Facilities and NH3 for all years, the TERT noted that 'NE' is reported. This was raised during the 2019 NECD review. The TERT noted that the issue is expected to be below the threshold of significance for a technical correction. The 2020 review noted that the IIR states that the issue has been included in the list of improvements and that the recommendation will be addressed in the 2022-2025 submission. **The TERT reiterates the recommendation that Finland estimates NH3 emissions in this sector as soon as possible.**		The calculation of these emissions is included in a project running in 2021 and will be included in the 2022 submission.

Table 6: All recommendations, revised estimates, technical corrections and unquantified potential technical corrections including those additionally made during the NECD Review 2020 and those not implemented from previous reviews, for heavy metals and POPs

Observation	KC	Recommendation	RE, TC or PTC in 2019	Response
FI-0A-2019-0002	No	**Assessment of the implementation of the initial recommendation** For 1A1a Public Electricity and Heat Production, 1A1b Petroleum Refining, 1A1c Manufacture of Solid Fuels and Other Energy Industries, 1A2a Stationary Combustion in Manufacturing Industries and Construction: Iron and steel, 1A2b Stationary Combustion in Manufacturing Industries and Construction: Non-Ferrous Metals, 1A2c Stationary Combustion in Manufacturing Industries and Construction: Chemicals, 1A2d Stationary Combustion in Manufacturing Industries and Construction: Pulp, Paper and Print, 1A2e Stationary Combustion in Manufacturing Industries and Construction: Food Processing, Beverages and Tobacco, 1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-Metallic Minerals, 1A2gviii Stationary Combustion in Manufacturing Industries and Construction: Other, 1A4ai Commercial/Institutional: Stationary, 1A4bi Residential: Stationary & 1A4ci Agriculture/Forestry/Fishing: Stationary, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene for all years, the TERT noted that Finland did not report emissions of individual PAHs. This was raised during 2019 NECD review. In response to a question raised during the review, Finland explained that Finland's PAH inventory in the Energy sector is based on national PAH-4 emission factors and on emissions reported by plants as PAH-4. Finland provided a revised estimate for all years. The revised estimate was based on the national PAH-4 emissions and used the default emission factors from the EMEP/EEA Guidebook to split the emissions. Finland indicated in their response that they would work to develop country-specific factors for estimating the individual PAHs. The TERT agreed with the revised estimate provided by Finland. **The TERT recommends that Finland includes the revised estimate or a developed country specific methodology in its 2021 NFR and IIR submission.**		The same method to split PAH-4 emissions into the four indicator species was used than which was provided as a revised estimate during the 2020 review. For details see IIR Part 2 Energy p. 36 and Table 2.24 p. 59
FI-2C3-2020-0001	Yes	**Recommendation** For 2C3 Aluminium Production and emissions of PCDD/F for the years 2017 and 2018, the TERT noted that emissions were almost twice as high as for the time series before. This issue is linked to ID FI-2C3-2018-0001 that was raised during 2018 and 2019 NECD review. In response to a question raised during the review, Finland explained that this had to do with the fact that emissions were reallocated only for the years 2017 and 2018 from 2C7a Copper Production, where they had been reported before. Finland provided revised estimates for years 1990-2016 and stated that it will be included in the next submission. The TERT agreed with the revised estimate provided by Finland. **The TERT recommends that Finland includes the revised estimate in its 2021 NFR and IIR submission.**		The 2021 submission includes the revised estimates, see IIR Part 4/Aluminium
FI-5C1bv-2018-0001	No	**Assessment of the implementation of the initial recommendation** For Hg emissions from 5C1bv Cremation, the TERT noted differences (approximately 10% in 2005, 2016 and 2017) between NECD Review 2019 Revise Estimates for Hg emissions provided by Finland and accepted in 2019 by the review team and Hg emissions provided in the NFR table in 2020 submission. In response to a question raised during the 2020 review, Finland explained that an incorrect calculation file was used for the 2020 submission and it did not include the final check. Finland provided a revised estimate for years 2005-2018 explaining that the same emissions as sent in 2019 revised estimate should be used. Finland stated that it will be included in the next submission. The TERT agreed with the revised estimate provided by Finland. **The TERT recommends that Finland includes the revised estimate in its 2021 NFR and IIR submission.**		The revised method provided during the 2020 review was used in the 2021 submission, see IIR Part6 Waste/Cremation.

FI-3Df-2020-0001	No	**Recommendation** For 3Df Use of Pesticides for HCB emissions for 2010 and 2011, the TERT noted that for chlorothalonil, Finland used an impurity factor of 10 mg/kg in 2009 and then 40 mg/kg in 2010 and 2011. In response to a question raised during the review Finland indicated that as the product providers and the products themselves did not change through these 3 years, the impurity factor of 10 mg/kg can be applied for 2010 and 2011. The TERT noted that the issue is related to non-mandatory years. **The TERT recommends that Finland corrects the impurity factor used for chlorothalonil for the next submission.**		The correction has been made, IIR Part 5 Agriculture p. 75

Table 8: All recommendations, revised estimates and unquantified potential technical corrections made during the NECD Review 2020 for LPS data

Initial recommendation (number of years)	KC	Recommendation	RE, TC or PTC in 2019	Response
FI-LPS-GEN-2020-0002		**Recommendation** The TERT notes that for the year 2015, emissions are reported for 81 facilities in the E-PRTR database (v18) which could not be found in the LPS submission using the National IDs provided and that these omissions mostly related to agricultural facilities. In response to the review Finland explained that the E-PRTR reporting includes ammonia emissions from a large number of agricultural operators and these facility reported emissions are not taken into account in the air emission inventory reporting (and hence LPS reporting), since all the ammonia emissions in the inventory are calculated in a separate calculation model for agricultural emissions. **The TERT recommends that Finland provides this clarification along with any analytical comparison of E-PRTR facility data and national inventory estimates in its IIR description of LPS and Gridded estimates in future submissions.**		The structure of the agricultural operations' inventory vs. E-PRTR reporting is included in the explanation in IIR Part 1B
FI-LPS-GEN-2020-0005		**Recommendation** For the LPS reporting, the TERT noted that there is a lack of transparency regarding the LPS emissions and the links to the national inventory. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Finland explained that the documentation will be improved in the 2021 submission. **The TERT recommends that Finland includes more documentation of the LPS emissions in the next submission, e.g. by including information on whether the LPS emissions are used directly in the inventory, the share of national emissions covered by LPS emissions and any differences between the LPS reporting and the reporting under PRTR.**		Documentation of how LPS emissions are included in the inventory and the reporting under PRTR are explained in IIR Part 1B. A comparison will be made to the 2019 data including calculation of the share of national emissions covered by LPS emissions and any differences between the LPS reporting. These will be documented in the 2022 IIR submission based on the 1.5.2021 LPS submission.
FI-LPS-B-2-2020-0002		**Recommendation** For LPS ID UPM-Kymmene Oyj, Kouvola, the TERT noted a discrepancy between coordinates provided under EPRTR and LPS. In response to a question raised during the review Finland explained that coordinates provided under LPS are incorrect. This does not relate to an over- or under-estimate of emissions. **The TERT recommends that Finland provides corrected data in the next submission.**		Work to correct LPS coordinates has been carried out as described in IIR Part 1B Chapters for LPS and Gridded data.

Initial recommendation (number of years)	KC	Recommendation	RE, TC or PTC in 2019	Response
FI-LPS-B-2-2020-0004		**Recommendation** For LPS IDs ID 2134 and ID 3500 and emissions of NH_3 and NMVOC respectively in 2015, the TERT noted a discrepancy between reported data under EPRTR and LPS. In response to a question raised during the review Finland explained that emissions under E-PRTR include only ammonia reported to the supervising authorities system (YLCA) and that ammoniacal nitrogen has been excluded from the E-PRTR reporting. For NMVOC emissions, data reported under the E-PRTR includes only NMVOC reported as NMVOC, and does not take into account benzene that is included into the LPS data. The TERT noted that the issue is below the threshold of significance for a technical correction. **The TERT recommends that Finland includes a detailed description of the difference between E-PRTR and LPS reporting in their next IIR.**		A comparison will be made to the 2019 data and any differences between the LPS reporting. These will be documented in the 2022 IIR submission based on the 1.5.2021 LPS submission.
FI-LPS-B-2-2020-0003		**Recommendation** For LPS ID 1913 SSAB Europe Oy emissions of PCDD/F in 2015, the TERT noted that there is a lack of transparency regarding the discrepancy between LPS and PRTR emissions for this plant. The TERT noted that the issue is below the threshold of significance for a technical correction. In response to a question raised during the review, Finland explained that LPS emissions take into account emissions from production of coke in addition to blast furnace process emissions, whilst E-PRTR reporting includes only emissions reported by plants according to the requirements set in the environmental permit. **The TERT recommends that Finland includes more documentation in the IIR including a description of any known inconsistencies with the PRTR reporting.**		This specific deviation is included in the general description of how inconsistencies between LPS and E-PRTR are dealt with, see IIR Part 1B .
FI-LPS-K-2020-0001		**Recommendation** The TERT notes that for the year 2015, emissions are reported for 77 facilities registered as “7(a) Installations for the intensive rearing of poultry or pigs” in Finland in the E-PRTR database (v18) which could not be found in the LPS submission using the National IDs provided and that these omissions related to agricultural facilities. In response to the review Finland indicated that E-PRTR facilities reported emission are not taken into account in the air emission inventory reporting (and hence LPS reporting), as all the ammonia emissions in the inventory are calculated in a separate calculation model for agricultural emissions. **The TERT recommends that Finland provide this clarification along with any analytical comparison of E-PRTR facility data and national inventory estimates in its IIR description of LPS and Gridded estimates in future submissions**		The clarification of the structure of the inventory is provided on IIR part 1B Chapter for LPS and Gridded data.

Table 10: All recommendations and unquantified potential technical corrections made during the NECD Review 2020 for gridded data

Observation	KC	Recommendation	RE, TC or PTC in 2019	Response
FI-GRID-A-2020-0001		**Recommendation** The TERT notes with reference to the latest resubmission provided by Finland for 2015 emissions for all pollutants except NH_3 an issue in the Gridding submission, which may relate to an under-estimate of emissions. Initially, the TERT had raised a question regarding a geographical distribution issue related to power plants being located at the wrong location. In response to a question raised during the review, Finland provided a resubmission (Annex_V_Gridded_emissions_2015_v3.xlsx, sent on 16 June) which resolved the distribution issue. However, when comparing the resubmitted gridded emissions to the national inventory (NFR table), the TERT found that for all pollutants except NH_3 emissions a part of the emissions was missing in the gridded data. The TERT found that this under-estimate is related to categories A_PublicPower and B_Industry. This under-estimate may have an impact on total emissions that is above the threshold of significance for Cd in particular. It is currently not possible for the TERT to provide a numerical emission estimate and therefore the issue will be flagged as an Unquantified Potential Technical Correction, and will be assessed as a high priority item in future reviews. **The TERT recommends that Finland ensures that all pollutant (in particular Cd) emissions from categories A_PublicPower and B_Industry are consistent with the national inventory (NFR tables) for inclusion in next years' inventory submission.**		The corrections provided to TERT 2020 are used in the 2021 submission
FI-GRID-GEN-2020-0003		**Recommendation** For the pollutants SO_2, NO_XNO_X, NMVOC, $PM_{2.5}$, PCBs, Hg, Pb, PCDD/F, PM_{10} and CO, the TERT noted that there are a number of locations (grid cells) where gridded and LPS data are inconsistent. The TERT had compared gridded emissions for each grid cell with LPS emissions (allocated to the respective grid cell), where several inconsistencies were found where LPS emissions exceed gridded emissions. In response to a question raised during the review Finland explained that the point sources set used for LPS reporting is different than the one used for the gridding methodology (different coordinates of facilities). Finland also announced the check of the coordinates of all large point sources and look for improvements. The TERT notes that the list of grid points where these errors were found, as provided to Finland during the review, may be outdated given the different resubmissions of the gridded data provided by Finland during the review, yet the issue of inconsistencies between gridded and LPS data likely still exists. **The TERT recommends that for the next submission, Finland improves the consistency between gridded and LPS data to the extent possible and reports in the IIR on the level of consistency between these two datasets, and what attempts have been undertaken to improve consistency.**		The coordinates of LPSs will be checked and consistency between LPS and gridded data ensured to the 1.5.2021 submission.

