FINLAND's INFORMATIVE INVENTORY REPORT 2017

Air Pollutant Emissions 1980-2015

under the UNECE CLRTAP and the EU NECD

Part I

General B

Revised 28.04.2017 FINNISH ENVIRONMENT INSTITUTE

Centre for Sustainable Consumption and Production

Environmental Management in Industry – Air Emissions Team

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10 OTHER - MEMO ITEMS

Changes in chapter	
Update of text	March 2016 KS
Change in methodology	
Other (e.g. language. layout)	March 2016 KS

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

IE/NE?

1 A 3 Transport (fuel used)

.Not applicable. The inventory is based on fuels sold.

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

Not occuring

11 A Volcanoes

There are no volcanoes in Finland.

11 B Forest fires

Not applicable.

11 C Other natural emissions

Not applicable.

10.1.1 Uncertainty and time series' consistency

No uncertainty estimation for international bunkers has been carried out.

The time series for 1990-1999 will be recalculated during 2010 and reported by February 15th 2011.

10.1.2 Source-specific QA/QC and verification

Normal statistical quality checking related to the assessment of the magnitude and trends has been carried out. At present. no verification has been performed for the specific source-sector emissions.

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

None.

10.1.4 Source-specific planned improvements

Emissions from international navigation will be available in the EMEP grid format in the future.

More pollutants will be included in the future to the emissions from international aviation.

11 DATA ON LARGE POINT SOURCES (LPS)

Changes in chapter	
Update of text	October 2016 KS
Change in methodology	none
Other (e.g. language. layout)	October 2016 KS

11.1 LPS SOURCES, GEOGRAPHICAL COORDINATES AND EMISSIONS

The definition of the set of Finnish Large Point Sources (LPS) was revised in the 2012 submission under the UNECE CLRTAP to correspond to the definition of E-PRTR installations, as defined in the revised UNECE Reporting Guidelines (ECE/EB.AIR/97)**.**

Emission data from LPS installations are reported by plants according to the environmental monitoring requirements in their environmental permits, as well as their reporting requirements under the E-PRTR Regulation. As described in Chapter 2.3.3 of the IIR, these data are available for the use in inventories from the regional environmentral authorities' VAHTI database.

Data on Finnish LPSs has been submitted annually under the CLRTAP as indicated in **Error! Reference source not found.**.

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. 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.

LPS data will be submitted to the EIONET CDR in May 2017 using the NFR2014 reporting tables.

12 GRIDDED EMISSIONS DATA

Changes in chapter	
Update of text	March 2016 KS
Change in methodology	New grid 2015
Other (e.g. language. layout)	March 2017 KS

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

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

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

Submissions of gridded data are presented in Table x in Chapter x.

Figure x. 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.

12 PROJECTED ACTIVITY DATA AND NATIONAL TOTAL EMISSIONS

Changes in chapter	
Update of text	April 2017 KS
Update of projections	Every 1-3 years
Other (e.g. language. layout)	April 2017 KS

13.1 Projections for 2020, 2025 and 2030

Emission pojections 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. Emission scenarios are also available up to 2050 for the agriculture and transport sectors, however, not currently included in the NFR tables. Projections for PM10 emissions are available for all sectors, however, PM10 is not one of the pollutants to be included in the NFR reporting table.

Projections for sulphur dioxide. nitrogen oxides. NMVOC and PM_{10} and $PM_{2.5}$ emissions in 2015, 2020, 2025/2030 and 2050 are estimated in the Finnish Regional Emission Scenarios (FRES) model (Karvosenoja 2008), which is used to support Finnish air pollution polices and in assessing the co-benefits and trade-offs of climate change strategies on air pollution. The scenarios were updated in 2015.

Agricultural NH3 emissions are based the national agriculture sector calculation model and projections for the other sectors on expert estimates on emission trends based on current inventories.

The current projected emission values are presented in Table 13.1 and the annual submissions of projected data in **Error! Reference source not found.**.

Table 13.1. Projected national total emissions for 2015, 2020, 2030 and 2050.

Pollutant	Unit	Current legislation projections			
		2020	2025	2030	2050
Sulphur oxides (SO_x as SO_2)	kt	38	31	19	NA
Nitrogen oxides (NO_x as NO_2)	kt	138	124	100	NA
Non-methane volatile organic compounds (NMVOC)	kt	99	93	88	NA
Ammonia (NH_3) (without adjustments)	kt	30	28	27	NA
$PM_{2.5}$	kt	23	24	19	NA
BC	kt	NA	NA	3.4	NA

13.2 Methodology for projections

13.2.1 FRES model

The FRES model (Figure 13.1) (Karvosenoja 2008) 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).

Transport sector emissions included in the model are calculated with the global GAINS model (http://gains.iiasa.ac.at) (Amann ym. 2011 and agriculture emissions with the national nitrogen (Grönroos et al. 2009).
The national FRES model is developed to be consistent with the GAINS model in respect to source sectors in order to be able to cross-check differences in the scenarios. FRES model, however, gives more accurate information than GAINS, due to inclusion of e.g. 400 point sources detailed techniques and emission factors. In addition, certain sectors, such as small combustion, has been calculated at a more detailed level (14 different national techniques).

Parametres used in the FRES model are optimized for every five historical years (2005 and 2010) and to target years according to specific needs. The intermediate years are presented linearly.

Information in the FRES model is currently consistent with the national emission inventory except for the transport sector emissions which in FRES are from the older version of the LIPASTO model, while the inventory uses the updated version of LIPASTO (http://lipasto.vtt.fi/)

Activity data in the FRES model

The emissions are calculated from the parameters of activity levels. emission factors and emission control technology removal efficiencies and utilization rates. The energy comsumption and industrial production scenarios used in planning the national climate strategy are used as input to the model (Table 13.2). In the FRES model the activity unit for combustion processes is annual primary energy use (e.g. PJ a-1) and for industrial non-combustion processes annual production or raw material use (e.g. Mg a-1). Other activity units include e.g. animal numbers and manure application for NH3 emissions from agriculture and driven vehicle km for non-exhaust primaryPM from road traffic.

Table 13.2. Key assumptions and GHG mitigation instruments in the Finnish Climate Strategy activity pathways (Table 3 in Karvosenoja 2008)

Activity pathway	Activity background assumptions		GHG emission target	Main primary energy carriers for meeting increasing energy demand	GHG mitigation instruments			
	Economic growth (% a^{-1} (GDP))	Agriculture, growth in cattle numbers (% a^{-1})			Energy production and industry	Traffic sector	Domestic sector	Agriculture and forestry
Business-as-usual (2001 Strategy)[1]	2.4	-1	No reductions	Coal, natural gas	-	-	-	-
Kyoto-Nuclear (2001 Strategy)[1]	2.4	-1	Kyoto target for Finland[3]	Nuclear, wood, natural gas	Energy saving, renewables	Economic instruments, logistics planning, information	Building regulations, urban planning	Emphasis on biofuel production
With-Additional-Measures (2005 Strategy)[2]	2.3	-1	Kyoto target for Finland[3]	Nuclear, wood, natural gas	Energy saving, renewables	Economic instruments, logistics planning, information, biofuels development	Building regulations, urban planning	Emphasis on biofuel production

[1] Hildén et al. 2001; [2] Hildén et al. 2005; [3] Stabilization of GHG emissions at 1990 level

Emission factors and abatement techniques

Emission factors in the FRES model are assumed to be constant over time. Changes in emission factors are thus to be described by changes in the use of emission control technologies. Emission factor changes due to e.g. modernization of combustion appliance stock can be described by corresponding source sector disaggregation and relative changes in activity levels.

The FRES model describes removal effi ciencies and costs of emission control technologies.
The technologies include e.g. end-of-pipe and process modifi cation measures of energy production and industry sources. technologies applied in traffi c vehicles and manipulations of fuel qualities. Emission abatement techniques are defined according to current legislation (CLE) and with measures (WM).

The current and future use of emission control technologies is to a large extent defined by the requirements of the environmental legislation. Nowadays different EU directives define emission limit values for different emission sources. either directly or by defining boundary conditions for national legislation. Major emission legislations include the Large Combustion Plants directive (LCP. EC 2001b) that sets limit values for SO2. NOx and primary PM (TSP) emission factors for combustion plants larger than 50 MWth (thermal capacity). so-called EURO standards (e.g. EC 1998) that give increasingly tightening emission limits for new traffic vehicles. and NMVOCs directives (EC 1999b. 1994) for solvents and fuel handling practices to reduce NMVOCs emissions.
Sources

The basic spatial and temporal domains of the model are the country of Finland and one year. respectively. which are then disaggregated to 1 km and 1 hour resolutions. respectively. The emission sources are aggregated into source sector categories. The FRES aggregation is convergent with the RAINS model categories. with more refined structure for some sectors with

specific national characteristics that are not described in RAINS with adequate disaggregation (e.g. domestic wood combustion).

The source sectors include combustion-related activities (centralized and industrial energy production plants. domestic combustion. road traffic. off-road and machinery). industrial noncombustion process plants. and various sources associated with NH3 (agriculture). primary PM (several fugitive dust and other small non-combustion sources) and NMVOCs (solvents use. fuel evaporation). Combustionrelated source sectors are described as sector fuel combinations (e.g. industrial boilers – coal). the numbers of sectors and fuels being 101 and 15. respectively. The number of noncombustion source sectors is 53. The emission sources are described with a combined bottom-up and top-down approach for large point sources and area sources. respectively. Emissions of most significant individual polluters are calculated as point sources. i.e. on an individual plant basis (bottom-up).

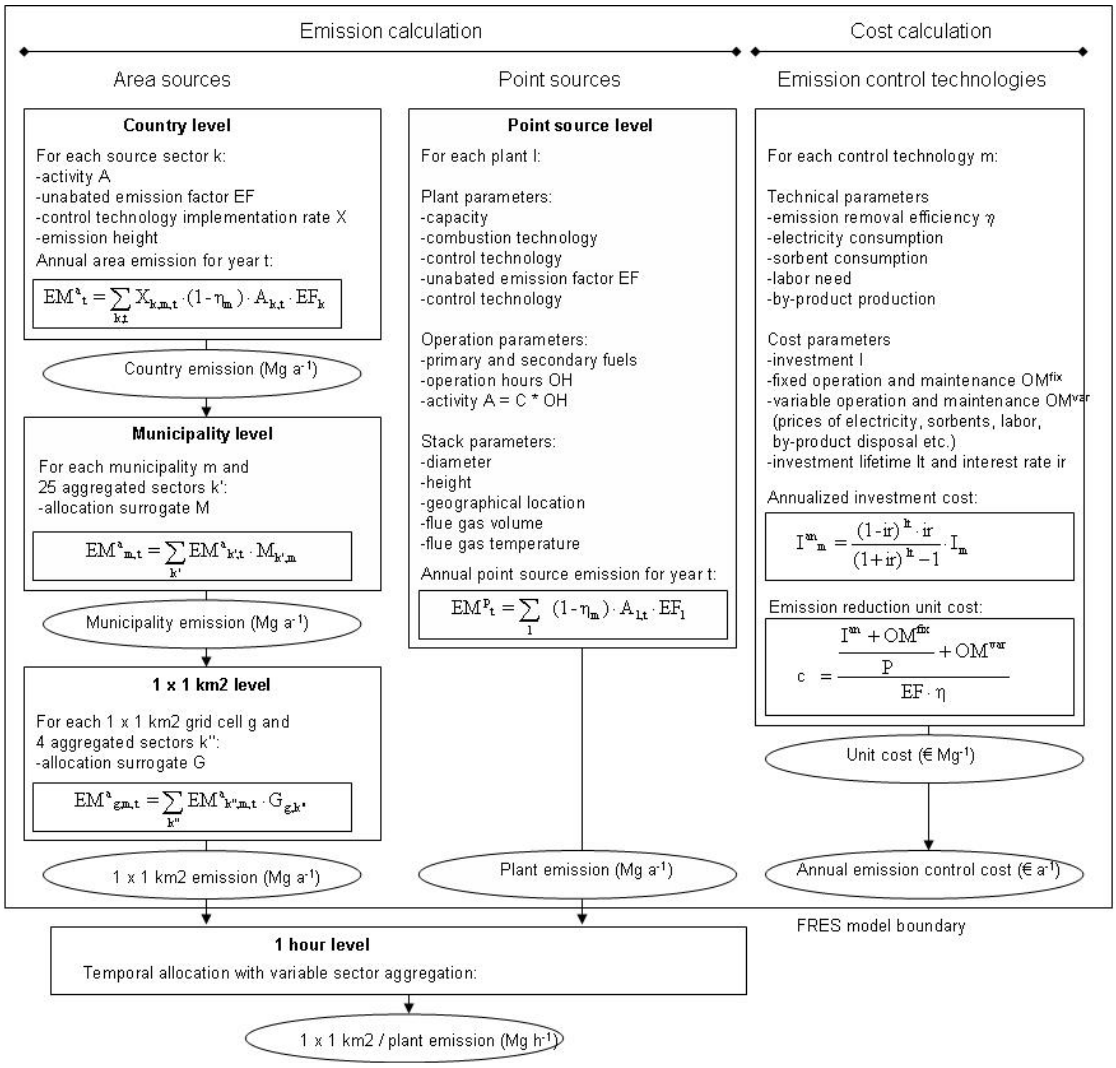

Figure 13.1. Structure of the FRES model.

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

The base line in the scenarios is based on fuel use according to the national energy and climate strategy from 2013 (TEM 2013). The legislation that have adopted includes IED with national transitional plans, EURO6 standards for vehicles and reduction of sulphur oxides in small combustion plants according to the Government Decree (VNa 750/2013) concerning combustion units less than 50 MWs.

Sulphur emissions as SOx

Sulphur dioxide emissions originate mainly from energy production and industrial processes. Emissions from energy production 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.

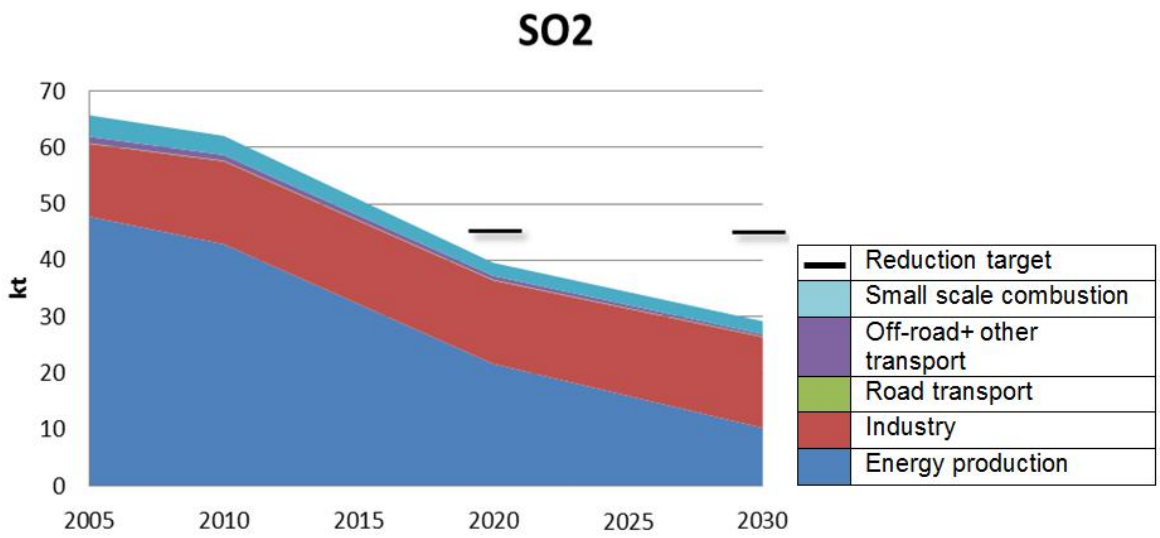

Figure x. Development of SOx emissions by sectors according to the baseline

Nitrogen oxides

The main sources for NOx 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,

NOx emissions from energy production increased 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, and the use of these fuels will also decrease towards 2020-2030

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.

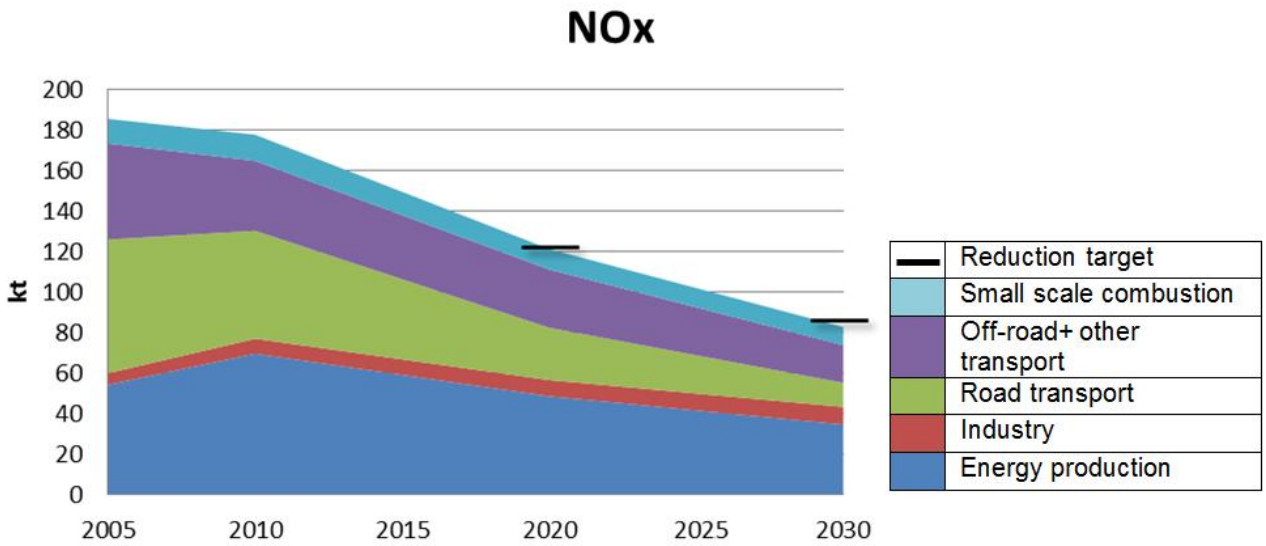

Figure x. Development of NOx emissions by sectors according to the baseline

Particles

Important particulate matter sources are transport, peat production and industry, while small scale combustion has increased in importance from the beginning of the 2000's due to sharp increase in the amount of wood combusted. In the national energy strategy it is assumed that the combustion volume will stay at the current level until 2020 but will then decrease by 2030 due to decreases in heating need as the building regulations require improvements in the energy efficiency of buildings. Renewal of the combustion equipment stock will be slow, however, by 2030 also changes in the devices can be seen in the emissions.

