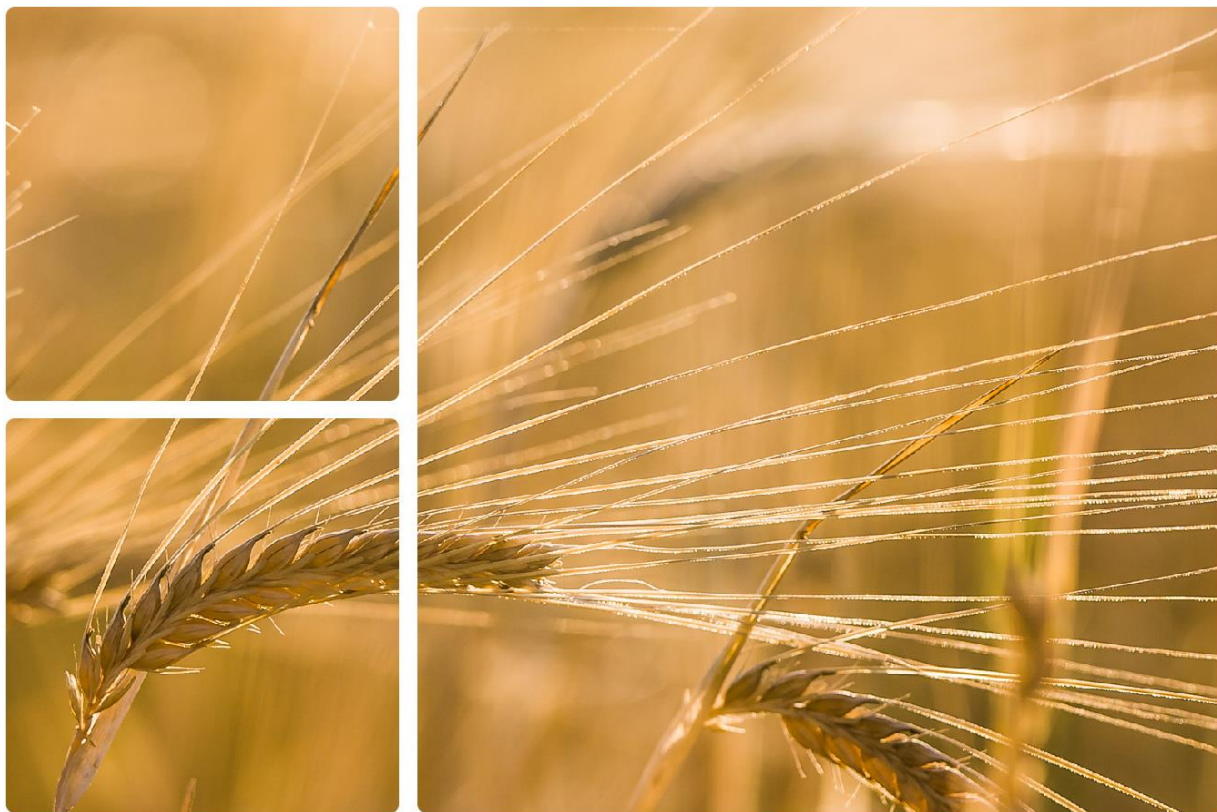


Informative Inventory Report Sweden 2017 - Annexes

Submitted under
the Convention on Long-Range Transboundary Air Pollution



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Contents

CONTENTS	1
1 ANNEX 1: UNCERTAINTIES AND KEY SOURCES	1
1.1 Methodology for analysis of Key Sources	1
1.1.1 Level assessment, approach 1	1
1.1.2 Level assessment, approach 2	1
1.1.3 Trend assessment, approach 1	2
1.1.4 Trend assessment, approach 2	2
1.2 Methodology for estimation of uncertainties	2
1.3 Key Sources and Uncertainty results	3
2 ANNEX 2: DETAILED DISCUSSION OF METHODOLOGY AND DATA FOR ESTIMATING EMISSIONS FROM FOSSIL FUEL COMBUSTION.	86
2.1 Sources for activity data in NFR 1A and parts of NFR 1B	86
2.1.1 Quarterly fuel statistics	87
2.1.2 Annual statistics on energy use in manufacturing industry	89
2.1.3 One- and two-dwelling statistics	90
2.1.4 Holiday cottages statistics	91
2.1.5 Multi-dwelling statistics	91
2.1.6 Premises statistics	91
2.1.7 Statistics on the supply and delivery of petroleum products	92
2.1.8 Statistics on the delivery of gas products	92
2.1.9 Other statistics from Statistics Sweden	92
2.1.10 European Union Emission Trading Scheme (ETS)	93
2.1.11 Environmental reports	94
2.1.12 Contacts with operators	94
2.1.13 Other data sources for mobile combustion	94
2.2 Net calorific values	95
2.2.1 Liquid fuels	96
2.2.2 Solid fuels and peat	98
2.2.3 Gaseous fuels	98
2.2.4 Biomass	100
2.2.5 Other fuels	100
2.3 Emission factors	101
2.3.1 Stationary combustion and fugitive emissions	101
2.3.2 Mobile combustion	119

2.3.3	References	119
2.4	Allocation of fuels for mobile combustion	121
2.4.1	Gasoline	121
2.4.2	Diesel	124
2.4.3	Marine distillate fuel	130
2.4.4	Residual fuel oils	131
2.4.5	Jet kerosene, jet gasoline and aviation gasoline	131
2.4.6	Natural Gas and biofuels	131
2.4.7	References	132
2.5	The HBEFA road model	133
2.5.1	National fleet data	135
2.5.2	Traffic activity data	136
2.5.3	References	142
2.6	Methodology for off-road vehicles and working machinery	143
2.6.1	Emission factors	143
2.6.2	Vehicle Stocks	144
2.6.3	Other parameters	144
2.6.4	Allocation to NFR-sectors	145
2.6.5	Most recent updates	145
2.6.6	References	146
3	ANNEX 3: OTHER DETAILED METHODOLOGICAL DESCRIPTIONS FOR INDIVIDUAL SOURCES	147
	Annex 3.1. Methodological issues for emissions from solvent use (in NFR sector 2D3)	147
3.1.1	Definition of NMVOC	147
3.1.2	Substance list	147
3.1.3	Activity data	148
3.1.4	Allocation	148
3.1.5	Emission factors	149
	Annex 3.2. Size distribution for PM ₁₀ and PM _{2.5} as fraction of TSP	155
4	ANNEX 4: ENVIRONMENTAL REPORTS IN SWEDEN	156
4.1	References	158
5	ANNEX 5: UNITS AND ABBREVIATIONS	159

1 Annex 1: Uncertainties and Key Sources

1.1 Methodology for analysis of Key Sources

The complete analysis of Sweden's key sources and uncertainties are presented in section 1.3. Key sources are reported together with their order of priority. Some important key sources according to level and trend are also discussed in sections 1.3 – 1.4 of the main report.

The analysis has been done for 1990 and 2015 using both the approach 1 and the approach 2 levels and trend assessment according to the 2006 IPCC Guidelines. The approach 1 method assesses the impacts of various source categories on the level and the trend of the national emission inventory. In the approach 2 analyses the uncertainty of the emissions are also considered. The analyses are performed for the following pollutants: As, Cd, CO, Cr, Cu, dioxins/furans, Hg, NH₃, Ni, NMVOC, NO_x, PAH 1-4, Pb, PM_{2.5}, PM₁₀, Se, SO₂, TSP and Zn.

1.1.1 Level assessment, approach 1

For each source category and pollutant, the level assessment (LA) is calculated as:

$$L_{x,t} = E_{x,t} / E_t$$

Key source are those that, for each pollutant, when summed together in descending order of magnitude, add up to over 95 % of the total emission estimates in the inventory for each year.

1.1.2 Level assessment, approach 2

In the approach 2 analysis the uncertainty of the emissions are also taking into account.

$$LU_{x,t} = L_{x,t} \bullet U_{x,t}$$

The key sources are then those that adds up to 90 % of the cumulative value of LU_{x,t}.

1.1.3 Trend assessment, approach 1

The trend is calculated as:

$$T_{x,t} = L_{x,t} \left[\frac{E_{x,t} - E_{x,0}}{|E_{x,0}|} \right] - \frac{\sum_y E_{y,t} - \sum_y E_{y,0}}{\left| \sum_y E_{y,0} \right|}$$

For each pollutant, the percentage contribution to the overall trend (C%) is then calculated for each source as:

$$C\% = \frac{T_{x,t}}{\sum T_{x,t}}$$

Finally the cumulative total of percentage contribution is calculated for each pollutant in the same way as for the level assessment. Key source categories are those that for each pollutant, when summed together in descending order of magnitude, add up to more than 95% of the contribution to trend.

1.1.4 Trend assessment, approach 2

In the same way as for the level assessment, in the approach 2 analysis the uncertainty is also considered.

$$TU_{x,t} = T_{x,t} \times U_{x,t}$$

The approach 2 key sources for trend are then those that add up to 90 % of the cumulative value of $T_{x,t}/\sum T_{x,t}$.

1.2 Methodology for estimation of uncertainties

As a basis for the calculations the 95 % confidence intervals have been assessed for all subcategories and substances. This information is documented in Swedish in “Expert Protocols”, describing how and what sources was used to quantify the individual uncertainty ranges. National references on uncertainty estimates of emission factors are used when available (e.g. emission factors for stationary combustion, emission factors for navigation and fisheries). Most other uncertainty estimates for emission factors derive from expert judgments or information from the EMEP/EEA Guidebook. Uncertainty estimates of activity data are mostly based on expert judgments. The data in the Expert Protocols are then used to calculate the 95 % confidence interval for the aggregated emissions reported in section 1.4. The calculations are made according to the 2006 IPCC guidelines. Lack of completeness, i.e. in this context entire source categories missing (NE), are not taken into consideration when quantifying uncertainties.

1.3 Key Sources and Uncertainty results

In Table A1-1 to Table A1-19 the results are presented for the key sources and uncertainty analyses for the following substances: As, Cd, CO, Cr, Cu, dioxines/furanes, Hg, NH₃, Ni, NMVOC, NO_x, PAH 1-4, Pb, PM_{2.5}, PM₁₀, Se, SO₂, TSP and Zn. The identified key sources for the approach 1 and the approach 2 analyses are presented in the tables. In the bottom of the tables information on total emissions and total uncertainty in the inventory both for the level and for the trend are given.

Table A1-1 Summary of the key source and uncertainty analysis of As emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	As	0.02	0.12	2.03	404.8	404.8	54.08	402.04	0.7		2	2	4	1	1
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	As	0.01	C	1.46	73.89	73.9	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	As	0.01	0.04	1.99	908.64	908.65	38.85	338.79	0.5		4	4	5	2	2
1 A 1 a Public Electricity and Heat Production: Peat	As	0.05	0.01	2.02	100	100.02	0.02	-82.54	<0.005	6	13		9		
1 A 1 a Public Electricity and Heat Production: Solid Fuels	As	0.11	C	1.12	69.92	69.93	0.16	C	<0.005	3	5	5	3	9	
1 A 1 b Petroleum refining: Liquid Fuels	As	0	C	9.65	90.3	90.82	0	C	<0.005						
1 A 2 a Iron and Steel: Biomass	As	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	As	0.01	C	4.07	92.45	92.54	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	As	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	As	0	C	3.47	71.13	71.22	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	As	0	0					-100							
1 A 2 c Chemicals: Biomass	As	0	0	3.04	220.05	220.07	0	101.5	<0.005						
1 A 2 c Chemicals: Liquid Fuels	As	0	0	8.89	85.06	85.52	0	-55.16	<0.005						
1 A 2 c Chemicals: Other Fuels	As	0	0					-100							
1 A 2 c Chemicals: Solid Fuels	As	0	C	2.38	296.88	296.89	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	As	0.02	C	4.33	343.51	343.54	1.13	C	0.01		7	6	8	4	4
1 A 2 d Pulp, Paper and Print: Liquid Fuels	As	0.03	0.01	3.5	97.42	97.48	0.01	-77.3	<0.005		16				
1 A 2 d Pulp, Paper and Print: Other Fuels	As	0	0					-100							
1 A 2 d Pulp, Paper and Print: Solid Fuels	As	0.01	C	4.42	115.33	115.42	0	C	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	As	0	0	4.09	309.92	309.95	0	255.75	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	As	0.01	0	3.06	71.53	71.6	0	-88.32	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	As	0	0					-100							
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	As	0	C	5	100	100.12	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	As	0	C	9.52	380.98	381.1	0	C	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	As	0.01	0.01	8.51	74.17	74.66	0.01	10.92	<0.005		15	13			
1 A 2 f Non-metallic minerals: Solid Fuels	As	0.04	0.02	9.28	92.8	93.27	0.09	-44.45	<0.005	8	6	7			
1 A 2 g viii Other: Biomass	As	0.01	0.01	9.9	396.22	396.34	0.17	-29.17	<0.005		14	14		8	8
1 A 2 g viii Other: Liquid Fuels	As	0.02	0	11.13	66.74	67.66	0	-75.59	<0.005						
1 A 2 g viii Other: Solid Fuels	As	0	C	9.36	93.47	93.94	0.04	C	<0.005		12	10			
1 A 3 b i Road Transportation, Cars: Biomass	As	0	0	3.66	73.14	73.23	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	As	0	0	5	100	100.12	0	823.29	<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	As	0	0	3	100	100.04	0	-43.38	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Biomass	As	0	0	4.67	93.47	93.58	0		<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	As	0	0	5	100	100.12	0	762.24	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	As	0	0	3	100	100.04	0	-80.03	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	As	0	0	3.74	74.86	74.95	0	7890.5	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	As	0	0	4.33	86.58	86.68	0	10.23	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	As	0	0	3	100	100.04	0	-63.57	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	As	0	0	4.06	81.14	81.24	0	-44.9	<0.005						
1 A 3 d Domestic Navigation: Residual Oil	As	0.05	0.02	15	100	101.12	0.09	-63.23	<0.005	7	8	11		10	
1 A 4 a Commercial/Institutional: Biomass	As	0	0	9.6	394.02	394.13	0	129	<0.005						
1 A 4 a Commercial/Institutional: Liquid Fuels	As	0.02	0	15.4	100	101.18	0	-96.84	<0.005						
1 A 4 b Residential: Biomass	As	0.02	0.02	10	400	400.12	1.08	7.98	0.01		9	9	7	5	5
1 A 4 b Residential: Liquid Fuels	As	0.04	0	19.06	100	101.8	0	-96.17	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	As	0	0	7.98	319.02	319.12	0.01	2501.92	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	As	0	0	9.12	59.13	59.83	0	-28.11	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	As	0.01	0					-100							
1 A 5 b Mobile: Liquid Fuels	As	0	0	5	100	100.12	0	-36.23	<0.005						
2 A 3 Glass Production	As	0.11	0		100	100	0	-98.51	<0.005	4		12	2		
2 C 1 Iron and Steel Production	As	0.06	0.01	3.32	35.48	35.63	0.01	-78.83	<0.005	5	11				
2 C 7 Other	As	4.71	0.23	4	50	50.16	3.24	-95.05	0.11	1	1	1	1	3	3
2 G 4 Other	As	0	0	11.76	665.52	665.62	0.06	-11.57	<0.005						
2 H Other	As	0.18	0.11	4.99	49.86	50.11	0.67	-39.32	0.01	2	3	3	6	6	6
5 C 1 Waste Incineration	As	0	0	4.71	601.48	601.5	0.02	89.94	<0.005						
5 C 2 Open burning of waste	As	0	0.02	75	200	213.6	0.25		<0.005		10	8		7	7
5 E Other	As	0.01	0	50	100	111.8	0.01	-19.24	<0.005		17				
Total		5.56	0.72			89.74	100	-87	11.62						

Table A1-2 Summary of the key source and uncertainty analysis of Cd emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	Cd	0.05	0.13	1.97	39.37	39.42	6.45	142.77	0.04	6	1	2	7	2	3
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	Cd	0.01	C	1.45	71.8	71.82	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	Cd	0.02	0.01	1.99	100.96	100.98	0.31	-40.7	<0.005	9	12	11	8	9	12
1 A 1 a Public Electricity and Heat Production: Peat	Cd	0.01	0	2.02	100	100.02	0	-99.45	<0.005				13		
1 A 1 a Public Electricity and Heat Production: Solid Fuels	Cd	0.02	C	1.13	100	100.01	0.03	C	<0.005	11	19		9		
1 A 1 b Petroleum refining: Liquid Fuels	Cd	0	C	9.65	89.82	90.34	0	C	<0.005						
1 A 2 a Iron and Steel: Biomass	Cd	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	Cd	0	C	4.07	89.34	89.43	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	Cd	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	Cd	0	C	3.47	70.67	70.75	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	Cd	0	0					-100							
1 A 2 c Chemicals: Biomass	Cd	0	0	3.04	30.46	30.61	0	-1.82	<0.005						
1 A 2 c Chemicals: Liquid Fuels	Cd	0	0	8.89	80.67	81.16	0	-54.5	<0.005						
1 A 2 c Chemicals: Other Fuels	Cd	0	0					-100							