Observation	KC	Recommendation	RE, TC or PTC in 2019	Response
FI-GRID-B-2020-0001		**Recommendation** For the pollutant NMVOC and GNFR category B_Industry and D_Fugitives, the TERT noted a geographical allocation issue. This does not relate to an over- or under-estimate of emissions. The TERT noted that the grid cell containing the highest NMVOC emission for all sectors combined (3.1 kton for categories B and D together) was in a remote area of Finland with very little human activity. A similar issue was found for SO_2, where 15% of the national total emissions were allocated to the same specific grid cell. In response to a questions raised during the review, Finland identified an error in the location of point sources within the gridded data, and provided a resubmission that resolved the issue. **The TERT recommends that for the next submission, Finland carefully checks the locations of point sources prior to submission, and documents the methodology for inclusion of point sources in the gridded data clearly in the IIR.**		The location for the specific case has been checked and the methodology provided in IIR Part 1B
FI-GRID-C-2020-0001		**Recommendation** For the pollutant $PM_{2.5}$ and GNFR category C_OtherStationaryComb, but also for NMVOC emissions from category E_Solvents and NO_XNO_X emissions from F_RoadTransport, the TERT noted significant geographical allocation issues. This does not relate to an over- or under-estimate of emissions. The TERT noted that for each of these cases highest emissions were found over rural areas with very little human activity, while urban areas such as Helsinki and surroundings had very low emissions. In response to a questions raised during the review, Finland provided a resubmission of the gridded data which resolved these issues. However, the TERT was unable to review the specific methodology due to the technical errors in the original gridded emissions and a lack of information provided in the IIR. **The TERT recommends that for the next submission, Finland carefully checks for technical errors in the gridded emissions prior to submission, and documents the methodology used for spatial distribution of emissions (for all GNFR categories) in the IIR, in line with the requirements outlined in Annex 2 of the reporting guidelines.**		Documentation of the methodology used for gridding is provided in IIR Part 1B
FI-GRID-L-2020-0001		**Recommendation** For the pollutant NH_3 and GNFR category L_AgriOther, the TERT noted a geographical allocation issue. This does not relate to an over- or under-estimate of emissions. The TERT noted that highest emissions were found on the western coast of Finland in an area which has only limited agricultural area. In response to a question raised during the review, Finland provided a resubmission of all gridded emissions. However, in these resubmitted data the NH_3 emissions from category L_AgriOther showed a pattern very similar to a population distribution, with highest emissions in the cities of Helsinki and Turku. In response to a follow-up question, Finland explained that another mistake was found, since two of the underlying categories were erroneously spatially distributed using population density. Finland provided another resubmission which resolved this issue. However, the TERT was unable to check the gridding methodology in more detail due to these mistakes and the fact that the IIR does contain specific information on the gridding methodology used. **The TERT recommends that for the next submission, Finland carefully checks for any sources which are distributed using wrong proxies, and documents the proxies used for each individual underlying source in the IIR in order for the TERT to be able to review the methodology used.**		The observation by the TERT has been examined carefully, and upon investigation two allocation problems were found, which however did not affect the geographical distribution of emissions in a notable scale. Agricultural activities concentrate to the Southwest of Finland and coastal areas. This is explained in the IIR in the Chapter for Gridded data.

9 PROJECTIONS

Changes in chapter	
Update of text 2021	MS, KS, KM, JG, TF, JMP
Update of projections	Every 1-3 years, since 2020 every 2 years

9.1 Projections for 2020, 2025 and 2030

With existing measures (WM) projections

The activity pathways in Finland's Energy and Climate Strategy (Huttunen, 2017[1]) are used as the basis for most of the projections. The Strategy had two scenarios: With Existing Measures and With Additional Measures. When making the National Air Pollution Control Programme 2030 (Ministry of the Environment, 2019[2]), the two scenarios were combined to best represent the contemporary status of national legislation and agreed measures. Emissions for this one combined scenario, called Baseline, were then estimated. It was found that the Baseline scenario is already expected to meet the reduction targets for Finland. This conclusion was further supported by a sensitivity analysis for key sectors. Due to this, no additional scenarios were made (although the Programme did suggest additional measures). The Baseline scenario of the Programme is called WM scenario in this document. Some tweaks have been made to the projections with the emergence of new information (e.g. emission factors for some wood burning appliances), but a more thorough update will follow after a new Energy and Climate Strategy has been made during 2021.

Projections for 2020, 2025, 2030, 2040 and 2050

Emission projections for 2020, 2025 and 2030 are reported in the NFR reporting table for nitrogen oxides, sulphur oxides, non-methane volatile organic compounds, ammonia and small particles <2.5um. For black carbon projections are reported for 2030 only. For all compounds, projection estimates are made for some NFR categories, however, not for all, and thus these are reported as NE.

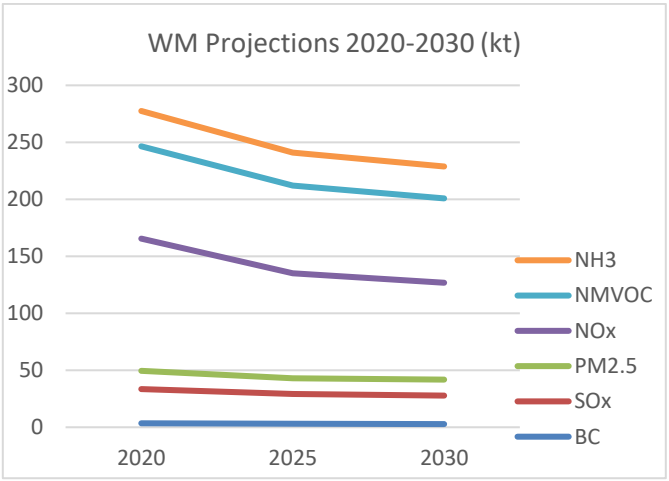
For agriculture and transport sectors, emission scenarios are available up to 2050. For IPPU, fugitive emissions and waste sector, expert estimates were made also for the years 2040 and 2050 for the 2020 submission, however, these will be further developed in the coming years.

The current projected emission values are presented in Table 8.3.

[1] Huttunen R. (Ed.) 2017. Government Report on the National Energy and Climate Strategy for 2030. Publications of the Ministry of Economic Affairs and Employment, 2017-02-08.
[2] Ministry of the Environment. 2019. National Air Pollution Control Programme 2030. Publications of the Ministry of Environment 2019:7

Table 8.3. Projected national total emissions for 2015, 2020 and 2030 as reported on 15 March 2021

Pollutant	Unit	WM projections		
		2020	2025	2030
SO_x	kt	30	26	25
NO_x	kt	116	92	85
NMVOC	kt	81	77	74
NH_3(without adjustments)	kt	31	29	28
$PM_{2.5}$	kt	16	14	14
BC	kt	3.5	3.1	2.8



Projections for Energy

In the WM scenario, The FRES model (Karvosenoja 2008[3]) was used to calculate emission projections for combustion plants, industrial processes and residential combustion. It covers the emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x), ammonia (NH_3), non-methane volatile organic compounds (NMVOCs) and primary particulate matter (TSP, PM_{10}, $PM_{2.5}$, PM_1 and $PM_{0.1}$). Primary PM includes the fractionation to main chemical species (black and organic carbon. sulfate. main heavy metals and mineral matter).

FRES is a scenario model, where a new reference year is added every five years (2010, 2015 etc.) and target years are selected according to specific needs and available activity data. The intermediate years are presented linearly. Since 2015 was the most recent historic year when making the National Air Pollution Control Programme 2030, it has been used as the reference year (a new reference year 2020 will be implemented to the model in 2021). The projected emissions in the WM scenario are thus estimated as a relative change to the reported 2015 emissions (IIR), according to FRES calculations.

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 produsedin the national Energy and Climate Strategy are used as input to the model (Annex IV B-WM. The reference year in cells B10-B40 is 2014, since that was the reference year in the Strategy). 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). The statutes affecting the emission limits of combustion plants are:

[3] Karvosenoja N. 2008 Emission scenario model for regional air pollution. Morographs Boreal Environ. Res. 32. 2008.

- 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 age of the plant (available at request).

For process industry plants a similar emission factor table can't be made on the basis of IE Directive. For the reference year, we have used reported emissions (average of preceding years) of the industrial facilities as found in the national YLVA database. The projections are a combination of assumed activity changes and developments in cleaner technology. A specific inquiry of the future development prospects was conducted to main industrial sectors as part of the National Air Pollution Control Programme 2030.

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)[4]. 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, and this trend is expected to continue up to 2030, although improvements in energy efficiency are expected to reduce the overall heating demand. 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 a major polluter 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 by 2030, and thus decrease the emissions.

For ammonia, the projections are expert estimates based on knowledge of fuel use at plants.

For NFRs 1A1 and 1A2 the projections have been divided with the share from the inventory as the boilers are allocated differently in FRES model and in the inventory, while their sum equals that in FRES. In some cases the projection may be higher than the emission in the latest historical year. These cases can occur, as the years are different regarding the heating and energy need and the use of fuels. Annual fluctuations cannot be predicted into the projections, but they are based on general expectations in the sector.

[4] 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

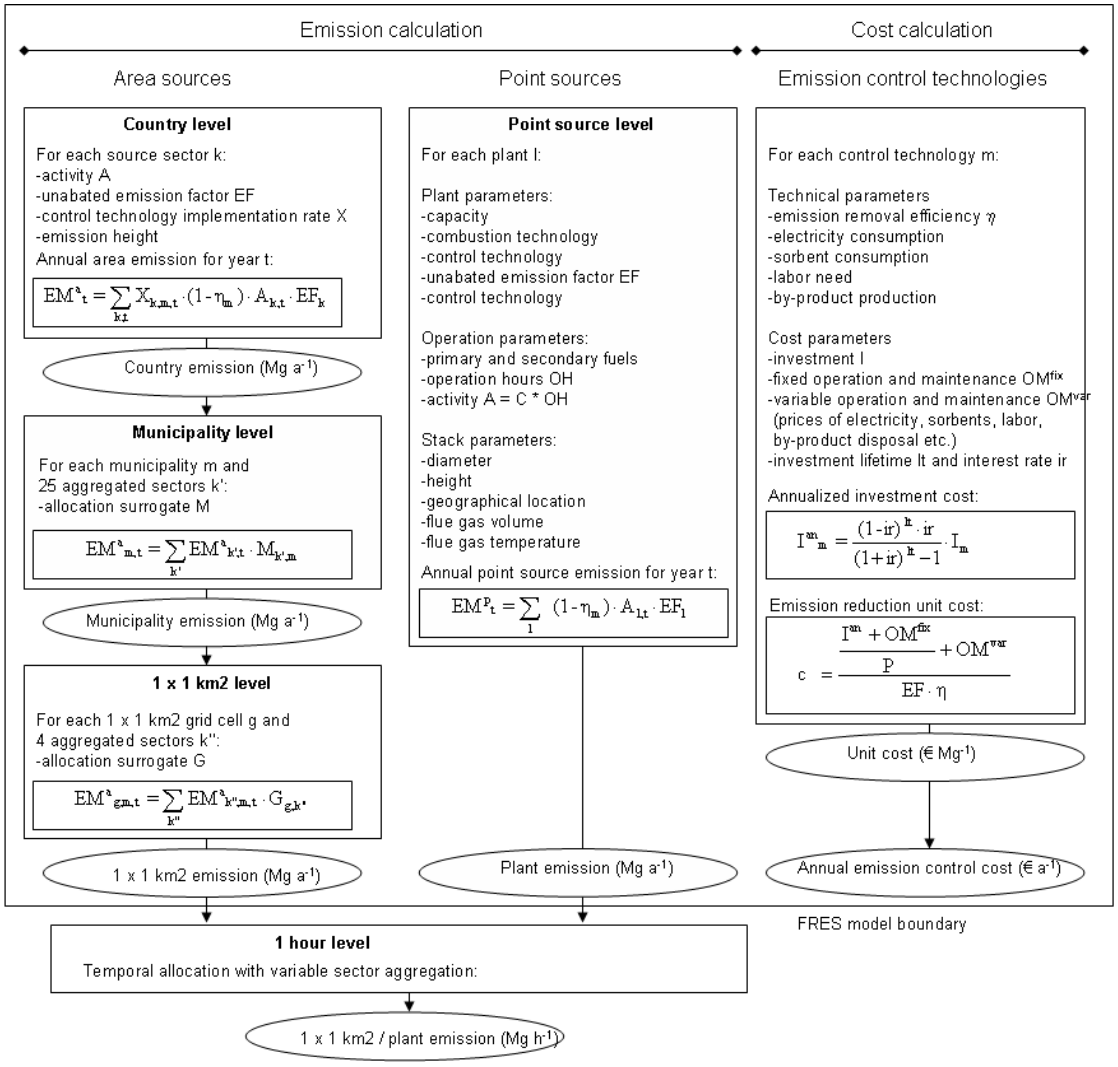


Figure 9.1. Structure of the FRES model.