In transport, exhaust gas emissions decrease due to the increasing number of EURO standard vehicles. Although direct particulate emissions in exhaust gases almost cease by 2030 will transport still stay as a significant source due to road dust. While there is no technique to abate road dust emissions, which follow the increase of transport volumes, improvements in maintenance and cleaning of streets and roads can impact these emission levels. Transport is a significant contributor to health because the emissions occur at the hight of inhalaton 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.

Emissions from the combustion are low due to efficient combustion and end of pipe techniques. Emission reductions due to the between 2010-2020 and the predicted increase in the volume of biomass combusted after 2020 can be seen in the scenarios. Decrease in combustion of coal from 2020 onwards cannot be seen in emissions because coal is only combusted in large combustion plants.

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

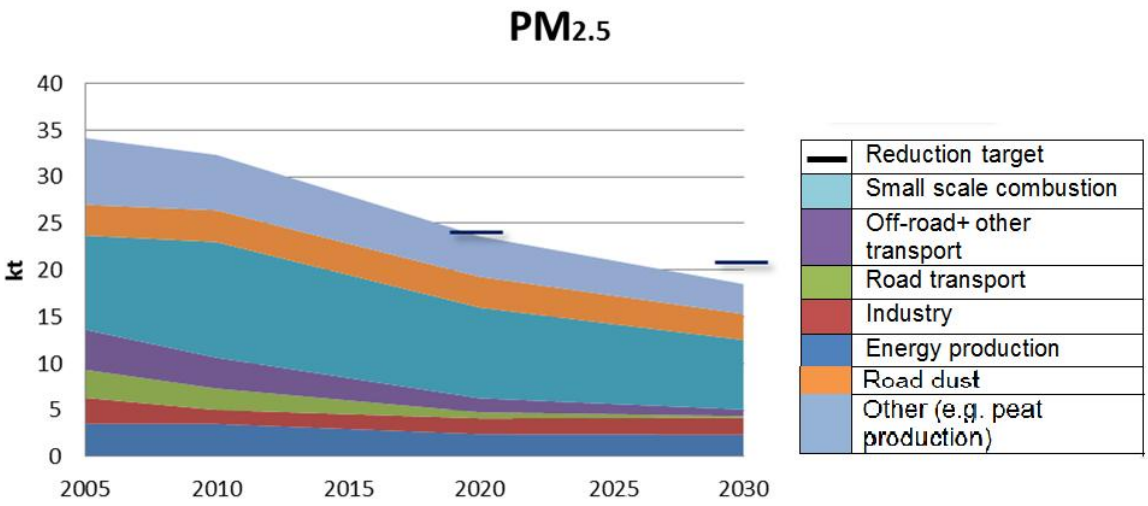

Figure x. Development of small particle emissions by sectors according to the baseline

Ammonia ***(text to be updated for resubmission in May 2017)***

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.

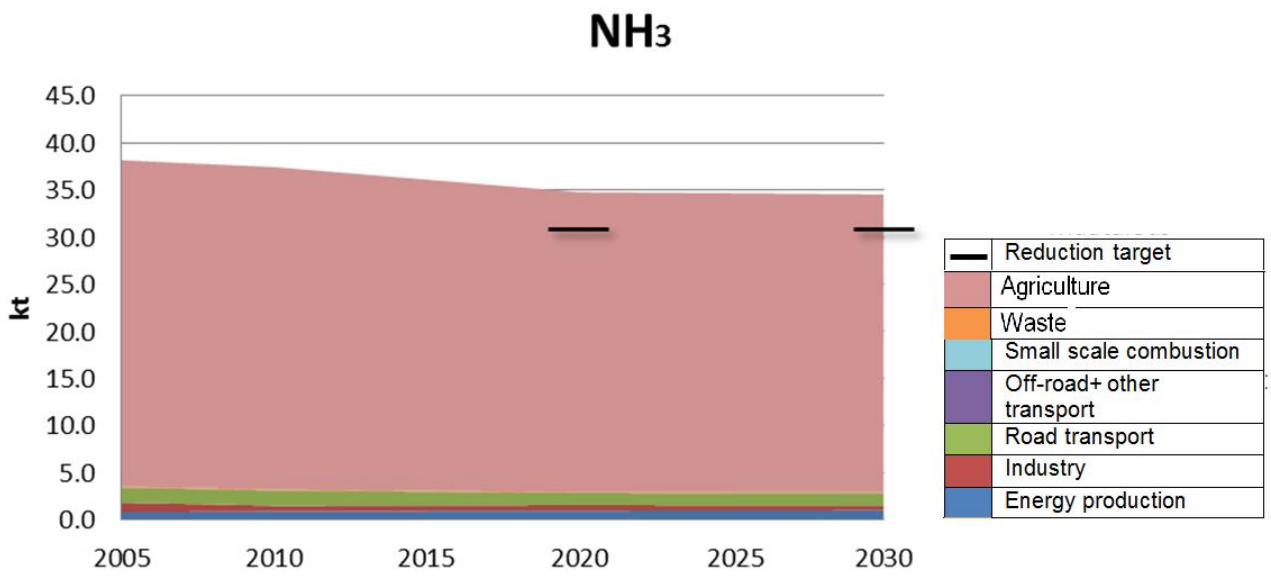

Figure x. Development of ammonia emissions by sectors according to the baseline

NMVOC ***(text to be updated for the submission in 2018)***

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.

FRES model 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 2012. 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.

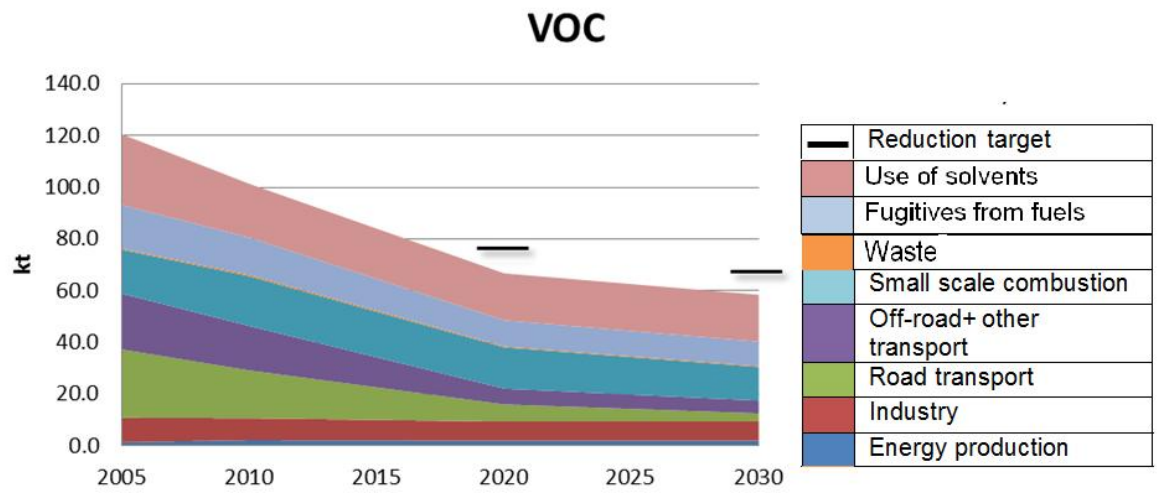

Figure x. Development of NMVOC emissions by sectors according to the baseline

14 RECALCULATIONS AND IMPROVEMENTS

Changes in chapter	
Update of text	April 2017 KS
Other (e.g. language. layout)	April 2017 KS

14.1 Explanations and justifications for recalculations

(text to be updated for the 2018 submission)

The time series has been recalculated for several subcategories as is indicated in Parts 2-4 under the relevant subcategories. No impact assessment of the recalculations have been made thus far, however, their impacts are considered rather low compared to major sources of emissions, such as energy, the recalculation of which has not yet been finalized when writing this.

Reporting of the fully recalculated time series 1990 – 2013 is waiting for the finalization of the energy sector recalculations, which is under way in 2017. Due to the structure of the inventory (see Chapter 2.3.2.) this also prevents a complete recalculation of emissions e.g. in the industrial processes sector.

Checking of both the basic data, methods and underlying assumptions in all sectors is currently carried out at ad hoc basis. but will be systematical only when the recalculations can be completed. Some emission figures for the previous years were corrected in the NFR tables to reflect chages in AD. data reported by the plants or errors found for earlier years. The changed figures are indicated in red in the NFR tables.

Reallocation of emissions under consistent reporting categories will be carried out when the full recalculation of the inventory is allowed after energy sector emissions have been recalculated. The recalculation of fuel use is scheduled to be finalized during the spring 2017 and the recalculation of the whole time series thereafter for the 2018 submission.

Due to difficulties in reaching the ammonia reduction targets and ceilings, the ammonia emission inventory for all sources has been checked recalculated for all source categories. Further details are provided in the Annex for Adjustment and in the Chapter for Agriculture. An analysis of the impacts of the recalculations will be added to the documentation.

14.1.1 Implications for emission levels and trends. including time series consistency

Finland has not performed regular analysis of the impacts of new sources added to the inventory or new methods introduced to the calculation of emissions from existing sources due to resource limitations. Inclusion of this to the annual inventory work is seriously considered.

15 REVIEW

Changes in chapter	
Update of text	March 2017 KS
Change in methodology	none
Other (e.g. language. layout)	December 2016 KS

15.2 Identification of improvement needs in the CLRTAP inventory

Identification of further development needs in the Finnish UNECE CLRTAP inventory is carried out on a continuous basis according to annual work programmes (Table 14.1). although larger scale improvements are possible only when the necessary resources for the improvement projects are available.

Information of the Nordic cooperation in harmonization and improvement of air pollutant emission inventories in the Nordic countries is presented in Chapter 14.3.1

Sector-specific improvements that have already been implemented due to the QA/QC work and the inventory improvement programme are presented in Table 14.2 and those still remaining in Table 14.1

Table 14.1. Finnish Air Pollutant Emission Inventory Improvement Programme 2016-2020

Air Pollutant Inventory Improvement Programme 2016-2020

Pollutant / Category	General	SO_x	NO_x	CO	NMVOCs	NH_3	PMs	HMs	POPs
Energy	Recalculation of fuel use data 2014-2017 Update of all EFs 2018	Update of EFs 2018	Update of EFs 2018	Update of EFs 2018	Speciation profile NS		Update of EFs 2018	Checking of EFs Refineries/As NS	Update of EFs 2018
Small combustion							Improving data collection of residential wood combustion Spring-Autumn 2017		
Transport					Speciation profile NS			Road transport: Hg NS	EFs for other mobile sources and heavy vehicles. NS
Industrial processes	Allocation of emissions in the time series Check and completion of possible missing emissions in the time series when combining with recalculated energy inventory				Speciation profile NS		Road construction Earth removal. NS	Emission factors NS	PAH-4 from metal industry. NS
Solvent and other product use									fluorescent tubes. accumulators. thermometers
Agriculture									
Forestry									
Waste									
Memo items								Method	
All Sectors					Speciation profile/model → indirect CO_2			Checking of sources and methods NS	

Inventory checked (however. will be improved according to new findings and according to the results from the UC analysis)
No emissions/reporting obligation
NS = Not Scheduled

Table 14.2. Sector-specific improvements implemented

(to be updated to the 2018 submission)

Changes in chapter	
Update of text	March 2017 KS
Change in methodology	none
Other (e.g. language. layout)	March 2017 KS

NFR	Identified improvement	Completed	Reason
All	The first national PCB. PCP and SCCP inventories were carried out and reported to the UNECE CLRTAP Secretary	2006 submission	To prepare for the revision of the scope of the POPs Protocol
All	Emission inventories of TSP. PM_{10} and $PM_{2.5}$ were checked	2008 submission	New information in the Guidebook
All	NH_3 emissions from 1990-2009 were revised	2011 submission	Emission from agriculture were calculated using calculation method introduced in 2009 submissions. Also emissions from the other sectors were checked. The whole time-serie is calculated consistent methods but not yet reported in the NFR tables.
General/ IIR	Subcategory levels to aid navigation in the IIR	2010 submission	Review 2009
1A3	The calculation of tyre and brake wear and road abrasion emissions was revised	2009 submission	Nordic project on harmonization of the inventories
1A3	The calculation of heavy metals and particles from road abrasion and tyre and brake wear was checked and errors in the calculation were corrected	2010	QA/QC
1A3	Emissions from pipeline compressors have been reallocated under 1A3e since year 2009 emissions.	2011 submission	
1B1b	Revision of NMVOC EF according to GB13 (old 17.7 yksikkö, nes 7.7 yksikkö)	2016	
1A3bvi-1A3bvii	Particle emissions from road abrasion and tyre and brake wear in 1990-2009 were reported according to previous time series updates in order to ensure timeseries consistency	2011 submission	Improvement of timeseries consistency and inclusion of 1990-1999 emissions to reporting tables.
1A3bvi	Heavy metal emissions from tyre and brake wear in 1990-2009 were reported according to previous time series updates in order to ensure timeseries consistency	2011 submission	Improvement of timeseries consistency and inclusion of 1990-1999 emissions to reporting tables.

NFR	Identified improvement	Completed	Reason
1A3bvi	Brake wear AD updated (ratio of new/old vehicles) 2010-2015	2017 submission	EF update
1B	Allocation of fugitive emissions were checked. Few facilities were changed from 1B1ai to 1B2. Method descriptions in the IIR from this sector were improved as a result of review feedback	2010 submission	QA/QC. Review 2009
2D1 and 2D3	Allocation of mechanical wood processing. including manufacture of plywood. chipboard. reconstructed wood products. engineered wood products and sawmills. was changed from 2D1 to 2D3	2010 submission	New reporting templates 2010
2C5d	The emission factor for PCDD/F emissions from zinc manufacturing was revised to correspond the measurements performed at the zinc plant in 2003	2010 submission	QA/QC
2G	Tobacco smoking NMVOC EF according to GB 13 (4.8 -> 4.84)	2016 submission	
2G	Firework particles, AD updated, GB 2016 EFs, Completed with NOx, CO and Sox – emissions not yet reported because the earlier estimates in 2G include various sources which cannot be separated before recalculation of the time series	2018	
2G	Tobacco smoking particles GB 2016	2017 submission	EF update
2G			
3	A new calculation model for NH3 emissions from agriculture sector was introduced	2009 submission	Revision of the national method (QA/QC) and harmonization between the "ghg" and "air pollutant" nitrogen inventories
3	Recalculation of ammonia time series	2012-2015	Revision of national emission factors.
3A1-2	NMVOC emissions from NFR 3A were previously reported aggregated. The separation between 3A1 and 3A2 was performed.	2010 submission	New reporting templates
3B	Animal numbers (1990-2009) were cross-checked and harmonazed between "ghg" and "air pollutant" reporting	2011 submission	To make sure. that emissioin calculations are made using same animal numbers
3B	Particle emissions from manure management in 1990-2009 were recalculated and reported	2011 submission	Improvement of timeseries consistency and inclusion of 1990-1999 emissions to reporting tables.
3Da1	Particles calculated for the first time	2017 submission	Completeness
3Dc	Particles calculated for the first time	2017 submission	Completeness

NFR	Identified improvement	Completed	Reason
3D3	NO_x. CO. PAH-4 and NMVOC emissions from tobacco smoking were added to the inventory	2010 submission	QA/QC
3F	NH_3. CO and NO_x emissions from agricultural waste burning were included to the inventory	2009 submission	QA/QC
3F	NH3 emissions before 2011 were corrected due to updating AD	2016	
3F	Field burning heavy metals GB 2016	2017 submission	EF update
5C1bv	HCB from crematoria, GB 2016	2017 submission	EF update
5Cd	New activity data for cremation of corpses .	2010 submission	QA/QC. new sources for AD
5E	Car and house fires Particles, PCDD/F, heavy metals (GB 2016/Aasestad), 1990-2015	2017 submission	Check of EFs

Table 14.3. Sector-Spesific Improvement Needs According to QA/QC (revision in the 2018 submission)

NFR	Identified improvement	Time schedule	Reason for possible delay
General	Time series recalculation	2017 submission	Lack of resources
General	Documentation of the recalculation of the Energy sector	2018 submission	Lack of resources
General	Adding sub-category level chapters to navigation	2010	Partly carried out. to be finalized by 2015
1. 2 and 3	The splitting between energy and process based emissions (in cases where the reported emissions in VAHTI consist of both energy and process originated emissions together) will be improved in the forthcoming inventories when the energy sector recalculation has been finalized.	2018	Delay in recalculation of energy sector emissions
1A3	Emissions from the small scale inland cruising passenger transport are not included in the inventory at the moment as there is no data available for estimation of these emissions. The inventory includes inland waterway ferries and leisure boats.	not scheduled	Project with VTT not yet approved
1A3	Possibilities to revise the POP emission factors from off-road machinery will be studied further.	Project application 2018-2020 by VTT submitted	Lack of resources
1B2c and 1B2aiv	Emissions from venting and flaring (NFR 1B2c) are currently reported aggregated in NFR 1B2aiv. Reallocation will be considered parallel with the 2010 inventory.	2018	Delay in recalculation of energy sector emissions
2	The completeness of emission sources for heavy metals. persistent organic pollutants and ammonia and the need for new measurements shall be further studied. Input from Nordic cooperation project in 2016-2018	2017-2018	
2A	Activity data for production of glass was updated	2013	
2A1	PAH-4 emissions from cement production will be completed to cover both plants in the future inventories for the whole time series.	2018	Delay in recalculation of energy sector emissions
2D3	Allocation of SOx. NOx and PM2.5 emissions in NFR 2D3 will be corrected when the energy sector recalculation is finalized.	2018	Delay in recalculation of energy sector emissions
2G	NMVOCs from tobacco smoking were left under 2G, other emissions were moved under 2D3i (HCB from use of chlorochemicals and NMVOCs reported by plants)	2014	
3D3	Heavy metal emissions from fireworks will be considered to be added to the inventory	2018	Lack of resources
3D3	Improving accuracy of the new calculation model for NMVOCs from households	2016-2017	
3A3	NMVOC emissions from NFR 3A were previously reported aggregated. The separation of 3A3 from 3A1 and 3A2 will be considered by e.g. adding these subcategories to the annual data collection.	2012	Improvement of annual data collection did not result information detailed enough for data disaggregation at this point.
3B1-2	The calculation method for NMVOC emissions from NFR 3B1 and 3B2 to be improved in order to report these categories separately. Data collection on the volume of NMVOC in imported products needs to be arranged.	2012	Lack of resources
3D1	NMVOC emissions from agricultural soils should be included in the future inventories. Suitability of the method in the EMEP/CORINAIR Emission Inventory Guidebook (EEA. 2002) to the Finnish conditions should be studied.	2016	Lack of resources