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 c Chemicals: Solid Fuels	Cd	0	C	2.38	31.36	31.45	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	Cd	0.06	C	4.33	39.9	40.13	0.73	C	<0.005	5	3	5	6	5	8
1 A 2 d Pulp, Paper and Print: Liquid Fuels	Cd	0.01	0	3.5	96.2	96.26	0.01	-77.02	<0.005						
1 A 2 d Pulp, Paper and Print: Other Fuels	Cd	0	0					-100							
1 A 2 d Pulp, Paper and Print: Solid Fuels	Cd	0	C	4.42	32.69	32.99	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	Cd	0	0	4.09	30.99	31.26	0	145.85	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	Cd	0	0	3.06	69.55	69.62	0	-86.71	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	Cd	0	0					-100							
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	Cd	0	C	5	40	40.31	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	Cd	0	C	9.52	38.1	39.27	0	C	<0.005		23				
1 A 2 f Non-metallic minerals: Liquid Fuels	Cd	0	0	8.51	66.82	67.36	0	-29.74	<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	Cd	0.01	0	9.28	37.12	38.26	0	-44.45	<0.005		20				
1 A 2 g vii Off-road vehicles and other machinery: Biomass	Cd	0	0	4.98	99.7	99.82	0		<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	Cd	0	0	4.92	98.33	98.45	0.04	31.55	<0.005		16	16		16	
1 A 2 g viii Other: Biomass	Cd	0.04	0.02	9.9	39.62	40.84	0.12	-52.78	<0.005	8	8	10	11	14	

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in baseyear	Level in 2015	Trend	Level in baseyear (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 g viii Other: Liquid Fuels	Cd	0.01	0	11.13	66.1	67.03	0	-74.03	<0.005						
	Cd	0	C	9.36	37.39	38.54	0	C	<0.005						
	Cd	0	0	3.39	65.9	65.98	0.03		<0.005	13	12				
	Cd	0	0.01	5	100	100.12	0.31	823.29	<0.005	11	8		8	9	
	Cd	0	0	10	100	100.5	0		<0.005						
	Cd	0.04	0.02	3	100	100.04	1.33	-43.38	<0.005	7	6	7	5	3	6
	Cd	0	0		75	75	0	24.58	<0.005						
	Cd	0	0	4.86	97.12	97.24	0		<0.005						
	Cd	0	0	5	100	100.12	0.04	762.24	<0.005	17	14		15		
	Cd	0	0	3	100	100.04	0	-80.03	<0.005						
	Cd	0	0	4.04	80.83	80.93	0.01	17472.17	<0.005	22					
	Cd	0.01	0.01	4.33	86.58	86.68	0.25	10.23	<0.005	10	9		10	10	
	Cd	0	0	3	100	100.04	0	-63.57	<0.005						
	Cd	0	0	5	95	95.13	0	-53.07	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 d Domestic Navigation: Gas/Diesel Oil	Cd	0	0	4.06	81.14	81.24	0	-44.9	<0.005					
1 A 3 d Domestic Navigation: Residual Oil	Cd	0	0	15	100	101.12	0	-63.23	<0.005					
1 A 3 e Other Transportation: Biomass	Cd	0	0	5	100	100.12	0		<0.005					
1 A 3 e Other Transportation: Diesel Oil	Cd	0	0	5	100	100.12	0	7.57	<0.005					
1 A 4 a Commercial/Institutional: Biomass	Cd	0	0	9.6	149.24	149.55	0.13	126.7	<0.005	14	13		13	13
1 A 4 a Commercial/Institutional: Diesel Oil	Cd	0	0	5	100	100.12	0	-12.02	<0.005					
1 A 4 a Commercial/Institutional: Ethanol	Cd	0	0	5	100	100.12	0		<0.005					
1 A 4 a Commercial/Institutional: FAME	Cd	0	0	5	100	100.12	0		<0.005					
1 A 4 a Commercial/Institutional: Gasoline	Cd	0	0	5	100	100.12	0	10.72	<0.005					
1 A 4 a Commercial/Institutional: Liquid Fuels	Cd	0.01	0	15.4	100	101.18	0	-96.14	<0.005					
1 A 4 b Residential: Biomass	Cd	0.12	0.13	9.99	149.89	150.22	87.81	8.06	0.41	3	2	3	2	1
1 A 4 b Residential: Liquid Fuels	Cd	0.02	0	7.11	69.46	69.82	0	-89.24	<0.005	10			10	
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	Cd	0	0.01	7.47	127.92	128.14	0.86	2235.52	0.01		9	6	4	4
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	Cd	0	0	3.66	51.41	51.54	0.01	-4.53	<0.005	15	17			
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	Cd	0.01	0					-100						
1 A 5 b Mobile: Liquid Fuels	Cd	0	0	5	100	100.12	0	-36.23	<0.005					

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
2 A 3 Glass Production	Cd	0	0		100	100	0	-98.07	<0.005						
2 C 1 Iron and Steel Production	Cd	0.43	0.02	0.54	17.29	17.3	0.03	-95.37	<0.005	2	7	4	3		5
2 C 7 Other	Cd	1.34	0.04	4	20	20.4	0.17	-96.94	0.05	1	4	1	1	11	2
2 G 4 Other	Cd	0	0	12.75	708.69	708.81	0.66	0.53	<0.005				12	6	7
2 H Other	Cd	0.11	0.03	4.96	49.56	49.81	0.43	-76.22	<0.005	4	5		4	7	
5 C 1 Waste Incineration	Cd	0	0	6.12	384.96	385.01	0.03	159.04	<0.005						
5 C 2 Open burning of waste	Cd	0	0	75	200	213.6	0.15		<0.005		18	15		12	11
5 E Other	Cd	0	0	50	100	111.8	0.03	-19.25	<0.005		21				
Total		2.34	0.54			37.29	100	-76.76	7.28						

Table A1-3 Summary of the key source and uncertainty analysis of CO emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	CO	0.59	4.46	1.93	67.95	67.98	0.09	656.49	<0.005					
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels	CO	0.09	C	2	29.98	30.05	0	C	<0.005					
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	CO	0.36	C	1.44	26.58	26.61	0	C	<0.005					
1 A 1 a Public Electricity and Heat Production: Other Fuels	CO	0.12	0.49	2	29.37	29.44	0	315.99	<0.005					
1 A 1 a Public Electricity and Heat Production: Peat	CO	1.64	0.14	2.02	30	30.07	0	-91.27	<0.005					
1 A 1 a Public Electricity and Heat Production: Solid Fuels	CO	0.32	C	1.12	22.83	22.85	0	C	<0.005					
1 A 1 b Petroleum refining: Gaseous Fuels	CO	0	C	2	30	30.07	0	C	<0.005					
1 A 1 b Petroleum refining: Liquid Fuels	CO	0.34	C	9.65	47.46	48.43	0	C	<0.005					
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels	CO	0.04	C	4.19	25.15	25.5	0	C	<0.005					
1 A 2 a Iron and Steel: Biomass	CO	0	0					-100						
1 A 2 a Iron and Steel: Gaseous Fuels	CO	0	C	5	30	30.41	0	C	<0.005					
1 A 2 a Iron and Steel: Liquid Fuels	CO	0.2	C	4.07	24.84	25.17	0	C	<0.005					
1 A 2 a Iron and Steel: Solid Fuels	CO	0.04	C	3.57	21.39	21.69	0	C	<0.005					
1 A 2 b Non-ferrous metals: Gaseous Fuels	CO	0	C	5	30	30.41	0	C	<0.005					
1 A 2 b Non-ferrous metals: Liquid Fuels	CO	0.03	C	3.47	22.04	22.32	0	C	<0.005					
1 A 2 b Non-ferrous metals: Solid Fuels	CO	0	0					-100						
1 A 2 c Chemicals: Biomass	CO	0.17	0.23	3.04	60.86	60.93	0	31.54	<0.005					

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 c Chemicals: Gaseous Fuels	CO	0.03	0.04	5	30	30.41	0	38.73	<0.005						
1 A 2 c Chemicals: Liquid Fuels	CO	0.18	0.26	8.89	44.69	45.56	0	41.61	<0.005						
1 A 2 c Chemicals: Other Fuels	CO	0	C	10	50	50.99	0	C	<0.005						
1 A 2 c Chemicals: Solid Fuels	CO	0.06	C	2.38	24.51	24.62	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	CO	11.4	C	4.33	73.9	74.02	0.9	C	<0.005	9	9	10	5	7	8
1 A 2 d Pulp, Paper and Print: Gaseous Fuels	CO	0.01	0.01	5	30	30.41	0	1.55	<0.005						
1 A 2 d Pulp, Paper and Print: Liquid Fuels	CO	0.56	0.12	3.5	26.51	26.74	0	-79.54	<0.005						
1 A 2 d Pulp, Paper and Print: Other Fuels	CO	0.02	C	10	50	50.99	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Solid Fuels	CO	0.16	C	4.42	32.22	32.52	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	CO	0.06	0.29	4.09	63.82	63.95	0	360.87	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Gaseous Fuels	CO	0.04	0.05	5	30	30.41	0	18.48	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	CO	0.18	0.04	3.06	20.76	20.98	0	-79.78	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	CO	0	C	10	50	50.99	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	CO	0.05	C	5	40	40.31	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	CO	0.02	C	9.52	68.38	69.04	0	C	<0.005						
1 A 2 f Non-metallic minerals: Gaseous Fuels	CO	0.01	0.03	10	30	31.62	0	151.7	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	CO	0.17	0.11	8.51	26.92	28.23	0	-31.82	<0.005						
1 A 2 f Non-metallic minerals: Other Fuels	CO	0	C	10	50	50.99	0	C	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 f Non-metallic minerals: Solid Fuels	CO	0.62	0.34	9.28	37.12	38.26	0	-44.48	<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	CO	8.21	11	2.92	14.14	14.44	0.02	34.03	<0.005	11	10	11			
1 A 2 g viii Other: Biomass	CO	7.17	5.06	9.9	74.64	75.29	0.14	-29.45	<0.005		15			11	
1 A 2 g viii Other: Gaseous Fuels	CO	0.02	C	9.99	29.98	31.6	0	C	<0.005						
1 A 2 g viii Other: Liquid Fuels	CO	0.74	0.19	11.13	23.38	25.9	0	-74.85	<0.005						
1 A 2 g viii Other: Other Fuels	CO	0	C	10	50	50.99	0	C	<0.005						
1 A 2 g viii Other: Solid Fuels	CO	0.04	C	9.36	37.39	38.54	0	C	<0.005						
1 A 3 a Domestic Aviation: Aviation Gasoline	CO	0.02	0.01	10	100	100.5	0	-71.06	<0.005						
1 A 3 a Domestic Aviation: Jet Kerosene	CO	0.82	0.6	10	100	100.5	0	-26.59	<0.005						
1 A 3 b i Road Transportation, Cars: Biomass	CO	0	0.68	5	50	50.25	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	CO	2.82	2.66	5	50	50.25	0.02	-5.61	<0.005						
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	CO	0	0.37	10	50	50.99	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	CO	678.72	50.29	3	50	50.09	6.06	-92.59	1.11	1	4	1	1	2	1
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	CO	0.85	0.96	5	50	50.25	0	12.51	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	CO	62.89	2.8	3	50	50.09	0.02	-95.55	0.01	3		5	3		4
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	CO	0.01	0.04	5	50	50.25	0	767.86	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	CO	12.34	7.55	4.28	42.77	42.98	0.1	-38.81	<0.005	7	12			12	
1 A 3 b iii Road Transportation, Heavy duty trucks: Gaseous Fuels	CO	0	0.09	10	50	50.99	0	15709.48	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	CO	0.11	0.04	3	50	50.09	0	-62.57	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b iv Road Transportation, Motorcycles: Gasoline	CO	6.95	6.29	3	50	50.09	0.09	-9.57	<0.005		14				
1 A 3 c Railways: Liquid Fuels	CO	0.54	0.24	5	75	75.17	0	-55.04	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	CO	23.85	28.76	4.91	19.66	20.26	0.32	20.58	<0.005	6	5	6		9	
1 A 3 d Domestic Navigation: Residual Oil	CO	0.23	0.09	15	20	25	0	-59.44	<0.005						
1 A 3 e Other Transportation: Diesel Oil	CO	0.97	0.73	5	20	20.62	0	-23.96	<0.005						
1 A 4 a Commercial/Institutional: Biomass	CO	2.85	6.43	9.6	74.95	75.56	0.23	125.69	<0.005		13	13		10	10
1 A 4 a Commercial/Institutional: Diesel Oil	CO	0.45	0.4	5	20	20.62	0	-11.93	<0.005						
1 A 4 a Commercial/Institutional: Gaseous Fuels	CO	0.04	0.08	9.7	29.1	30.67	0	115.8	<0.005						
1 A 4 a Commercial/Institutional: Gasoline	CO	47.28	58.01	5	20	20.62	1.37	22.71	0.01	4	3	4	4	5	6
1 A 4 a Commercial/Institutional: Liquid Fuels	CO	1.83	0.06	15.4	33.48	36.85	0	-96.86	<0.005						
1 A 4 a Commercial/Institutional: Other Fuels	CO	0	0	10	50	50.99	0		<0.005						
1 A 4 b Residential: Biomass	CO	143.25	125.38	10	75	75.66	85.93	-12.48	0.22	2	1	2	2	1	2
1 A 4 b Residential: Gaseous Fuels	CO	0.04	0.03	9.15	27.45	28.93	0	-33.43	<0.005						
1 A 4 b Residential: Liquid Fuels	CO	42.41	65.45	2.99	19.95	20.17	1.66	54.34	0.01	5	2	3	6	3	5
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	CO	0.84	16.77	7.98	74.13	74.56	1.49	1902.98	0.01		7	7		4	3
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels	CO	0.01	0.01	10	30	31.62	0	-52.93	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	CO	9.72	19.53	1.9	12.43	12.57	0.06	100.81	<0.005	10	6	8			

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	CO	0.09	0					-100							
1 A 5 b Mobile: Liquid Fuels	CO	5.95	0.56	8.57	85.64	86.07	0	-90.64	<0.005						
1 B 1 c Flaring of gas: Solid Fuels	CO	0	0.01	50	30	58.31	0	342.07	<0.005						
1 B 2 a Oil	CO	0.03	C	1.57	73.04	73.05	0	C	<0.005						
1 B 2 c Venting and flaring	CO	0.01	C	17.5	49.99	52.96	0	C	<0.005						
1 D International Aviation: Jet kerosene	CO	0.67	0.86	10	100	100.5	0.01	28.63	<0.005						
2 B 10 Other	CO	0.24	0.14		60.68	60.68	0	-42	<0.005						
2 C 1 Iron and Steel Production	CO	2.36	2.27	0.16	96.8	96.8	0.05	-3.75	<0.005						
2 C 3 Aluminium production	CO	6.74	9.81	2	100	100.02	0.92	45.58	<0.005	11	12		6	7	
2 C 7 Other	CO	0.11	0.08	4	100	100.08	0	-25.07	<0.005						
2 D 3 Other	CO	0	0	10	216	216.23	0	53.13	<0.005						
2 G 4 Other	CO	0.47	0.22	14.38	5.1	15.26	0	-53.12	<0.005						
2 H Other	CO	11.96	14.56	5	50	50.25	0.51	21.76	<0.005	8	8	9	8	9	
5 B 1 Composting	CO	0.01	0.12	15	91	92.23	0	949.55	<0.005						
5 C 1 Waste Incineration	CO	0.01	0.04	7.47	239.59	239.7	0	378.7	<0.005						
Total		1102.2	460.9			22.2	100	-58.18	11.8						