Projections for Transport

Emissions calculations and projections for transport and working machines are produced using VTT's LIPASTO system, which has a time series of 1980-2050. Calculation results are available on the LIPASTO website http://lipasto.vtt.fi/en/inventaarioe.htm

Ammonia

In transport, most of 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 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 projections.

Road transport

In road transport, the projections are based on the authorities' (The Finnish Transport Infrastructure Agency) forecast of vehicle kilometrage for 2030 and 2050. In the LIISA model, sales forecasts for vehicles are adjusted so that the national kilometrage forecast is achieved. The fleet is thus linked to the projected kilometrage development. Sales forecasts consider both new sales and used vehicle imports (in Finland a significant amount). Scrappage rate is based on an estimate based on actual changes in the fleet. The model considers the penetration of the Euro classes and the fuel efficiency development of the vehicles.

The modelled fleet is divided into 40 different sub-types: 5 main types, passenger cars (with and without catalytic converter), vans, buses, trucks without a trailer and trucks with a trailer. These, in turn, are divided into seven propulsion groups: gasoline, diesel, E85, ED95, gas, electricity and hydrogen. Each of these has its own forecasts. In addition, fuels consider the proportions of different fuel components (fossil, renewables).

Baseline forecasts (expert estimate, VTT) that new passenger car sales will be on average 4.7% annually in 2016-2020, 5.1% on average in 2021-2030 and 5.3% on average in 2031-2050. Corresponding figures for vans are: 4.8% 5.0% 4.8% and for trucks: 4.0% 3.9% 3.7%. Finland's specialty is very heavy trucks (gigatrucks), which reduces the number of trucks with trailer. The increase in the number and kilometrage of motorcycles and mopeds is expected to stabilise in the coming years.

Railways

The forecast for rail transport is based on the expert estimation of the development of diesel train transport volume. The proportion of diesel trains has decreased significantly in recent years and they are mainly used in non-electrified, smaller rail sections. The diesel train transport has stabilised, and no major changes 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 focus on experts' (The Finnish Transport Infrastructure Agency's) estimation of the development of port calls. 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.

Working machines

For working machines, the forecasts are based on expert judgment on the evolution of fleet (50 different machine types) and the penetration of emission standars (Stage levels). 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 and work and emission restrictions and increasing electrification of machines will reduce emissions in projections.

Projections for IPPU and Waste

Projections earlier based on FRES model were updated as expert estimates to the 2020 submission, based on knowledge of the development of the sector in Finland and the general expectations and forecasts (population forecast, GDP) for future years. Further work will be carried out in for the next submissions to find suitable surrogates for the development of the emissions in the different sectors.

Projections for Agriculture

Projections for agriculture are based the national Agriculture sector calculation model available up to 2050. The animal numbers, development of nitrogen excretion and mineral fertilizers and land use areas are forecasts by LUKE 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, 2021[5]).

There are some differences in projected emissions for agriculture compared to the ones presented in the pervious reporting. The reasons for these differences are:

- Changes in animal number and inorganic fertilizer use estimations: for cattle, sheep and goats, animal statistics for 2020 were already available when the projections were calculated and they were used.The numbers of goats and suckler cows are higher compared to the estimated ones, whereas the numbers of all other cattle and sheep are lower. Additionally, the animal number estimations for the other animals groups for 2020 and for all animal groups for the years 2025, 2030, 2040 and 2050 were updated based on the data provided by the Natural Resources Institute Finland (Luke; Lehtonen 2021). Furthermore, the annual inorganic nitrogen fertilizer consumption estimations were updated by Lehtonen (2021). Animal numbers and the use of mineral nitrogen fertilizers are the same as are used in the latest national ghg-emission WEM-scenarios for agriculture.
- Changes in estimated nitrogen excretion rates: nitrogen excretion rates of bulls, dairy cows, heifers, suckler cows and weaned pigs were re-estimated based on the recent development. For all above mentioned animal groups the N excretion rate was estimated to be higher in the projected years than was estimated earlier.
- Changes in manure management:
    - the share of injected slurry was lowered (70% -> 65%) for 2020, based on the most recent knowledge,
    - shares of slurry and urine incorporation methods (for slurry and urine spread on stubble) were corrected for 2025, 2040 and 2050,
    - for pig slurry it was estimated that cooling of slurry channels and increased slurry removal frequency will be more common in the future, due to the implementation of IRPP BAT conclusions in pig production.
- A ban on field burning of agricultural residues from the beginning of 2021, resulting zero emissions for the year 2025 and beyond.

[5] Lehtonen, H. 2021. Personal communication 12.2.2021. Natural Resources Institute Finland (Luke)

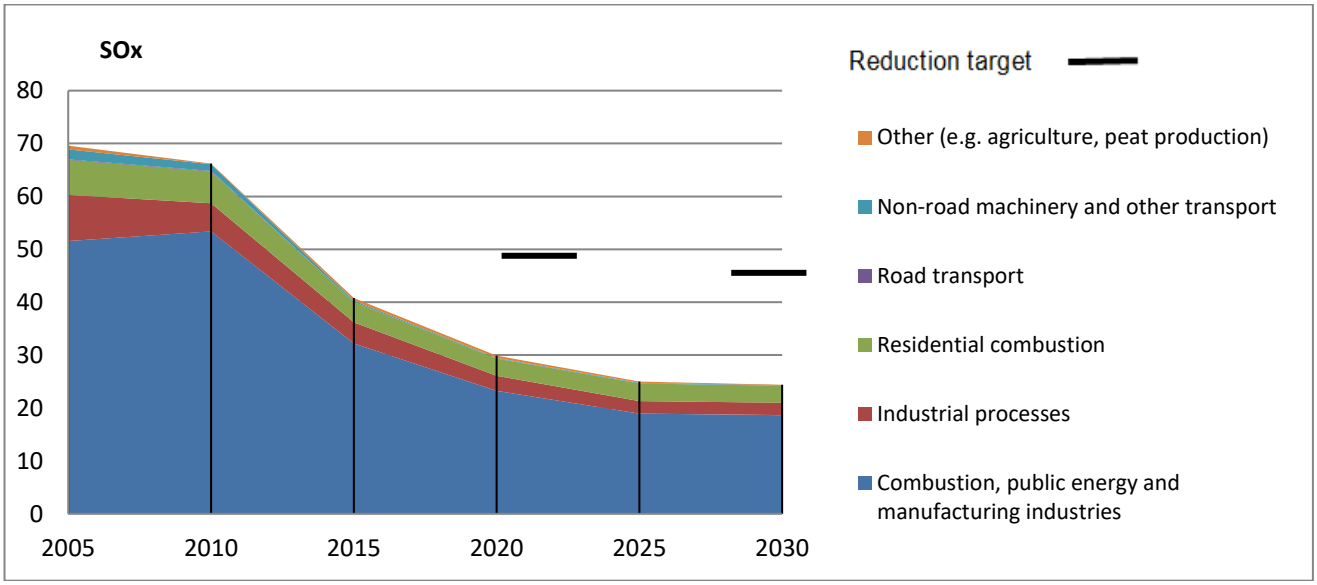
9.2 Emission reductions based on existing measures and measures that have been adopted in the legislation

This chapter presents the historic development of emissions from 2005 as well as the projections of the WM scenario up to 2030. Projections are calculated using the models described earlier in this document. The activity pathways are based on the latest Energy and Climate Strategy (prepared in 2016) which is why the estimates for 2020 are not fully in line with reported emissions of 2019. A new Strategy, complemented with a new WM scenario should be ready by the end of 2021.

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 are projected to decrease sharply due to decreasing combustion of coal, peat and HFO and the limitations in the IED. From 2020 to 2030 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.



9.2. Development of SO_x emissions by sectors according to the baseline

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 EURO6 standards from 2015 onwards,

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 2020-2030, 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.

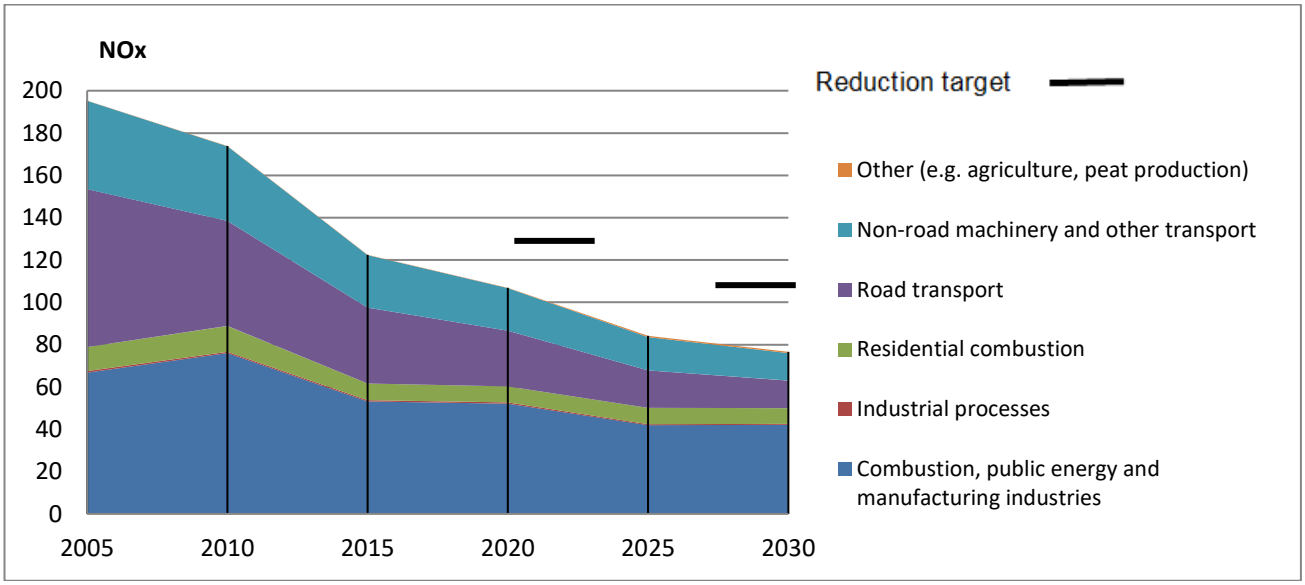


Figure 9.3. Development of NO_x emissions by sectors according to the baseline

Particles

Important particulate matter sources are residential wood combustion, traffic, industry and peat production. In the national Energy and Climate strategy it is assumed that the combustion volume will increase slightly from 2015 to 2030, but particulate emissions will decrease due to the renewal of the combustion equipment stock.

In transport, exhaust gas emissions decrease due to the increasing number of EURO6 standard vehicles. Although direct particulate emissions in exhaust gases almost cease by 2030, 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 producton volumes which depend on weather (for instance between 2005–2012 from 2.7 to 5.5 kt. In the scenarios these emissions are projected to follow the projected use of peat each target year. During the last two years, peat production volumes in Finland have decreased significantly. This development is expected to continue and will probably be reflected in the renewal of the Energy and Climate Strategy.

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.