NFR	Identified improvement	Time schedule	Reason for possible delay
All	The results of the recalculated emissions from e.g. processes and product use will be officially reported when the energy sector recalculation has been finalized	?	Delay in recalculation of energy sector emissions
All	Allocation of emissions to be consistent with the greenhouse gas inventory as far as possible..	2016	Delay in recalculation of energy sector emissions
3D3	Update the time series of emissions from house fires due to changes in the activity data statistics (consistency)	2012	
5C1a	Municipal waste incineration: correction of erroneous values in NFR tables until 2011	2016	
5C1a, 5D1, 5D3, 5E	Allocation of emissions was corrected: NFR 5C1a is NE and the emissions from WWTPs are now included under 5D1 and 5D3 (industrial and domestic ww handing). also double reporting of some values was corrected	2016	

Table 14.4. Response to Review Requests. (Revision in the 2018 submission)

Changes in chapter	
Update of text	March 2012 KS
Change in methodology	none
Other (e.g. language. layout)	March 2012 KS

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
Part A: Key review findings			
General	**8/2009.** Finland does not yet compile a KCA using the trend assessment due to pending recalculations for the earlier parts of some time series. The ERT encourages Finland to perform these recalculations as soon as possible and to compile the level assessment in the next submission	Will be added to the IIR when the time series recalculation is completed.	Not competed
General	**9/2009.** The ERT recognises the level of effort undertaken by Finland in providing an inventory with a significant level of detail to undertake a detailed review. Finland's IIR is generally well presented with all occurrences of the notation key “IE” in some small source categories explained in the report. However. the methodology descriptions are too general in the energy. Solvents. industrial processes and waste sectors preventing detailed analysis of emission methodologies and data sources by the ERT. The ERT noted that the description of the timeseries could be more detailed and that a number of	Description of time series will be more detailed when recalculation of the time series has been carried out. At the moment. Finland has not carried out major recalculations for air pollutants.	.Not completed

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
	methodology descriptions could be improved or added (e.g. 1.B fugitive emissions. assumptions on solvent content of paints. corrections of small errors on Waste for industrial waste water). The ERT encourages Finland to compliment the excellent work done on the inventory with more detailed for the solvents. energy. IP and waste sectors and to include more detailed descriptions of the timeseries of emissions for Key Categories.	A detailed description of the reporting obligations of plants and development of country-specific emission factors is already provided in the IIR 2009 in Chapter 2.3.3.3 Emission data reported by the facilities.	Invalid comment
General	**12/2009**. Finland reports some emissions as zero (0) in its data submission (e.g. NH3 in NFR 1A. some Heavy metals in NFR 2 and PM in NFR 4). The ERT encourages the use of notation key instead of zeros.	Finland is a small country (population 5 mill.) where the number of activities in some sectors can be 1 or 2. the applied abatement technologies efficient and the technologies/raw material can differ from those in other parts of Europe. Therefore the total emission levels can be very low. However. accurate information of the emissions is available in VAHTI (mostly measured emission data) and we use this data in the inventories. If the emissions (from one facility or several facilities summed up) are. for instance. 100 kg/a. and the reporting unit in the N08 tables is Gg's. the figure in the NFR table will be 0.000. Thus the actual emission is 0.0001 Ggs. which is written in the cell. but due to the required 3-decimal rounding it appears as 0.000). These emissions which are low when expressed in Gg's can. however. sum up to > 0.0005 or more. where after discarding them with a notation key would lead to slight under-evaluation of true emissions. Also. putting a notation key NA in stead of the real value would mean that the same source is reported inconsistently in the time series. when the emissions some years sum up to a significant number (e.g. 0.010) due to annually occurring actual fluctuations e.g. in the energy sector in some countries (e.g. Finland). In stead of reporting these emissions as "NO". Finland prefers to continue reporting the actual emissions even if they are low.	Completed: The explanation is provided in the Explanations to Abbreviations and under Chapter 2.4.4
General	**13/2009**. Finland has not undertaken any recalculations for their 2009 submission. Finland recognises. in its IIR. that some recalculations are necessary. but were not performed due to lacking resources. The recalculations are mainly needed for the years before 2000. The ERT encourages Finland to submit a consistent timeseries in its next submission.	Finland is striving to finalize the on-going recalculations as soon as possible. but succeeding in this will depend on the resources available for the work.	Not completed
General	**15/2009**. The ERT notes that there are some minor differences between the estimates provided by Finland under LRTAP and NECD. The differences occur mainly in agriculture and affect the national totals. The ERT encourages Finland to resolve these issues.	The NECD report (deadline until now 31st December but to be changed to 15th January the subsequent year) should be. according to the guidance. the "Final data" for a given year. To our understanding. the correct way of comparing NECD Final data and CLRTAP data is to compare data for a given year submitted to NECD by 31st December in year N (or after the NECD reporting rules change by 15th January in year N+1) and data for the given year submitted to CLRTAP by 15th February in year N+1. The Finnish CLRTAP report (deadline 10 months earlier than the deadline under the NECD. 15th February) is produced under very strict time limits due to late arrival of energy related source data. and therefore the	Completed A new chapter (Ch 2.8.1) has been added to explain the differences between CLRTAP and NECD.

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
		emission data reported by 15th February may include more or less errors and inaccuracies. Due to this fact. we annually correct all errors found between February 15th and December and report the corrected data under the NECD in December as the Final data for the given year. We also strive to make these corrections to the emission data for that given year when we submit the CLRTAP report by 15th February the subsequent year. To our understanding NECD Preliminary data for a given year submitted by 31st December in year N (or later by 15th January in year N+1) can be compared to CLRTAP data in year N+1. However. for Finland the reporting deadline for CLRTAP comes too early to enable matching the NECD Preliminary data and CLRTAP data. anyway. Finland has expressed the above mentioned difficulties in meeting the reporting deadlines for CLRTAP and NECD when these reporting guidelines have been reviewed in the past years.	
General	**18/2009**. Although having QA/QC measures in place. some errors occurred in Finland's 2009 submission. These mistakes led to a resubmission of the inventory data. The ERT encourages Finland to provide the resources to enable it to follow its QA/QC rules strictly and to thoroughly check future submissions before delivery.	We regret reporting of erroneous data and refer to lack of resources during the extremely narrow time window for preparation of the CLRTAP data set. Finland has expressed the possibility of not being able to report final data by the reporting deadline of CLRTAP when the reporting guidelines were under reviewed in the past years.	Not completed
General	**19/2009.** Finland did not resolve many of the questions identified in the stage 2 review 2008 due to a lack of resources and back-up experts available to deal with the questions. The ERT encourages Finland to improve the availability of staff in to respond to the CEIP to resolve stage 3 questions.	Finland will submit the remaining information attached to the comments to this review report as agreed in August with the lead reviewer. Part of the requests are already included in the IIR submitted by 15th March 2009. Finland suggests that future reviews will be scheduled earlier in the spring or alternatively in the autumn as availability of experts is rather limited between mid-June and mid- August	Completed
Part B: Recommendations for improvements to the party			
General	**25/2009.** The ERT encourages Finland to perform pending recalculations as soon as possible and to offer a key category analysis including trend assessment in the next submission.	Some sectoral recalculations have been carried out. Energy sector emissions have not been recalculated.	Partially completed
General	**26/2009**. The ERT encourages Finland to elaborate on the rational and explanation of recalculations and its implication to trends could for some sectors in the IIR.	Will be added to the IIR when the time series recalculation is completed.	Not completed

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
General	**27/2009**. The ERT encourages Finland to focus more effort on following its well defined checking routines before submitting its inventory to avoid errors in the reporting tables.	Cannot be carried out with the present resources.	Not completed
General	**28/2009**. The ERT encourages Finland to use notation key instead of zeros where estimates are not made.	See the response under para 12.	Completed
General	**29/2009**. The ERT encourages Finland to resolve and describe the differences between their NECD and CLRTAP submissions in the agriculture sector.	Explanation in chapter	Completed
General	**30/2009**. The ERT urges Finland to address the pending issues from its 2008 stage 3 review.	see the response under para 19	Completed
General	**31/2009**. The ERT encourages Finland to provide more details of methods. data sources and assumptions for the sub categories in the energy (including for 1.B fugitive emissions). solvents (assumptions on solvent content of paints). industrial process and waste sectors.	Will be added to the IIR 2010.	Completed
General	**32/2009**. The ERT encourages Finland to provide more detailed description of the time series of key categories into the IIR.	Will be added to the IIR when the time series recalculation is completed.	Not completed
General	**33/2009**. The ERT encourages Finland to provide sub category level chapters to aid navigation in the document.	Will be added to the IIR 2011	Completed
General	**34/2009**. The ERT encourages Finland to include missing sources (including cremation. sludge spreading) and estimation methods for Landfill NH3	Cremation and sludge spreading are indeed included in the inventory and allocated as follows: POP and PM emissions from cremation under NFR 6Cd and NH3 emissions from sludge (slurry) spreading under NFR4B. The new calculation model on agricultural nitrogen emissions (Grönroos et al. 2009) and EFs include the whole manure management chain. i.e. the agricultural sludge (slurry) spreading on fields is included in the EFs. These explanations will be included in the IIR to increase the transparency of the inventory. For Landfill NH3 see the reply under point 94.	Invalid comment & explanations completed
1	**38/2009**. The ERT notes that Finland's IIR explains that the methodology presented in the CORINAIR guidebook has been applied in this inventory and completed by national methods where available. according to the Guidebook principles. However. only the general methodology by code NFR are provided which are not sufficient for the ERT to analyse the underlying methods.The ERT encourages Finland to provide more detailed explanations of the methods. data sources and assumptions applied for each sub category. The ERT also encourages Finland to provide an explanation for the use if "IE" for 1A5b.	Explanations have been included in the IIR 2011 Finland considers ways to reallocate the data or change the notation key.	Completed

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
1	**40/2009**. The ERT commends Finland for providing an explanation for the differences between LRTAP submission and UNFCCC submission. However. the ERT noted that some minor differences between NECD and LRTAP submissions were not explained in the IIR for the energy sector. The ERT encourages Finland to resolve these issues and describe any remaining differences in its IIR	The explanations will be added in the IIR (see the response under para 15).	
1A1. 1A2. 1A4 and 1B	**45/2009**. For 1A1. 1A2. 1A4 and 1B the IIR only provides very general methodology descriptions making it difficult for the ERT to analyze the individual calculations in detail for each subsector. The ERT encourage Finland to provide more detail in its IIR the sub-sectors included within each NFR code as provided by Finland in a table during the review.	The detailed explanations added to the IIR 2011. Methodology descriptions of sector 1B improved	Completed
1A1. 1A2. 1A4 and 1B	**46/2009**. Finland's IIR explains the use of bottom-up data in the emission inventory. Good schemes are given in this report to explain the processing of emission data reported by the plants. The Finland explains that emissions data reported by the plants has been the basis of its inventory. But that the old data include only a few pollutants from. i.e. SOx. NOx. TSP and fuel consumption. The ERT recommends Finland to explain in its IIR what methodology is used to calculate the other pollutants for the categories which use a bottom-up (plant data) based approach.	No major recalculations are included in the Finnish air pollutant time series. Therefore the time series does not include many of the other pollutants that are not reported by the plants. Calculation of all pollutants is carried out on basis of fuel data available at process/boiler level in VAHTI. Reported data (mainly SOx. NOx and TSP for the earlier years) is QA/QC checked according to the description provided in the IIR and the calculated default values replaced with this always when found to be correct. Work to include missing emission estimates is going on annually when resources allow this work.	Not completed
1A1. 1A2. 1A4 and 1B	**48/2009**. The ERT notes that in the IIR a specific paragraph for the overview of energy sector describes the timeseries of fuel consumption. The ERT recommends that Finland explains with more detail the timeseries of the energy balance and provides a scheme which shows the evolution of fuel consumption per fuel and per year to improve transparency of the sector.	The detailed explanations will be added to the IIR.	Partly completed
1A1. 1A2. 1A4 and 1B	**49/2009.** The ERT notes that the number of Finnish energy plants is given in the IIR for the NFR codes 1A1. 1A2. 1A4a. 1A4b and 1A4c. The ERT encourages Finland to provide the number of Finnish energy plants by sub-sectors (for example. the number of cement industries. glass industries. etc.) in future IIRs to improve transparency.	The number of plants by SNAP sectors under NFR 1A1 and 1A2 is provided in Table 4.1 and the number of plants by SNAP sectors under NFR 1A4 a. b and c is provided in Table 4.13. The number of plants in the industrial sectors in Finland can be only 1 or 2. it is not possible to give the numbers by branches due to confidentiality reasons.	Invalid comment
mobile sources	**50/2009**. The ERT consider the Mobile sector to be complete for the latest inventory year (2007). For previous years emission estimates are in some cases missing (e.g. all transport modes before 2000; non road industry and non road comm../inst. sectors before 2007). The ERT encourages the Finland to complete the time series of emissions.	The estimates are not missing but are aggregated in the old time series. This will be corrected when the time series recalculation is finalized.	Not completed

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
mobile sources	**51/2009**. Finland have provided a detailed and generally transparent emissions inventory. Finland use a country specific methodology and emission factors for all mobile sectors which is in agreement with EMEP/CORINAIR guidelines. A comprehensive methodology description is given on the LIPASTO web site. The ERT recommends Finland to include more detail in the IIR/LIPASTO c.f. paragraphs 45-50 in order to improve transparency. The missing explanations relate to the fuel balance approach for road transport (1A3b). civil aviation (1A3a) and national navigation (1A3d). and the split between domestic and international sea transport (1A3d i & ii). and the implementation of cold start and deterioration emission effects for road transport vehicles (1A3b)	This information is available in the Finnish NIR and will copied to the IIR in the next submission.	Partly completed
mobile sources	**52/2009**. Finland has reported uncertainty estimates for mobile sources. at an aggregated sector level (e.g. 1A2. 1A3 and 1A4). The ERT encourage the Finland to make sub sectoral uncertainty estimates for all mobile sources.	Will be added to the future UC analysis.	Invalid comment
mobile sources	**54/2009**. Finland has not made recalculations to previous years in its latest (2009) submission. The ERT encourages Finland to recalculate the emissions prior to 2007 for mobile sources in order to take account of new methods and assumptions used for the latest year (2007) to obtain complete and consistent time series of emissions in the full inventory by the Finland.	Finland has submitted annual inventories by the latest reporting year and only the two last years a complete set of NFR tables from 1980. However. as explained earlier. this data is a compilation of the earlier submissions in the old reporting formats (different SNAP and NFR formats) and only copied to the new reporting tables and does therefore not fit the new NFR codes. However. for the transport sector. a complete time series is available for all years 1980-2027 from the LIPASTO system and this data can in principle be copied by subsectors to the new N08 tables in the next submission although it is uncertain whether the recalculations in the other sectors can be finalized and QAQC checked before 15th February 2010.	Not completed
mobile sources	**55/2009**. The ERT notes that Finland indicates in its IIR that it will recalculate the emissions for inventory years prior to 2007. Finland do not provide any further details on planned improvements for the mobile sector. The ERT commends Finland for its commitment to complete a consistent timeseries and encourages it to present details of other improvements needed and planned in its future IIRs.	see the reply for point 54 above	Not completed
1A3a	**57/2009**. The ERT noted that documentation is missing in the IIR/LIPASTO regarding how the fuel balance is handled between statistical fuel sales and calculated fuel for aviation. The ERT encourages Finland to include more details about what sub sector (LTO/cruise; national/international) estimates are being adjusted in order to obtain the fuel balance necessary to meet the EMEP/CORINAIR requirements.	This information is available in the Finnish NIR and will copied to the IIR in the next submission.	Not completed
1A3b	**58/2009**. No documentation is given in IIR/LIPASTO of how the fuel balance (sales vs. calculated fuel) has been accounted for in the LIISA model (fuel types. vehicle categories). The ERT encourages Finland to explain this in detail in future IIR/LIPASTO submissions/version.	This information is available in the Finnish NIR and will copied to the IIR in the next submission.	Not completed