Table A1-4 Summary of the key source and uncertainty analysis of Cr emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	Cr	0.58	0.46	1.97	39.51	39.56	1.25	-21	<0.005	3	3	3	5	4	6
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	Cr	0.01	C	1.43	69.37	69.39	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	Cr	0.3	0.06	1.99	100.96	100.98	0.12	-81.72	<0.005	4	11	13	3	8	11
1 A 1 a Public Electricity and Heat Production: Peat	Cr	0.05	0.03	2.02	40	40.05	0	-47.61	<0.005						
1 A 1 a Public Electricity and Heat Production: Solid Fuels	Cr	0.25	C	1.13	50	50.01	0.05	C	<0.005	5	7			10	
1 A 1 b Petroleum refining: Liquid Fuels	Cr	0	C	9.65	89.21	89.74	0	C	<0.005						
1 A 2 a Iron and Steel: Biomass	Cr	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	Cr	0	C	4.07	85.88	85.98	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	Cr	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	Cr	0	C	3.47	72.53	72.61	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	Cr	0	0					-100							
1 A 2 c Chemicals: Biomass	Cr	0	0	3.04	30.46	30.61	0	41.41	<0.005						
1 A 2 c Chemicals: Liquid Fuels	Cr	0	0	8.89	76.58	77.1	0	-53.75	<0.005						
1 A 2 c Chemicals: Other Fuels	Cr	0	0					-100							
1 A 2 c Chemicals: Solid Fuels	Cr	0.01	C	2.38	32.68	32.77	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	Cr	0.13	C	4.33	39.9	40.13	0.12	C	<0.005		5	5		7	7
1 A 2 d Pulp, Paper and Print: Liquid Fuels	Cr	0.02	0	3.5	94.7	94.76	0	-79.42	<0.005						
1 A 2 d Pulp, Paper and Print: Other Fuels	Cr	0	0					-100							
1 A 2 d Pulp, Paper and Print: Solid Fuels	Cr	0.03	C	4.42	46.4	46.61	0	C	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	Cr	0	0	4.09	30.99	31.26	0	77.47	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	Cr	0	0	3.06	70.09	70.15	0	-84.87	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	Cr	0	0					-100						
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	Cr	0.01	C	5	50	50.25	0	C	<0.005					
1 A 2 f Non-metallic minerals: Biomass	Cr	0	C	9.52	38.1	39.27	0	C	<0.005					
1 A 2 f Non-metallic minerals: Liquid Fuels	Cr	0	0.02	8.51	92.03	92.43	0.01	312.52	<0.005					
1 A 2 f Non-metallic minerals: Solid Fuels	Cr	0.12	0.07	9.28	46.4	47.32	0.04	-44.45	<0.005	8	9			
1 A 2 g vii Off-road vehicles and other machinery: Biomass	Cr	0	0.01	4.98	99.7	99.82	0		<0.005					
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	Cr	0.02	0.02	4.92	98.33	98.45	0.01	31.55	<0.005					
1 A 2 g viii Other: Biomass	Cr	0.08	0.06	9.9	39.62	40.84	0.02	-29.17	<0.005	10	10			
1 A 2 g viii Other: Liquid Fuels	Cr	0.01	0	11.13	67.58	68.49	0	-72.58	<0.005					
1 A 2 g viii Other: Solid Fuels	Cr	0.01	C	9.36	46.81	47.73	0.02	C	<0.005	12	7			
1 A 3 b i Road Transportation, Cars: Biomass	Cr	0	0.01	3.89	77.62	77.71	0		<0.005					
1 A 3 b i Road Transportation, Cars: Diesel oil	Cr	0	0.04	5	100	100.12	0.06	823.29	<0.005	14	8		9	8
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	Cr	0	0	10	100	100.5	0		<0.005					
1 A 3 b i Road Transportation, Cars: Gasoline	Cr	0.06	0.03	3	100	100.04	0.04	-43.38	<0.005	15	14		12	
1 A 3 b i Road Transportation: Automobile tyre and brake wear	Cr	0	0		75	75	0	24.69	<0.005					
1 A 3 b ii Road Transportation, Light duty trucks: Biomass	Cr	0	0	4.94	98.73	98.86	0		<0.005					

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	Cr	0	0.01	5	100	100.12	0.01	762.24	<0.005					
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	Cr	0	0	3	100	100.04	0	-80.03	<0.005					
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	Cr	0	0.01	4.2	83.93	84.03	0	39171.81	<0.005					
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	Cr	0.04	0.04	4.33	86.58	86.68	0.05	10.23	<0.005	13	11		11	9
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	Cr	0	0	3	100	100.04	0	-63.57	<0.005					
1 A 3 c Railways: Liquid Fuels	Cr	0	0	5	95	95.13	0	-53.07	<0.005					
1 A 3 d Domestic Navigation: Gas/Diesel Oil	Cr	0	0	4.06	81.14	81.24	0	-44.9	<0.005					
1 A 3 d Domestic Navigation: Residual Oil	Cr	0.08	0.03	15	100	101.12	0.03	-63.23	<0.005					
1 A 3 e Other Transportation: Biomass	Cr	0	0	5	100	100.12	0		<0.005					
1 A 3 e Other Transportation: Diesel Oil	Cr	0	0	5	100	100.12	0	7.57	<0.005					
1 A 4 a Commercial/Institutional: Biomass	Cr	0	0	9.6	196.72	196.95	0	129.35	<0.005					
1 A 4 a Commercial/Institutional: Diesel Oil	Cr	0	0	5	100	100.12	0	-12.02	<0.005					
1 A 4 a Commercial/Institutional: Ethanol	Cr	0	0	5	100	100.12	0		<0.005					
1 A 4 a Commercial/Institutional: FAME	Cr	0	0	5	100	100.12	0		<0.005					
1 A 4 a Commercial/Institutional: Gasoline	Cr	0	0	5	100	100.12	0	10.72	<0.005					
1 A 4 a Commercial/Institutional: Liquid Fuels	Cr	0.02	0	15.4	100	101.18	0	-95.53	<0.005					
1 A 4 b Residential: Biomass	Cr	0.12	0.13	9.96	199.26	199.51	2.39	8.38	0.01	6	6	4	3	3
1 A 4 b Residential: Liquid Fuels	Cr	0.04	0.01	4.74	75.69	75.83	0	-82.48	<0.005					

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	Cr	0	0.02	6.28	123.93	124.09	0.03	3306.41	<0.005			12			10
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	Cr	0.02	0.02	2.92	53.88	53.96	0	-2.66	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	Cr	0.02	0					-100							
1 A 5 b Mobile: Liquid Fuels	Cr	0	0	5	100	100.12	0	-36.23	<0.005						
2 A 3 Glass Production	Cr	0.02	0		100	100	0	-99.19	<0.005						
2 C 1 Iron and Steel Production	Cr	12.6	1.11	0.25	46.13	46.13	9.72	-91.22	0.16	1	2	1	1	2	1
2 C 2 Ferroalloys production	Cr	8.41	2.99	5	50	50.25	84.08	-64.48	0.04	2	1	2	2	1	2
2 C 7 Other	Cr	0.15	0.32	4	45	45.18	0.77	116.24	<0.005		4	4		6	5
2 G 4 Other	Cr	0.02	0.02	14.09	796.59	796.72	1.12	18.24	<0.005			15		5	4
2 H Other	Cr	0.22	0.07	4.74	47.7	47.93	0.04	-70.6	<0.005	6	9				
5 C 1 Waste Incineration	Cr	0	0	7.48	240.13	240.25	0	292.18	<0.005						
5 C 2 Open burning of waste	Cr	0	0	75	250	261.01	0		<0.005						
5 E Other	Cr	0.01	0	50	100	111.8	0	-19.26	<0.005						
Total		23.51	5.89			27.78	100	-74.94	4.7						

Table A1-5 Summary of the key source and uncertainty analysis of Cu emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	Cu	0.66	1.18	1.96	97.85	97.87	0.23	78.15	0.01	4	2	4		3	5
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	Cu	0.04	C	1.44	70.05	70.07	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	Cu	0.3	0.04	1.99	908.64	908.65	0.02	-88.3	0.04				3		3
1 A 1 a Public Electricity and Heat Production: Peat	Cu	0.09	0.05	2.02	100	100.02	0	-45.42	<0.005						
1 A 1 a Public Electricity and Heat Production: Solid Fuels	Cu	0.25	C	1.13	100	100.01	0	C	<0.005						
1 A 1 b Petroleum refining: Liquid Fuels	Cu	0.02	C	9.65	90.11	90.63	0	C	<0.005						
1 A 2 a Iron and Steel: Bio-mass	Cu	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	Cu	0.02	C	4.07	91.15	91.25	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	Cu	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	Cu	0	C	3.47	70.57	70.65	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	Cu	0	0					-100							
1 A 2 c Chemicals: Biomass	Cu	0.01	0.01	3.04	30.46	30.61	0	-2.21	<0.005						
1 A 2 c Chemicals: Liquid Fuels	Cu	0.01	0	8.89	83.15	83.63	0	-54.89	<0.005						
1 A 2 c Chemicals: Other Fuels	Cu	0	0					-100							
1 A 2 c Chemicals: Solid Fuels	Cu	0.01	C	2.38	47.54	47.6	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	Cu	0.57	C	4.33	39.9	40.13	0.01	C	<0.005	6	7				
1 A 2 d Pulp, Paper and Print: Liquid Fuels	Cu	0.11	0.02	3.5	96.93	96.99	0	-77.19	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 d Pulp, Paper and Print: Other Fuels	Cu	0	0					-100							
1 A 2 d Pulp, Paper and Print: Solid Fuels	Cu	0.03	C	4.42	35.62	35.89	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	Cu	0	0.01	4.09	30.99	31.26	0	122.45	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	Cu	0.03	0	3.06	70.32	70.39	0	-87.66	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	Cu	0	0					-100							
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	Cu	0.01	C	5	40	40.31	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	Cu	0	C	9.52	38.1	39.27	0	C	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	Cu	0.02	0.02	8.51	71.21	71.71	0	-5.93	<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	Cu	0.12	0.07	9.28	37.12	38.26	0	-44.45	<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Biomass	Cu	0	0.22	4.98	99.7	99.82	0.01		<0.005	10	8				
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	Cu	0.51	0.67	4.92	98.33	98.45	0.08	31.55	<0.005	8	4	5	5	7	
1 A 2 g viii Other: Biomass	Cu	0.36	0.17	9.9	39.62	40.84	0	-52.78	<0.005						
1 A 2 g viii Other: Liquid Fuels	Cu	0.08	0.02	11.13	66.11	67.05	0	-74.9	<0.005						
1 A 2 g viii Other: Solid Fuels	Cu	0.01	C	9.36	37.43	38.58	0	C	<0.005						
1 A 3 b i Road Transportation, Cars: Biomass	Cu	0	0.02	3.34	64.39	64.48	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	Cu	0	0.03	5	100	100.12	0	823.29	<0.005						

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	Cu	0	0	10	100	100.5	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	Cu	0.16	0.09	3	100	100.04	0	-43.38	<0.005						
1 A 3 b i Road Transportation: Automobile tyre and brake wear	Cu	38.83	31.87		75	75	98.66	-17.92	1	1	1	2	1	1	1
1 A 3 b ii Road Transportation, Light duty trucks: Biomass	Cu	0	0	4.78	95.53	95.65	0		<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	Cu	0	0.01	5	100	100.12	0	762.24	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	Cu	0.01	0	3	100	100.04	0	-80.03	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	Cu	0	0.01	3.9	78.04	78.14	0	11368.89	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	Cu	0.03	0.03	4.33	86.58	86.68	0	10.23	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	Cu	0	0	3	100	100.04	0	-63.57	<0.005						
1 A 3 c Railways: Liquid Fuels	Cu	0.05	0.03	5	95	95.13	0	-53.07	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	Cu	0.15	0.08	4.06	81.14	81.24	0	-44.9	<0.005						
1 A 3 d Domestic Navigation: Residual Oil	Cu	0.12	0.04	15	100	101.12	0	-63.23	<0.005						
1 A 3 e Other Transportation: Biomass	Cu	0	0.05	5	100	100.12	0		<0.005						
1 A 3 e Other Transportation: Diesel Oil	Cu	0.14	0.15	5	100	100.12	0	7.57	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 4 a Commercial/Institutional: Biomass	Cu	0	0.01	9.6	485.38	485.47	0	132.45	<0.005						
1 A 4 a Commercial/Institutional: Diesel Oil	Cu	0.05	0.04	5	100	100.12	0	-12.02	<0.005						
1 A 4 a Commercial/Institutional: Ethanol	Cu	0	0.01	5	100	100.12	0		<0.005						
1 A 4 a Commercial/Institutional: FAME	Cu	0	0.01	5	100	100.12	0		<0.005						
1 A 4 a Commercial/Institutional: Gasoline	Cu	0.1	0.11	5	100	100.12	0	10.72	<0.005						
1 A 4 a Commercial/Institutional: Liquid Fuels	Cu	0.09	0	15.4	100	101.18	0	-96.53	<0.005						
1 A 4 b Residential: Biomass	Cu	0.2	0.23	9.3	465	465.09	0.19	16.11	0.01	9			5	4	6
1 A 4 b Residential: Liquid Fuels	Cu	0.28	0.21	2.78	89.95	89.99	0.01	-24.95	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	Cu	0	0.19	3.21	86	86.06	0	18266.36	<0.005			9			
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	Cu	0.6	0.6	2.87	57.58	57.66	0.02	-0.03	<0.005	5	5	7			
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	Cu	0.02	0					-100							
1 A 5 b Mobile: Liquid Fuels	Cu	0.03	0.02	5	100	100.12	0	-36.23	<0.005						
2 A 3 Glass Production	Cu	0	0					-100							
2 C 1 Iron and Steel Prod.	Cu	1.77	0.24	0.48	42.81	42.81	0	-86.54	<0.005	3	8	3			
2 C 7 Other	Cu	18.55	1.05	4	50	50.16	0.05	-94.32	0.58	2	3	1	2	6	2
2 G 4 Other	Cu	0.44	0.58	14.98	349.65	349.97	0.71	32.14	0.03	9	6	6	4	2	4
2 H Other	Cu	0.53	0.13	4.98	49.82	50.07	0	-75.6	<0.005	7		10			
5 C 1 Waste Incineration	Cu	0	0	5.73	431.8	431.84	0	33.33	<0.005						
5 C 2 Open burning of waste	Cu	0	0.01	75	195	208.93	0		<0.005						
5 E Other	Cu	0.01	0.01	50	100	111.8	0	-19.26	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (gI-TEQ)	Year 2014 emissions or removals (gI-TEQ)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 d Pulp, Paper and Print: Biomass	DIOX	4.16	C	4.33	99.75	99.85	1.58	C	0.2	4	3	2		8	7
1 A 2 d Pulp, Paper and Print: Liquid Fuels	DIOX	0.02	0					-100							
1 A 2 d Pulp, Paper and Print: Other Fuels	DIOX	0.01	0					-100							
1 A 2 d Pulp, Paper and Print: Solid Fuels	DIOX	0.29	C	4.42	88.17	88.28	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	DIOX	0.03	0.12	4.09	77.48	77.59	0	310.02	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	DIOX	0	0					-100							
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	DIOX	0.1	C	5	100	100.12	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	DIOX	0.01	C	9.52	95.25	95.72	0	C	<0.005		16	15			
1 A 2 f Non-metallic minerals: Liquid Fuels	DIOX	0	0.14	8.51	100	100.36	0		<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	DIOX	1.23	0.68	9.28	92.8	93.27	0.03	-44.45	<0.005	10	8				
1 A 2 g viii Other: Biomass	DIOX	2.63	1.86	9.9	99.05	99.55	0.24	-29.17	0.01	9	5	9			
1 A 2 g viii Other: Solid Fuels	DIOX	0.08	C	9.36	93.56	94.03	0.01	C	<0.005		13	13			
1 A 3 b i Road Transportation, Cars: Diesel oil	DIOX	0.02	0.11	5	1000	1000.01	0.09	632.99	0.03						
1 A 3 b i Road Transportation, Cars: Gasoline	DIOX	3.85	0.21	3	1000	1000	0.32	-94.47	4.56	5	17	6	2	11	3
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	DIOX	0.01	0.04	5	1000	1000.01	0.01	584.52	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	DIOX	0.22	0	3	1000	1000	0	-98.05	0.02						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (gJ-TEQ)	Year 2014 emissions or removals (gJ-TEQ)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	DIOX	0.13	0.12	4.33	865.76	865.77	0.07	-12.49	0.01						
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	DIOX	0.01	0	3	1000	1000	0	-96.44	<0.005						
1 A 3 b iv Road Transportation, Motorcycles: Gasoline	DIOX	0.01	0	3	1000	1000	0	-78.11	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	DIOX	0.01	0.01	4.06	81.14	81.24	0	-44.9	<0.005						
1 A 3 d Domestic Navigation: Residual Oil	DIOX	0.03	0.01	15	100	101.12	0	-63.23	<0.005						
1 A 4 a Commercial/Institutional: Biomass	DIOX	0.05	0.12	9.6	976.8	976.84	0.09	130.97	0.02						
1 A 4 b Residential: Biomass	DIOX	2.73	2.95	10	1000	1000.05	60.94	7.98	7.19	8	4	5	3	1	2
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	DIOX	0.01	0.43	7.98	746.57	746.61	0.73	2857.51	0.23		14	12		9	6
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	DIOX	0.01	0.01	5	100	100.12	0	-28.66	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	DIOX	0.17	0					-100							
1 A 5 b Mobile: Liquid Fuels	DIOX	0	0	5	100	100.12	0	-36.23	<0.005						
1 B 2 a Oil	DIOX	0.22	C	7.5	1000	1000.03	0.49	C	0.07		15			10	
2 B 10 Other	DIOX	0	0.02		1000	1000	0		<0.005						
2 C 1 Iron and Steel Production	DIOX	25.94	1.33	2.19	683.63	683.63	5.79	-94.87	98.05	1	6	1	1	3	1
2 C 3 Aluminium production	DIOX	0	0	2	2900	2900	0	24.02	<0.005						
2 C 7 Other	DIOX	0.85	0.59	4	1000	1000.01	2.46	-29.86	0.12	12	10	16	7	6	10
2 G 4 Other	DIOX	0	0	15	100	101.12	0	-54.41	<0.005						
2 H Other	DIOX	0.8	0.52	5	1000	1000.01	1.87	-35.49	0.07		11	17	8	7	
5 C 1 Waste Incineration	DIOX	0.53	0.73	4.64	911.02	911.03	3.1	38.34	0.48		7	10		4	5