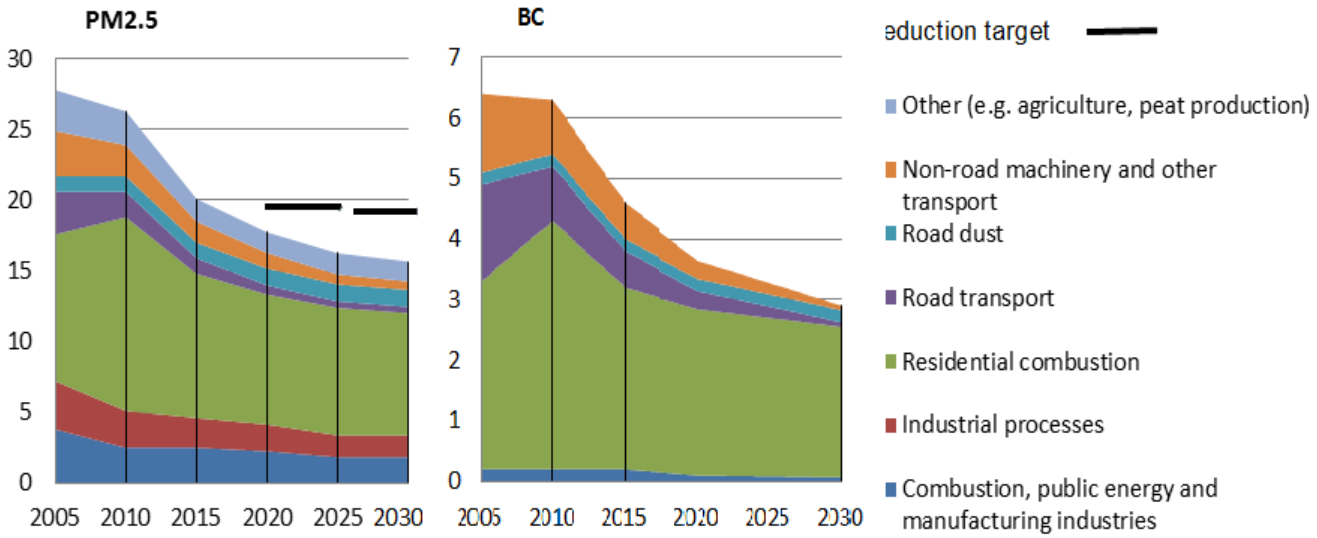


Figure 9.4. Development of small particle and black carbon emissions by sectors according to the baseline

Ammonia

The main ammonia source is agriculture where manure management drives the emissions. Small emissions are generated in transport, waste handling and industrial processes. The emission ceiling of 31 kt under the NECD and the Gothenburg Protocol is based in calculations in the RAINS model (Regional Air Pollution INformation and Simulation). In the revision of the NECD the target was to limit emissions to the level of 2010. For Finland this means a reduction of 20% in ammonia emissions from 2005, while the optimization in the GAINS would have been 15% for 2030. Both targets require the use of additional measures because the emission reduction according to the base line would be only 10% by 2030.

In the base line approach, reductions in agricultural ammonia emissions follow the decrease in animal numbers, impacts from liquid manure systems to become more common in line with the growth of the unit size, as well as the implementation of new regulations for storage and spreading of sludge according to the updated nitrates directive (Government Decree VNa 1250/2014). On the other hand, increased production volumes raise the level of nitrogen excretion, which partly cancel the reduction by the decrease in animal numbers.

Although ammonia emissions from transport already have decreased due to improvements in technology and will further decrease, the emissions in the model are estimated at the level in 2012.

Emissions from energy production were not included in the inventory the time the FRES model was updated. These emissions will be included in the model when the inventory results are finalized.

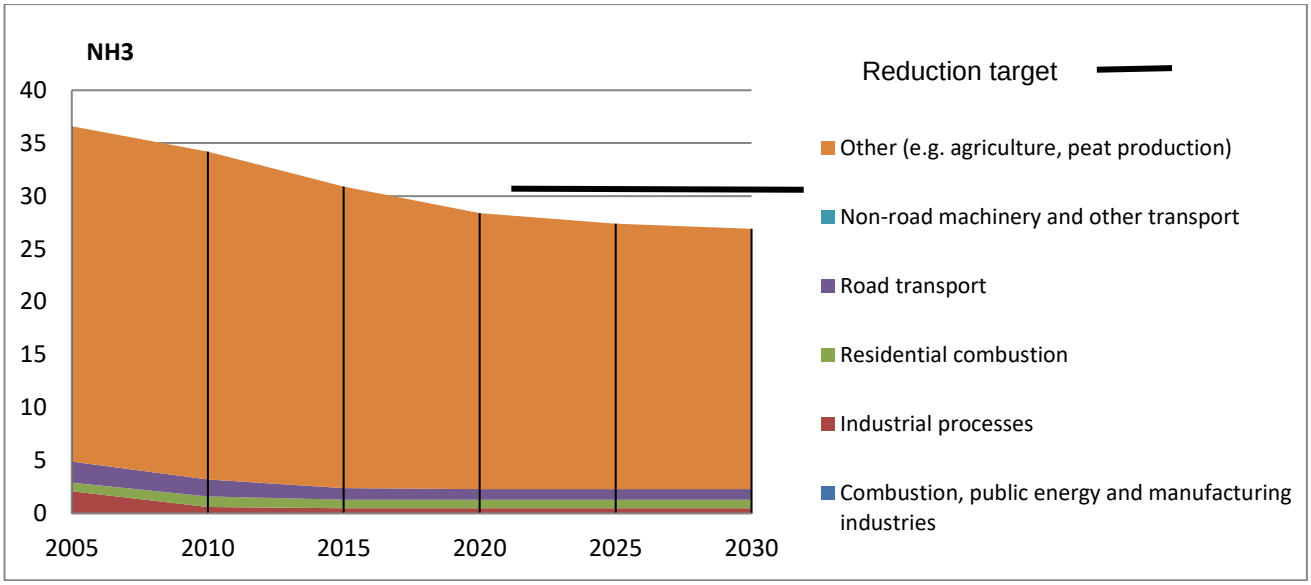


Figure 9.5. Development of ammonia emissions by sectors according to the baseline

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 EURO5/6 standard vehicles. Half of exhaust gas emissions originate in gasoline vehicles and half from fuel refining, storage and distribution.

LIPASTO and FRES models only covers NMVOC emission from transport and small combustion. Projections for emissions from industry and product use are based on national emission inventory values in 2016.
These emissions 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. For oil refineries the emission factor is estimated to decrease by 2030, however, the expected growth of the activity volume keeps the projected emission levels constant.

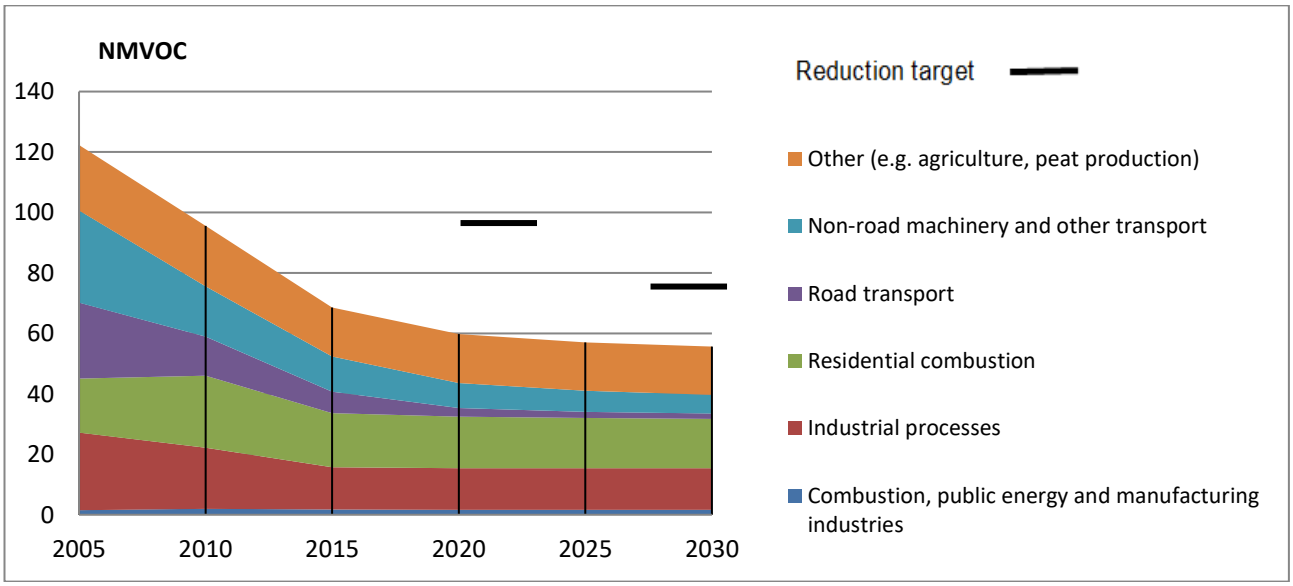


Figure 9.6. Development of NMVOC emissions by sectors according to the baseline

9.3 NECD 2019 review of projections

In the table below actions made in response to the 2019 NECD review of projections are presented on the right hand side column.

NECD Review on Projections 2019 - Recommendations (Final Review Report)

Table 4-1 Recommendations from the 2019 projections review [6]

Observation	Year	Scenario	KC	Recommendation	Response
FI-1A1-20190001	2020	With Measures (WM)	No	For category 1A1 Energy industries, $PM_{2.5}$ for year 2020, the TRT noted a large increase from 2017 to 2020. In response to a question raised during the review, Finland explained the emission projections in the National Air Pollution Control Programme did not separate emissions from 1A1 and 1A2, only their sum. In the Annex IV this sum was divided 50/50 between those two. Finland corrected this and provided updated data to the TRT. **The TRT notes that this issue does not relate to an underestimate and recommends that Finland in future projection submissions use sectoral emissions distribution that is consistent with the historical inventory and the actual distribution between 1A1 and 1A2.**	The split has been made to the 2020 submission between 1A1 and 1A2 according to the respective ratio in the inventory.
FI-1A3a,c,d,e2019-0001	2020, 2025, 2030	With Measures (WM)	No	For 1A3a,c,d,e Off-road transport, BC, NMVOC, NO_X and $PM_{2.5}$ for 2020, the TRT noted very big increases in the emissions from 2017 to 2020. In response to a question raised during the review, Finland explained that the emission differences are because the projections have not been updated recently. Updated projections are currently part of the updated LIPASTO model as presented in the revised Annex IV attached by Finland to this observation. **The TRT notes that this issue relates to an overestimate and recommends that revised emissions for off road transport from the updated LIPASTO system will be included in the next emission reporting.**	LIPASTO scenarios have been included in the 2020 submission.

[6] Where multiple pollutants are included, the issue is flagged as referring to a key category if relevant for one or more of the pollutants.

Observation	Year	Scenario	KC	Recommendation	Response
FI-1A3a,c,d,e2019-0002	2020, 2025, 2030	With Measures (WM)	No	For 1A3a,c,d,e Off-road transport, NH_3 for all projection years, the TRT noted that no NH_3 emissions are reported in the projections. NH_3 emissions are reported for 1A3a,c,d,e Off-road transport in the historical years for Finland. In response to a question raised during the review, Finland explained that emission projections of NH_3 were missing because the old LIPASTO model did not include NH_3. Emissions of NH_3 are now added to the upgraded LIPASTO system and included in the revised data provided by Finland during the review. **The TRT notes that this issue relates to an underestimate and recommends that NH_3 emissions for off road transport from the upgraded LIPASTO system will be included in the next submission.**	NH3 emissions are included in the 2020 submission.
FI-1A3b-20190001	2020, 2025, 2030	With Measures (WM)	No	For 1A3b Road transport, SO_2 for 2020, 2025, 2030, the TRT noted that no SO_2 emissions are reported in the projections. SO_2 emissions are reported for 1A3b in the historical years for Finland. In response to a question raised during the review, Finland explained that the SO_2 emissions are excluded because they were rounded out to 0.0 kt. The decimals will be included in the next submission as provided to the TRT during the review. **The TRT notes that this issue relates to an underestimate and recommends that the decimals for the SO_2 emission results are included in the next emission reporting.**	The emissions are corrected to the 2020 submission.
FI-1A3bi-20190001 FI-1A3biii2019-0001	2020, 2025, 2030	With Measures (WM)	No	For 1A3bi Passenger cars and 1A3biii Heavy Duty Vehicles, SO_2 for 2020, 2025, 2030, the TRT noted that no SO_2 emissions are reported in the projections. SO_2 emissions are reported for these sources in the historical years for Finland. In response to a question raised during the review, Finland explained that the SO_2 emissions are excluded because they were rounded out to 0.0 kt. The decimals will be included in the next submission as presented in the revised projections provided to the TRT. The **TRT notes that this issue relates to an underestimate and recommends that the decimals for the SO_2 emission results are included in the next emission reporting.**	The emissions are corrected to the 2020 submission.