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
1A3b	**59/2009**. No documentation is given in IIR/LIPASTO of how the effects of cold start and deterioration (catalyst vehicles) on emissions are implemented in the LIISA model. The ERT encourage the Finland to include more details regarding the model approach for deterioration and cold start in future IIR/LIPASTO submissions/version.	This information is available in the Finnish NIR and will copied to the IIR in the next submission.	Not completed
1A3dii	**60/2009**. No documentation is given in IIR/LIPASTO of how the split is made between domestic and international sea transport in the MEERI model. Finland is encouraged to explain this aspect of the methodology in the future IIR/LIPASTO versions.	This information is available in the Finnish NIR and will copied to the IIR in the next submission.	Not completed
1A3dii	**6/2009** No documentation is given in IIR/LIPASTO of how fuel sales statistics are treated in relation to calculated figures for national navigation. The ERT encourages Finland to describe the adjustment of calculated results. the sector transferral of fuel consumption to other fuel consuming sectors in the future IIR/LIPASTO versions.	This information is available in the Finnish NIR and will copied to the IIR in the next submission.	Not completed
1A2f ii. 1A4a ii. 1A4b ii. 1A4c ii	**62/2009**. For non-road machinery. a documentation report is available from the LIPASTO website. The ERT encourages Finland to provide a translation of this report into English language or to summarise the main details of the methodology. assumptions and data sources in its IIR.	A short description in English is provided on the LIPASTO website for the non-road machinery with the TYKO model. link http://lipasto.vtt.fi/tyko/tyko2007results.xls Information has been added to the IIR	Completed
2A-2G	**63/2009**. Completeness: The inventory is complete with respect to the most important sources of emissions. However. The timeseries for emission of NH3 from chemical industry is only presented from 1999-2007. The ERT encourage The Party to complete the timeseries or to provide an explanation.	The missing emissions will be provided when the on-going recalculation of time series is finalized.	Not completed
2A-2G	**64/2009**. QA/QC procedures: The IIR state that a general QA/QC plan has been implemented and for IP statistical quality checking has been carried out. however. no QA/QC has been described for the specific source-sector emissions in the IP sector. The ERT encourage the Party to describe and implement sector specific QA/QC procedures.	The information will be added to the IIR.	Partly completed
2A-2G	**65/2009**. Recalculations: The ERT encourage Finland to implement its recalculations as identified in its IIR. For Industrial Processes. the ERT encourages Finland to focus on recalculations for Cd. CO. Hg. NMVOC. NOx. Pb. and SO2 in order to allocate the emissions to relevant sectors rather that 2G Other production.	The sources under NFR2G will be checked but it is likely that these are mainly sectors that do not belong under other NFRs. therefore these emissions will remain in 2G also after reallocation (these emissions are mainly reported by the plants and not calculated). Note that the reporting threshold for operators in Finland has been much lower than in the EU directives or E-PRTR.	Not completed

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
2A-2G	**67/2009**. Transparency: The description of the applied methodology is very brief. Finland refer to The Compliance Monitoring Data system - VAHTI (http://www.ymparisto.fi/default.asp?contentid=142451&lan=EN) for IP. The data system contains information on the environmental permits of clients and on their wastes generated. discharges into water and emissions to air. The content of the database is checked and approved by the authorities before inclusion of the emission data in the inventory (IIR p. 132; footnote). The data reported to VAHTI may be of good quality but it is not possible to evaluate the data. According to the abovementioned webpage the database contains a lot of information on the individual sources. The ERT encourages Finland to provide more detailed explanations of the methods. data sources - i.e. VAHTI database - and assumptions applied for each sub category.	Information will be added to the IIR This information is already provided under Chapter 2.3.3.3.	Invalid comment
2A-2G	**68/2009.** The IIR indicate that improvements are planned for production of glass as NMVOC is planned to be included in the inventory. The ERT encourages Finland to implement these improvements and to continue to document planned and possible improvements in its IIR.	When the Glass Industry BREF is available	Not completed
2A-2G	**69a/2009**. The ERT encourages Finland allocate the emissions to specific sectors rather that 2G Other production.	see the reply under point 65.	Not completed
2A-2G	**69b/2009**. In general the inventory of industrial emissions is largely based on data reported by the plants. As the description of the content of the database is brief the ERT have been unable to review many of the individual sector methodologies.	The IP sector inventory is based both on data reported by the plants in VAHTI and on calculated estimates. For each pollutant there is a description in Chapter 3.2 of the share of data reported by the plants by each NFR codes. For the IP sector. the shares range between and 0 to 100% depending on the pollutant. For instance for SOx. NOx. CO. NH3. As. Cd. Cr. Cu. Pb. Hg. Ni and Zn the shares of VAHTI data are 100% (the plants have a monitoring obligation in their environmental permits).For NMVOCs. particles. PCDD/F. PAH-4.. HCB. PCB. PCP part of the IP NFR sectors . emissions from those processes that do not have the monitoring obligation in their permit. are calculated (share of data reported by the plants range from <0.1 to 100%) The descriptions in the IIR will be checked to see if it is possible to make the existing text more clear.	Partly completed
3	**70/2009**. The Finnish solvent emissions inventory appears to be of good quality. However the ERT Finland to improve the transparency to achieve a better transparency on activity levels considered and on EF used or derived from the bottom up approaches used.	See the reply under point 75.	Completed
3	**71/2009**. Completeness: The ERT considers the solvent use sector almost complete. The application of glues and adhesives (SNAP 060405) is not considered due to lack of data. The ERT encourages Finland to consider this activity.		Not completed

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
3	**75/2009**. Transparency: Finland is encouraged to improve the transparency of the IIR report. The description of methodologies used for the solvent sectors could be improved by adding emissions factors and information on activity levels. Methodologies used in Finland. for solvent uses. are mainly based on a bottom up approach. Emissions are collected but no information is provided on activity levels. It is consequently difficult to analyse if the reduction of emissions is due to a decrease of activities or to a real decrease of the emission levels or to assess the impact of regulations aiming at reducing emissions.	The inventory is based on 1. NMVOC emissions reported by the plants that have a monitoring obligation for their NMVOC emissions from solvent use 2. Calculation based on the amount of solvents in the products used and the volatilation rate of the solvents. The inventory is based on the actual volume of solvent in the products. Information on the annual volume of solvents in the products with their volatilation rates will be added for those sources where it is possible (there are likely confidentiality constraints). and the description of the methodology will be improved to clarify the principles. Calculation of emissions from the following sources is based on confidentiality of the data (either received through inquiries or the number of reporting plants is ≤ 3): printing. plastic product manufacturing. leather. oil extraction plants. paint manufacturing and application.	Completed
3	**76/2009**. Improvement: Finland plan to re-assess the EF used for degreasing and dry cleaning. The ERT supports this improvement as well as the re-allocation of each of these activities respectively under NFR 3B1 and NFR 3B2. Finland do not provide any further details on planned improvements for the solvents sector. The ERT commends Finland for its commitment to complete a consistent timeseries and encourages it to present details of other improvements needed and planned in its future IIRs.		Not completed
3A1	**77/2009**. Emissions are derived from industry expert opinions and data from sales and imports. The method is consistent with those proposed by the Guidebook. The ERT encourages Finland to present activity data more transparently per activity considered under the NFR 3A1. This could then provide an average emission factor which can be used to analyse trends across the time series and improve transparency.	Documentation of the calculations will be made more clear where possible. Information on the annual volume of solvents in the products with their volatilation rates will be added for those sources where it is possible. Finland is a small country (population 5 mill.) where the number of activities in some sectors can be 1 or 2.	Not completed
3A2	**78/2009**. Emission estimations are based on a bottom up approach through mandatory emission reporting and additional questionnaires for plants not concerned by the mandatory reporting. The overall methodology is robust. However activity data are not provided. The ERT encourages Finland to present activity data more transparently per activity considered under the NFR 3A2. This could enable to derive an average emission factor which can be used to analyse trends across the time series.	Information on the annual volume of solvents in the products with their volatilation rates will be added for those sources where it is possible. Finland is a small country (population 5 mill.) where the number of activities in some sectors can be 1 or 2.	Underway
3D3	**79/2009**. The ERT also encourages Finland to check whether emissions from vehicles dewaxing (SNAP 060409). underseal treatment and conservation of vehicles (SNAP 060407) are included in emissions reported by car manufacturers. If not. the ERT recommends to Finland to check the significance of these activities and if necessary to estimate and report emissions.	These emissions are included in the inventory according to our reply to the ERT in our reply from 16th July (see the table on pages 6-8 in our reply)	Invalid comment

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
3B	**80/2009**. 3B1 and 3B2: the methodology used for degreasing and dry cleaning is based on a mix of bottom up approach and top down approach. Solvent consumption is determined from a balance between input and known outputs of solvent in wastes. The emission factor used for area sources is 0.7 kg VOC / kg solvent. This EF is valid both for degreasing activity and dry cleaning. Finland plans to re-assess this EF. The ERT supports this re-assessment and would suggest to Finland to differentiate metal degreasing emissions and dry cleaning emissions.	This improvement will be considered and carried out when resources available.	Not completed
3B	**81/2009**. The ERT also recommends that Finland provide the consumption of solvents at the activity level in its IIR. This could be used to provide transparency on the trends across the time series.	For data reported by the plants this information is not possible to receive as the plants are obliged to report only the emissions which are QA/QC checked by the supervising authority. For sources calculated the activity data used will be added to the IIR.	Completed
3C	**82/2009**. The inventory is complete for 3C. Emission estimations are based on a bottom up approach through mandatory emissions reporting and additional questionnaires for plants not concerned by the mandatory reporting. The overall methodology is robust. However activity data are not provided. The ERT encourages Finland to present activity data more transparently in its IIR to provide transparency on the trends across the time series.	See the reply under point 75.	Completed
3D	**83/2009**. 3D1 to 3D3. The inventory is almost complete for 3D. The ERT recommends to Finland to set up a methodology to estimate NMVOC emissions from glue and adhesive application.	This is already included in the Finnish inventory improvement plan but is not possible to be included due to lack of activity data although the methodology exists.	Not completed
3D	**84/2009**. Emission estimations are based on a bottom up approach through mandatory emissions reporting and additional questionnaires for plants not concerned by the mandatory reporting. The overall methodology is robust. However activity data are not provided. The ERT encourages Finland to present activity data more transparently per activity considered under NFR 3D1. 3D2 and 3D4. This could enable to derive an average emission factor which can be used to analyse trends across the time series and understand them for each activity considered under the NFR 3D1. 3D2 and 3D3.	Activity data for NFR 3D1 will be added to the IIR. The activity data for sectors 3D2 and 3D3 will be added to the IIR for those sources where it is possible (confidentiality constraints likely). Finland is a small country (population 5 mill.) where the number of activities in some sectors can be 1 or 2.	Completed
4	**85/2009**. The ERT encourages Finland to recalculate emissions from years prior to 2007 using the current methodology.		Not completed
4	**88/2009**. Recalculations: The ERT note that recalculations using the corrected EFs have not been carried out. The ERT acknowledges the effort needed for this revision but encourages Finland to carry out recalculation of previous years emissions using the consistent methodologies EFs.	The intention is to include the missing estimates in the next submission.	Not completed
4D1	**93/2009**. The ERT encourages Finland to implement the planned improvement by including direct soil emissions of NMVOC when methodology available under 4D1 Direct Soil Emissions.		Not completed

NFR	Comment	Finland's response	Completed/ Not completed/ Invalid comment
6	**94/2009**. Completeness: The inventory is complete with respect to the most important sources of emissions. However. NH3 from landfills is missing from the estimates. The Party is encouraged to investigate whether this source is relevant under Finnish conditions.	NH3 emission from landfills is considered irrelevant under the Finnish conditions. The explanation will be added to the IIR.	Completed
6	**95/2009**. QA/QC procedures: The IIR state that “no quality checking is applicable for the current method” and “no verification has been carried out for the specific source-sector emissions”. The ERT encourage the Party to indicate in its IIR why this is the case and to identify possible methods for QC of the estimates.	We have forgotten to update this part of the IIR after a new calculation method was introduced some years ago. The requested information will be added to the IIR.	Completed
6	**98/2009.** Transparency: The IIR refer to the UNFCCC reporting regarding methodologies applied for Solid waste disposal on land and Wastewater handling as well as VAHTI (The Compliance Monitoring Data system). The ERT encourage Finland to present the methodology descriptions in the IIR including and specific additional assumptions applied for air pollutants in order to improve the transparency.	The requested information will be added to the IIR.	Completed
6	**99/2009**. Improvement: The IIR state that the methodology for emission of NMVOC from Wastewater handling as well as Waste incineration “should be revised in the future”. The ERT encourage Finland to implement the improvements in the coming inventory. No improvements are planned for Solid waste disposal on land and Other waste.	We have forgotten to update also this part of the IIR and at the moment there are no plans to revise the current methodology.	Completed
6	**100/2009**. As the description of the content of the database is brief the ERT have been unable to review many of the individual sector methodologies. Finland is encouraged to present applied methodology in the IIR rather than referring to the UNFCCC reporting to apply the NRF version 08 for the complete timeseries and to improve the description of the content of VAHTI.	The requested information will be added to the IIR.	Completed

15.1.1 Review. improvement and harmonisation of the Nordic Air Emission Inventories by cooperation in the Nordic Air Emissions Expert Group

Since 2004 the Nordic countries 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.

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) and POP and heavy metals from all sectors (2016-2018).

This method of working in the NAEEG group is based on

- exchange of data and information between experts in the institutions in the Nordic countries working with emission inventories
- comparison of data and methodologies. elaboration of reasons for deviations and comparing LRTAP emission inventories for verification purposes
- improving the quality of inventories based on information sharing
- compilation of reports containing the collected inventory knowledge and suggestions for research and development projects needed to increase the accuracy of the inventories.

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Appendix 1

Overview of ammonia emissions in Finland 1980-2050
Recalculation of emissions 1990-2012
Last updated 14.3.2014

1 AMMONIA EMISSIONS 1980 – 2012 IN FINLAND

1.1 Ammonia emission reduction targets

Finland has not reached the national ceiling for ammonia (31 kt). Factors impacting the development of emissions were not thoroughly recognized when the emission ceiling was set. New emission sources have been identified since, emission estimation methods have been significantly improved, and, the need for further reduction needs, especially in the agriculture sector, which contributes to 90% of emissions, were not recognized at the time the ceiling was set.

Although the declining number of animals was known for a longer period, the growth of the amount of nitrogen excreted in the manure of dairy cows, especially, was only later discovered. Changes in animal feed to contain more of nitrogen rich raw material was not compensated by the decrease in animal numbers and information on manure management practices was not sufficient to support further analysis. In addition, ammonia emissions from catalytic converters in cars, amounting 3 kt at the moment, were not yet identified.

1.2 Ammonia emission inventory in Finland

Ammonia emissions are generated in activities in the agriculture, transport, energy production, industrial processes and waste sectors. The Finnish ammonia emission inventory was updated in 2008 according to the results of the new model for agriculture emissions (Grönroos et al, 2009). This model takes into account the changes in the animal specific ammonia emissions from manure management.

The Finnish ammonia emission trend 1980-2012 including recalculated ammonia emissions in 1990-2012 are presented in Figure A1 and in Table A1. At the moment, ammonia emissions in 1980-1989 are based on expert estimates instead of calculations.

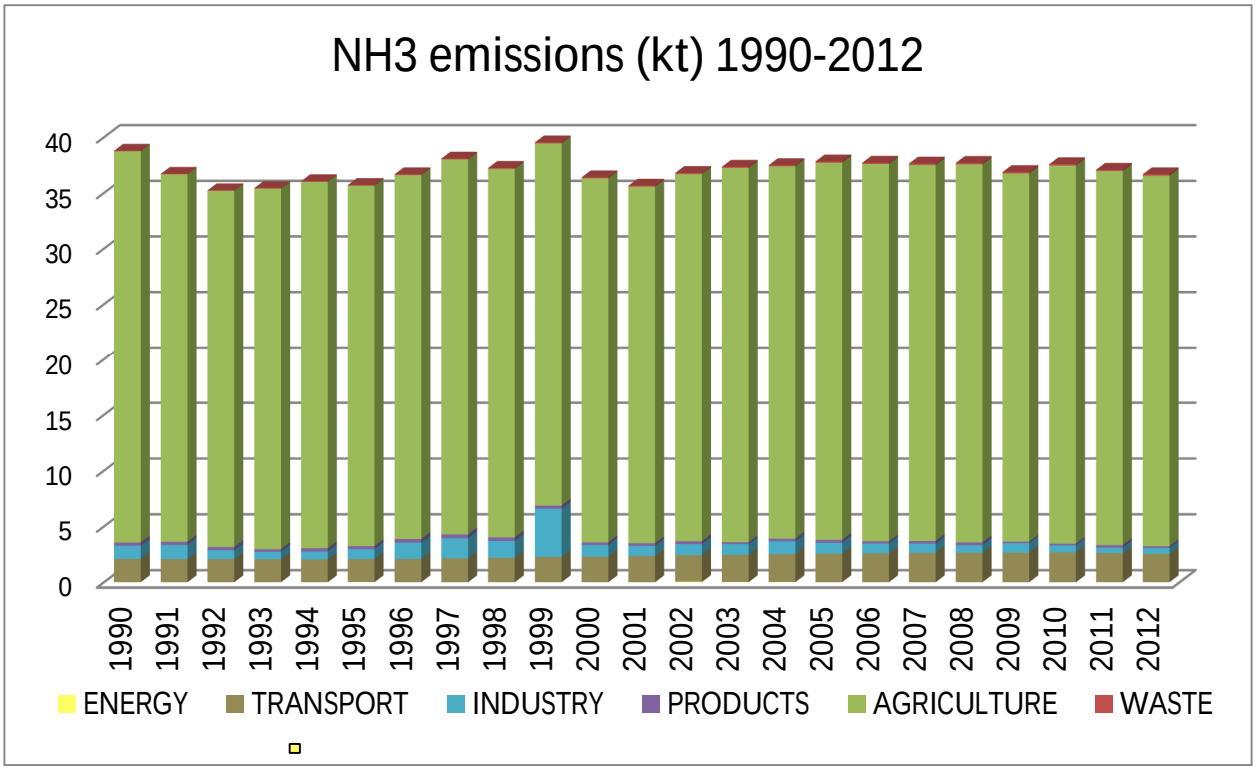

Figure A1. Ammonia emissions by source sectors in 1990-2012 with the revised NH3 model

Table A1. Ammonia emissions by source sectors in 1980-2011, revised method.