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (gI-TEQ)	Year 2014 emissions or removals (gI-TEQ)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
5 C 2 Open burning of waste	DIOX	0	0.47	60.23	262.21	269.03	0.11		0.04		12	11			
5 E Other	DIOX	6.57	5.35	50	100	111.8	2.51	-18.63	0.47	3	2	3	6	5	8
Total		66.67	28.34			133.31	100	-57.49	106.19						

Table A1-7 Summary of the key source and uncertainty analysis of Hg emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	Hg	0.23	0.08	2.03	40.61	40.66	1.43	-63.13	<0.005	2	1	4	3	2	4
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	Hg	0	C	1.41	73.29	73.31	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	Hg	0.13	0.03	1.99	908.64	908.65	97.11	-75.43	0.03	6	3	19	1	1	1
1 A 1 a Public Electricity and Heat Production: Peat	Hg	0.02	0.01	2.02	40	40.05	0.02	-56.34	<0.005	11	14	15			
1 A 1 a Public Electricity and Heat Production: Solid Fuels	Hg	0.09	C	1.13	49.2	49.21	0.15	C	<0.005	7	5	18	8	4	
1 A 1 b Petroleum refining: Liquid Fuels	Hg	0	C	9.65	86.65	87.18	0	C	<0.005						
1 A 2 a Iron and Steel: Bio-mass	Hg	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	Hg	0	C	4.07	76.02	76.13	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	Hg	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	Hg	0	C	3.47	81.62	81.69	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	Hg	0	0					-100							
1 A 2 c Chemicals: Biomass	Hg	0	0	3.04	30.46	30.61	0	21.39	<0.005						
1 A 2 c Chemicals: Liquid Fuels	Hg	0	0	8.89	70.2	70.76	0	-51.33	<0.005						
1 A 2 c Chemicals: Other Fuels	Hg	0	0					-100							
1 A 2 c Chemicals: Solid Fuels	Hg	0	C	2.38	28.3	28.4	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	Hg	0.01	C	4.33	39.9	40.13	0.03	C	<0.005	13	13	10			17
1 A 2 d Pulp, Paper and Print: Liquid Fuels	Hg	0	0	3.5	88.85	88.92	0	-83.64	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 d Pulp, Paper and Print: Other Fuels	Hg	0	0					-100							
1 A 2 d Pulp, Paper and Print: Solid Fuels	Hg	0.01	C	4.42	36.89	37.15	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	Hg	0	0	4.09	30.99	31.26	0	-43.67	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	Hg	0	0	3.06	77.59	77.65	0	-78.82	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	Hg	0	0					-100							
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	Hg	0	C	5	40	40.31	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	Hg	0	C	9.52	38.1	39.27	0	C	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	Hg	0	0	8.51	96.98	97.36	0.02	942.57	<0.005	18	14				14
1 A 2 f Non-metallic minerals: Solid Fuels	Hg	0.04	0.02	9.28	37.12	38.26	0.07	-44.45	<0.005	8	7	8		10	16
1 A 2 g viii Other: Biomass	Hg	0.01	0.01	9.9	39.62	40.84	0.01	-29.17	<0.005		17	16			
1 A 2 g viii Other: Liquid Fuels	Hg	0	0	11.13	74.75	75.58	0	-69.4	<0.005						
1 A 2 g viii Other: Solid Fuels	Hg	0	C	9.36	37.44	38.6	0.03	C	<0.005		12	7			11
1 A 3 b i Road Transportation, Cars: Biomass	Hg	0	0	3.54	70.74	70.83	0.01		<0.005		19	17			
1 A 3 b i Road Transportation, Cars: Diesel oil	Hg	0	0.01	5	100	100.12	0.06	823.29	<0.005		16	12		12	6
1 A 3 b i Road Transportation, Cars: Gasoline	Hg	0.03	0.02	3	100	100.04	0.43	-43.38	<0.005	10	10	9		3	3
1 A 3 b ii Road Transportation, Light duty trucks: Biomass	Hg	0	0	4.81	96.25	96.37	0		<0.005						

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	Hg	0	0	5	100	100.12	0.01	762.24	<0.005		21			18
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	Hg	0	0	3	100	100.04	0	-80.03	<0.005					
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	Hg	0	0	3.96	79.27	79.37	0	13487.9	<0.005					
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	Hg	0.01	0.01	4.33	86.58	86.68	0.05	10.23	<0.005	15	13		13	13
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	Hg	0	0	3	100	100.04	0	-63.57	<0.005					
1 A 3 d Domestic Navigation: Gas/Diesel Oil	Hg	0	0	4.06	81.14	81.24	0	-44.9	<0.005					
1 A 3 d Domestic Navigation: Residual Oil	Hg	0	0	15	100	101.12	0	-63.23	<0.005					
1 A 4 a Commercial/Institutional: Biomass	Hg	0	0	9.6	39.64	40.78	0	127.62	<0.005					
1 A 4 a Commercial/Institutional: Liquid Fuels	Hg	0	0	15.4	100	101.18	0	-94.36	<0.005					
1 A 4 b Residential: Biomass	Hg	0.02	0.02	10	40	41.23	0.09	7.98	<0.005	12	6	6	5	7
1 A 4 b Residential: Liquid Fuels	Hg	0.01	0	19.06	100	101.8	0	-95.65	<0.005					
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	Hg	0	0	7.98	34.25	35.16	0	2253.01	<0.005		20			
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	Hg	0	0	14.37	78.28	79.58	0	-28.05	<0.005					

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	Hg	0.01	0					-100				23			
1 A 5 b Mobile: Liquid Fuels	Hg	0	0	5	100	100.12	0	-36.23	<0.005						
2 A 3 Glass Production	Hg	0.01	0		1000	1000	0.07	-86.63	<0.005				5	11	5
2 B 10 Other	Hg	0.19	0.02		41.31	41.31	0.08	-89.53	0.01	3	8	2	4	7	2
2 C 1 Iron and Steel Production	Hg	0.3	0.05	0.5	17.28	17.29	0.08	-84.42	<0.005	1	2	1	7	8	10
2 C 7 Other	Hg	0.18	0.02	4	20	20.4	0.02	-89.67	<0.005	4	9	3			8
2 G 4 Other	Hg	0	0	12.81	154.12	154.65	0	-49.01	<0.005						
2 H Other	Hg	0.03	0.02	5	50	50.25	0.09	-49.14	<0.005	9	11	11	2	6	15
5 C 1 Waste Incineration	Hg	0.17	0.03	4.53	26.84	27.22	0.08	-83.04	<0.005	5	4	5	6	9	12
5 C 2 Open burning of waste	Hg	0	0	50	1000	1001.25	0.05		<0.005						9
5 E Other	Hg	0	0	50	100	111.8	0.01	-19.25	<0.005			22			19
Total		1.53	0.41			69.61	100	-73.08	2.55						

Table A1-8 Summary of the key source and uncertainty analysis of NH₃ emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	NH ₃	0.05	0.19	1.99	19.44	19.55	0	318.28	<0.005		17			
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels	NH ₃	0.02	C	2	39.96	40.01	0	C	<0.005					
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	NH ₃	0.03	C	1.47	24.91	24.95	0	C	<0.005					
1 A 1 a Public Electricity and Heat Production: Other Fuels	NH ₃	0.01	0.05	2	38.02	38.08	0	298.47	<0.005					
1 A 1 a Public Electricity and Heat Production: Peat	NH ₃	0.02	0.01	2.02	40	40.05	0	-56.34	<0.005					
1 A 1 a Public Electricity and Heat Production: Solid Fuels	NH ₃	0.02	C	1.12	12.1	12.15	0	C	<0.005					
1 A 1 b Petroleum refining: Gaseous Fuels	NH ₃	0	C	2	40	40.05	0	C	<0.005					
1 A 1 b Petroleum refining: Liquid Fuels	NH ₃	0.06	C	9.65	49.12	50.06	0	C	<0.005					
1 A 2 a Iron and Steel: Biomass	NH ₃	0	0					-100						
1 A 2 a Iron and Steel: Gaseous Fuels	NH ₃	0	C	5	40	40.31	0	C	<0.005					
1 A 2 a Iron and Steel: Liquid Fuels	NH ₃	0.02	C	4.07	17.52	17.99	0	C	<0.005					
1 A 2 a Iron and Steel: Solid Fuels	NH ₃	0	0					-100						
1 A 2 b Non-ferrous metals: Gaseous Fuels	NH ₃	0	C	5	40	40.31	0	C	<0.005					
1 A 2 b Non-ferrous metals: Liquid Fuels	NH ₃	0	C	3.47	16.82	17.18	0	C	<0.005					
1 A 2 b Non-ferrous metals: Solid Fuels	NH ₃	0	0					-100						
1 A 2 c Chemicals: Biomass	NH ₃	0	0	3.04	26.27	26.44	0	159.97	<0.005					

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 c Chemicals: Gaseous Fuels	NH ₃	0.01	0	5	40	40.31	0	-53.76	<0.005					
1 A 2 c Chemicals: Liquid Fuels	NH ₃	0.03	0.02	8.89	44.07	44.95	0	-40.29	<0.005					
1 A 2 c Chemicals: Other Fuels	NH ₃	0	C	10	50	50.99	0	C	<0.005					
1 A 2 c Chemicals: Solid Fuels	NH ₃	0	C	2.38	28.7	28.8	0	C	<0.005					
1 A 2 d Pulp, Paper and Print: Biomass	NH ₃	0.08	C	4.33	36.19	36.45	0	C	<0.005					
1 A 2 d Pulp, Paper and Print: Gaseous Fuels	NH ₃	0	0	5	40	40.31	0	-66.15	<0.005					
1 A 2 d Pulp, Paper and Print: Liquid Fuels	NH ₃	0.05	0.01	3.5	25.43	25.67	0	-83.81	<0.005					
1 A 2 d Pulp, Paper and Print: Other Fuels	NH ₃	0	C	10	50	50.99	0	C	<0.005					
1 A 2 d Pulp, Paper and Print: Solid Fuels	NH ₃	0.01	C	4.42	35.62	35.89	0	C	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	NH ₃	0	0	4.09	31.56	31.83	0	483.59	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Gaseous Fuels	NH ₃	0.01	0	5	40	40.31	0	-60.51	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	NH ₃	0.02	0	3.06	17.78	18.05	0	-85.13	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	NH ₃	0	C	10	50	50.99	0	C	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	NH ₃	0	C	5	40	40.31	0	C	<0.005					
1 A 2 f Non-metallic minerals: Biomass	NH ₃	0	C	9.52	37.25	38.45	0	C	<0.005					

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 f Non-metallic minerals: Gaseous Fuels	NH ₃	0	0	10	40	41.23	0	-16.1	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	NH ₃	0.02	0.01	8.51	23.52	25.01	0	-67.31	<0.005						
1 A 2 f Non-metallic minerals: Other Fuels	NH ₃	0	C	10	50	50.99	0	C	<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	NH ₃	0.02	0.01	9.28	37.12	38.26	0	-44.58	<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	NH ₃	0	0	4.96	29.75	30.16	0	43.62	<0.005						
1 A 2 g viii Other: Biomass	NH ₃	0.05	0.05	9.9	39.74	40.95	0	5.93	<0.005						
1 A 2 g viii Other: Gaseous Fuels	NH ₃	0	C	9.99	39.95	41.18	0	C	<0.005						
1 A 2 g viii Other: Liquid Fuels	NH ₃	0.06	0.01	11.13	22.38	25	0	-83.92	<0.005						
1 A 2 g viii Other: Other Fuels	NH ₃	0	C	10	50	50.99	0	C	<0.005						
1 A 2 g viii Other: Solid Fuels	NH ₃	0	C	9.36	37.43	38.58	0	C	<0.005						
1 A 3 b i Road Transportation, Cars: Biomass	NH ₃	0	0.01	5	400	400.03	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	NH ₃	0	0.03	5	400	400.03	0.01	975.47	<0.005						
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	NH ₃	0	0	10	400	400.12	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	NH ₃	1.66	1.93	3	400	400.01	25.76	16.09	0.06	10	11	10	2	2	3
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	NH ₃	0	0.01	5	400	400.03	0	1030.76	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	NH ₃	0.09	0.05	3	400	400.01	0.01	-48.51	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	NH ₃	0	0	5	400	400.03	0	1805.9	<0.005						

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	NH ₃	0.01	0.02	4.35	348.08	348.1	0	18.93	<0.005					
1 A 3 b iii Road Transportation, Heavy duty trucks: Gaseous Fuels	NH ₃	0	0	10	400	400.12	0	64876.52	<0.005					
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	NH ₃	0	0	3	400	400.01	0	-61.52	<0.005					
1 A 3 b iv Road Transportation, Motorcycles: Gasoline	NH ₃	0	0	3	400	400.01	0	142.6	<0.005					
1 A 3 c Railways: Liquid Fuels	NH ₃	0	0	5	75	75.17	0	-53.77	<0.005					
1 A 3 d Domestic Navigation: Gas/Diesel Oil	NH ₃	0	0	3.1	24.8	24.99	0	126.79	<0.005					
1 A 3 d Domestic Navigation: Residual Oil	NH ₃	0	0	15	40	42.72	0	197.51	<0.005					
1 A 3 e Other Transportation: Diesel Oil	NH ₃	0	0	5	30	30.41	0	14.31	<0.005					
1 A 4 a Commercial/Institutional: Biomass	NH ₃	0	0	9.6	39.26	40.42	0	129.83	<0.005					
1 A 4 a Commercial/Institutional: Diesel Oil	NH ₃	0	0	5	30	30.41	0	-7.33	<0.005					
1 A 4 a Commercial/Institutional: Gaseous Fuels	NH ₃	0	0	9.7	37.65	38.88	0	38.99	<0.005					
1 A 4 a Commercial/Institutional: Gasoline	NH ₃	0	0	5	30	30.41	0	23.22	<0.005					
1 A 4 a Commercial/Institutional: Liquid Fuels	NH ₃	0.07	0	15.4	30.81	34.44	0	-96.84	<0.005					
1 A 4 a Commercial/Institutional: Other Fuels	NH ₃	0	0	10	50	50.99	0		<0.005					
1 A 4 b Residential: Biomass	NH ₃	0.12	0.13	10	40	41.23	0	7.98	<0.005					
1 A 4 b Residential: Gaseous Fuels	NH ₃	0	0	9.15	33.6	34.82	0	-54.67	<0.005					

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 4 b Residential: Liquid Fuels	NH ₃	0.16	0	16.71	33.57	37.5	0	-97.48	<0.005			18			
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	NH ₃	0	0.02	7.98	33.79	34.72	0	2294.49	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels	NH ₃	0	0	10	40	41.23	0	-70.58	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	NH ₃	0.01	0.01	7.17	16.65	18.13	0	-45.92	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	NH ₃	0	0					-100							
1 A 5 b Mobile: Liquid Fuels	NH ₃	0.01	0	2.43	226.92	226.94	0	-82.57	<0.005						
1 B 1 b Coke production	NH ₃	0	0	5	170	170.07	0	8.16	<0.005						
1 B 2 a Oil	NH ₃	0	C	3.77	43.93	44.09	0	C	<0.005						
1 B 2 c Venting and flaring	NH ₃	0	C	17.5	49.99	52.97	0	C	<0.005						
2 A 1 Cement Production	NH ₃	0	0.01	2	400	400	0		<0.005						
2 A 3 Glass Production	NH ₃	0.25	0.04		400	400	0.01	-84.4	0.01			14			5
2 B 10 Other	NH ₃	0.19	0.02		38.19	38.19	0	-90.18	<0.005			15			
2 B 2 Nitric Acid Production	NH ₃	0.01	0.01	2	5	5.39	0	-22.81	<0.005						
2 G 4 Other	NH ₃	0.04	0.02	15	6	16.16	0	-54.41	<0.005						
2 H Other	NH ₃	1.91	2.37	4.86	49.88	50.11	0.61	24.53	<0.005	9	8	6	11	11	10
3 B 1 Dairy cattle	NH ₃	9.41	3.9	20	50	53.85	1.91	-58.57	0.16	2	5	1	3	6	1
3 B 1 Non-dairy cattle	NH ₃	6.94	9.6	20	50	53.85	11.56	38.45	0.23	4	2	2	5	3	2
3 B 3 Swine	NH ₃	4.97	2.97	20	50	53.85	1.1	-40.33	0.03	5	7	3	6	9	4
3 B 4 Fur-bearing animals	NH ₃	0.61	0.43	20	50	53.85	0.02	-29.27	<0.005			19			
3 B 4 Goats	NH ₃	0.01	0.01	20	50	53.85	0	27.59	<0.005						
3 B 4 Horses	NH ₃	2.66	3.06	20	50	53.85	1.18	14.92	0.02	7	6	7	9	8	9
3 B 4 Poultry	NH ₃	1.55	1.94	15.03	37.58	40.47	0.27	25.42	<0.005	11	10	9			13
3 B 4 Sheep	NH ₃	0.39	0.69	20	50	53.85	0.06	78.19	<0.005			12			15
3 D a 1 Inorganic N fertilizers	NH ₃	7.05	7.13	35	50	61.03	8.19	1.18	0.29	3	3	5	4	4	7