FI-1A3bii-2019-0001	2020, 2025, 2030	With Measures (WM)	No	For 1A3bii Light duty vehicles, all pollutants for the projections years, the TRT noted that the emissions of BC, NMVOC, NOX and PM2.5 decrease notably from 2017 to 2020 and that no NH3 and SO2 emissions are reported in the projections. There is no explanation provided in the IIR. In response to a question raised during the review, an explanation was not given of the level of BC, NMVOC, NOX and PM2.5 emission decreases for light duty vehicles in the projections from 2017 to 2020**. The TRT notes that this issue relates to a potential underestimate and recommends that an explanation of the emission trends from 2017 to projection years are given in the next submissions, e.g. accompanied with data for the developments in total mileage and aggregated emission factors for the emission components.** In response to a question raised during the review regarding SO2 and NH3, Finland explained that the SO2 emissions are excluded because they were rounded out to 0.0 kt. Finland further explained that NH3 emissions were not included in the projections because NH3 has not earlier been estimated in the LIPASTO model. Both SO2 and NH3 emissions will be included in the next submission as provided to the TRT during the review. **The TRT notes that this issue relates to an underestimate and recommends that the decimals for the SO2 emission results are included in the next emission reporting as well as totals for NH3.**	The error is corrected as LIPASTO scenarios have been included in the 2020 submission.
FI-1A3biv-2019-0001	2020, 2025, 2030	With Measures (WM)	No	For 1A3biv Mopeds and Motorcycles, NMVOC, $PM_{2.5}$, SO_2 and NH_3 for all projection years, the TRT noted that the emissions of NMVOC and $PM_{2.5}$ decrease notably from 2017 to 2020. No NH_3 and SO_2 emissions are reported in the projections. In response to a question raised during the review, an explanation was not given of the level of NMVOC and $PM_{2.5}$ emission decreases for mopeds and motorcycles in the projections from 2017 to 2020. In response to a question raised during the review regarding SO_2 and NH_3, Finland explained that the SO_2 emissions are excluded because they were rounded out to 0.0 kt. Finland further explained that NH_3 emissions were not included in the projections because NH_3 has not earlier been estimated in the LIPASTO model. Both SO_2 and NH_3 emissions will be included in the next submission as provided to the TRT during the review. **The TRT notes that this issue relates to an underestimate and recommends that the decimals for the SO_2 emission results are included in the next emission reporting as well as totals for NH_3. The TRT also recommends that an explanation of the emission trends from 2017 to projection years are given in the next submission, e.g. accompanied with data for the developments in total mileage and aggregated emission factors for the emission components.**	The emissions have been corrected and NH3 emissions included to the 2020 submission.

FI-1A3bvii-2019-0001	2020, 2030 2025,	With Measures (WM)	No	For 1A3bvii Automobile road abrasion, $PM_{2.5}$ for 2020, 2025, 2030, the TRT noted that the emissions of $PM_{2.5}$ decrease by around 15 % from 2017 to 2020. $PM_{2.5}$ emissions are kept constant in the projection years. In response to a question raised during the review, Finland explained that no projections have earlier been made for this category (automobile road abrasion). The emissions will be revised as part of the upgraded LIPASTO system and will be included in the next reporting round. **The TRT notes that this issue relates to an underestimate and recommends that revised emissions from the upgraded LIPASTO system will be included in the next emission reporting.**	It was not possible to include the emissions to the 2020 submission due to need to improve the inventory methodology and changes in the organization of the inventory (all transport sector calculations were moved to VTT/Tremo). To the 2021 submission these have been included.
FI-1A4-20190001	2020	With Measures (WM)	No	For category 1A4 Other sectors, NO_X for 2020, the TRT noted a large decrease from 2017 to 2020. In response to a question raised during the review, Finland explained that, in the projections, the emissions were not distributed using the same NFR codes as in Annex I. Finland corrected this and provided updated data to the TRT. The TRT observe that the national total emissions differ between the projection submission and the revised estimates provided for all NO_X, NMVOC, SO_2, NH_3, $PM_{2.5}$ and BC. Finland informed the TRT that emissions have been corrected for NMVOC, NH_3, $PM_{2.5}$ and SO_2 for 1B (refer to observation FI-1B-2019-0003 and FI-1B-2019-0002), but these emission changes do not correspond to the changes of neither the national total emissions nor the emissions from the Energy sector. **The TRT notes that this issue relates to an over and/or underestimate and recommends that Finland in future projection submissions use sectoral emissions distribution that is consistent with the historical inventory, and to extend the documentation of the projection in the IIR to improve transparency.**	The emissions have been corrected to the 2020 submission.

FI-1A5-2019-0001 FI-1A5-2019-0002	2025, 2030	With Measures (WM)	No	For category 1A5 Other, NO_X for years 2025 and 2030, the TRT noted that no emissions were reported in the WM projection, but emissions are reported for 2020. For $PM_{2.5}$ projections in 2020 there is a large decrease from 2017 to 2020. In response to a question raised during the review, Finland explained that, in the projections, the emissions were not distributed using the same NFR codes as in Annex I. Finland corrected this and provided updated data to the TRT. The TRT observe that the national total emissions differ between the projection submission and the revised estimates provided for all NO_X, NMVOC, SO_2, NH_3, $PM_{2.5}$ and BC. Finland informed the TRT that emissions have been corrected for NMVOC, NH_3, $PM_{2.5}$ and SO_2 for 1B (refer to observation FI-1B-2019-0003 and FI-1B-2019-0002), but these emission changes does not correspond to the changes of neither the national total emissions nor the emissions from the Energy sector. **The TRT notes that this issue relates to an over and/or underestimate and recommends that Finland in future projection submissions use sectoral emissions distribution that is consistent with the historical inventory, and to extend the documentation of the projection in the IIR to improve transparency.**	The emissions have been corrected to the 2020 submission
FI-1B-20190002	2020, 2025, 2030	With Measures (WM)	No	For category 1B Fugitive emissions, NH_3, $PM_{2.5}$ and SO_2, for all projection years, the TRT noted that no emissions were reported in the WM projection, which would be expected, because emissions are reported in the historical inventory. In response to a question raised during the review, Finland explained that, "in the projections, NFR 1B was not included in the NMVOC projections and thus the projections for NFR 1B have now been corrected as frozen to the 2017 emission levels". The TRT observe that emissions of NH3, PM2.5 and SO2 have been included in the revised estimates provided during the review, and expect that the answer from Finland refer to these pollutants and not NMVOC as written in the answer. **The TRT notes that this issue relates to an underestimate and recommends that Finland include emissions from 1B in future projection submissions and provide a methodological description in the IIR.**	The emissions have been corrected to the 2020 submission
FI-1B-20190003	2020	With Measures (WM)	No	For category 1B Fugitive emissions, NMVOC for 2020, the TRT noted a large increase from 2017 to 2020. In response to a question raised during the review, Finland explained that, the NMVOC emission is an old expert estimate and is likely overestimated. Finland corrected this and provided updated data to the TRT. The updated estimate is an expert estimate based on recent years' data. **The TRT notes that this issue relates to an overestimate and recommends that Finland use updated emissions estimates in future projection submissions.**	The emissions have been corrected to the 2020 submission

FI-2A,B,C,H,I,J,K,L-2019-0002	2020, 2025, 2030	With Measures (WM)	No	For category 2A,B,C,H,I,J,K,L Industrial processes, NMVOC, for 2020,2025 and 2030, the TRT noted that the projected emission level is almost double (13.70 kt) compared to any of the historically reported emissions (reference year, 2017, is 7.13 kt). In response to a question raised during the review, Finland corrected the projected emissions for the sector by excluding (wrongly included) NFR categories 2D and 2G. **The TRT recommends that Finland corrects the error in future submissions and ensures that the projections are consistent with the inventory to the extent possible.**	The emissions have been corrected to the 2020 submission
FI-2D, 2G-2019-0001	2025, 2030	With Measures (WM)	No	For 2D, 2G Solvent and other product use, SO_2 for years 2025 and 2030, the TRT noted that Finland reported IE, while a projected emission of 0.05 kt are reported for 2020 and for the historical years a reduction form 0.05 kt in 2010 to 0.009 kt in the reference year 2017 is reported. In response to a question raised during the review, Finland explained that the SO_2 projection for 2020 was based on an old estimate that was not updated. Finland further explained that the estimates have been revised and held constant at the 2017 level in the porjected emissions as provided to the TRT during the review. **The TRT recommends that Finland in future submissions ensure consistency between the projections and the inventory to the extent possible and describe any differences in the IIR.**	The emissions have been corrected to the 2020 submission
FI-2D, 2G-2019-0004	2020, 2025, 2030	With Measures (WM)	No	For 2D, 2G Solvent and Other Product Use, NO_X for years 2020, 2025, 2030, the TRT noted that emissions are reported as NA, while historical emissions are reported (0,006 kt for the reference year 2017). In response to a question raised during the review, Finland explained that the emissions in the inventory are allocated through a boiler/process specific inventory and the projections are made on a more aggregated level, thus the emissions are included under the energy sector NFRs 1A1/1A2. **The TRT recommends that Finland explains such differences in allocation according to differences in aggregation level in its next submission.**	Estimates to the projections have been included for these sources to the 2020 submission
FI-2D, 2G-2019-0005	2020, 2025, 2030	With Measures (WM)	No	For category 2D, 2G Solvent and other product use, $PM_{2.5}$ for years 2020, 2025 and 2030, the TRT noted that zero emissions have been reported while historical $PM_{2.5}$ emissions are reported (0.24 kt PM2,5 for the reference year 2017). In response to a question raised during the review, Finland explained that the $PM_{2.5}$ emissions from NFRs 2D and 2G were not included in the projections but have now been estimated based on an expert view of the last 10 years emission levels and provided to the TRT during the review. **The TRT recommends that Finland reports correctly in the next submission and explain any differences in scope between the projections and the inventory in the projections chapter in the IIR.**	Estimates to the projections have been included for these sources to the 2020 submission

FI-5-20190001	2020, 2025, 2040	With Measures (WM)	No	For category 5 Waste, $PM_{2.5}$ for years 2020,2025 and 2030, the TRT noted that projected emissions are reported as as factor 50 below the reference year (0,11 kt $PM_{2.5}$ in 2017 and 0,002 kt PM2,5 in 2020,2025 and 2030). In response to a question raised during the review, Finland explained that the $PM_{2.5}$ projection was not updated to reflect inclusion of new sources in the latest inventory. The TRT acknowledges that the corrected $PM_{2.5}$ emissions have been estimated and provided by Finland during the review. **The TRT notes that this issue relates to an underestimate and recommends that Finland in the next reporting ensures consistency between the inventory and the projection.**	Estimates in the projections have been included for these sources to the 2020 submission
FI-5-20190003	2020, 2025, 2030	With Measures (WM)	No	For category 5 Waste and SO_2, the TRT noted that Finland reported emissions of 0.02 kt in each of the years 2020,2025 and 2030, while historical emissions are reported as NA, NO. Finland explains that projections have not recently been updated to reflect the updates in the inventory, where SO_2 emissions are no more included for the waste sector. In the earlier inventories, emissions were reported due to allocation/division of point source data. **The TRT recommends that that Finland explains clearly such changes in allocation in its next submission of projected emissions and ensures that projections are consistent with the emission inventory to the extent possible.**	The projections have been aligned with the inventory reporting to the 2020 submission
FI-NATIONAL TOTAL-20190001	2020, 2030 2025,	With Measures (WM)	NA	The TRT noted that the reference year is not given in the submission of emission projections. The TRT noted that as outlined in Annex IV Part 2 (3) of EU Directive 2016/2284, 'National emission projections shall be consistent with the national annual emission inventory for the year x-3'. In response to a question raised during the review, Finland explained that the projections reported in 2019 are not yet fully in line with the principles presented in the new "General Guidance on Estimating and Reporting Air Pollutant Emission Projections" (which currently still is under preparation) but that they are in the process of updating the projections to align with the guidelines and to harmonise the principles throughout the sectors. The projections reported for the energy, industry and domestic sectors are according to the National Air Pollution Control Programme 2030 and are estimated as a relative change to the reported emissions in 2015. For IPPU and waste sector projections assessment against the recent inventories is also made. Transport sector emissions are based on mileage forecasts that are updated on demand by the Finnish Transport Infrastructure Agency, legislation requirements for fuel bio shares and using transport experts' knowledge. **The TRT recommends that Finland report on the reference year of the projections in the NFR and IIR**.	The reference year has been included in the NFR template.The projections in the FRES model were not recalculated to the 2021 submission, therefore this information will be included in the IIR after the FRES model projections are updated during the work in 2021 and will be reported in the 2022 submission.

FI-NATIONAL TOTAL-20190004	2020, 2030 2025,	With Measures (WM)	NA	Related to the overall projection information, the TRT noted that limited information is available in the IIR on the methodologies, assumptions and data sources. In response to a question raised during the review, Finland explained the information provided in the IIR and the NAPCP and provided information on a sensitivity analysis carried out for the fuel combustion sector. Furthermore, Finland indicated that the information included in the IIR will be expanded in future reporting. **The TRT notes that this issue does not relate to an over or underestimate and recommends that Finland includes more information in the IIR on the methodologies, assumptions and data sources used in the projection**.	The requested information will be included when the FRES projections are updated. This is underway in 2021 and will be updated to the 2022 submission.