Year	Energy	Road transportation	Other transportation	Industrial processes	Solvent Use	Agriculture	Waste	Total
1980	0.02	1.361	0.00477	2.167	0.260	43.844	0.035	47.691
1981	0.02	1.4	0.00479	2.167	0.260	43.844	0.035	47.730
1982	0.02	1.456	0.00480	2.167	0.260	43.844	0.035	47.786
1983	0.02	1.516	0.00485	2.167	0.260	43.844	0.035	47.846
1984	0.02	1.582	0.00483	2.167	0.260	43.844	0.035	47.912
1985	0.02	1.647	0.00487	2.167	0.260	42.401	0.035	46.534
1986	0.02	1.716	0.00486	2.167	0.260	40.958	0.035	45.161
1987	0.02	1.812	0.00505	2.167	0.260	39.516	0.035	43.815
1988	0.02	1.924	0.00523	2.167	0.260	38.073	0.035	42.484
1989	0.02	2.038	0.00541	2.167	0.260	36.631	0.035	41.156
1990	0.0006	2.0911	0.00536	1.167	0.257	35.188	0.035	38.744
1991	0.0006	2.0721	0.00535	1.260	0.255	33.038	0.039	36.670
1992	0.0006	2.0693	0.00529	0.794	0.246	32.036	0.044	35.194
1993	0.0003	2.0537	0.00531	0.663	0.215	32.418	0.047	35.402
1994	0.0008	2.0437	0.00537	0.708	0.259	32.945	0.050	36.012
1995	0.008	2.0648	0.00529	0.889	0.243	32.404	0.058	35.673
1996	0.004	2.0817	0.00525	1.456	0.291	32.736	0.066	36.640
1997	0.001	2.1352	0.00540	1.809	0.300	33.727	0.070	38.048
1998	0.0009	2.19	0.00546	1.508	0.281	33.146	0.075	37.206
1999	0.0009	2.253	0.00557	4.332	0.243	32.590	0.080	39.504
2000	0.0009	2.2865	0.00559	1.056	0.192	32.743	0.085	36.370

2001	0.0027	2.3358	0.00550	0.915	0.209	32.058	0.090	35.615
2002	0.0429	2.3923	0.00556	0.966	0.229	33.024	0.094	36.753
2003	0.01491	2.4461	0.00557	0.943	0.147	33.665	0.098	37.320
2004	0.0183	2.5036	0.00555	1.147	0.208	33.482	0.103	37.467
2005	0.0111	2.5458	0.00554	0.973	0.235	33.916	0.113	37.800
2006	0.0075	2.5744	0.00561	0.871	0.186	33.927	0.108	37.679
2007	0.0048	2.6328	0.00561	0.807	0.229	33.802	0.129	37.610
2008	0.002	2.6243	0.00550	0.681	0.215	33.989	0.127	37.643
2009	0.0071	2.6446	0.00498	0.840	0.124	33.100	0.124	36.844
2010	0.0027	2.6711	0.00531	0.614	0.138	33.990	0.126	37.547
2011	0.004	2.616	0.00544	0.470	0.198	33.636	0.126	37.051
2012	0.003	2.546	0.005	0.517	0.162	33.319	0.125	36.678

The trend from 1990 to 2050 using the revised calculation method is presented in Figure A2 and in Table A2.

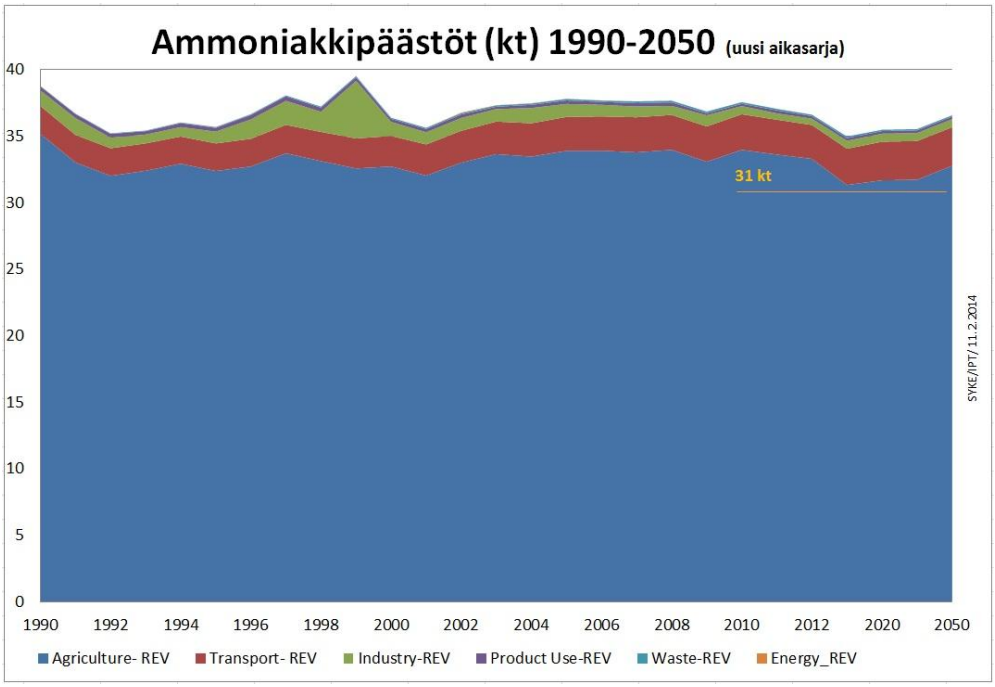

Figure A2. Ammonia emission trend 1980-2050

Table A2. Projected total ammonia emissions by source sectors

Year	Energy	Road transport	Industrial processes	Solvent Use	Agri-culture	Waste	TOTAL
2020	0.00003	2.9	0.6	0.2	30.92	0.11	34.73
2030	0.00003	2.9	0.6	0.2	31.74	0.11	35.55
2050	0.00003	2.9	0.6	0.2	32.78	0.11	36.59

1.2 Ammonia emissions recalculation 1990-2012

NH_3 emission calculation methods have been improved since setting the national ceiling for NH_3 under the UNECE CLRTAP and EU NECD. The Finnish ammonia emission inventory has been updated during 2011-2012 according to new information on sources of ammonia emissions and related emission rates. The updated estimates are based on improved calculation methods for the agriculture sector as explained below under paragraph Agriculture, as well as updated information on emissions from other sectors which were excluded from the earlier estimates.

According to the new calculations, total NH_3 emissions were 48 kt in 1980, out of which agriculture contributed to 43.8 kt. In 1990 total emissions were 39 kt, out of which 35.2 kt from agriculture. After that, total NH_3 emissions have stayed at the level of 38 kt, agriculture contribution varying between 32 - 34 kt annually. In 2011 total ammonia emissions were 37 kt.

Road transport emissions were 1.4 kt in 1980 and have increased to 2.6 kt in 2011 due to increase in the driven kilometres. Emissions from industrial processes and product use were 2.2kt in 1980 and have decreased to 0.5 kt in 2011, while emissions from waste sector are annually at the level of <0.1 kt.

The total ammonia emissions in 1990 have been estimated at around 38 or 39 kilotonnes in all national inventories. The shares of the sources contributing to the emissions in 1990 and 2010 are presented in Table A3 and Figure A3, the earlier estimates in Table A4 and the recalculated inventory 2012 in Table A1.

The recalculation was carried out to include sources not included in the earlier estimates and to take into account the results of the improved basis for agricultural NH_3 inventory based on a new model (Grönroos J. et al., 2010). The changes made to the earlier estimates are discussed below and illustrated in Figures A4-6.

Table A3. Sources included in the earlier and 2012 recalculated inventories

Year	Energy	Transport	Industry	Solvent Use	Agriculture	Waste	Total
1990	No	No	Yes	No	Yes	No	38.00
1990 recalculated 2012	Yes	Yes	Yes	Yes	Yes	Yes	38.74
2010	Yes	Yes	Yes	Yes	Yes	Yes	36.92

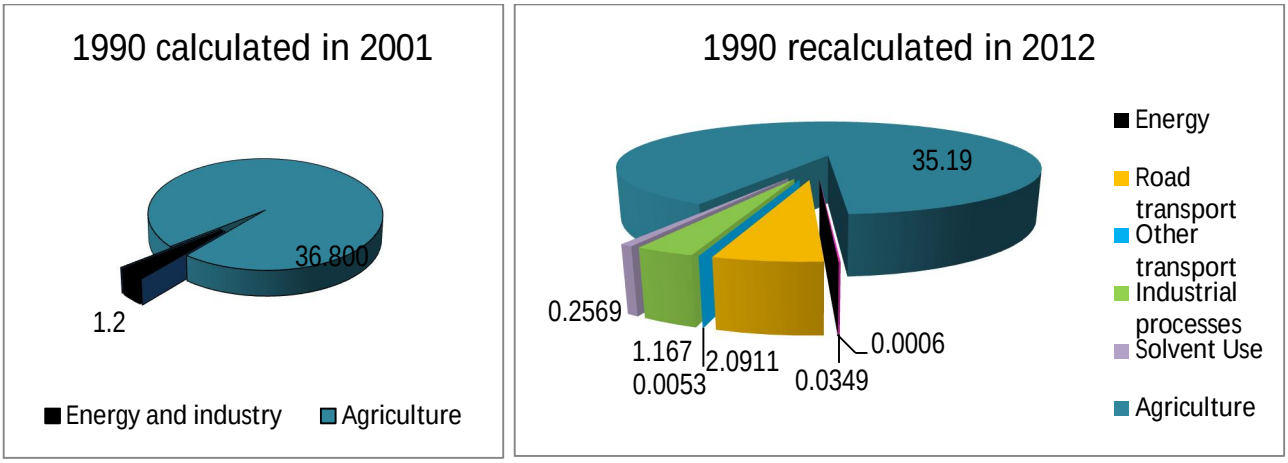

Figure A3. Shares of sources contributing to total ammonia emissions in 1990

Table A4. Ammonia emission inventory 1990-2005 reported in 2001-2006

Year	Energy	Transport	Industrial processes	Solvent Use	Agriculture	Waste	TOTAL
1990	1.2	NE	IE	NE	36.800	NE	38.00
1991	NE	NE	IE	NE	NE	NE	NE
1992	NE	NE	IE	NE	NE	NE	NE
1993	NE	NE	IE	NE	NE	NE	NE
1994	NE	NE	IE	NE	NE	NE	NE
1995	1.2	NE	IE	NE	34.000	NE	35.20
1996	NE	NE	IE	NE	NE	NE	NE
1997	1.2	NE	IE	NE	36.800	NE	38.00
1998	NE	NE	IE	NE	NE	NE	NE
1999	0.4	NE	2.6	NE	32.300	NE	34.90
2000	0.01	NE	0.8	NE	32.200	NE	33.01
2001	NE	NE	0.83	NE	32.200	NE	NE
2002	NE	NE	0.12	NE	32.100	NE	32.22
2003	NE	NE	0.12	NE	32.100	NE	32.22
2004	0.02	NE	1.1	NE	33.000	NE	NE
2005	NE	NE	NE	NE	33.000	NE	33.00

Differences between the earlier and recalculated NH_3 inventories

A short summary of the differences between the inventory in 2012 (table A1) and the inventory reported in 2001 is provided below.

Agriculture sector

The agriculture sector contributed to 90.8% (1990) and 91% (2012) (Figure A4) of total annual ammonia emissions. The uncertainty for the agriculture sector inventory varies from ±50% in waste burning to ±80% in fertilizer use and to -96-+117% in animal husbandry. While the activity data in animal husbandry is accurate the uncertainties concerning the elements of the final emission factors are high (130%).

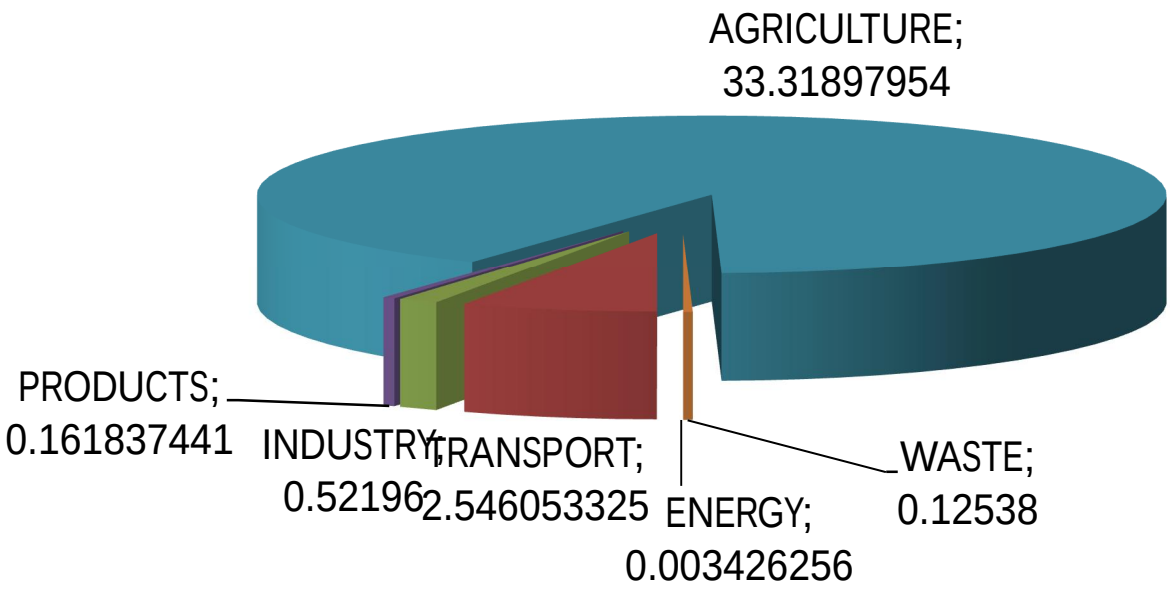

Figure A4. Ammonia emissions in 2012

In the recalculated inventory the factors affecting emissions were adjusted for the time series 1990-2010 to reflect the actual changes in emissions. As a result, the emission trend in the updated inventory is clearly lower for the years 1990-1997 and slightly higher for the years after 1997 than in the earlier inventory (Figure A5). A comparison of ammonia emission factors and nitrogen excretion values to EMEP/EEA Emission Inventory Guidebook, RAINS model and some other countries is provided in Annex 1. A detailed description of the project to revise the agriculture ammonia calculation model is published in Development of the ammonia emission inventory in Finland (Grönroos et al., 2009, The Finnish Environment 8/2009) and information on data used in the calculations is presented below under Chapter 2.

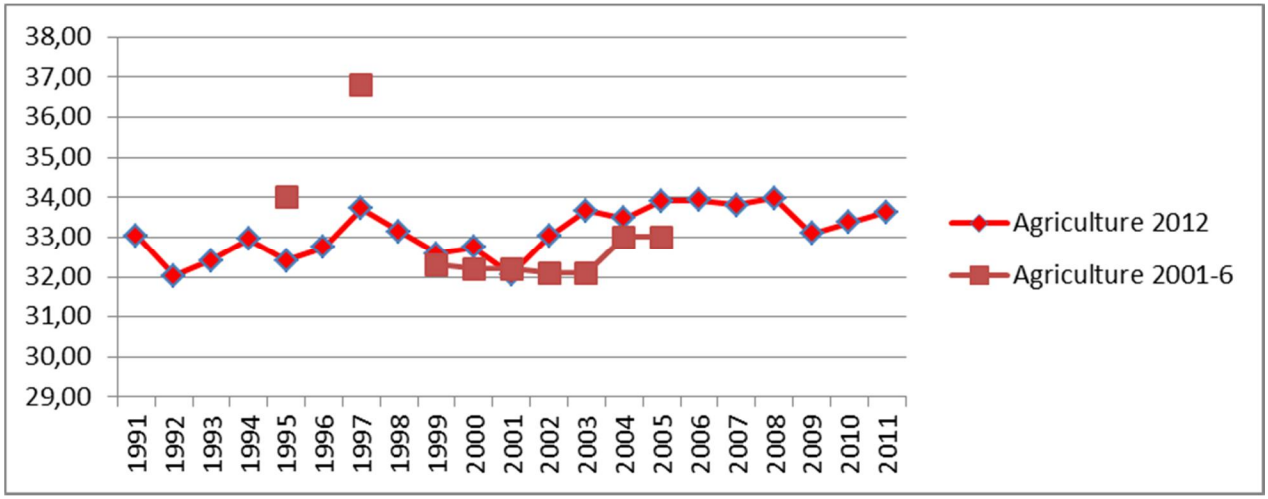

Figure A5. Comparison of the agriculture sector NH3 inventories calculated in 2001-6 and 2012

Industrial processes

The industrial processes sector contributed to 3% (1990) and 1,7% (2010) of total annual ammonia emissions. However, emissions from industrial processes are fluctuating over the years, e.g. in 1999 the contribution was 11% to total emissions. The uncertainty for the industrial processes sector emissions varies from ±67% to ±100%. The inventory was recalculated in 2012 for 1990-2010 (Figure A6) to cover all industrial sources, while the earlier estimates included emissions from scattered industrial sources in a non-consistent manner. The fluctuation of the time series reflects the actual emissions. Industrial sources include chemical, non-ferrous metals and pulp and paper industries. It is estimated that the emissions from industrial processes will stay at the level of 1 kt annually.