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
3 D a 2 a Animal manure applied to soils	NH ₃	18.73	16.46	35	50	61.03	43.64	-12.11	1.56	1	1	4	1	1	6
3 D a 2 b Sewage sludge applied to soils	NH ₃	0.27	0.59	35	50	61.03	0.06	122.88	<0.005			11			12
3 D a 2 c Other organic fertilizers applied to soils	NH ₃	0.38	0.9	35	50	61.03	0.13	136.4	0.01		13	8			8
3 D a 3 Urine and dung deposited by grazing animals	NH ₃	4.11	4.03	35	50	61.03	2.61	-2.01	0.09	6	4	13	7	5	
5 B 1 Composting	NH ₃	0.03	0.14	15	192	192.59	0.03	469.61	<0.005						11
5 C 1 Waste Incineration	NH ₃	0	0	10	510	510.1	0		<0.005						
5 D 1 Domestic wastewater	NH ₃	2.08	2.08	10	100	100.5	1.89	0	<0.005	8	9	16	8	7	
5 E Other	NH ₃	0.99	1.04	1.04	141.53	141.54	0.94	5.19	<0.005	12	12	20	10	10	14
Total		65.32	60.33			25.21	100	-7.64	15.78						

Table A1-9 Summary of the key source and uncertainty analysis of Ni emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	Ni	0.6	0.58	1.97	39.3	39.35	2.07	-3.88	<0.005	12	4	3		10	4
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	Ni	2.44	C	1.52	99.51	99.52	3.55	C	0.01	3	8	6	3	6	3
1 A 1 a Public Electricity and Heat Production: Other Fuels	Ni	0.3	0.04	1.99	424.03	424.04	1.42	-85.37	<0.005	17	22		6	12	13
1 A 1 a Public Electricity and Heat Production: Peat	Ni	0.44	0.02	2.02	40	40.05	0	-94.54	<0.005	15		16			
1 A 1 a Public Electricity and Heat Production: Solid Fuels	Ni	0.22	C	1.13	40	40.02	0.02	C	<0.005		18				
1 A 1 b Petroleum refining: Liquid Fuels	Ni	0.75	C	9.65	91.27	91.78	2.9	C	<0.005	11	9	11	12	7	11
1 A 2 a Iron and Steel: Biomass	Ni	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	Ni	1.02	C	4.07	99.91	100	2.75	C	<0.005	9	10	19	10	8	17
1 A 2 a Iron and Steel: Solid Fuels	Ni	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	Ni	0.12	C	3.47	99.24	99.3	0.05	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	Ni	0	0					-100							
1 A 2 c Chemicals: Biomass	Ni	0	0	3.04	28.68	28.84	0	52.59	<0.005						
1 A 2 c Chemicals: Liquid Fuels	Ni	0.46	0.2	8.89	98.21	98.61	1.5	-56.74	<0.005	14	12	12		11	12
1 A 2 c Chemicals: Other Fuels	Ni	0	0					-100							
1 A 2 c Chemicals: Solid Fuels	Ni	0.01	C	2.38	36.17	36.25	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	Ni	0.18	C	4.33	38.8	39.04	0.24	C	<0.005		11	10		16	15
1 A 2 d Pulp, Paper and Print: Liquid Fuels	Ni	4.85	1.12	3.5	99.97	100.03	50.31	-76.82	<0.005	2	1	15	2	1	14
1 A 2 d Pulp, Paper and Print: Other Fuels	Ni	0	0					-100							
1 A 2 d Pulp, Paper and Print: Solid Fuels	Ni	0.03	C	4.42	28.4	28.75	0	C	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	Ni	0	0	4.09	30.99	31.26	0	111.29	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	Ni	1.26	0.1	3.06	99.35	99.4	0.39	-92.06	<0.005	7	15	8	7	15	7
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	Ni	0	0					-100							
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	Ni	0.01	C	5	40	40.31	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	Ni	0	C	9.52	38.1	39.27	0	C	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	Ni	1.01	0.38	8.51	96.92	97.3	5.49	-62.09	<0.005	10	6	9	11	5	9
1 A 2 f Non-metallic minerals: Solid Fuels	Ni	0.1	0.05	9.28	37.12	38.26	0.02	-44.45	<0.005		19	22			
1 A 2 g vii Off-road vehicles and other machinery: Biomass	Ni	0	0.01	4.98	99.7	99.82	0		<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	Ni	0.02	0.03	4.92	98.33	98.45	0.03	31.55	<0.005			25			
1 A 2 g viii Other: Biomass	Ni	0.11	0.08	9.9	39.62	40.84	0.04	-29.17	<0.005		17	18			
1 A 2 g viii Other: Liquid Fuels	Ni	2.3	0.44	11.13	99.05	99.67	7.52	-81.04	<0.005	4	5	17	4	3	16
1 A 2 g viii Other: Solid Fuels	Ni	0.01	C	9.36	37.21	38.37	0.01	C	<0.005			21			
1 A 3 b i Road Transportation, Cars: Biomass	Ni	0	0.01	3.36	65.56	65.65	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	Ni	0	0.01	5	100	100.12	0.01	823.29	<0.005						
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	Ni	0	0	10	100	100.5	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	Ni	0.05	0.03	3	100	100.04	0.03	-43.38	<0.005						
1 A 3 b i Road Transportation: Automobile tyre and brake wear	Ni	0	0		1000	1000	0.03	24.61	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Biomass	Ni	0	0	4.83	96.61	96.73	0		<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	Ni	0	0	5	100	100.12	0	762.24	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	Ni	0	0	3	100	100.04	0	-80.03	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	Ni	0	0	3.99	79.89	79.99	0	14862.14	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	Ni	0.01	0.01	4.33	86.58	86.68	0	10.23	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	Ni	0	0	3	100	100.04	0	-63.57	<0.005						
1 A 3 c Railways: Liquid Fuels	Ni	0	0	5	95	95.13	0	-53.07	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	Ni	0.09	0.05	4.06	40.57	40.77	0.01	-44.9	<0.005		21	24			
1 A 3 d Domestic Navigation: Residual Oil	Ni	2.08	0.76	15	50	52.2	6.33	-63.23	0.01	6	3	4	8	4	8
1 A 3 e Other Transportation: Biomass	Ni	0	0	5	100	100.12	0		<0.005						
1 A 3 e Other Transportation: Diesel Oil	Ni	0.01	0.01	5	100	100.12	0	7.57	<0.005						
1 A 4 a Commercial/Institutional: Biomass	Ni	0	0	9.6	38.94	40.11	0	131.76	<0.005						
1 A 4 a Commercial/Institutional: Diesel Oil	Ni	0	0	5	100	100.12	0	-12.02	<0.005						
1 A 4 a Commercial/Institutional: Ethanol	Ni	0	0	5	100	100.12	0		<0.005						
1 A 4 a Commercial/Institutional: FAME	Ni	0	0	5	100	100.12	0		<0.005						
1 A 4 a Commercial/Institutional: Gasoline	Ni	0	0	5	100	100.12	0	10.72	<0.005						
1 A 4 a Commercial/Institutional: Liquid Fuels	Ni	2.23	0	15.4	100	101.18	0	-99.94	0.02	5		2	5		2
1 A 4 b Residential: Biomass	Ni	0.1	0.11	9.94	39.76	40.98	0.08	8.65	<0.005		14	13			
1 A 4 b Residential: Liquid Fuels	Ni	1.12	0.01	5.11	74.32	74.5	0	-99.01	<0.005	8		5	9		6

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	Ni	0	0.02	5.78	29.03	29.6	0	4246.74	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	Ni	0.41	0.3	11.56	80.39	81.22	2.39	-25.96	<0.005	16	7	7		9	5
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	Ni	0.01	0					-100							
1 A 5 b Mobile: Liquid Fuels	Ni	0.02	0.01	5	50	50.25	0	-36.23	<0.005						
2 A 3 Glass Production	Ni	0.18	0.04		317	317	0.54	-79.85	<0.005		23			14	
2 C 1 Iron and Steel Production	Ni	8.66	0.92	0.84	56.81	56.82	10.94	-89.34	0.03	1	2	1	1	2	1
2 C 2 Ferroalloys production	Ni	0	0.01	5	75	75.17	0		<0.005						
2 C 7 Other	Ni	0.04	0.09	4	53	53.15	0.08	115.94	<0.005		16	14			18
2 G 4 Other	Ni	0.05	0.05	12.26	322.17	322.41	1.02	-5.44	<0.005		20	20		13	10
2 H Other	Ni	0.52	0.15	4.89	48.91	49.15	0.21	-71.98	<0.005	13	13	23			
5 C 1 Waste Incineration	Ni	0	0	5.98	401.19	401.24	0.01	117.66	<0.005						
Total		31.82	6.89			23.02	100	-78.36	2.9						

Table A1-10 Summary of the key source and uncertainty analysis of NMVOC emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	NMVOC	1.57	2.43	1.96	73.45	73.47	0.29	55.28	<0.005	13	14		12	11
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels	NMVOC	0.02	C	2.03	29.99	30.06	0	C	<0.005					
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	NMVOC	0.05	C	1.46	19.96	20.02	0	C	<0.005					
1 A 1 a Public Electricity and Heat Production: Other Fuels	NMVOC	0.13	0.12	2	49.21	49.25	0	-5.73	<0.005					
1 A 1 a Public Electricity and Heat Production: Peat	NMVOC	0.55	0.24	2.02	50	50.04	0	-56.34	<0.005					
1 A 1 a Public Electricity and Heat Production: Solid Fuels	NMVOC	0.25	C	1.13	40.57	40.59	0	C	<0.005					
1 A 1 b Petroleum refining: Gaseous Fuels	NMVOC	0	C	2	30	30.07	0	C	<0.005					
1 A 1 b Petroleum refining: Liquid Fuels	NMVOC	0.06	C	9.65	47.58	48.55	0	C	<0.005					
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels	NMVOC	0.01	C	4.19	25.15	25.5	0	C	<0.005					
1 A 2 a Iron and Steel: Biomass	NMVOC	0	0					-100						
1 A 2 a Iron and Steel: Gaseous Fuels	NMVOC	0	C	5	30	30.41	0	C	<0.005					
1 A 2 a Iron and Steel: Liquid Fuels	NMVOC	0.03	C	4.07	20.64	21.04	0	C	<0.005					
1 A 2 a Iron and Steel: Solid Fuels	NMVOC	0.01	C	3.57	21.39	21.69	0	C	<0.005					
1 A 2 b Non-ferrous metals: Gaseous Fuels	NMVOC	0	C	5	30	30.41	0	C	<0.005					
1 A 2 b Non-ferrous metals: Liquid Fuels	NMVOC	0	C	3.47	17.86	18.19	0	C	<0.005					
1 A 2 b Non-ferrous metals: Solid Fuels	NMVOC	0	0					-100						
1 A 2 c Chemicals: Biomass	NMVOC	0.06	0.02	3.04	51.68	51.77	0	-68.63	<0.005					
1 A 2 c Chemicals: Gaseous Fuels	NMVOC	0.01	0	5	30	30.41	0	-53.76	<0.005					
1 A 2 c Chemicals: Liquid Fuels	NMVOC	0.03	0.02	8.89	39.54	40.52	0	-37.27	<0.005					

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 c Chemicals: Other Fuels	NMVOC	0	C	10	50	50.99	0	C	<0.005						
1 A 2 c Chemicals: Solid Fuels	NMVOC	0.01	C	2.38	45.22	45.28	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	NMVOC	3.78	C	4.33	73.03	73.16	0.04	C	<0.005	15	20	20	12		
1 A 2 d Pulp, Paper and Print: Gaseous Fuels	NMVOC	0	0	5	30	30.41	0	-66.15	<0.005						
1 A 2 d Pulp, Paper and Print: Liquid Fuels	NMVOC	0.07	0.02	3.5	24.65	24.9	0	-74.67	<0.005						
1 A 2 d Pulp, Paper and Print: Other Fuels	NMVOC	0	C	10	50	50.99	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Solid Fuels	NMVOC	0.03	C	4.42	35.51	35.78	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	NMVOC	0.03	0.02	4.09	55.68	55.83	0	-12.49	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Gaseous Fuels	NMVOC	0.01	0	5	30	30.41	0	-60.51	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	NMVOC	0.02	0	3.06	17.24	17.51	0	-81.08	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	NMVOC	0	C	10	50	50.99	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	NMVOC	0.01	C	5	50	50.25	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	NMVOC	0.01	C	9.52	47.7	48.64	0	C	<0.005						
1 A 2 f Non-metallic minerals: Gaseous Fuels	NMVOC	0	0	10	30	31.62	0	-16.1	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	NMVOC	0.02	0.02	8.51	33.38	34.45	0	-16.93	<0.005						
1 A 2 f Non-metallic minerals: Other Fuels	NMVOC	0	C	10	50	50.99	0	C	<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	NMVOC	0.1	0.05	9.28	46.4	47.32	0	-44.48	<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	NMVOC	1.34	1.35	3.96	16.24	16.71	0	0.46	<0.005		17				