Encouragements

Table 4-2 Encouragements from the 2019 projections review

Scenario	KC			Encouragement	Response
FI-2A,B,C,H,I,J,K,L-2019-0001	2025, 2030, 2040	With Measures (WM)	No	For 2A,B,C,H,I,J,K,L Industrial processes, Black Carbon for years 2020, 2025, 2030, the TRT noted that zero emissions are reported, while historical emissions are reported. Furthermore, in methodology sections of different sub-categories in the IIR, Black Carbon is estimated as a percentage of PM_{10} and $PM_{2.5}$ respectively. The NECD refers to Black Carbon projections reporting "if available". In response to a question raised during the review, Finland explained that black carbon emissions have not been projected for industrial processes. During the review, Finland provided a BC projection that included emissions as the 2017 value for all future years. **The TRT encourages Finland to provide projections of black carbon in future submissions for these sources if the data are available.**	Projections for these setors were estimated and included in the 2020 submission.
FI-5-20190004	2020, 2025, 2030	With Measures (WM)	No	For category 5 Waste, NO_X for years 2020, 2025, 2030, the TRT noted that historical emissions are reported as "NA,NO,IE" while projections are reported as 0. NO_X emissions are expected to occur from incineration in Finland. In response to a question raised during the review, Finland explained that all waste is combusted with energy recovery and therefore included in the energy sector. **The TRT is satisfied with the explanation provided by Finland. The TRT encourages Finland to report correct notation keys in the next submission.**	The notation key was corrected.

10 GRIDDED EMISSIONS AND LPS

10.1 Gridded data

Changes in chapter	
March 2021	TF, JM, KS
Change in methodology	New grid 2015

10.1.1 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^{o} and 70^{o}, where one degree corresponds to approximately to a 7 km *7 km area.

The presentation of gridded data in the 1^{o} * 1^{o} 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 1.07 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.

10.1.2 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.

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

	Public power and industries*		**Other stationary combustion****		**Traffic and agriculture*****		**Products and waste******	
Pollutant	**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 – 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

10.1.3 Data sources for disaggregation of non-point emission sources

Changes in chapter	
March 2021	JM

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

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

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

Table 10.4 – Listing 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 – 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. The following table presents the passenger numbers for selected cities.

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

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

ObjectID	Municipality	Passengers
133	Lappeenranta	98300
119	Kuusamo	74583
71	Kajaani	74558
111	Kruunupyy	68991
88	Kemi	57681
65	Jyväskylä	50570
207	Pori	26229
11	Enontekiö	20169
246	Savonlinna	12215
59	Joroinen	6759
109	Kouvola	500

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

Building and Dwelling Register

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

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

For models based on all buildings several models were constructed based on count, floor area and the overall volume to be used for different purposes. For example for categories of product use the it can be assumed that the activity rate is more connected to the count of households rather than volumetric parametres. For emissions resulting from heating, the overall volume gives a better estimate as the amount of energy required correlates with building volume.

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:

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

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)

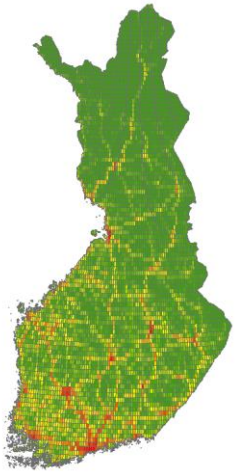


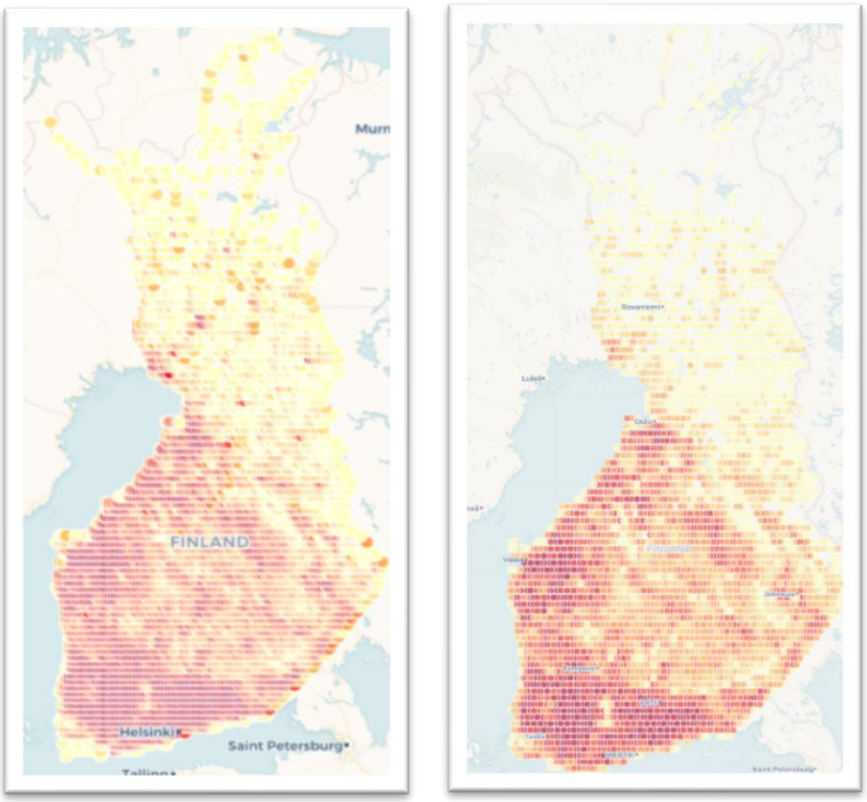
Figure 10.3 - $PM_{2.5}$ emissions of 2013 in the national street system

Figure 10.3 illustrates the resulting map after applying the methodology.

10.1.4 Other

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, iiiiinorganic 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).

10.1.4 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 6.

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

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

10.1.5 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*)

Source-specific planned improvements

- Updating VAHTI-based coordinates to more accurate YLVA coordinates, scheduled spring 2021.
- Unifying facility locations with LPS, scheduled spring 2021.

10.2 LPS data, sources, geographical coordinates and emissions

Changes in chapter	
March 2021	TF, KS
Change in method	none

According to the 2014 CLRTAP Reporting Guidelines (ECE/EB.AIR/125), 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 1of the reporting guidelines. In the Finnish inventory, LPS facilities are identified as facilities that have at least one E-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 E-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 E-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 E-PRTR reporting comprise only E-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 E-PRTR installations is detected from the YLVA system (e.g. emissions reported in a wrong unit). When detected, these are corrected to the inventory data extracted from YLVA. The facility supervisors from the Centres for Economic Development, Transport and the Environment are informed of these data. If these data are not corrected to the E-PRTR reporting, this causes also differences between inventory/LPS data and E-PRTR data.

E-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.

Following the recommendations in the 2020 NECD review, the 2019 LPS emission data set to be reported by 1st May 2021 will include a description of the differences between 2019 LPS emission data and 2019 emission data reported under the E-PRTR. In addition, the incorrect coordinates detected in the 2020 NECD review will be corrected to the 2019 LPS data.

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 E-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

Source-specific planned improvements

- Updating VAHTI-based coordinates to more accurate YLVA coordinates, scheduled spring 2021.
- Unifying facility locations with gridded data, scheduled spring 2021.

11 ADJUSTMENTS

11.1 Adjustment Application 2015

Finland applied for adjustments for the ammonia emissions inventories in Manure Management (NFR 3B). Small Scale Combustion (NFR 1A4) and Road transport. Railways. Navigation (NFRs 1A3b. 1A3c. 1A3d). The application was due to the fact that the 2010 emission ceiling for ammonia emissions set for Finland in the 1999 Gothenburg Protocol is 31 kilotonnes and according to the best science inventories. ammonia emissions in Finland were 38.2 kt in 2010. 37.4 kt in 2011. 37.3 kt in 2012 and 37.1 kt in 2013. The application of adjustments is presented as Annex 3 to Finnish IIR 2015.

The Adjustments Expert Review Team in 2015 accepted two of the applied adjustments the sums of which are presented in Table ES2 below. The Adjustments ERT Review Report is in Appendix 2 of this IIR.

Table ES2 Aggregated Sum of Recommended Inventory Adjustments (ktonnes). Finland 2010-2013

Pollutant		2010	2011	2012	2013
NH_3	kt	-2.05	-1.85	-1.85	-1.72

11.2 Reporting of Approved Adjustments

Documentation of the adjusted Small Scale Combustion NH_3 inventory and the adjusted Road Transport NH_3 inventory is provided in files:

- FI IIR 2021 Appendix 3B Documentation Small Combustion February 2021.xls
  Saved in reporting folder B. Informative Inventory Report – IIR 2021

- FI IIR 2019 Appendix 3B Documentation of Road Transport February 2021.xls
  Saved in reporting folder B. Informative Inventory Report – IIR 2021

- Approved Adjustments FI Reporting year 2021.docx
  Saved in reporting folder C. Adjustment – Declaration of consistent 2021

Finland has submitted the approved adjustments reporting (Annex VII) in 2016. 2017. 2018 and 2019 and included the in the submission the Declaration of consistency in the methods used (file name “Approved Adjustments Reporting”). Information on changes in activity data or new information to correct EFs has been included in these reports.

Adjustment for Small Scale Wood Combustion. submission 2019

In the 2019 submission. for small scale combustion of wood. Finland used the revised official wood use statistics. which is based on a survey conducted in 2017-2018. This traditional survey also includes use of wood in the different combustion equipment. which means that both the wood consumption data and the allocation of wood between the 14 techniques was revised. The new category for modern sauna stoves was added in the inventory due to the improved data.

In addition. the technique specific EFs were corrected according to new information from various national studies. The new EFs are higher for conventional devices and lower for modern devices. compared to the earlier used EFs. As a result of the revision. the emissions for 2017 increased by 0.344 kt compared to those calculated with the earlier used EF. The national total NH3 emissions in 2017 were 31.083 kt. which is 0.083 kt above the ceiling of 31 kt. As the share of wood combusted in modern sauna stoves. modern masonry ovens and modern iron stoves is continuously growing. the change in the EFs follows more closely the real world emissions than the earlier used EFs .

Detailed information on the changes is provided in the file “Approved Adjustments FI Reporting year 2019 RESUBMISSION 15032019”.

Adjustment for Road Transport

A revision of the kilometrage in the national road transport emissions model LIISA was carried out and four EFs were corrected (see file Approved Adjustments FI Reporting year 2019 RESUBMISSION 15032019).

11.3. Adjustment ERT’s review report 2015

(the following page)

Convention on Long-range Transboundary Air Pollution

emep Co - operative programme for monitoring and evaluation of the long-range transmissions of air pollutants in Europe

First Joint session of the EMEP SB and the Working Group on Effects
Geneva. 14–18 September 2015
CEIP/Adjustment RR/2015/Finland
1 September 2015
English ONLY

Review of the 2015 Adjustment Application by Finland

Expert Review Team Report for the EMEP Steering Body

Report title	Review of the 2015 Adjustment Application by Finland
Country	Finland
Report reference	CEIP/Adjustment RR/2015/ Finland
Date	20/07/2015
Version no	Final

Expert Review Team

Role	Sectors	Name	Country
Adjustment lead reviewer	All	Chris Dore	United Kingdom
Primary expert reviewer	Stationary combustion (1A2gviii. 1A4ai. 1A4bi. 1A4ci)	Stephan Poupa	Austria
Secondary expert reviewer	Stationary combustion (1A2gviii. 1A4ai. 1A4bi. 1A4ci)	Tomas Gustafson	Sweden
Primary expert reviewer	Road transport (1A3bi-iv)	Melanie Hobson	European Union
Secondary expert reviewer	Road transport (1A3bi-iv)	Michael Kotzulla	Germany
Primary expert reviewer	Manure management (3B)	Jim Webb	United Kingdom
Secondary expert reviewer	Manure management (3B)	Michael Anderl	European Union
Basic checks (Step 1 and 2)	N/A	Katarina Mareckova	CEIP

Executive Summary

1. As mandated by Decision 2012/3 (ECE/EB.AIR/111/Add.1) of the Executive Body to the Convention on Long-range Transboundary Air Pollution (CLRTAP) the nominated expert review team (ERT) undertook a detailed review of the adjustment application submitted by Finland. The review was undertaken on behalf of the EMEP EMEP[7] Steering Body (SB) and following the guidance published in the Annex to decision 2012/12 (ECE/EB.AIR/113/Add.1) and 2014/1 (ECE/EB.Air/130).