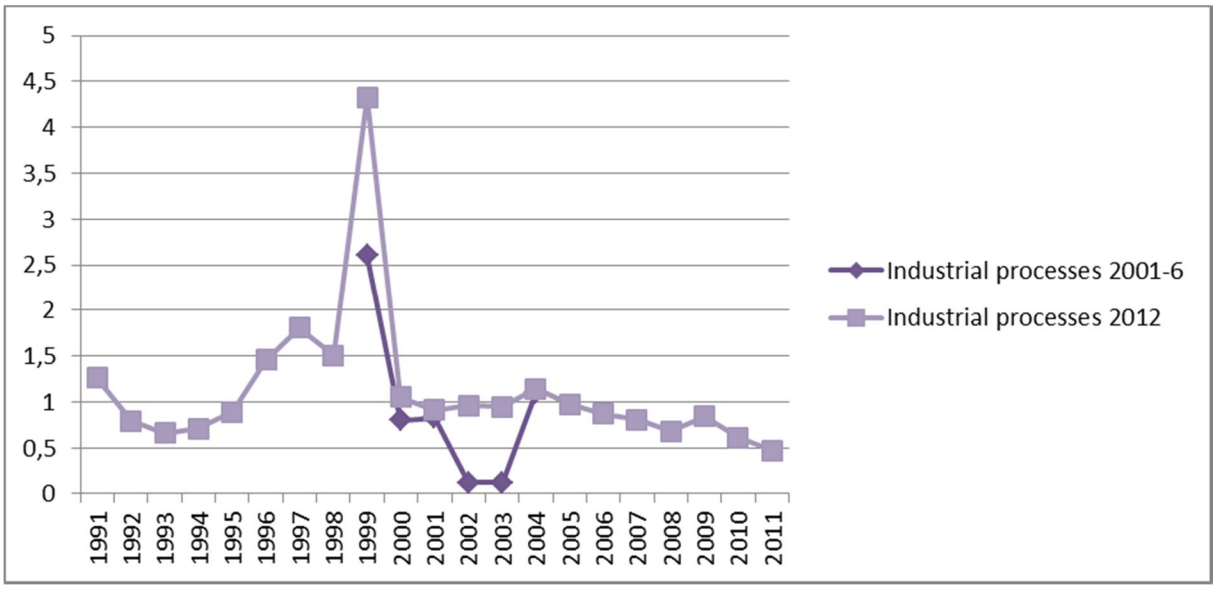

Figure A6. Comparison of industrial processes sector NH3 inventory in 2001-6 and 2012

Transport sector

The transport sector contributed to 5.4% (1990) and 7.2% (2010) of total annual ammonia emissions. The uncertainty for the transport sector inventory is 48-80%, depending on the accuracy and estimated reliability of the fuel statistics in different subsectors. In the recalculated inventory emissions from road transport, railway, navigation and other mobile sources, including off-road machinery were calculated for all years in the time series 1990-2010 (Figure A7), while the earlier inventory included no estimates for the transport sector. Emissions from road transport are slightly growing due to steady growth in road traffic. Emissions from other than road transport including mobile machinery fluctuate depending on the economic trend. The drop in emissions in 2009 is due to significantly reduced fuel use in machinery, rail and marine transportation that year.

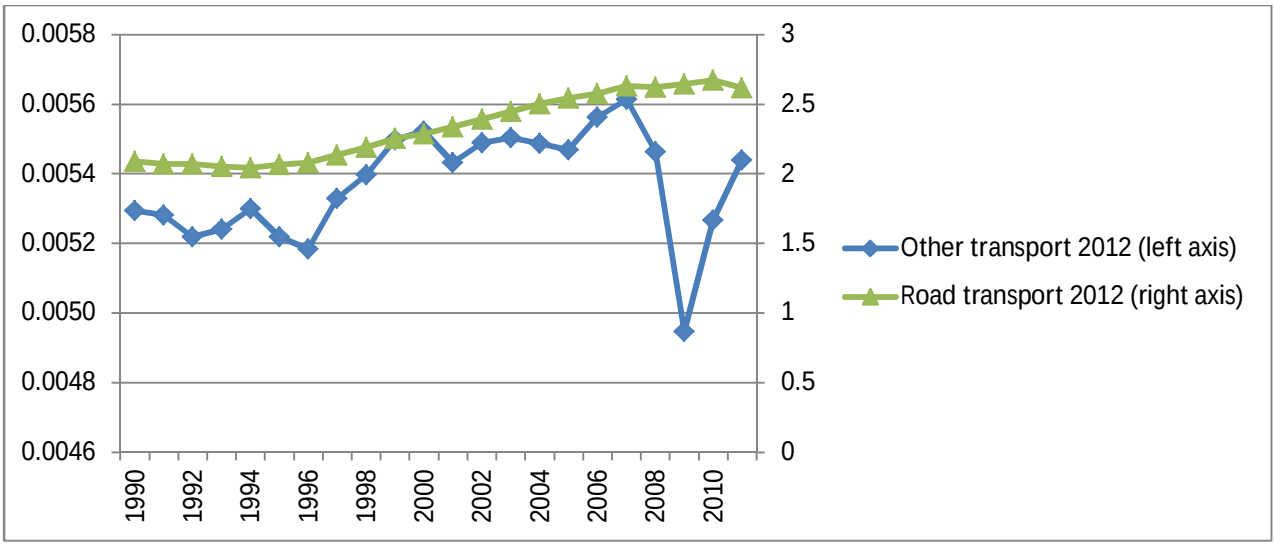

Figure A7. Comparison of transport sector NH3 inventory in 2001-6 and 2012

Energy sector

The energy sector contributed to 0.002% (1990) and 0.007% (2010) of total annual ammonia emissions. The uncertainty of the sector is 80%. Diesel power plants and boilers equipped with SCR abatement technique are included in the present energy sector inventory, but were only partly included in the earlier estimates non-consistently over the years. The emission trend is slightly increasing (Figure A7).

Solvent and other product use sector

The solvent and other product use sector contributed to 0.7% (1990) and 0.4% (2010) of total annual ammonia emissions. The uncertainty of the sector is ±100%. The earlier estimates did not include solvent and other product use while in the recalculated inventory emissions from mineral and textile manufacturing sectors are included. The emission trend is decreasing (Figure A7).

Waste sector

The waste sector contributed to 0.1% (1990) and 0.3% (2010) of total annual ammonia emissions. The uncertainty of the sector is ±200%. In the recalculated inventory includes emission from composting which is increasing (Figure A8). This source was not included in the earlier inventory.

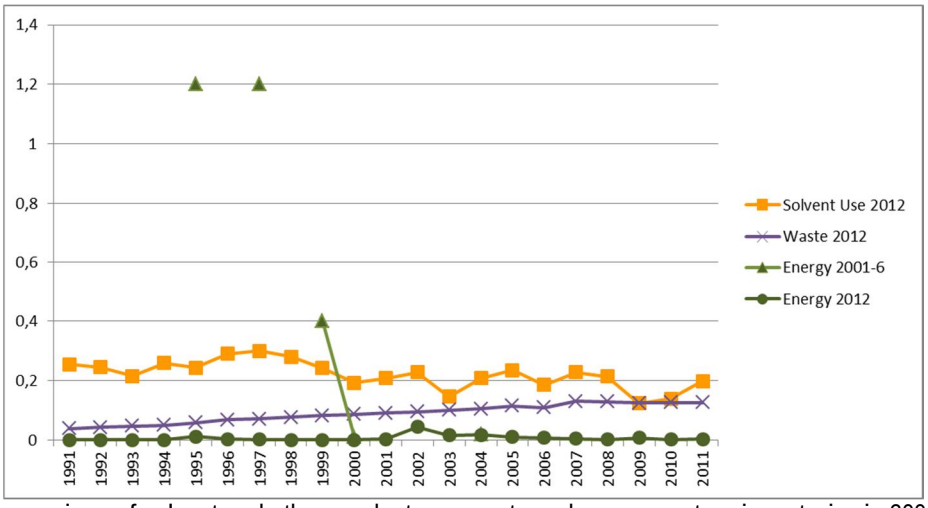

Figure A8. Comparison of solvent and other product use, waste and energy sectors inventories in 2001-6 and 2012

Table A5 comparison of ammonia emission factors and nitrogen excretion values to EMEP/EEA Emission Inventory Guidebook, RAINS model and some other countries

Ammonia emission factors for livestock animals by animal category (kg NH_3 per head (or animal place or pelt) per year) for the years 1990 and 2010 calculated with the revised model compared with emission factors used by EMEP/CORINAIR (EEA 2009), RAINS-model (Klimont and Brink 2004), based on Grönroos et al., 2009 Table 20

	Revised model 1990	Revised model 2010	EMEP/EEA Guidebook	RAINS[1)]
Dairy cows	25.7	35.9	slurry 39.3 and solid 28.5	33.4
Suckler cows	14.4	14.4	13.4	15.9
Heifers	9.7	12.7	13.4	15.9
Bulls	16.7	23.5	13.4	15.9
Calves < 1 yr.	8.9	12.6		
Sows (with piglets)	10.1	10.9	slurry 15.8 and solid 18.2	
Fattening pigs (kg NH_3 per animal place)	6.7	6.5	slurry 6.7 and solid 6.5	3.5
Boars	7.0	7.1		
Weaned pigs (20–50 kg)	3.3	3.3		
Laying hens	0.4	0.4	slurry 0.48 and solid 0.48	
Broilers (kg NH_3 per animal place)	0.2	0.2		
Chickens	0.2	0.2		
Cockerels	0.6	0.6		
Broiler hens	0.4	0.4	broilers (broilers and parents) 0.22	
Turkeys	0.4	0.6		
Other poultry	0.3	0.3	other poultry: ducs 0.68, geese 0.35, turkey 0.95	
Sheep with lambs	1.7	2.1	sheep and goats 1.4	
Goats with gilts	2.1	2.2		
Horses	15.8	16.5	horses and mules, asses 14.8	
Ponies	11.6	11.8		
Fur animals			fur animals 0.02	
Minks and fitches (kg NH3 per pelt)	0.40	0.42		
Foxes and racoons (kg NH3 per pelt)	0.67	0.74		
Reindeer	0.6	0.6		

Nitrogen excretion values used for the year 2006 in the calculation of ammonia emission in some European countries (Appendix B, NERI 2008, Swedish environmental protection agency 2008, Umweltbundesamt 2008, Federal Environment Agency 2006 (Table 21 in Grönroos et al, 1009)

	Finland	Denmark	Sweden	Austria	Germany
Dairy cows	121.9	134.66	125	95.63	[1)]
Non-dairy cattle		38.0			
Beef cows			63		44
Cattle. 1–2 yr.			47	53.6	
Suckler cows	63.9			69.5	96
Heifers	50.3				
Bulls	66.4			68.4	42
Calves < 1 yr.	37.6		28	25.7	16
Swine		8.55			[1)]
Sows (with piglets)	28.5		34[2)]	29.1	
Fattening pigs (kg NH_3 per animal place)	8.9		10.08	10.3	
Boars	19.7		34		
Weaned pigs (20–50 kg)	2.79				
Poultry		0.63			
Laying hens	0.67		0.64		0.74
Broilers (kg NH_3 per animal place)	0.398				
Chickens	0.354		0.28		0.29
Cockerels	1.00				
Broiler hens	1.33		0.29		
Turkeys	1.371				
Other poultry	0.67			1.1	
Sheep with lambs	9.97	16.95[3)]	13[4)]	13.1 [3)]	13[3)]
Goats with gilts	10.7	16.36[3)]		12.3 [3)]	
Horses	60.9	43.31	50	47.9	64
Ponies	43.5				
Fur animals		5.18			
Minks and fitches (kg NH3 per pelt)	1.305		4.1		
Foxes and racoons (kg NH3 per pelt)	2.34				
Reindeer	10.7				

2 Source specific overwies

2.1 Agriculture

Agriculture is the main source of ammonia emissions in Finland and the present emission trend is slowly increasing.

Ammonia emissions from agriculture have decreased over the period of 1980–2012. One reason for this is Finland's membership in the EU that resulted in changes in the economic structure followed by an increase in the average farm size and a decrease in the number of small farms. Those changes also resulted in the decrease of livestock numbers[1]. The use of nitrogen fertilisers has reduced while manure management has been improved due to measures taken by the farmers as a part of an agro-environmental program aiming to minimise nutrient loading to water courses.

The agriculture sector emissions originate mainly from animal manure management (95% of agriculture sector emissions), application of nitrogen fertilizers (5% of agriculture sector emissions) and field burning of agricultural wastes (0.02% of agriculture sector emissions).

2.2.1 Manure management

The emissions from manure management depend on animal numbers, annual N excretion per animal, manure management systems (how manure is handled), ammonia emission coefficients for different manure management phases (how much manure N is lost to the atmosphere as NH_3 without abatement measures in different manure management phases), ammonia emission abatement measures in the different manure management phases and emission reduction capacity of the abatement measures. Out of these factors the first two are the most important in terms of total emissions. There have been relatively big changes in the animal numbers: in 2010 the numbers of dairy cows were 44% lower than in 1990. The share of dairy cows of the total ammonia emissions from manure in 2010 was 35%. At the same time, however, there have been changes in annual N excretion per animal: in 1990, average N excretion value of dairy cow was 91.3 kg N/animal/year and in 2010 the value was 129.2 kg N/animal/year being 42% higher than in 1990. Similar trends can be seen for other cattle.

Milk production contributes to 10 kilotonnes of ammonia emissions annually, corresponding to 30% of NH_3 emissions from agriculture.

Meat production, including hens contribute to 21 kilotonnes (70%). Although the number of animals is decreasing, the specific emissions from milk and meat production are growing. Emissions related to animal husbandry total approximately 33 kilotonnes annually.

Ammonia emissions from the use of fertilizers are annually approximately 1 – 1.5 kilotonnes. The consumption of ammonia fertilizers is decreasing.

2.2.2 Calculation model for nitrogen emissions from agriculture

Ammonia emissions were calculated by the new calculation method (Grönroos et al., 2009) for the first time for 2007 emissions and have been reported in 2009 and 2010. The revised model takes into account the current knowledge on manure management practices and ammonia volatilization in Finland. The model includes gaseous nitrogen emissions (NH_3, N_2O and NO) and thus

[1] Except for the number of horses that has increased in the recent years due to the increasing interest in equitation. These emissions, however, are not a major contributor to the trend.

integrates the national greenhouse gas and air pollution inventories for nitrogen emissions. It also enables reporting of emissions at the level of detail given by the reporting guidelines of UNECE CLRTAP and UNFCCC. The ammonia calculation model is used both in calculation of air pollutant (by SYKE) and greenhouse gas emissions (by MTT Agrifood Finland) and the animal numbers are annually checked to equal in both calculations.

Activity data used for the calculation is retrieved from agricultural statistics from TIKE (Information Centre of the Ministry of Agriculture and Forestry) (TIKE, 2011), the Finnish Trotting and Breeding Association of horses (Suomen Hippos, 2011) and from the statistics of Finnish Fur Sales (Finnish Fur Sales, 2011), which are presented in Table 7.5. The number of reindeers is from the Yearbook of Farm Statistics (TIKE, 2011) and corresponds to the number of reindeer left alive during the reindeer herding year.

Ammonia emissions from manure are calculated separately for each animal category and, within each animal category, separately for each manure management system. The calculation is based on the mass flow approach, where the starting point is the amount of excreted nitrogen calculated from animal numbers and animal specific nitrogen excretion rates. The fate of excreted nitrogen is then followed during the manure management chain. Ammonia and nitrous oxide emissions to the atmosphere are calculated in each phase of the chain. Adding up the phase specific emissions gives the total emission. Animal specific ammonia emission factors are calculated by dividing the total emission of an animal category by the number of animals in the category. Nitric oxide (NO) emissions are assessed for mineral fertilizers only. For the detailed description of the calculation the reader is adviced to the original report available in http://www.ymparistokeskus.fi/download.asp?contentid=105290&lan=en.

Emission factors for calculation of the time series 1990-2010 emissions are presented in Table A6 and animal numbers in Tables A7.

Table A6 Ammonia emissions factors for manure management in 1990-2011 (kg NH_3 / animal) (Ammonia model based on Grönroos et al.. 2009).

Year	Dairy cows	Suckler cows	Bulls	Heifers	Calves < 1 year	Sows with piglets	Fattening pigs (50-kg)	Boars	Weaned pigs (20-50 kg)
1990	25.7	14.4	16.7	9.7	8.9	10.2	6.7	7.0	3.3
1991	26.0	14.4	16.9	9.9	9.1	10.1	6.6	7.0	3.3
1992	26.3	14.5	17.1	10.1	9.3	10.0	6.5	6.9	3.2
1993	26.5	14.5	17.4	10.4	9.5	10.0	6.5	6.9	3.2
1994	26.8	14.5	17.6	10.6	9.7	9.9	6.4	6.9	3.2
1995	26.9	14.5	17.7	10.6	9.8	9.9	6.4	6.9	3.1
1996	27.5	14.6	18.0	10.8	10.0	10.0	6.4	6.8	3.2
1997	28.1	14.7	18.3	11.0	10.2	10.1	6.4	6.7	3.1
1998	28.7	14.7	18.6	11.1	10.4	10.2	6.4	6.6	3.2
1999	29.3	14.8	18.6	11.3	10.6	10.3	6.4	6.5	3.2
2000	30.0	14.9	19.2	11.5	10.7	10.4	6.4	6.4	3.2
2001	30.7	15.0	19.9	11.7	11.1	10.4	6.4	6.5	3.2
2002	31.4	15.1	20.6	12.0	11.4	10.4	6.4	6.8	3.2
2003	32.0	15.1	21.5	12.2	11.7	10.5	6.5	6.9	3.2
2004	32.7	15.2	22.0	12.5	12.0	10.5	6.5	7.1	3.3
2005	33.4	15.3	22.6	12.7	12.3	10.5	6.5	7.3	3.3
2006	33.9	15.4	23.0	12.9	12.5	10.6	6.5	7.4	3.3
2007	34.4	15.4	23.7	13.2	12.8	10.7	6.5	7.3	3.3
2008	35.1	14.9	23.6	12.9	12.7	10.8	6.5	7.2	3.3
2009	35.9	14.4	23.5	12.7	12.6	10.9	6.5	7.1	3.3
2010	35.9	15.9	24.4	13.9	13.5	10.5	6.5	7.4	3.3
2011	35.9	15.9	24.1	13.9	13.5	10.6	6.4	7.5	3.3

Year	Sheep with lambs	Goats with gilts	Laying hens	Broilers	Chicken	Turkeys	Other poultry	Horses	Ponies
1990	1.7	1.7	0.3	0.2	0.2	0.4	0.3	15.8	11.6
1991	1.7	1.7	03	0.2	0.2	0.5	0.3	15.5	11.4
1992	1.8	1.8	03	0.2	0.2	0.5	0.3	15.2	11.1
1993	1.8	1.8	0.4	0.2	0.2	0.5	0.3	14.8	10.9
1994	1.8	1.8	0.3	0.2	0.2	0.5	0.3	14.5	10.6
1995	1.8	1.8	0.3	0.2	0.2	0.5	0.3	14.4	10.6
1996	1.9	1.9	0.4	0.2	0.2	0.5	0.3	14.4	10.6
1997	1.9	1.9	0.3	0.2	0.2	0.5	0.3	14.4	10.6
1998	1.9	1.9	0.4	0.2	0.2	0.5	0.3	14.4	10.6
1999	1.9	1.9	0.4	0.2	0.2	0.6	0.4	14.3	10.5
2000	2.0	2.0	0.4	0.2	0.2	0.6	0.4	14.3	10.5
2001	2.0	2.0	0.3	0.2	0.2	0.6	0.4	14.8	10.8
2002	2.0	2.0	0.3	0.2	0.2	0.6	0.4	15.2	11.0
2003	2.0	2.0	0.4	0.2	0.2	0.6	0.3	15.6	11.3
2004	2.1	2.1	0.4	0.2	0.2	0.6	0.3	16.1	11.6
2005	2.1	2.1	0.3	0.2	0.2	0.6	0.3	16.5	11.8
2006	2.1	2.1	0.3	0.2	0.2	0.6	0.3	16.5	11.8
2007	2.1	2.1	0.3	0.2	0.2	0.6	0.3	16.5	11.7
2008	2.1	2.1	0.3	0.2	0.2	0.6	0.3	16.5	11.7
2009	2.1	2.1	0.3	0.2	0.2	0.6	0.4	16.5	11.8
2010	2.1	2.2	0.3	0.2	0.2	0.6	0.3	16.5	11.8
2011	2.1	2.2	0.3	0.2	0.2	0.6	0.3	16.5	11.8

Year	Minks&fitches	Foxes&racoons	Reindeer
1990	0.4	0.7	0.6
1991	0.4	0.7	0.6
1992	0.4	0.7	0.6
1993	0.4	0.7	0.6
1994	0.4	0.7	0.6
1995	0.4	0.7	0.6
1996	0.4	0.7	0.6
1997	0.4	0.7	0.6
1998	0.4	0.7	0.6
1999	0.4	0.7	0.6
2000	0.4	0.7	0.6
2001	0.4	0.8	0.6
2002	0.4	0.8	0.6
2003	0.4	0.8	0.6
2004	0.4	0.8	0.6
2005	0.4	0.9	0.6
2006	0.4	0.9	0.6
2007	0.4	0.9	0.6
2008	0.4	0.8	0.6
2009	0.4	0.7	0.6
2010	0.4	0.9	0.6
2011	0.4	0.9	0.6

Table 7 Animal numbers in Finland in 1990-2011 (x 1 000 heads).