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1 A 2 g viii Other: Biomass	NMVOC	2.39	0.34	9.9	74.29	74.94	0.01	-85.83	<0.005	18		21			
1 A 2 g viii Other: Gaseous Fuels	NMVOC	0	C	9.99	29.98	31.6	0	C	<0.005						
1 A 2 g viii Other: Liquid Fuels	NMVOC	0.07	0.03	11.13	20.18	23.05	0	-64.15	<0.005						
1 A 2 g viii Other: Other Fuels	NMVOC	0	C	10	50	50.99	0	C	<0.005						
1 A 2 g viii Other: Solid Fuels	NMVOC	0.01	C	9.36	46.51	47.45	0	C	<0.005						
1 A 3 a Domestic Aviation: Aviation Gasoline	NMVOC	0	0	10	100	100.5	0	-79.01	<0.005						
1 A 3 a Domestic Aviation: Jet Kerosene	NMVOC	0.11	0.06	10	100	100.5	0	-46.75	<0.005						
1 A 3 b i Road Transportation, Cars: Biomass	NMVOC	0	0.03	5	50	50.25	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	NMVOC	0.61	0.47	5	50	50.25	0.01	-22.05	<0.005						
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	NMVOC	0	0.01	10	50	50.99	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	NMVOC	80.47	7.55	3	50	50.09	1.29	-90.62	0.16	2	8	1	1	10	1
1 A 3 b i Road Transportation: Gasoline evaporation	NMVOC	43.83	0.68	3	50	50.09	0.01	-98.45	0.07	3		2	3		2
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	NMVOC	0.19	0.14	5	50	50.25	0	-25.98	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	NMVOC	4.93	0.26	3	50	50.09	0	-94.68	<0.005	13		12			13
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	NMVOC	4.04	0.4	4.26	42.58	42.79	0	-90.21	<0.005	14		15			
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	NMVOC	0.09	0.03	3	50	50.09	0	-64.27	<0.005						
1 A 3 b iv Road Transportation, Motorcycles: Gasoline	NMVOC	1.22	0.63	3	50	50.09	0.01	-48.34	<0.005						
1 A 3 c Railways: Liquid Fuels	NMVOC	0.15	0.05	5	75	75.17	0	-68.18	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	NMVOC	10.5	8.27	4.91	19.63	20.24	0.25	-21.26	<0.005	6	6	8		13	
1 A 3 d Domestic Navigation: Residual Oil	NMVOC	0.07	0.02	15	20	25	0	-68.95	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 e Other Transportation: Diesel Oil	NMVOC	0.26	0.11	5	20	20.62	0	-56.72	<0.005						
1 A 4 a Commercial/Institutional: Biomass	NMVOC	0.21	0.48	9.6	74.92	75.53	0.01	125.8	<0.005						
1 A 4 a Commercial/Institutional: Diesel Oil	NMVOC	0.19	0.16	5	20	20.62	0	-13.5	<0.005						
1 A 4 a Commercial/Institutional: Gaseous Fuels	NMVOC	0	0	9.7	29.1	30.67	0	169.75	<0.005						
1 A 4 a Commercial/Institutional: Gasoline	NMVOC	1.82	1.39	5	20	20.62	0.01	-23.93	<0.005	16					
1 A 4 a Commercial/Institutional: Liquid Fuels	NMVOC	0.12	0.01	15.4	28.55	32.44	0	-91.94	<0.005						
1 A 4 a Commercial/Institutional: Other Fuels	NMVOC	0	0	10	50	50.99	0		<0.005						
1 A 4 b Residential: Biomass	NMVOC	10.29	8.86	10	75	75.66	4.04	-13.96	0.01	7	4	6	9	8	8
1 A 4 b Residential: Gaseous Fuels	NMVOC	0	0	9.15	27.45	28.93	0	-16.79	<0.005						
1 A 4 b Residential: Liquid Fuels	NMVOC	5.01	6.87	2.98	19.88	20.11	0.17	37.16	<0.005	12	10	5		14	14
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	NMVOC	0.06	1.27	7.98	73.48	73.91	0.08	1921.13	<0.005		18	16			15
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels	NMVOC	0	0	10	30	31.62	0	-41.16	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	NMVOC	3.3	3.96	1.93	12.67	12.82	0.02	20.26	<0.005	16	11	10			
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	NMVOC	0.17	0					-100							
1 A 5 b Mobile: Liquid Fuels	NMVOC	0.86	0.04	7.2	71.47	71.83	0	-94.84	<0.005						
1 B 1 c Flaring of gas: Solid Fuels	NMVOC	0	0	50	30	58.31	0	342.07	<0.005						
1 B 2 a Oil	NMVOC	31.29	13.24	0.01	54.18	54.18	4.63	-57.68	<0.005	4	2	17	6	6	
1 B 2 b Natural gas	NMVOC	0.51	0.35		47.34	47.34	0	-30.91	<0.005						
1 B 2 c Venting and flaring	NMVOC	0	0	9	35.37	36.49	0	11.37	<0.005						
1 D International Aviation: Jet kerosene	NMVOC	0.09	0.09	10	100	100.5	0	1.43	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
2 A 3 Glass Production	NMVOC	0.04	0		400	400	0	-93.03	<0.005						
2 B 10 Other	NMVOC	6	2		40.73	40.73	0.06	-66.73	<0.005	11	15		13		
2 C 1 Iron and Steel Production	NMVOC	0.11	0.1	0.76	171.74	171.74	0	-9.85	<0.005						
2 C 3 Aluminium production	NMVOC	0.01	0					-100							
2 D 3 Other	NMVOC	90.03	57.34	9.17	9.21	13	5	-36.31	0.04	1	1	3	5	5	9
2 G 4 Other	NMVOC	0.04	0.02	15	100	101.12	0	-54.41	<0.005						
2 H Other	NMVOC	9.52	10.82	8.51	99.67	100.03	10.54	13.63	0.03	9	3	4	8	4	5
3 B 1 Dairy cattle	NMVOC	14.42	8.33	20	200	201	25.26	-42.23	0.01	5	5	13	2	1	7
3 B 1 Non-dairy cattle	NMVOC	7.11	7	20	200	201	17.82	-1.57	0.05	10	9	7	7	3	3
3 B 3 Swine	NMVOC	1.28	0.66	20	200	201	0.16	-48.45	<0.005				14		
3 B 4 Fur-bearing animals	NMVOC	0.32	0.23	20	200	201	0.02	-29.27	<0.005						
3 B 4 Goats	NMVOC	0	0	20	200	201	0	27.59	<0.005						
3 B 4 Horses	NMVOC	2.91	3.34	20	200	201	4.06	14.92	0.01	17	12	11	10	7	6
3 B 4 Poultry	NMVOC	0.84	1.26	14.11	141.08	141.78	0.29	50.07	<0.005		19	19		11	12
3 B 4 Sheep	NMVOC	0.24	0.43	20	200	201	0.07	78.19	<0.005						
3 D a 2 a Animal manure applied to soils	NMVOC	10.25	8.09	35	200	203.04	24.28	-21.1	0.05	8	7	9	4	2	4
3 D a 2 b Sewage sludge applied to soils	NMVOC	0.02	0.06	35	200	203.04	0	137.5	<0.005						
3 D a 3 Urine and dung deposited by grazing animals	NMVOC	0.26	0.24	35	200	203.04	0.02	-8.23	<0.005						
3 D e Cultivated crops	NMVOC	2.22	2.01	35	200	203.04	1.5	-9.44	<0.005	19	14	18	11	9	10
5 A 1 Managed waste disposal sites	NMVOC	2.16	0.62	55	92	107.19	0.04	-71.27	<0.005						
5 C 1 Waste Incineration	NMVOC	0	0	6.9	299.27	299.35	0	203.8	<0.005						
5 D 1 Domestic wastewater	NMVOC	0.02	0.02	10	233	233.21	0	-6.74	<0.005						
5 D 2 Industrial wastewater	NMVOC	0.01	0.01	50	233	238.3	0	-3.95	<0.005						
Total		358.88	163.88			20.33	100	-54.34	6.76						

Table A1-11 Summary of the key source and uncertainty analysis of NO_x emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	NO _x	2.45	8.79	1.97	47.93	47.97	1.38	259.25	0.02	23	5	4	18	6	6
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels	NO _x	0.51	C	2	19.99	20.09	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	NO _x	2.69	C	1.43	13.68	13.76	0	C	<0.005	22		20			
1 A 1 a Public Electricity and Heat Production: Other Fuels	NO _x	0.61	1.52	2.01	18.86	18.96	0.01	148.98	<0.005		18	17			
1 A 1 a Public Electricity and Heat Production: Peat	NO _x	2.08	0.33	2.02	20	20.1	0	-83.91	<0.005	25		24			
1 A 1 a Public Electricity and Heat Production: Solid Fuels	NO _x	6.01	C	1.13	14.86	14.9	0	C	<0.005	8	36	9			
1 A 1 b Petroleum refining: Gaseous Fuels	NO _x	0	C	2	50	50.04	0	C	<0.005						
1 A 1 b Petroleum refining: Liquid Fuels	NO _x	2.16	C	9.65	46.72	47.71	0.02	C	<0.005	24	23				
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels	NO _x	0.5	C	4.19	42.54	42.75	0	C	<0.005		32				
1 A 2 a Iron and Steel: Biomass	NO _x	0	0					-100							
1 A 2 a Iron and Steel: Gaseous Fuels	NO _x	0.01	C	5	50	50.25	0	C	<0.005						
1 A 2 a Iron and Steel: Liquid Fuels	NO _x	1.33	C	4.07	40.09	40.29	0.01	C	<0.005	29	28				
1 A 2 a Iron and Steel: Solid Fuels	NO _x	0.36	C	3.57	35.66	35.84	0	C	<0.005						
1 A 2 b Non-ferrous metals: Gaseous Fuels	NO _x	0.01	C	5	50	50.25	0	C	<0.005						
1 A 2 b Non-ferrous metals: Liquid Fuels	NO _x	0.16	C	3.47	36.68	36.85	0	C	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 b Non-ferrous metals: Solid Fuels	NO _x	0.01	0					-100							
1 A 2 c Chemicals: Biomass	NO _x	0.07	0.12	3.04	28.23	28.39	0	72.67	<0.005						
1 A 2 c Chemicals: Gaseous Fuels	NO _x	0.16	0.13	5	50	50.25	0	-22.93	<0.005						
1 A 2 c Chemicals: Liquid Fuels	NO _x	1.12	0.89	8.89	43.15	44.06	0.01	-20.59	<0.005	32	26	31			
1 A 2 c Chemicals: Other Fuels	NO _x	0.01	C	10	50	50.99	0	C	<0.005						
1 A 2 c Chemicals: Solid Fuels	NO _x	0.22	C	2.38	36.08	36.16	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	NO _x	4.92	C	4.33	40.7	40.93	0.14	C	<0.005	10	11	21	11	11	
1 A 2 d Pulp, Paper and Print: Gaseous Fuels	NO _x	0.07	0.03	5	50	50.25	0	-58.48	<0.005						
1 A 2 d Pulp, Paper and Print: Liquid Fuels	NO _x	3.69	0.36	3.5	34.76	34.94	0	-90.36	<0.005	17	37	16	14		16
1 A 2 d Pulp, Paper and Print: Other Fuels	NO _x	0.12	C	10	50	50.99	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Solid Fuels	NO _x	0.57	C	4.42	47.17	47.38	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	NO _x	0.03	0.1	4.09	34.78	35.02	0	228.87	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Gaseous Fuels	NO _x	0.27	0.18	5	50	50.25	0	-34.18	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	NO _x	1.09	0.15	3.06	31.86	32.01	0	-86.52	<0.005	33		33			
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	NO _x	0.01	C	10	50	50.99	0	C	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	NO _x	0.18	C	5	50	50.25	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	NO _x	0.01	C	9.52	36.35	37.57	0	C	<0.005						
1 A 2 f Non-metallic minerals: Gaseous Fuels	NO _x	0.07	0.1	10	50	50.99	0	39.83	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	NO _x	0.8	0.14	8.51	31.04	32.19	0	-81.88	<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	NO _x	0.99	0.4	9.28	41.44	42.47	0	-59.99	<0.005		34				
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	NO _x	12.55	9.5	4.97	19.9	20.51	0.3	-24.33	<0.005	4	4	7	9	9	12
1 A 2 g viii Other: Biomass	NO _x	2.87	1.36	9.9	49.33	50.32	0.04	-52.59	<0.005	21	19		16	17	
1 A 2 g viii Other: Gaseous Fuels	NO _x	0.12	C	9.99	49.95	50.94	0	C	<0.005						
1 A 2 g viii Other: Liquid Fuels	NO _x	3.75	1.3	11.13	36.27	37.94	0.02	-65.23	<0.005	15	20	29	17		
1 A 2 g viii Other: Other Fuels	NO _x	0	C	10	50	50.99	0	C	<0.005						
1 A 2 g viii Other: Solid Fuels	NO _x	0.14	C	9.36	49.06	49.95	0.11	C	<0.005		14	10		13	9
1 A 3 a Domestic Aviation: Aviation Gasoline	NO _x	0.02	0	10	100	100.5	0	-83.68	<0.005						
1 A 3 a Domestic Aviation: Jet Kerosene	NO _x	0.68	0.28	10	100	100.5	0.01	-58.61	<0.005						
1 A 3 b i Road Transportation, Cars: Biomass	NO _x	0	0.15	5	50	50.25	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	NO _x	2.02	12.61	5	50	50.25	3.12	525.11	0.05	26	2	2		5	4
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	NO _x	0	0.06	10	50	50.99	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	NO _x	71.95	5.17	3	50	50.09	0.52	-92.81	0.26	1	9	1	1	8	1
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	NO _x	1.04	5.88	5	50	50.25	0.68	464.72	0.01	34	8	6		7	8

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	NO _x	4.75	0.22	3	50	50.09	0	-95.35	<0.005	11		11	10		10
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	NO _x	0.02	0.24	5	50	50.25	0	1115.49	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	NO _x	59.65	18.65	4.2	41.98	42.19	4.82	-68.73	0.02	2	1	3	3	3	5
1 A 3 b iii Road Transportation, Heavy duty trucks: Gaseous Fuels	NO _x	0	0.58	10	50	50.99	0.01	20675.09	<0.005		31	25			
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	NO _x	0.15	0.06	3	50	50.09	0	-60.54	<0.005						
1 A 3 b iv Road Transportation, Motorcycles: Gasoline	NO _x	0.07	0.17	3	50	50.09	0	142.06	<0.005						
1 A 3 c Railways: Liquid Fuels	NO _x	1.89	0.59	5	100	100.12	0.03	-69.12	<0.005	27	30	35	12	19	
1 A 3 d Domestic Navigation: Gas/Diesel Oil	NO _x	3.83	2.94	3.17	6.34	7.09	0	-23.24	<0.005	14	13	18			
1 A 3 d Domestic Navigation: Residual Oil	NO _x	4.51	1.28	15	10	18.03	0	-71.62	<0.005	12	21	23			
1 A 3 e Other Transportation: Diesel Oil	NO _x	3.71	1.27	5	20	20.62	0.01	-65.86	<0.005	16	22	28			
1 A 4 a Commercial/Institutional: Biomass	NO _x	0.06	0.13	9.6	48.21	49.16	0	134.01	<0.005						
1 A 4 a Commercial/Institutional: Diesel Oil	NO _x	1.17	0.77	5	20	20.62	0	-34.43	<0.005	30	27				
1 A 4 a Commercial/Institutional: Gaseous Fuels	NO _x	0.06	0.17	9.7	48.15	49.11	0	171.81	<0.005						
1 A 4 a Commercial/Institutional: Gasoline	NO _x	0.33	0.39	5	20	20.62	0	18.11	<0.005		35				

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 4 a Commercial/Institutional: Liquid Fuels	NO _x	3.2	0.1	15.4	39.88	42.75	0	-96.75	<0.005	19		15	19		14
1 A 4 a Commercial/Institutional: Other Fuels	NO _x	0	0.01	10	50	50.99	0		<0.005						
1 A 4 b Residential: Biomass	NO _x	3.2	3.32	10	50	50.99	0.22	3.67	<0.005	20	10	12	15	10	11
1 A 4 b Residential: Gaseous Fuels	NO _x	0.06	0.05	9.15	44.87	45.79	0	-14.93	<0.005						
1 A 4 b Residential: Liquid Fuels	NO _x	6.59	1.65	3.17	16.67	16.97	0.01	-74.94	<0.005	7	17	14	6		
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	NO _x	0.02	0.47	7.98	38.03	38.86	0	2735.27	<0.005		33	27			
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels	NO _x	0.02	0.01	10	50	50.99	0	-41.16	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	NO _x	15.43	7.34	2.71	8.95	9.35	0.04	-52.46	<0.005	3	7		13	15	
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	NO _x	0.34	0					-100							
1 A 5 b Mobile: Liquid Fuels	NO _x	4.34	1.04	5.26	47.62	47.91	0.02	-75.92	<0.005	13	24	19	7		17
1 B 1 c Flaring of gas: Solid Fuels	NO _x	0.01	0.02	50	20	53.85	0	187.18	<0.005						
1 B 2 a Oil	NO _x	0.27	0.34	2.21	44.58	44.63	0	30.12	<0.005		38				
1 B 2 c Venting and flaring	NO _x	0.09	0.07	17.5	49.99	52.97	0	-18.33	<0.005						
1 D International Aviation: Jet kerosene	NO _x	0.55	0.62	10	100	100.5	0.03	12.17	<0.005		29	32		18	
2 A 1 Cement Production	NO _x	5.25	2.27	2	50	50.04	0.1	-56.67	<0.005	9	15		8	14	
2 A 3 Glass Production	NO _x	0.73	0					-100				34			
2 B 10 Other	NO _x	0.68	0.32		40.53	40.53	0	-52.66	<0.005						
2 B 2 Nitric Acid Production	NO _x	1.15	0.12	2	5	5.39	0	-89.79	<0.005	31		30	21		

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined un-certainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
2 C 1 Iron and Steel Production	NO _x	0.88	0.9	1.46	46.25	46.27	0.01	2.92	<0.005		25	26			
2 C 2 Ferroalloys production	NO _x	0.3	0.03	5	75	75.17	0	-89.67	<0.005						
2 C 3 Aluminium production	NO _x	0.01	0	2	50	50.04	0	-79.05	<0.005						
2 C 7 Other	NO _x	0.39	0.34	4	50	50.16	0	-14.12	<0.005						
2 G 4 Other	NO _x	0.02	0.01	14.32	7.38	16.11	0	-52.98	<0.005						
2 H Other	NO _x	10.46	10.53	4.98	9.97	11.15	0.11	0.72	<0.005	5	3	5	20	12	13
3 B 1 Dairy cattle	NO _x	0.5	0.08	20	80	82.46	0	-82.89	<0.005						
3 B 1 Non-dairy cattle	NO _x	0.26	0.17	20	80	82.46	0	-33.69	<0.005						
3 B 3 Swine	NO _x	0.14	0.03	20	80	82.46	0	-79.96	<0.005						
3 B 4 Fur-bearing animals	NO _x	0.04	0.03	20	80	82.46	0	-29.27	<0.005						
3 B 4 Goats	NO _x	0	0	20	80	82.46	0	27.59	<0.005						
3 B 4 Horses	NO _x	0.06	0.07	20	80	82.46	0	14.92	<0.005						
3 B 4 Poultry	NO _x	0.07	0.11	14.8	59.2	61.02	0	70.11	<0.005						
3 B 4 Sheep	NO _x	0.01	0.02	20	80	82.46	0	78.19	<0.005						
3 D a 1 Inorganic N fertilizers	NO _x	8.95	7.58	35	400	401.53	72.16	-15.28	0.26	6	6	8	2	1	2
3 D a 2 a Animal manure applied to soils	NO _x	3.32	3.13	35	400	401.53	12.27	-5.8	0.05	18	12	13	4	2	3
3 D a 2 b Sewage sludge applied to soils	NO _x	0.05	0.11	35	400	401.53	0.02	137.5	<0.005						
3 D a 2 c Other organic fertilizers applied to soils	NO _x	0.07	0.17	35	400	401.53	0.04	151.9	<0.005					16	15
3 D a 3 Urine and dung deposited by grazing animals	NO _x	1.76	1.72	35	400	401.53	3.71	-2.55	0.02	28	16	22	5	4	7
5 C 1 Waste Incineration	NO _x	0.07	0.15	6.21	373.56	373.61	0.02	126.09	<0.005						
Total		277.89	129.61			27.65	100	-53.36	8.33						