2. Each sector of the application was reviewed by two independent sectoral experts during May and June 2015. The findings were discussed at the meeting held from 22-26 June 2015 in Copenhagen at the EEA. The conclusions and recommendations for the EMEP SB are documented in this country report.

Table ES1 Summary Information on the Submitted Application. Finland 2015

Reasons for adjustment application (Decision 2012/3. para 6 as amended by decision 2014/1. annex. para 3)	Stationary combustion 1A2gviii. 1A4ai. 1A4bi. 1A4ci: New Source Road transport 1A3bi-iv: Significantly different EFs Manure management 3B: Significantly different EFs
Pollutant for which adjustment is applied for	NH_3
Year(s) for which inventory adjustment is applied	2010. 2011. 2012. 2013
Date of notification of adjustment to the Secretariat	20 February 2015
Date of submission of supporting documentation	13 March 2015

3. The expert review team (ERT) reviewed and evaluated the documents submitted by Finland.

4. **NH_3 emissions from stationary combustion (1A2gviii. 1A4ai. 1A4bi. 1A4ci):** Finland provided information that transparently presented "extraordinary" revisions to emission factors for NH_3. and also clearly quantified the impact of the revisions to the EFs. The Expert Review Team has concluded that the application does meet all of the requirements laid out in Decision 2012/12 of the Executive Body of the CLRTAP. and therefore recommends that the EMEP Steering Body **ACCEPT** this adjustment application.

5. **NH_3 emissions from road transport (1A3bi-iv):** Finland provided information that transparently presented "extraordinary" revisions to emission factors for NH_3. and also clearly quantified the impact of the revisions to the EFs alone. The Expert Review Team has concluded that the application does meet all of the requirements laid out in Decision 2012/12 of the Executive Body of the CLRTAP. and therefore recommends that the EMEP Steering Body **ACCEPT** this adjustment application.

6. **NH_3 emissions from manure management (3B):** Finland provided information that transparently presented revisions to N excretion rates for livestock. and the resulting impact on NH_3 emissions. The ERT reviewed the information provided and concluded that the application regarding NH_3 from Manure Management[8] (3B) does not meet the requirements laid out in Decision 2012/12 of the Executive Body of the CLRTAP. The ERT noted that revisions of N excretion estimates are regarded as revisions to activity data. and that the application was therefore not based on one of the three circumstances listed in paragraph 6 of

[7] Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
[8] NFR 3B1a, 3B1b, 3B2, 3B3, 3B4d, 3B4e, 3B4gi-iv and 3B4h henceforth referred as 3B

decision 2012/3. as amended by Decision 2014/1. The ERT therefore recommends that the EMEP Steering Body **REJECT** the adjustment submitted for NH_3 from Manure Management 3B.

7. The quantity and impact of the adjustments recommended for acceptance is summarized in tables ES2 and ES3 below.

Table ES2 Aggregated Sum of Recommended Inventory Adjustments (ktonnes). Finland 2010-2013

Pollutant		2010	2011	2012	2013
NH_3	kt	-2.05	-1.85	-1.85	-1.72

Table ES3 Impact of the Recommended Inventory Adjustments on National Emissions. Finland 2010 and 2013

Poll.	GP Emission Commitment (kt)	2010 Emission reported in 2015 (kt)	2010 Emission (adjusted) (kt)	Difference (%)	2013 Emission reported in 2015 (kt)	2013 Emissions (adjusted) (kt)	Difference (%)
NH3	31	38.25	36.20	5%	37.28	35.56	5%

8. Finland's national total emissions will remain above the 1999 Gothenburg Protocol ceilings if the EMEP SB follow the recommendations of the ERT.

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11 INTRODUCTION AND CONTEXT

9. Parties may apply to adjust their inventory data or emission reduction commitments if they are (or expect to be) in non-compliance with their emission reduction targets[9]. However. in making an adjustment application. they must demonstrate that extraordinary circumstances have given rise to revisions to their emissions estimates. These extraordinary circumstances fall into three broad categories:

a) Emission source categories are identified that were not accounted for at the time when the emission reduction commitments were set; or

b) For a particular source. the emission factors used to estimate emissions for the year in which emissions reduction commitments are to be attained are significantly different to those used when the emission reduction commitments were set; or

c) 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.

10. Any Party submitting an application for an adjustment to its inventory is required to notify the Convention Secretariat through the Executive Secretary by 15 February at the latest. The supporting information detailed in Decision 2012/12 must be provided (either as part of the Informative Inventory Report. or in a separate report) by 15 March of the same year.

11. As mandated by Decision 2012/12 as amended by the Decision 2014/1 of the Executive Body of the CLRTAP. applications for adjustments that are submitted by Parties are subject to an expert review[10]. Technical coordination and support to the review is provided by EMEP's Centre on Emission Inventories and Projections (CEIP). The members of the review team are selected from the available review experts[11] that Parties have nominated to the CEIP roster of experts.

12. The expert review team (ERT) undertakes a detailed technical review of the adjustment application in cooperation with the EMEP technical bodies and makes a recommendation to the EMEP Steering Body on the acceptance or rejection of the application. The EMEP Steering Body then takes its decision on any adjustment application based on the outcome of the technical assessment completed by ERT.

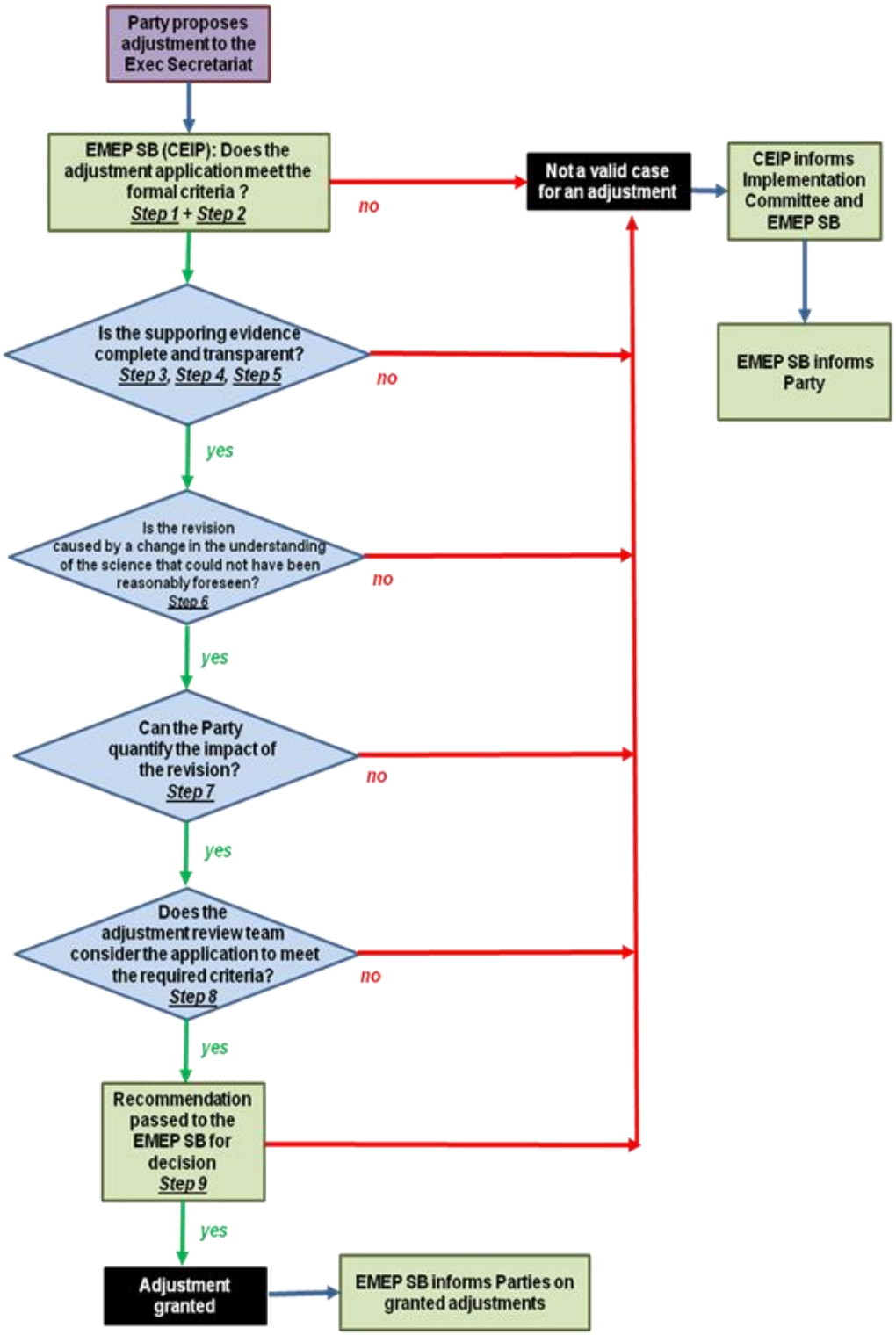
13. The flow diagram below outlines the different stages of the technical review. The following sections of this report are structured in the same way. and describe in detail the findings of the ERT at each of the decision gates in the process.

[9] Throughout this report the term "emission reduction commitments" is used. However, the term "emission ceilings" is equally applicable.

[10] The EMEP Steering Body, in conjunction with other appropriate technical bodies under EMEP, shall review the supporting documentation and assess whether the adjustment is consistent with the circumstances described in paragraph 6 of EB decision 2012/3 and the further guidance in EB decision 2012/12 as amended by EB decision 2014/1 and Technical guidance document ECE/AB.Air/130 ..

[11] http://www.ceip.at/fileadmin/inhalte/emep/pdf/2015/0_Roster_2015.pdf

Figure 2.010: Flow Diagram/Decision Tree for the Review of Adjustment Applications



1 Review of Submitted Adjustments

1.1 Assessment of Formal Criteria

14. Finland notified the Convention Secretariat through the Executive Secretary of its intention to apply for an adjustment on 20/02/2015 and thus after the legal deadline of 15 February. All supporting information requested by Decision 2012/12 amended by Decision 2014/1 was provided as part of the Informative Inventory Report before the legal deadline of the 15 March of the same year that it is being submitted for review by the EMEP Steering Body(Decision 2012/12. annex. para 1). Additional documentation was provided during the review in response to requests from the CEIP and ERT. Section 4 lists the documentation provided by the Party.

15. Finland submitted an application for emissions adjustments to NH_3 for 2010-2013 for the following sectors:

a) NH_3 Stationary combustion 1A2gviii. 1A4ai. 1A4bi. 1A4ci

b) NH_3 Road transport 1A3bi-iv

c) NH_3 Manure management 3B1a. 3B1b. 3B2. 3B3. 3B4d. 3B4e. 3B4gi-iv and 3B4h (henceforth referred as 3B).

16. Finland does not comply with its emission reduction commitments listed in Annex II of the Gothenburg Protocol (paragraph 1 of Decision 2012/3).

17. Finland provided information on the impact of the adjustment to its emission inventory. and the extent to which it would reduce the current exceedance and possibly bring the Party in compliance with emission reduction commitments.

18. Finland did include information on when it will meet its emission ceiling for NH_3 in the supporting documentation.

1.2 Stationary Combustion 1A2gviii. 1A4ai. 1A4bi. 1A4ci (NH_3)

1.2.1 Assessment of Consistency with Requirements of EB Decision 2012/3 as amended by EB Decision 2014/1

19. Finland initially made an adjustment application based on new sources. However following some discussion with the ERT. elected to amend this to an application based on significant revisions to emission factors (EFs).

20. The adjustment application requires the provision of specific supporting information to demonstrate compliance with specific criteria (Decision 2012/3. para. 6a-c as amended by decision 2014/1. annex. para 3). The ERT reviewed the supporting documentation (see section 4) with regard to these criteria and concluded that NH_3 emission factors used to determine emission levels for the source categories 1A2gviii. 1A4ai. 1A4bi and 1A4ci 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.

21. The biomass NH_3 EFs used for calculation of the 2015 submission are significantly higher than those which were available in the Second Edition of the EMEP/CORINAR Emissions Inventory Guidebook 1999. However. NH_3 EFs used for coal are lower than those in the second edition of the EMEP/CORINAR Emissions Inventory Guidebook 1999.