Year	Cattle[1]	Dairy cows	Suckler cows	Bulls	Heifers	Calves	Horses	Ponies	Sheep with lambs
1990	1 360	490	14	149	219	488	39.4	6.0	103
1991	1 310	446	21	144	214	486	41.7	6.4	107
1992	1 273	428	28	143	211	463	42.7	6.4	108
1993	1 252	426	33	139	217	437	42.7	6.3	120
1994	1 233	417	33	144	215	425	42.1	6.2	121
1995	1 148	399	29	109	189	422	43.7	6.2	159
1996	1 146	392	31	115	201	407	45.6	6.4	150
1997	1 142	391	32	121	197	402	47.9	6.8	150
1998	1 117	383	31	115	190	398	49.2	6.9	128
1999	1 087	372	30	118	188	379	49.6	6.6	107
2000	1 057	364	28	115	185	365	50.7	6.7	100
2001	1 037	355	27	111	182	362	51.9	6.7	96
2002	1 025	348	28	115	180	354	52.1	7.0	96
2003	1 000	334	28	116	179	344	52.9	7.3	98
2004	969	324	31	111	173	330	53.8	7.3	109
2005	959	319	35	108	169	329	56.1	7.7	90
2006	949	309	39	113	171	318	58.1	8.0	117
2007	927	296	43	110	167	311	59.5	8.5	119
2008	915	289	48	109	165	305	60.6	8.8	122.2
2009	918	290	52	110	163	304	63.0	9.3	117.7
2010	926	289	55	114	164	303	64.6	9.7	125.7
2011	914	286	57	111	162	299	65.3	10.2	129.1

Year	Goats with gilts	Swine[3]	Sows with piglets	Fattening pigs (50- kg)	Boars	Veaned pigs (20-50 kg)	Reindeer	Mink and polecat	Fox and racoon
1990	5.9	936	179	438	5.9	313	239	1805	1478
1991	5.4	911	174	426	5.8	305	260	1505	1092
1992	4.8	879	168	411	5.6	294	232	1576	1272
1993	4.8	862	165	403	5.5	289	215	1659	1221
1994	5.7	879	168	411	5.6	294	214	1639	1645
1995	6.0	925	161	451	6.5	306	208	1945	1804
1996	6.5	940	180	445	6.6	309	213	1801	2344
1997	8.0	1 029	185	470	7.1	367	203	1828	2493
1998	8.1	972	187	421	7.8	357	196	1646	2322
1999	7.9	914	180	431	5.8	297	195	1733	1972
2000	8.6	884	184	405	6.0	289	203	1498	1863
2001	7.4	852	164	391	5.4	292	186	1399	1544
2002	6.6	878	172	405	5.3	296	200	1408	2003
2003	6.8	924	178	444	5.0	297	197	1379	2205
2004	7.3	912	175	441	4.7	291	201	1355	2175
2005	6.9	950	177	460	4.4	309	207	1466	2320
2006	6.7	959	171	457	4.0	327	198	1466	2320
2007	6.2	1 020	175	497	4.1	345	193	1422	2025
2008	5.9	1 031	169	504	3.9	354	195	1768	1713
2009	5.9	985	153	492	3.2	337	193	1259	1440
2010	4.9	958	151	488	3.1	316	194	1576	1898
2011	4.9	944	143	471	3.3	327	196	1576	1898

Year	Laying hens	Broilers	Turkeys	Chicken	Cocerels	Broiler hens	Other poultry
1990	4845	2993	60	1633	50	62	21
1991	4138	3250	64	1304	45	97	32
1992	3969	3506	68	1598	40	133	43
1993	4025	3763	72	1522	35	168	54
1994	4090	4020	76	1422	30	203	65
1995	4179	4276	80	1482	25	240	75
1996	4184	4052	96	1246	25	279	54
1997	4152	4911	112	1288	32	299	33
1998	3802	5507	145	1185	30	347	35
1999	3361	5998	210	1025	17	382	39
2000	3110	7918	215	914	18	364	32
2001	3202	5412	455	1043	12	394	35
2002	3213	5766	531	772	9	402	41
2003	3016	6050	603	931	10	346	40
2004	3069	5573	535	912	10	287	18
2005	3128	5472	495	954	12	287	20
2006	3103	5366	493	844	13	391	15
2007	3134	5074	431	764	13	369	24
2008	3190	5675	415	865	19	339	19
2009	2926	4918	306	859	15	329	16
2010	3394	4616	280	838	14	433	12
2011	3304	5421	308	745	22	421	14

The growth of the emission factors versus the declining population of animals are presented in Figure A8.

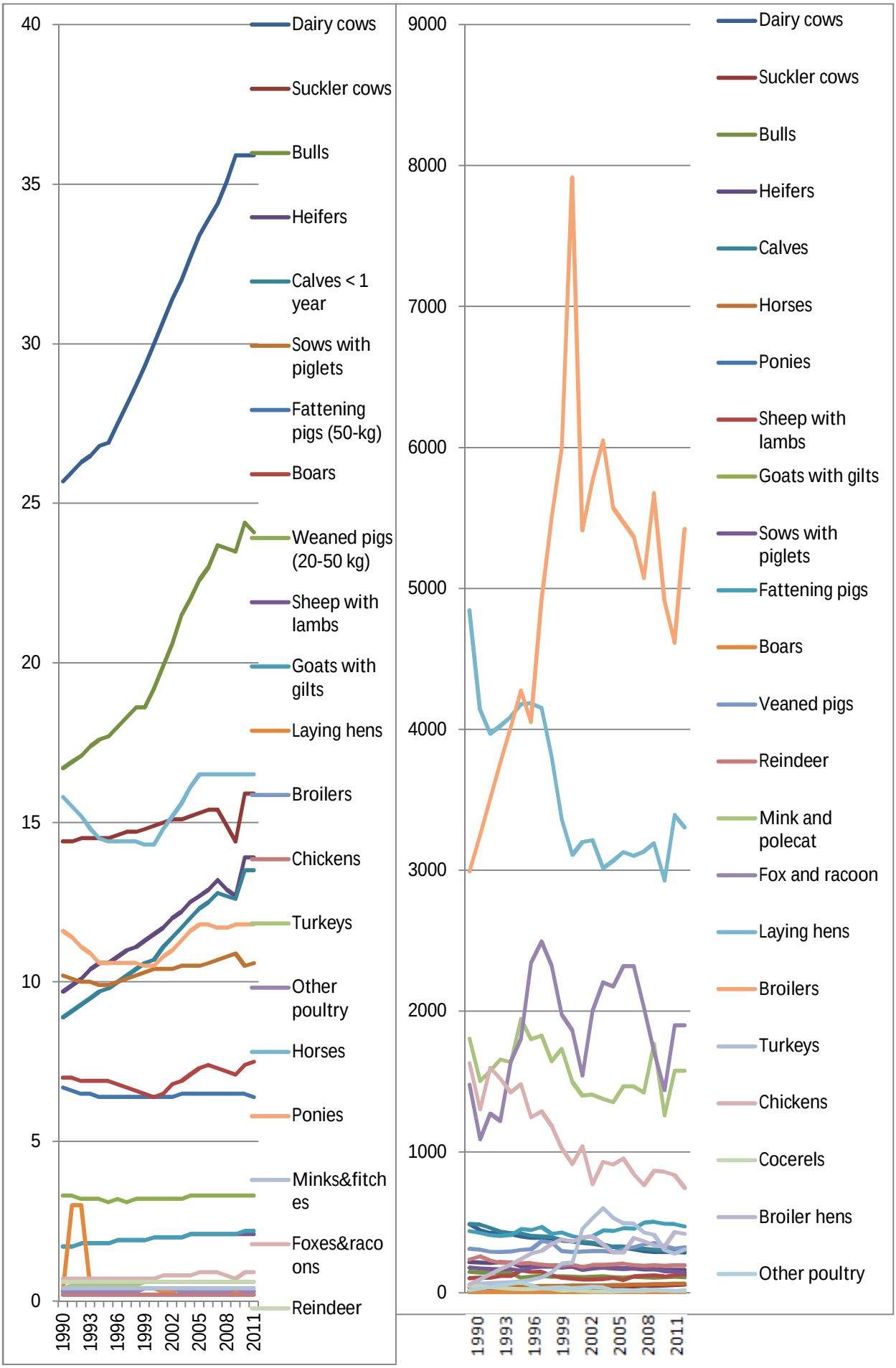

Figure A8. The growth of NH3 emission factors and the declining numbers of animals.

According to the results of the model, ammonia emissions from agriculture in 2010 are 33.3 kilotonnes, and approximately 31.6 kilotonnes for years after that. No significant changes are estimated in the development of emissions.

A comparison between the earlier and current estimates is presented in Figure A9.

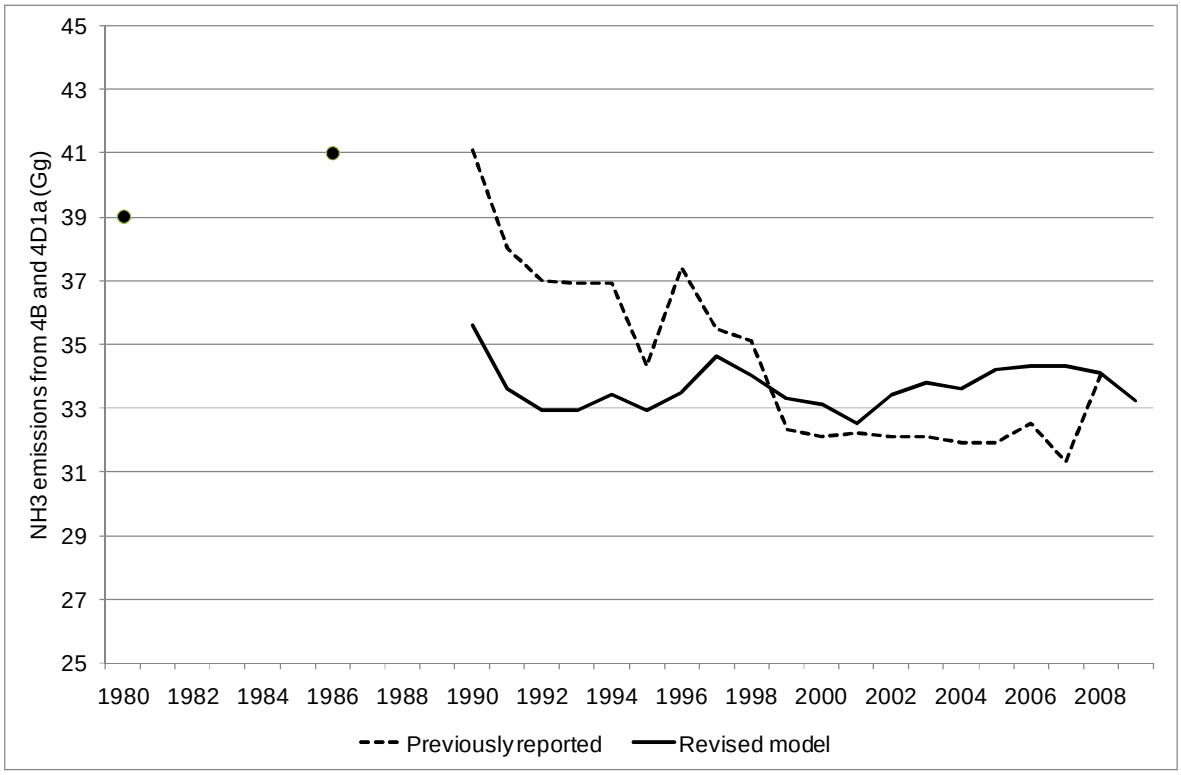

Figure A9. Comparison of the earlier estimates of NH_3 emissions from Manure Management and from the Use of Synthetic Fertilizers to the new estimates of NH_3 emissions from the same sources calculated with the revised ammonia model reported in the 2011 submission (1990-2009).

2.2.3 Application of Synthetic fertilizers

Calculation of NH_3 emissions from application of nitrogen fertilizers was carried out with the new calculation model for agricultural nitrogen emissions (Grönroos et al., 2009). The calculation is consistent with guidance in EMEP/EEA Guidebook (EEA, 2002) and uses national emission factors (Grönroos *et al* 2009). Activity data for calculation of emissions from agricultural soils in received from Yara Finland Ltd. (Brenback, 2010) and the Yearbook of Farm Statistic (TIKE, 2011).

Ammonia emissions due to the use of mineral N-fertilizers is calculated separately for the different fertilizer types using emission factors derived from those presented in the EMEP/EEA Emission Inventory Guidebook (EEA, 2007). The total amount of nitrogen sold annually in Finland is divided by fertilizer type using information obtained from Yara Finland Ltd. Furthermore, the use of different mineral N-fertilizers is allocated between arable and grassland soils according to the agricultural land use statistics from the Information Centre of the Ministry of Agriculture and Forestry. In Finland, placement fertilization is typically used for cereals. Based on the emission reduction efficiencies of the different manure applications and emission abatement methods, it was

assumed that placement fertilization reduces ammonia volatilization by 50% compared to surface application of mineral fertilizers. Thus, emission factors for arable land were multiplied by 0.5 except for nitrogen solutions for which placement fertilization is not used. (Grönroos et al., 2009). For the detailed description of the calculation the reader is adviced to the original report available in http://www.ymparistokeskus.fi/download.asp?contentid=105290&lan=en . The distribution of mineral fertilizers is presented in Table 8.

Table 8. Distribution of mineral N-fertilizers used in Finland by fertilizer type (%), distribution of each fertilizer type by application target (arable or grassland, %), and emission factors (EF) for different fertilizer types applied on arable and grassland. (Grönroos et al., 2009)

Spread as:	% of applied N	On arable land, %	On grassland, %	EF arable, %	EF grass, %
Ammonium sulphate	0.0	65	35	1.5	1.5
Ammonium nitrate	0.0	65	35	0.6	1.6
Calcium ammonium nitrate	19.6	65	35	0.6	1.6
Anhydrous ammonia	0.0	65	35	2.0	2.0
Urea	0.0	65	35	11.5	23.0
Nitrogen solutions[1)]	0.04	100	0	7.0	7.0
Ammonium phosphates	0.13	65	35	1.5	1.5
Other NK and NPK	80.2	65	35	0.6	1.6
Nitrate only	0.05	65	35	0.5	0.5

[1)] Nitrogen solutions are not used on grasslands. Because solutions are applied with sprayers, no emission correction factor due to placement fertilization is used.

2.2.4 Field burning of crop residues

Field burning of crop residues is a source of NH_3. In Finland, burning of agricultural residues occurs only at small scale and it is becoming increasingly rare. Straw is assumed as the most important residue burned. The emissions from cereal straw (wheat, barley, oats, rye) burning were included into the inventory for first time in the submission in 2009.

Ammonia emissions are calculated according EMEP/CORINAIR Emission Inventory Guidebook (EEA, 2002). The emission factor 2.4 mg NH_3 per gram straw was used according the Guidebook.

3 Energy production, industrial processes, product use

Energy production, industrial processes and product use sectors contribute at the moment together to approximately 0.7 kt/a (< 2%) to annual ammonia emissions.

For these sectors rough estimates of ammonia emissions have been used for the inventory of years 1980-1999 and it will be studied in the next years if these estimates need to be revised.

3.1 Energy production

Ammonia emissions in the energy production sector originate from combustion of light fuel oil and motor gasoline and the implied emission factors calculated from the inventory are 0.00012 t/TJ and 0.00018 t/TJ, respectively. The emissions are annually at the level of < 0.005 kt/a contributing to < 0.01% of total emissions.

1.2 Industrial processes

Ammonia emissions from industrial processes were reported by plants in the mineral products sector in 2000-2006, originating from some surface treatment processes, and the reported

emissions were at the level of 0.01 kt/a (0.03% of total NH_3). These emissions are not included in the inventories for 2007-2010 emissions but the need to complete the inventory with these estimates will be checked in the next years.