Table A1-12 Summary of the key source and uncertainty analysis of PAH 1-4 emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	PAH 1-4	0.27	0.34	1.95	97.58	97.6	0	23.88	0.01	7	6	8			
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels	PAH 1-4	0	0					-100							
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	PAH 1-4	0	C	1.41	75.57	75.59	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	PAH 1-4	0	0	1.99	302.88	302.89	0	338.79	<0.005						
1 A 1 a Public Electricity and Heat Production: Peat	PAH 1-4	0.03	0.01	2.02	100	100.02	0	-56.34	<0.005						
1 A 1 a Public Electricity and Heat Production: Solid Fuels	PAH 1-4	0	C	1.13	100	100.01	0	C	<0.005						
1 A 1 b Petroleum refining: Liquid Fuels	PAH 1-4	0	C	9.65	85.8	86.34	0	C	<0.005						
1 A 2 a Iron and Steel: Biomass	PAH 1-4	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	PAH 1-4	0	C	4.07	75.51	75.62	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	PAH 1-4	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	PAH 1-4	0	C	3.47	83.69	83.76	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	PAH 1-4	0	0					-100							
1 A 2 c Chemicals: Biomass	PAH 1-4	0.01	0	3.04	70.89	70.95	0	-76.4	<0.005						
1 A 2 c Chemicals: Liquid Fuels	PAH 1-4	0	0	8.89	70.16	70.72	0	-50.73	<0.005						
1 A 2 c Chemicals: Other Fuels	PAH 1-4	0	0					-100							
1 A 2 c Chemicals: Solid Fuels	PAH 1-4	0	C	2.38	98.28	98.31	0	C	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 d Pulp, Paper and Print: Biomass	PAH 1-4	0.76	C	4.33	97.16	97.25	0	C	0.05	5		5			
1 A 2 d Pulp, Paper and Print: Liquid Fuels	PAH 1-4	0.01	0	3.5	87.08	87.15	0	-76.99	<0.005						
1 A 2 d Pulp, Paper and Print: Other Fuels	PAH 1-4	0	0					-100							
1 A 2 d Pulp, Paper and Print: Solid Fuels	PAH 1-4	0.01	C	4.42	85.65	85.76	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	PAH 1-4	0.01	0	4.09	77.48	77.59	0	-33.69	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	PAH 1-4	0	0	3.06	79.61	79.67	0	-77.27	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	PAH 1-4	0	0					-100							
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	PAH 1-4	0	C	5	100	100.12	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	PAH 1-4	0	C	9.52	95.25	95.72	0	C	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	PAH 1-4	0	0	8.51	63.58	64.15	0	-31.48	<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	PAH 1-4	0.01	0	9.28	92.8	93.27	0	-44.45	<0.005						
1 A 2 g viii Other: Biomass	PAH 1-4	0.48	0.05	9.9	99.05	99.55	0	-89.38	0.02	6		6			
1 A 2 g viii Other: Liquid Fuels	PAH 1-4	0.01	0	11.13	76.33	77.14	0	-68.83	<0.005						
1 A 2 g viii Other: Solid Fuels	PAH 1-4	0	C	9.36	89.75	90.24	0	C	<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	PAH 1-4	0.03	0.01	5	1000	1000.01	0	-53.33	<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	PAH 1-4	0.11	0.04	3	1000	1000	0	-58.4	0.03						

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b i Road Transportation: Automobile tyre and brake wear	PAH 1-4	0	0		1000	1000	0	24.54	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	PAH 1-4	0.01	0	5	1000	1000.01	0	-50.93	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	PAH 1-4	0.01	0	3	1000	1000	0	-83.33	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	PAH 1-4	0.06	0.01	4.35	870.19	870.2	0	-81.17	0.02						
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	PAH 1-4	0	0	3	1000	1000	0	-74.61	<0.005						
1 A 3 b iv Road Transportation, Motorcycles: Gasoline	PAH 1-4	0	0	3	1000	1000	0	37.7	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	PAH 1-4	0	0	4.06	40.57	40.77	0	-44.9	<0.005						
1 A 3 d Domestic Navigation: Residual Oil	PAH 1-4	0	0	15	50	52.2	0	-63.23	<0.005						
1 A 4 a Commercial/Institutional: Biomass	PAH 1-4	0.18	0.4	9.6	999.82	999.86	0.23	125.59	2.46	5	7				4
1 A 4 a Commercial/Institutional: Liquid Fuels	PAH 1-4	0.01	0	15.4	100	101.18	0	-94.17	<0.005						
1 A 4 b Residential: Biomass	PAH 1-4	9.39	8.18	10	1000	1000.05	96.33	-12.88	86.8	1	1	2	1	1	1
1 A 4 b Residential: Liquid Fuels	PAH 1-4	0.04	0	19.06	100	101.8	0	-95.62	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	PAH 1-4	0.05	1.04	7.98	996.25	996.28	1.54	1887.1	31.84	3	3		3		2
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	PAH 1-4	0	0	7.59	64.54	64.99	0	-28.37	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	PAH 1-4	0.09	0					-100							
1 A 5 b Mobile: Liquid Fuels	PAH 1-4	0	0	5	50	50.25	0	-36.23	<0.005						
1 B 1 b Coke production	PAH 1-4	1.06	C	5	1000	1000.01	1.88	C	5.32	4	2	4	3	2	3
1 B 2 a Oil	PAH 1-4	0	C	7.5	1000	1000.03	0	C	<0.005						
2 C 1 Iron and Steel Production	PAH 1-4	1.17	0.84	0.12	99.56	99.56	0.01	-28.44	<0.005	3	4				
2 C 3 Aluminium production	PAH 1-4	3.89	0					-100		2		1	2		
2 G 4 Other	PAH 1-4	0	0	15	100	101.12	0	-54.41	<0.005						
2 H Other	PAH 1-4	0.01	0.02	5	1000	1000.01	0	29.02	<0.005						
5 C 1 Waste Incineration	PAH 1-4	0	0	10	199.9	200.15	0	485.25	<0.005						
5 C 2 Open burning of waste	PAH 1-4	0	0.03	74.45	992.74	995.53	0		0.03						
Total		17.72	12.31			676.98	100	-30.51	112.51						

Table A1-13 Summary of the key source and uncertainty analysis of Pb emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	Pb	1.08	1.73	1.97	98.53	98.55	56.16	60.73	<0.005	3	2		1	1
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	Pb	0.18	C	1.48	82.58	82.59	0.01	C	<0.005					
1 A 1 a Public Electricity and Heat Production: Other Fuels	Pb	0.51	0.17	1.99	100.96	100.98	0.55	-67.09	<0.005	10	12		8	8
1 A 1 a Public Electricity and Heat Production: Peat	Pb	0.35	0.01	2.02	40.34	40.39	0	-95.91	<0.005					
1 A 1 a Public Electricity and Heat Production: Solid Fuels	Pb	0.63	C	1.13	78.72	78.73	0.02	C	<0.005					
1 A 1 b Petroleum refining: Liquid Fuels	Pb	0.05	C	9.65	90.81	91.32	0.01	C	<0.005					
1 A 2 a Iron and Steel: Biomass	Pb	0	0					-100						
1 A 2 a Iron and Steel: Liquid Fuels	Pb	0.07	C	4.07	96.13	96.22	0.01	C	<0.005					
1 A 2 a Iron and Steel: Solid Fuels	Pb	0	0					-100						
1 A 2 b Non-ferrous metals: Liquid Fuels	Pb	0.01	C	3.47	77.74	77.82	0	C	<0.005					
1 A 2 b Non-ferrous metals: Solid Fuels	Pb	0	0					-100						
1 A 2 c Chemicals: Biomass	Pb	0.01	0.01	3.04	37.83	37.95	0	45.27	<0.005					
1 A 2 c Chemicals: Liquid Fuels	Pb	0.03	0.01	8.89	91.1	91.53	0	-55.94	<0.005					
1 A 2 c Chemicals: Other Fuels	Pb	0	0					-100						
1 A 2 c Chemicals: Solid Fuels	Pb	0.03	C	2.38	30.52	30.61	0	C	<0.005					
1 A 2 d Pulp, Paper and Print: Biomass	Pb	0.5	C	4.33	49.88	50.06	1.52	C	<0.005	5	5		6	5
1 A 2 d Pulp, Paper and Print: Liquid Fuels	Pb	0.31	0.07	3.5	98.74	98.8	0.09	-77.14	<0.005	15			11	10
1 A 2 d Pulp, Paper and Print: Other Fuels	Pb	0.01	0					-100						
1 A 2 d Pulp, Paper and Print: Solid Fuels	Pb	0.07	C	4.42	33.54	33.83	0	C	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	Pb	0.01	0.01	4.09	38.74	38.96	0	171.47	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	Pb	0.08	0.01	3.06	79.56	79.61	0	-90.18	<0.005					
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	Pb	0	0					-100						
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	Pb	0.02	C	5	40	40.31	0	C	<0.005					
1 A 2 f Non-metallic minerals: Biomass	Pb	0	C	9.52	47.62	48.57	0	C	<0.005					

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 f Non-metallic minerals: Liquid Fuels	Pb	0.07	0.06	8.51	70.86	71.36	0.03	-12.23	<0.005		16				
1 A 2 f Non-metallic minerals: Solid Fuels	Pb	0.3	0.16	9.28	37.12	38.26	0.08	-44.45	<0.005		11	11		12	11
1 A 2 g viii Other: Biomass	Pb	0.31	0.22	9.9	49.53	50.51	0.24	-29.17	<0.005		9	9		9	9
1 A 2 g viii Other: Liquid Fuels	Pb	0.18	0.04	11.13	73.83	74.66	0.02	-77.89	<0.005						
1 A 2 g viii Other: Solid Fuels	Pb	0.02	C	9.36	37.4	38.55	0.03	C	<0.005		13	13			
1 A 3 a Domestic Aviation: Aviation Gasoline	Pb	0.95	0.23	10	100	100.5	1.05	-75.47	<0.005		8	10		7	6
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	Pb	0	0	10	100	100.5	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	Pb	246.16	2.05	3	15	15.3	1.88	-99.17	<0.005	1	2	1	1	5	2
1 A 3 b i Road Transportation: Automobile tyre and brake wear	Pb	6.09	0.45		75	75	2.19	-92.61	<0.005	5	6	7	4	3	7
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	Pb	14.2	0.04	3	15	15.3	0	-99.68	<0.005	4		6	5		12
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	Pb	0.33	0	3	15	15.3	0	-99.42	<0.005						
1 A 3 b iv Road Transportation, Motorcycles: Gasoline	Pb	0.79	0.03	3	15	15.3	0	-96.45	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	Pb	0.01	0.01	4.06	81.14	81.24	0	-44.9	<0.005						
1 A 3 d Domestic Navigation: Residual Oil	Pb	0.01	0	15	100	101.12	0	-63.23	<0.005						
1 A 4 a Commercial/Institutional: Biomass	Pb	0.01	0.02	9.6	49.35	50.28	0	128.54	<0.005						
1 A 4 a Commercial/Institutional: Liquid Fuels	Pb	0.19	0	15.4	100	101.18	0	-98.02	<0.005						
1 A 4 b Residential: Biomass	Pb	0.59	0.63	10	50	50.99	2	7.98	<0.005		4	4		4	4
1 A 4 b Residential: Liquid Fuels	Pb	0.25	0.01	19.06	100	101.8	0	-96.7	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	Pb	0	0.08	7.98	40.73	41.5	0.02	2418.95	<0.005		14	15			
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	Pb	0.03	0.03	11.12	66.14	67.06	0.01	-27.89	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	Pb	0.04	0					-100							
1 A 5 b Mobile: Liquid Fuels	Pb	1.9	0.01	7.88	79.99	80.38	0	-99.48	<0.005						
2 A 3 Glass Production	Pb	1.31	0.01		50	50	0	-99.28	<0.005						
2 C 1 Iron and Steel Production	Pb	22.47	0.4	1.47	19.3	19.35	0.12	-98.21	<0.005	3	7	8	3	10	
2 C 2 Ferroalloys production	Pb	0.03	0.01	5	50	50.25	0	-51.78	<0.005						
2 C 7 Other	Pb	52.05	2.65	4	50	50.16	33.86	-94.92	<0.005	2	1	3	2	2	3
2 G 4 Other	Pb	0	0	15	100	101.12	0	-54.41	<0.005						
2 H Other	Pb	0.86	0.12	4.95	49.54	49.78	0.07	-85.65	<0.005		12	14			13
5 C 1 Waste Incineration	Pb	0	0	4.49	684.38	684.39	0.01	29.8	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
5 C 2 Open burning of waste	Pb	0	0.02	75	200	213.6	0.03		<0.005						
5 E Other	Pb	0	0	50	110	120.83	0	-19.22	<0.005						
Total		353.09	10.16			22.46	100	-97.12	0.57						

Table A1-14 Summary of the key source and uncertainty analysis of PM_{2.5} emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	PM _{2.5}	0.61	0.8	1.95	39.02	39.07	0.77	30.91	<0.005	14	5	8	13	8	11
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels	PM _{2.5}	0	C	2	99.95	99.97	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	PM _{2.5}	0.05	C	1.64	45.3	45.33	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	PM _{2.5}	0.11	0.15	2.07	37.42	37.48	0.02	30.31	<0.005	36	24	23			28
1 A 1 a Public Electricity and Heat Production: Peat	PM _{2.5}	0.46	0.01	2.02	40	40.05	0	-97.92	<0.005	16		11	17		16
1 A 1 a Public Electricity and Heat Production: Solid Fuels	PM _{2.5}	0.92	C	1.13	61.97	61.98	0	C	0.01	9		9	9		5
1 A 1 b Petroleum refining: Gaseous Fuels	PM _{2.5}	0	C	2	100	100.02	0	C	<0.005						
1 A 1 b Petroleum refining: Liquid Fuels	PM _{2.5}	1.56	C	9.65	93.86	94.36	0.26	C	0.03	7	19	7	3	14	2
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels	PM _{2.5}	0.05	C	4.19	74.65	74.77	0.02	C	<0.005						
1 A 2 a Iron and Steel: Biomass	PM _{2.5}	0	0					-100							
1 A 2 a Iron and Steel: Gaseous Fuels	PM _{2.5}	0	C	5	100	100.12	0	C	<0.005						
1 A 2 a Iron and Steel: Liquid Fuels	PM _{2.5}	0.05	C	4.07	90.78	90.87	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	PM _{2.5}	0.01	C	3.57	71.31	71.4	0	C	<0.005						
1 A 2 b Non-ferrous metals: Gaseous Fuels	PM _{2.5}	0	C	5	100	100.12	0	C	<0.005						
1 A 2 b Non-ferrous metals: Liquid Fuels	PM _{2.5}	0.01	C	3.47	72.44	72.52	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	PM _{2.5}	0.01	0					-100							
1 A 2 c Chemicals: Biomass	PM _{2.5}	0.03	0.02	3.04	73.45	73.51	0	-6.37	<0.005						
1 A 2 c Chemicals: Gaseous Fuels	PM _{2.5}	0	0	5	100	100.12	0	-7.51	<0.005						
1 A 2 c Chemicals: Liquid Fuels	PM _{2.5}	0.06	0.02	8.89	61.31	61.95	0	-75.33	<0.005						
1 A 2 c Chemicals: Other Fuels	PM _{2.5}	0.01	C	10	100	100.5	0.01	C	<0.005						
1 A 2 c Chemicals: Solid Fuels	PM _{2.5}	0.03	C	2.38	73.51	73.55	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	PM _{2.5}	1.74	C	4.33	98.82	98.92	5.5	C	<0.005	6	4	25	2	2	18
1 A 2 d Pulp, Paper and Print: Gaseous Fuels	PM _{2.5}	0	0	5	100	100.12	0	-53.56	<0.005						
1 A 2 d Pulp, Paper and Print: Liquid Fuels	PM _{2.5}	0.18	0.03	3.5	97.89	97.95	0.01	-85.05	<0.005	28		30	21		21