22. The ERT therefore concludes that the provided supporting evidence does comply with the criteria presented in Decision 2012/3. and that the circumstances on which the adjustment is based could not have been reasonably foreseen by Finland when the emission ceilings were established for 2010.

1.2.2 Assessment of the Quantification of the Impact of the Revision

23. The adjustment application process requires that the Party submit a quantification of the impact of the adjustment for which an application has been submitted. Table 1 provides an overview of the NH_3 adjustment applications of Finland in Stationary combustion. The Adjustments for categories 1A2gviii. 1A4ci and 1A4ai are positive because the selected EFs for coal are lower than those in the Second Edition of the EMEP/CORINAR Emissions Inventory Guidebook 1999.

Table 1: Finland's NH_3 Adjustment Applications for the Stationary Combustion. 2010-2013

Reference number	Pollutant	NFR14	unit	2010	2011	2012	2013
11a-11b	NH3	1A2gviii	kt	0.015	0.014	0.017	0.015
12a-12b	NH3	1A4ai	kt	0.023	0.022	0.026	0.024
13a-13af	NH3	1A4bi	kt	-0.610	-0.485	-0.594	-0.542
14a-14c	NH3	1A4ci	kt	0.042	0.036	0.044	0.041
	NH3	**Total**	**kt**	**-0.531**	**-0.413**	**-0.507**	**-0.462**

1.3 Road Transport 1A3bi-iv (NH_3)

1.3.1 Assessment of Consistency with Requirements of EB Decision 2012/3 as amended by EB Decision 2014/1

24. Finland initially made an adjustment application based on new sources. However following some discussion with the ERT. elected to amend this to an application based on significant revisions to the NH_3 road transport emission factors (EFs).

25. The adjustment application requires the provision of specific supporting information to demonstrate compliance with specific criteria (Decision 2012/3. para. 6a-c as amended by decision 2014/1. annex. para 3). The ERT reviewed the supporting documentation (see section 4) with regard to these criteria and concluded that emission factors used to determine emission levels for the road transport source categories 1A3bi-iv 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.

26. Finland provided information to support its application for an adjustment. which was based on NH_3 emission factors for the transport sector being significantly different. This was on the basis that the NH_3 emission factors in the 1999 EMEP/EEA Guidebook are significantly different to that provided in the 2013 EMEP / EEA Guidebook.

27. Finland did not include NH_3 emissions from the transport sector in their inventory until their 2005 submission. However. for the basis of determining whether the emission factor has significantly changed. a comparison of the 1999 and 2013 EMEP/EEA Guidebooks has been undertaken.

28. The changes in EFs highlighted in the adjustment application could not have been foreseen at the time of setting 2010 emission ceilings. and result from NH_3 emissions being higher from vehicles fitted with catalysts than originally accounted for.

29. The ERT therefore concludes that the provided supporting evidence does comply with the criteria presented in Decision 2012/3. and that the circumstances on which the adjustment is based could not have been reasonably foreseen by the Party when the emission ceilings were established for 2010.

30. The supporting information provided by the Party on the revisions made to emission factors was considered to be complete. A spreadsheet outlining the NH_3 emission factors contained in the 1999 and 2013 versions of the Emissions Inventory Guidebook and the emission factors used in the Finland emissions inventory was provided.

1.3.2 Assessment of the Quantification of the Impact of the Revision

31. The adjustment application process requires that the Party submit a quantification of the impact of the adjustment for which an application has been submitted. Table 2 provides an overview of the NH_3 adjustment applications of Finland in the Road transport sector.

Table 2: Finland's NH_3 Adjustment Applications for Road Transport. 2010-2013

Reference number	Pollutant	NFR14	unit	2010	2011	2012	2013
FI/2014/1a	NH3	1A3bi-iv	kt	-1.52	-1.44	-1.34	-1.26

1.4 Manure Management 3B (NH_3)

1.4.1 Assessment of Consistency with Requirements EB Decision 2012/3 as amended by EB Decision 2014/1

32. The Party made an application based on revised EFs for Manure management (3B1a. 3B1b. 3B2. 3B3. 3B4d. 3B4e. 3B4gi-iv and 3B4h - referred to as "3B").

33. The adjustment application requires the provision of specific supporting information to demonstrate compliance with specific criteria (Decision 2012/3. para. 6a-c as amended by decision 2014/1. annex. para 3). The ERT reviewed the supporting documentation (see section 4) with regard to these criteria.

34. The ERT noted that the basis of the application was that N excretion from livestock had increased since the ceilings were set in 1999. However the ERT consider N excretion to be activity data. and not a component of an EF. In addition. the ERT considered that applying year-specific N excretion values (rather than a fixed value) did not represent a change in methodology. The ERT recognized that it was good practice to revise input data when productivity and farming practices changed. but considered this particular revision to constitute routine emissions inventory development.

35. Consequently the ERT concluded that the application for an NH_3 adjustment from Manure management 3B did not comply with the criteria presented in Decision 2012/3. In particular. the ERT noted that the application was not based on one of the three circumstances listed in paragraph 6 of decision 2012/3. as amended by decision 2014/1.

1.4.2 Assessment of the Quantification of the Impact of the Revision

36. The adjustment application process requires that the Party submit a quantification of the impact of the adjustment for which an application has been submitted. Table 3 provides an overview of the NH_3 adjustment applications of Finland from Manure management.

Table 3: Finland's NH_3 Adjustment Applications for Manure Management. 2010 - 2013

Reference number	Pollutant	NFR14	unit	2010	2011	2012	2013
FI/2015/1	NH_3	3B1a	kt	-1.149	-1.194	-1.260	-1.271
FI/2015/2a-2d	NH_3	3B1b	kt	-3.389	-3.274	-3.093	-3.116
FI/2015/3	NH_3	3B2	kt	0.259	0.261	0.257	0.268
FI/2015/ 4a-4d	NH_3	3B3	kt	-0.111	-0.068	-0.108	-0.169
FI/2015/5	NH_3	3B4d	kt	0.010	0.009	0.009	0.009
FI/2015/6a-6b	NH_3	3B4e	kt	0.261	0.253	0.236	0.237
FI/2015/7a-7b	NH_3	3B4gi	kt	-0.281	-0.259	-0.254	-0.273
FI/2015/8a-8b	NH_3	3B4gii	kt	-0.710	-0.819	-0.894	-1.012
FI/2015/9	NH_3	3B4giii	kt	-0.161	-0.171	-0.163	-0.152
FI/2015/10a-10b	NH_3	3B4giv	kt	-0.307	-0.284	-0.294	-0.326
FI/2015/11a-11c	NH_3	3B4h	kt	1.119	1.157	0.987	1.075
	NH_3	**3B TOTAL**	**kt**	**-4.459**	**-4.387**	**-4.578**	**-4.730**

37. Finland did not inform the ERT when the emission ceilings would be reached. However. Finland noted that it continued implementing measures to abate ammonia emissions and would further develop the inventory to timely reflect impacts of the measures on the emission levels.

2 Conclusions and Recommendations

38. The ERT has undertaken a full and thorough assessment of the application for adjustments of NH_3 emissions inventory that was submitted by Finland for the following source sectors:

a. Stationary combustion- 1A2gviii. 1A4ai. 1A4bi. 1A4ci
b. Road transport - 1A3bi-iv
c. Manure management - 3B.

39. The review of the submitted application followed the guidance provided in the Annex to Decision 2012/12 of the Executive Body of the CLRTAP as amended by Technical Guidance ECE/EB.AIR/130. The findings of the ERT are described in detail in Section 2 of this report.

40. Table 4 below provides a summary of the adjustment applications received from Finland. and the subsequent recommendations made by the ERT to the EMEP SB.

Table 4: Recommendations from the ERT to the EMEP SB. Finland 2015

Country	Sector	NFRs	Pollutant	Years	ERT Recommendation
Finland	Stationary Combustion	1A2gviii. 1A4ai. 1A4bi. 1A4ci	NH_3	2010- 2013	Accept
	Road Transport	1A3bi-iv	NH_3	2010 – 2013	Accept
	Manure Management	3B	NH_3	2010 - 2013	Reject

41. **Stationary combustion (1A2gviii. 1A4ai. 1A4bi. 1A4ci. 1A2gviii) NH_3:** Finland provided information to support their application for an adjustment. During the review. the ERT requested more detailed information from Finland. which they were able to provide. and this is detailed in Table 6. The ERT therefore recommends that the EMEP Steering Body **ACCEPT** the adjustments submitted for these sectors.

42. **Road transport (1A3bi-iv) NH_3**: Finland provided information to support their application for an adjustment. During the review. the ERT requested more detailed information from Finland. which they were able to provide. and this is detailed in Table 6. The ERT therefore recommends that the EMEP Steering Body **ACCEPT** the adjustments submitted for these sectors

43. **Manure management (3B) NH_3:** Finland provided information that transparently presented the quantification of an adjustment for NH_3 Manure management 3B. However. the ERT concluded that the application does not meet the requirements laid out in Decision 2012/12 of the Executive Body of the CLRTAP. and in particular. that the application was not based on one of the three circumstances listed in paragraph 6 of Decision 2012/3. as amended by Decision 2014/1. The ERT therefore recommends that the EMEP Steering Body **REJECT** the adjustment submitted for NH_3 Manure Management 3B. Finland did not provide information on when it will meet its emission ceiling for NH_3 in the supporting documentation. However. Finland noted that it continued implementing measures to abate ammonia emissions and would further develop the inventory to timely reflect the impacts of the measures on the emission levels.

3 Information Provided by the Party

44. Table 5 lists the information provided by the Party in its adjustment application. The information provided by Party can be downloaded from the CEIP website[12].

Table 5: Information Provided by the Finland

Filename	Short description of content
Appendix 3 to FI IIR 2015 DOCUMENTATION ADJUSTMENT APPLICATION 13March2015.docx	Special Appendix to IIR 2015. Includes documentation of adjustments.
FI_IIR2015_22_May2015_revised_Part_1.pdf	IIR 2015. Revised version 22nd May.
FI_IIR2015_13March2015_Part2.pdf	IIR 2015 Annexes. Version 13th March
FI_NotificationTemplate__CLRTAP_EMEP_emission_inventory_status_report_2015_20022014.docx	CLRTAP submission 2015 notification template.
FI_YM12_44_2014.pdf	Official letter from Ministry of Environment to UNECE about adjustment application. 12th Feb 2015.

45. The ERT found it necessary to ask the Party for further information. The information provided is described in Table 6 below.

Table 6: Additional Information Provided by Finland

Filename	Short description of content
Documentation Transport 24 June 2015.xls	Road transport NH3 emission factors provided in the 1999 EMEP/EEA Guidebook and those used in the 2014 Finland emissions inventory and accompanying calculations to assess the difference in emission estimates.
Documentation Small Combustion 23June2015.xlsx	Detailed calculations of NH3 emissions for biomass and coal with EFs from GB 1999 and EFs used for the 2015 submission.

[12] http://www.ceip.at/ms/ceip_home1/ceip_home/adjustments_gp/

4 References

Decision 2012/3 (ECE/EB.AIR/111/Add.1): Adjustments under the Gothenburg Protocol to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them

Decision 2012/12 (ECE/EB.AIR/113/Add.1): Guidance for adjustments under the 1999 Protocol to Abate Acidification. Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them

Decision 2014/1 (ECE/EB.Air/127/Add.1) Improving the guidance for adjustments under the 1999 Protocol to Abate Acidification. Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them

Data submitted by Parties applying for an adjustment:
http://www.ceip.at/ms/ceip_home1/ceip_home/adjustments_gp/

EMEP/EEA Air Pollutant Emission Inventory Guidebook 2013
http://www.eea.europa.eu/publications/emep-eea-guidebook-2013

EMEP/CORINAIR Air Pollutant Emission Inventory Guidebook 1999. 2nd edition
http://www.eea.europa.eu//publications/EMEPCORINAIR

2014 Reporting Guidelines **(**ECE/EB.AIR/125) for Estimating and Reporting Emission Data under CLRTAP
http://www.ceip.at/ms/ceip_home1/ceip_home/reporting_instructions/

ECE/EB.AIR/130: Technical Guidance for Parties Making Adjustment Applications and for the Expert Review of Adjustment Applications. 14 April 2015

The 1999 Gothenburg Protocol to Abate Acidification. Eutrophication and Ground-level Ozone
http://www.unece.org/env/lrtap/multi_h1.htm

12 MEMO ITEMS

Changes in chapter	
Update of text	March 2020 KS
Change in methodology	
Other (e.g. language. layout)	

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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