Chemical industry contribution to ammonia emission is approximately 0.3 kt/a (0.7% of total NH_3). The emissions originate in production of fertilizers and silicon wafers. Only imported ammonia is used in the production process of fertilizers at the moment. In 1990–1992 small amounts of ammonia (12–30 Gg per year) were produced domestically and this was mainly used as a raw material for fertilizers and in the production of nitric acid.

The contribution of metal industry to ammonia emissions has decreased from the period 2000-2005 when it was approximately approximately 1 kt/a to the current level of 0.1 kt/a (0.3 %). Ammonia emissions originate in non-ferrous metals production and are not fully included in the current estimates for the earlier years 1980-1999 . The need for revising these estimates will be studied in the next years.

Ammonia emissions from pulp and paper industry has been at the level of 0.2 kt/a (0.5% of total emissions) during the last years. Emissions have been included as point source data in the inventory since year 2000 and the need to revise the calculated estimates for the earlier years will be studied in the next years.

Food and drink sector contributes currently to ammonia emissions by 0.0002 kt/a (<0.001% of total emissions).

3.3. Solvent and other product use

Ammonia emissions from mineral wool production have been at the level of 0.2 kt/a (0.5% of total emissions) in 200-2010 for which period emissions from this source have been calculated.

3.4 Emissions reported by the plants

Ammonia emissions from energy production, industrial processes and product use sectors are either reported by the plants or calculated using methods in the EMEP/EEA Emission Inventory Guidebook, or from other sources. The contribution of emissions reported by the plants in 2010 is presented in Table A9.

Table A9. NH_3 emissions, the share of emissions reported by the plants of the total emissions by NFR categories in 2011. The table has not been updated according to the recalculated data 15.12.2012.

NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	<0.1	<0.001	<0.1	2G	0.1	0.019	100
1A2fii	<0.1	0.002	<0.1	3C	<0.1	0.001	100
1A3bi	6.8	2.594	<0.1	3D3	0.5	0.198	100
1A3bii	<0.1	0.008	<0.1	4B13	6.4	2.456	<0.1
1A3biii	<0.1	0.011	<0.1	4B1a	26.9	10.25	<0.1
1A3biv	<0.1	0.003	<0.1	4B1b	25.8	9.862	<0.1
1A3c	<0.1	<0.001	<0.1	4B3	0.7	0.271	<0.1
1A3di(i)	<0.1	<0.001	<0.1	4B4	<0.1	0.011	<0.1
1A3dii	<0.1	0.001	<0.1	4B6	3.2	1.204	<0.1

1A4aii	<0.1	0.001	<0.1	4B8	14.7	5.627	<0.1
1A4bii	<0.1	<0.001	<0.1	4B9a	2.6	0.991	<0.1
1A4cii	<0.1	0.001	<0.1	4B9b	2.8	1.084	<0.1
1A4ciii	<0.1	<0.001	<0.1	4B9c	0.5	0.185	<0.1
1A5a	<0.1	<0.001	<0.1	4B9d	0.9	0.335	<0.1
2B5a	0.6	0.244	100	4D1a	3.5	1.345	<0.1
2C5c	0.2	0.092	100	4F		0.014	<0.1
2C5e	<0.1	<0.001	100	6D	0.3	0.111	<0.1
2D1	0.3	0.115	100	**Total**	**100**	**37.1**	**1.8**

4 Transport

Ammonia emissions from transport sector contribute to approximately 3 kilotonnes. i.e. 7% of total emissions. The main source is catalysators in cars which contributes to 2 -3 kilotonnes annually. and is estimated to increase gradually with the growing number of catalysators in cars.

Emissions for all transport modes are calculated using emission factors based on expert estimate (Mäkelä. 2007) and driven kilometres from VTT LIPASTO calculation system (Tables A10).

Table A10a. NH_3 emission factors (Mäkelä 2007).

Source	Emission factor	Unit
Passenger cars and vans without catalytic converter	2	mg/km
Passenger cars and vans with catalytic converter	90	mg/km
Passenger cars and vans. diesel	1	mg/km
Heavy duty	3	mg/km
Motorcycles	2	mg/km
Mopes	1	mg/km
Marine. gasoline	4.7	mg/kg fuel
Marine. other fuels	7.9	mg/kg fuel
Railway engine	7.9	mg/kg fuel
Other machines. gasoline	4.7	mg/kg fuel
Other machines. other fuels	7.9	mg/kg fuel

Table A10b. Activity data for 2011 in the LIISA sub-model.

	Driven kilometers (106 km/year)					Fuel consumption (t/year)				
Year	PC	V	B	L	M	PC	V	B	L	M
1990	35 757	3 593	660	2 780	467	2 138 470	320 819	173 647	816 880	12 974
1991	35 607	3 610	650	2 530	468	2 130 877	319 519	168 023	733 484	13 037
1992	35 530	3 667	640	2 500	470	2 119 034	325 663	166 761	729 043	13 106
1993	35 156	3 655	639	2 570	463	1 995 237	312 523	160 708	722 069	12 933
1994	34 980	3 626	633	2 582	456	2 043 741	323 865	166 818	762 309	12 760
1995	35 318	3 662	633	2 632	468	2 014 683	318 260	162 021	755 153	13 078
1996	35 595	3 685	635	2 669	478	1 968 274	321 504	164 050	774 497	13 344
1997	36 542	3 744	643	2 750	491	2 049 591	338 657	172 100	828 253	13 706
1998	37 522	3 865	606	2 795	515	2 045 917	351 414	164 935	856 069	14 396
1999	38 622	3 966	596	2 867	556	2 058 390	362 069	163 531	884 700	15 398
2000	39 257	4 033	596	2 807	607	2 025 930	367 868	163 821	880 140	16 728

2001	40 122	4 106	593	2 834	663	2 068 913	374 487	162 460	888 393	18 179
2002	41 100	4 153	598	2 905	733	2 130 860	378 861	161 961	892 246	19 860
2003	41 992	4 217	568	3 012	812	2 171 090	384 847	154 841	909 508	21 749
2004	42 945	4 280	590	3 077	898	2 223 932	398 837	162 715	948 820	23 800
2005	43 617	4 335	591	3 134	975	2 251 336	392 533	160 071	932 295	25 873
2006	44 009	4 371	589	3 189	1 003	2 262 374	396 576	159 674	950 312	28 389
2007	44 948	4 432	586	3 287	1 211	2 319 643	405 800	161 291	1 003 502	30 929
2008	44 672	4 416	597	3 292	1 311	2 311 528	395 313	161 599	973 050	33 099
2009	45 301	4 449	601	3 001	1 358	2 324 734	376 374	157 692	860 973	33 828
2010	45 608	4 466	604	3 141	1 437	2 357 740	391 758	161 178	944 011	35 405
2011	46 135	4 504	604	3 218	1 558	2 368 230	388 768	160 426	953 962	38 007

PC=Private cars, V=Vans, B=busses, L=lorries, M=Motorcycles

5 References

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Grönroos, J., Mattila, P., Regina, K., Nousiainen, J., Perälä, P., Saarinen, K. and Mikkola-Pusa, J. (2009) Development of ammonia emission inventory in Finland: Description of the revised model and results. Publication available at www.environment.fi>publications>The Finnish Environment.

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Appendix 2

Differences between SOx, NOx, NMVOC and CO emissions reported to the UNFCCC 15 April 2017 and under the UNECE CLRTAP 15 February/13 March 2017

Differences between SOx, NOx, NMVOC and CO emissions reported to the UNFCCC 15 April 2017 and under the UNECE CLRTAP 15 February 2017

In the Finnish submissions under the UNECE CLRTAP by 15th February 2017 (resubmission on 13 March 2017) and in the UNFCCC submission of the greenhouse gas inventory by 15th April 2017, differences between the reported NOx, SOx, NMVOC and CO emissions were as follows:

Pollutant	Difference (%)	Difference (kt)	NFR (kt)	CRF (kt)
NOx	6.639	9.272	139.653	130.381
SOx	2.689	1.131	42.060	40.929
NMVOC	2.856	2.507	87.774	85.267
CO	-3.412	-11.073	324.572	335.645

Differences for the other pollutants were below 5%, however the difference between NOx emissions was 6.6% originating from the inclusion of agricultural NOx emission to the CLRTAP inventory.

Appendix 3A

TO THE FINNISH IIR 2016

DOCUMENTATION OF THE CALCULATION OF ACCEPTED NH3 ADJUSTMENTS

Appendix 3 will be updated to the resubmission of the IIR by 1st May 2017

CONTENTS

1 Adjustment Application 2015

2 Declaration on consistent reporting of Approved Adjustments
2.1 Small scale wood combustion (NFR 1A4)
2.2 Road transport, Railways, Navigation (NFRs 1A3b, 1A3c, 1A3d)

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 2016.

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

2 Declaration on consistent reporting of Approved Adjustments

Finland has submitted the Declaration on consistent reporting of Approved Adjustments as part of its submission on 15th February 2016 (*file FI_ApprovedAdjustments_FI_Reporting year 2016.docx)* concerning adjustments approved in 2015. In the Declaration Finland declares that the methods and emission factors used for the calculation of ammonia emissions for the years 2010-2014 are the same for NFR sectors 1A4ai, 1A4bi, 1A4ci, 1A3bi, 1A3bii, 1A3biii and 1A3biv as in the year the adjustments were approved.

Table 1 below from the Adjustments ERT's Review Report presents the approved adjustments for Small Scale Combustion and Table 2 below for Road Transport.

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

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

2.1 Small scale wood combustion (NFR 1A4)

<u>Activity data correction for NFR sectors 1A2gvii, 1A4ai, 1A4bi and 1A4ci (Small combustion)</u>

In 2015 the Adjustments ERT accepted adjustments to the Finnish inventory regarding NH3 emissions from small scale combustion, including NFR sectors 1A2gviii, 1A4ai, 1A4bi and 1A4ci. The Finnish inventory team has thereafter gained improved understanding of emissions under NFR 1A2gviii as follows:

(1) *No small scale combustion occurs under NFR 1A2gviii*: The recalculation of the energy sector emissions in the Finnish CLRTAP/NECD inventory has been pending many years, therefore a thorough review of the sector has not yet been completed. However, it has now been identified that no small scale combustion occurs under NFR 1A2gviii, but instead, this wood is combusted in boilers, which do not emit NH_3. Therefore the approved adjustment for NFR 1A2gviii has been deleted.

(1) *Recalculation of the shares of wood in the 13 small scale wood combustion equioment under NFR 1A4:* Deleting wood combustion under NFR 1A2gviii resulted in the need to recalculate the shares of wood for the 13 small scale wood combustion equipment in NFR 1A4 sectors because the shares in the approved adjustments were calculated from combined wood use in NFR 1A2gviii and in NFR 1A4 sectors. The correction resulted in decrease of wood energy used in small scale combustion equipment during 2010-2013 from -8.4% to -22.3%, decreased ammonia emissions from -9.7% to -26.5%, and decreased adjusted emissions from -11.1% to -31.8% as shown in Table A3.1 below.

Table A3.1. Summary of differences between the adjustments accepted in 2015 (A) and the adjustments accepted in 2014 using recalculated shares of wood in 2016 (B) in NFR 1A4 and 1A2gviii categories

NH3 (kt)	**2010**		**2011**		**2012**		**2013**		**2014**	
(A) accepted 2015 **(B)** recalculated 2016	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
National total	38.246	38.151	37.450	37.356	37.318	37.086	37.283	37.074	NA	36.919
*Adjustment: Small combustion**	-0.531	-0.477	-0.413	-0.370	-0.507	-0.394	-0.462	-0.351	NA	-0.364
*Adjustment: Transport***	-1.52	-1.525	-1.44	-1.437	-1.34	-1.338	-1.26	-1.264	NA	-1.205
Sum of adjustments	-2.05	-2.002	-1.85	-1.807	-1.85	-1.732	-1.72	-1.615	NA	-1.569
National total for compliance	35.745	36.149	35.597	35.549	35.471	35.354	35.561	35.471	NA	35.350

*See Table 1 above **See Table 2 above from Adjustment ERT's Review Report

Documentation of the corrected calculations is presented in Appendix 3B annexed to Finland's IIR 2016 (*file FI IIR 2016 Appendix 3B Documentation Small Combustion February 2016.xlsx*). The improvement is important for the inventory to be consistent with the national scenario model to correctly reflect combustion equipment changes in time.

Note: no change was made to the original method approved by the Adjustments ERT in 2015.

2.2 Road transport, Railways, Navigation (NFRs 1A3b, 1A3c, 1A3d)

No changes made. Documentation of the corrected calculations is presented in Appendix 3C annexed to Finland's IIR 2016 (*file FI IIR 2016 Appendix 3CDocumentation Transport February 2016.xlsx*).

Appendix 3B

TO THE FINNISH IIR 2016

DOCUMENTATION OF THE ADJUSTED SMALL SCALE COMBUSTION NH3 INVENTORY (MsExcel File)

Saved as a separate file in the EIONET CDR.

Appendix 3C

TO THE FINNISH IIR 2016

DOCUMENTATION OF THE ADJUSTED TRANSPORT NH3 INVENTORY (MsExcel File)

Saved as a separate file in the EIONET CDR.

APPENDIX 3D

ADJUSTMENTS ERT’s REVIEW REPORT 2015

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[2] 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

[2] Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

Management[3] (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 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)	Differenc e (%)	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.

[3] NFR 3B1a, 3B1b, 3B2, 3B3, 3B4d, 3B4e, 3B4gi-iv and 3B4h henceforth referred as 3B

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17 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[4]. 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[5]. 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[6] 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.

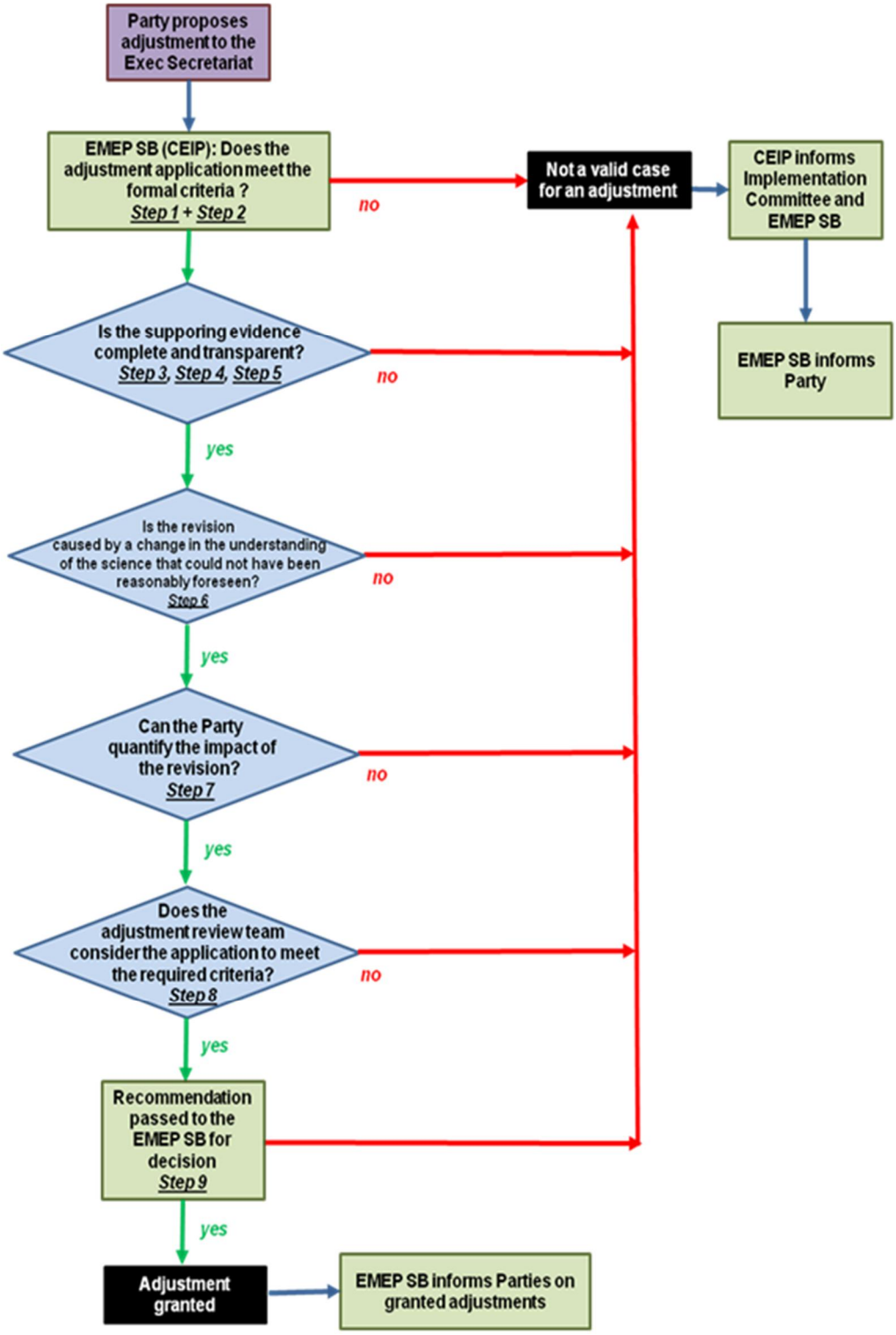
13. The flow diagram below outlines the different stages of the technical review. The following sections of this report are structured in the same way, and describe in detail the findings of the ERT at each of the decision gates in the process.

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

[5] 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 ..

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

Figure 1: Flow Diagram/Decision Tree for the Review of Adjustment Applications



2 Review of Submitted Adjustments

2.1 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.

2.2 Stationary Combustion 1A2gviii, 1A4ai, 1A4bi, 1A4ci (NH_3)

2.2.1 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.

2.2.2 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

2.3 Road Transport 1A3bi-iv (NH_3)

2.3.1 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.

2.3.2 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

2.4 Manure Management 3B (NH_3)

2.4.1 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.

2.4.2 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.

3 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.

4 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[7].

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__CLRTA P_EMEP_emission_inventory_sta tus_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.

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

5 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