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 d Pulp, Paper and Print: Other Fuels	PM _{2.5}	0.07	C	10	100	100.5	0	C	<0.005						
	PM _{2.5}	0.05	C	4.42	85.01	85.13	0	C	<0.005						
	PM _{2.5}	0.01	0.03	4.09	77.45	77.56	0	171.3	<0.005						
	PM _{2.5}	0	0	5	100	100.12	0	-21.02	<0.005						
	PM _{2.5}	0.05	0.01	3.06	75.35	75.41	0	-90.55	<0.005						
	PM _{2.5}	0.01	C	10	100	100.5	0	C	<0.005						
	PM _{2.5}	0.02	C	5	100	100.12	0	C	<0.005						
	PM _{2.5}	0	C	9.52	70.96	71.59	0	C	<0.005						
	PM _{2.5}	0	0	10	100	100.5	0	67.8	<0.005						
	PM _{2.5}	0.04	0.01	8.51	92.6	92.99	0	-76.11	<0.005						
	PM _{2.5}	0.1	0.03	9.28	77.74	78.29	0	-74.17	<0.005						
	PM _{2.5}	0.8	0.74	4.96	29.77	30.18	0.4	-8.07	<0.005	11	6	10	14	11	15
	PM _{2.5}	1.09	0.47	9.9	99.05	99.55	1.78	-56.41	<0.005	8	10	20	6	4	14
	PM _{2.5}	0	C	9.99	99.94	100.43	0	C	<0.005						
	PM _{2.5}	0.18	0.03	11.13	70.29	71.16	0	-83.56	<0.005	29		31	25		24
	PM _{2.5}	0	C	10	100	100.5	0	C	<0.005						
	PM _{2.5}	0.03	C	9.36	92.49	92.96	0.01	C	<0.005						
	PM _{2.5}	0	0	10	20	22.36	0	-81.93	<0.005						
	PM _{2.5}	0.02	0.01	10	20	22.36	0	-54.16	<0.005						
	PM _{2.5}	0	0	5	15	15.81	0		<0.005						
	PM _{2.5}	0.37	0.17	5	15	15.81	0.01	-52.87	<0.005	17	21				
	PM _{2.5}	0	0	10	15	18.03	0		<0.005						
	PM _{2.5}	0.28	0.07	3	15	15.3	0	-75.6	<0.005	19	34	26			
	PM _{2.5}	2.37	2.95		15	15	1.56	24.52	<0.005	5	2	2	10	5	7

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)	
	1 A 3 b i Automobile tyre and brake wear	PM _{2.5}	0.13	0.16		15	15	0	24.52	<0.005	33	23	21			
	1 A 3 b ii Light duty trucks: Diesel oil	PM _{2.5}	0.24	0.19	5	15	15.81	0.01	-22.81	<0.005	25	20	34			
	1 A 3 b ii Light duty trucks: Gasoline	PM _{2.5}	0.03	0	3	15	15.3	0	-86.83	<0.005						
	1 A 3 b iii Heavy duty trucks: Biomass	PM _{2.5}	0	0	5	15	15.81	0	496.27	<0.005						
	1 A 3 b iii Heavy duty trucks: Diesel oil	PM _{2.5}	2.39	0.3	4.33	12.98	13.68	0.01	-87.36	<0.005	4	12	5	12	12	
	1 A 3 b iii Heavy duty trucks: Gaseous Fuels	PM _{2.5}	0	0	10	15	18.03	0	4944.18	<0.005						
	1 A 3 b iv Motorcycles: Gasoline	PM _{2.5}	0.04	0.01	3	15	15.3	0	-68.55	<0.005						
	1 A 3 c Railways: Liquid Fuels	PM _{2.5}	0.04	0.02	5	10	11.18	0	-53.07	<0.005						
	1 A 3 d Domestic Navigation: Gas/Diesel Oil	PM _{2.5}	0.2	0.21	3.14	26.26	26.45	0.03	6.53	<0.005	27	17	19		22	
	1 A 3 d Domestic Navigation: Residual Oil	PM _{2.5}	0.26	0.1	15	40	42.72	0.01	-63.23	<0.005	23	28	37	26		
	1 A 3 e Other Transportation: Diesel Oil	PM _{2.5}	0.25	0.07	5	30	30.41	0	-71.22	<0.005	24	32	33			
	1 A 4 a Commercial/Institutional: Biomass	PM _{2.5}	0.11	0.24	9.6	9.96	13.84	0.01	126.2	<0.005		13	15			
	1 A 4 a Commercial/Institutional: Diesel Oil	PM _{2.5}	0.11	0.08	5	30	30.41	0.01	-25.14	<0.005	35	29				
	1 A 4 a Commercial/Institutional: Gaseous Fuels	PM _{2.5}	0	0	9.7	9.7	13.72	0	169.75	<0.005						
	1 A 4 a Commercial/Institutional: Gasoline	PM _{2.5}	0.03	0.04	5	30	30.41	0	72.44	<0.005						
	1 A 4 a Commercial/Institutional: Liquid Fuels	PM _{2.5}	0.27	0	15.4	9.8	18.25	0	-98.22	<0.005	21		18			
	1 A 4 a Commercial/Institutional: Other Fuels	PM _{2.5}	0	0	10	100	100.5	0		<0.005						
	1 A 4 b Residential: Biomass	PM _{2.5}	5.4	4.88	10	65	65.76	81.96	-9.61	0.17	2	1	1	1	1	
	1 A 4 b Residential: Gaseous Fuels	PM _{2.5}	0	0	9.15	59.47	60.17	0	-16.79	<0.005						
	1 A 4 b Residential: Liquid Fuels	PM _{2.5}	0.7	0.21	2.87	27.22	27.37	0.03	-70.37	<0.005	12	18	17	11	25	
	1 A 4 c Agriculture/Forestry/Fisheries: Bio-mass	PM _{2.5}	0.03	0.66	7.98	28.06	29.17	0.29	1995.8	<0.005		7	6		13	10
	1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels	PM _{2.5}	0	0	10	30	31.62	0	-41.16	<0.005						
	1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	PM _{2.5}	0.9	0.38	2.41	14.76	14.96	0.03	-57.11	<0.005	10	11	22	22	21	
	1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	PM _{2.5}	0.06	0					-100							
	1 A 5 b Mobile: Liquid Fuels	PM _{2.5}	0.09	0.02	5.6	19.19	19.99	0	-81.22	<0.005						
	1 B 1 c Flaring of gas: Solid Fuels	PM _{2.5}	0.1	0.05	5.98	19.93	20.81	0	-52.31	<0.005						
	1 B 2 a Oil	PM _{2.5}	0.06	0.04	0.04	19.7	19.7	0	-31.68	<0.005						
	1 B 2 c Venting and flaring	PM _{2.5}	0.06	0	17.5	100	101.52	0	-97.96	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 D International Aviation: Jet kerosene	PM _{2.5}	0.01	0.02	10	20	22.36	0	62.49	<0.005						
2 A 1 Cement Production	PM _{2.5}	0.57	0.08	2	30	30.07	0	-85.74	<0.005	15	30	13	20		22
2 A 2 Lime Production	PM _{2.5}	0.27	0.07	5.2	49.96	50.23	0.01	-73.95	<0.005	22	33	29	24		27
2 A 3 Glass Production	PM _{2.5}	0.22	0.03		100	100	0.01	-84.51	<0.005	26		24	16		17
2 B 10 Other	PM _{2.5}	0.02	0		111	111	0	-84.56	<0.005						
2 B 5 Carbide production	PM _{2.5}	0.1	0.12	10	50	50.99	0.03	28.92	<0.005		26	28		20	26
2 C 1 Iron and Steel Production	PM _{2.5}	3.41	0.56	3.65	29.76	29.98	0.22	-83.64	0.01	3	8	4	5	15	3
2 C 2 Ferroalloys production	PM _{2.5}	0.06	0.05	5	40	40.31	0	-22.37	<0.005						
2 C 3 Aluminium production	PM _{2.5}	0.15	0.06	2	40	40.05	0	-57.67	<0.005	32					
2 C 7 Other	PM _{2.5}	0.17	0.03	4	40	40.2	0	-84.86	<0.005	30		32			
2 D 3 Other	PM _{2.5}	0	0	0.73	185.46	185.46	0	11.97	<0.005						
2 G 4 Other	PM _{2.5}	0.28	0.17	10.84	55.31	56.36	0.08	-38.52	<0.005	20	22		19	19	
2 H Other	PM _{2.5}	6.69	1.91	4.64	19.1	19.65	1.12	-71.48	0.01	1	3	3	4	6	4
3 B 1 Dairy cattle	PM _{2.5}	0.16	0.13	20	150	151.33	0.3	-17.86	<0.005	31	25	36	15	12	20
3 B 1 Non-dairy cattle	PM _{2.5}	0.1	0.1	20	150	151.33	0.19	5.68	<0.005		27	35	23	16	19
3 B 3 Swine	PM _{2.5}	0.12	0.07	20	150	151.33	0.1	-39.52	<0.005	34	31		18	17	
3 B 4 Goats	PM _{2.5}	0	0	20	200	201	0	27.59	<0.005						
3 B 4 Horses	PM _{2.5}	0.04	0.05	20	200	201	0.08	14.92	<0.005					18	23
3 B 4 Poultry	PM _{2.5}	0.09	0.24	13.97	118.4	119.22	0.65	177.04	<0.005		14	14		9	8
3 B 4 Sheep	PM _{2.5}	0	0	20	200	201	0	78.19	<0.005						
3 D c Farm-level agricultural operations	PM _{2.5}	0.3	0.24	35	150	154.03	1.06	-20.27	<0.005	18	15	27	8	7	13
5 A Solid waste disposal	PM _{2.5}	0	0	10	385	385.13	0	-76.25	<0.005						
5 C 1 Waste Incineration	PM _{2.5}	0	0	4.61	626.91	626.93	0	51.89	<0.005						
5 C 2 Open burning of waste	PM _{2.5}	0	0.22	75	100	125	0.63		0.01		16	12		10	6
5 E Other	PM _{2.5}	0.65	0.52	50	100	111.8	2.74	-18.96	0.01	13	9	16	7	3	9
Total		36.26	19.23			18.42	100	-46.97	5.15						

Table A1-15 Summary of the key source and uncertainty analysis of PM₁₀ emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	PM ₁₀	0.8	1.14	1.95	39.01	39.05	0.59	41.56	<0.005	13	6	10	15	10	12
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels	PM ₁₀	0	C	2	99.95	99.97	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	PM ₁₀	0.11	C	1.63	47.66	47.69	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	PM ₁₀	0.11	0.15	2.07	37.8	37.86	0.01	29.37	<0.005		29				
1 A 1 a Public Electricity and Heat Production: Peat	PM ₁₀	0.6	0.15	2.02	40	40.05	0.01	-74.99	<0.005	20	28	17	19		18
1 A 1 a Public Electricity and Heat Production: Solid Fuels	PM ₁₀	1.04	C	1.13	63.24	63.25	0	C	0.01	10		8	12		8
1 A 1 b Petroleum refining: Gaseous Fuels	PM ₁₀	0	C	2	100	100.02	0	C	<0.005						
1 A 1 b Petroleum refining: Liquid Fuels	PM ₁₀	1.58	C	9.65	95	95.49	0.1	C	0.02	8	24	7	6	17	4
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels	PM ₁₀	0.17	C	4.19	74.65	74.77	0.03	C	<0.005						
1 A 2 a Iron and Steel: Biomass	PM ₁₀	0	0					-100							
1 A 2 a Iron and Steel: Gaseous Fuels	PM ₁₀	0	C	5	100	100.12	0	C	<0.005						
1 A 2 a Iron and Steel: Liquid Fuels	PM ₁₀	0.07	C	4.07	89.09	89.19	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	PM ₁₀	0.01	C	3.57	71.31	71.4	0	C	<0.005						
1 A 2 b Non-ferrous metals: Gaseous Fuels	PM ₁₀	0	C	5	100	100.12	0	C	<0.005						
1 A 2 b Non-ferrous metals: Liquid Fuels	PM ₁₀	0.01	C	3.47	70.35	70.43	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	PM ₁₀	0.01	0					-100							
1 A 2 c Chemicals: Biomass	PM ₁₀	0.03	0.03	3.04	73.11	73.17	0	-3.45	<0.005						
1 A 2 c Chemicals: Gaseous Fuels	PM ₁₀	0	0	5	100	100.12	0	-7.51	<0.005						
1 A 2 c Chemicals: Liquid Fuels	PM ₁₀	0.07	0.02	8.89	60.45	61.1	0	-74.36	<0.005						
1 A 2 c Chemicals: Other Fuels	PM ₁₀	0.01	C	10	100	100.5	0	C	<0.005						
1 A 2 c Chemicals: Solid Fuels	PM ₁₀	0.05	C	2.38	72.83	72.87	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	PM ₁₀	2.06	C	4.33	98.61	98.71	3.08	C	<0.005	7	7	14	3	5	9

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 d Pulp, Paper and Print: Gaseous Fuels	PM ₁₀	0	0	5	100	100.12	0	-53.56	<0.005						
1 A 2 d Pulp, Paper and Print: Liquid Fuels	PM ₁₀	0.22	0.03	3.5	97.47	97.53	0	-84.98	<0.005	34		27	22		17
1 A 2 d Pulp, Paper and Print: Other Fuels	PM ₁₀	0.07	C	10	100	100.5	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Solid Fuels	PM ₁₀	0.1	C	4.42	78.08	78.21	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	PM ₁₀	0.01	0.04	4.09	77.45	77.55	0	180.97	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Gaseous Fuels	PM ₁₀	0	0	5	100	100.12	0	-21.02	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	PM ₁₀	0.06	0.01	3.06	73.04	73.1	0	-90.76	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	PM ₁₀	0.01	C	10	100	100.5	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	PM ₁₀	0.03	C	5	100	100.12	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	PM ₁₀	0	C	9.52	70.96	71.59	0	C	<0.005						
1 A 2 f Non-metallic minerals: Gaseous Fuels	PM ₁₀	0	0	10	100	100.5	0	67.8	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	PM ₁₀	0.05	0.01	8.51	91.28	91.67	0	-74.64	<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	PM ₁₀	0.17	0.05	9.28	71.54	72.14	0	-73.07	<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	PM ₁₀	0.85	0.78	4.96	29.77	30.18	0.17	-8.07	<0.005	12	9	20	18	13	26
1 A 2 g viii Other: Biomass	PM ₁₀	1.29	0.58	9.9	99.05	99.55	1	-54.84	<0.005	9	12	15	8	9	10
1 A 2 g viii Other: Gaseous Fuels	PM ₁₀	0	C	9.99	99.94	100.43	0	C	<0.005						
1 A 2 g viii Other: Liquid Fuels	PM ₁₀	0.19	0.03	11.13	68.46	69.36	0	-83.22	<0.005			29			23
1 A 2 g viii Other: Other Fuels	PM ₁₀	0	C	10	100	100.5	0	C	<0.005						
1 A 2 g viii Other: Solid Fuels	PM ₁₀	0.04	C	9.36	86.84	87.34	0.02	C	<0.005						27
1 A 3 a Domestic Aviation: Aviation Gasoline	PM ₁₀	0	0	10	20	22.36	0	-81.93	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base-year	Level in 2015	Trend	Level in base-year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 a Domestic Aviation: Jet Kerosene	PM ₁₀	0.02	0.01	10	20	22.36	0	-54.16	<0.005						
1 A 3 b i Road Transportation, Cars: Biomass	PM ₁₀	0	0	5	15	15.81	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	PM ₁₀	0.37	0.17	5	15	15.81	0	-52.87	<0.005	21	26				
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	PM ₁₀	0	0	10	15	18.03	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	PM ₁₀	0.28	0.07	3	15	15.3	0	-75.6	<0.005	27		25			
1 A 3 b i Road Transportation: Automobile road abrasion	PM ₁₀	11.85	14.76		15	15	14.6	24.52	0.03	1	1	1	5	3	3
1 A 3 b i Road Transportation: Automobile tyre and brake wear	PM ₁₀	0.64	0.8		15	15	0.04	24.52	<0.005	18	8	13			
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	PM ₁₀	0.24	0.19	5	15	15.81	0	-22.81	<0.005	31	25				
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	PM ₁₀	0.03	0	3	15	15.3	0	-86.83	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	PM ₁₀	0	0	5	15	15.81	0	496.27	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	PM ₁₀	2.39	0.3	4.33	12.98	13.68	0.01	-87.36	<0.005	6	16	4	16		14
1 A 3 b iii Road Transportation, Heavy duty trucks: Gaseous Fuels	PM ₁₀	0	0	10	15	18.03	0	4944.18	<0.005						
1 A 3 b iv Road Transportation, Motorcycles: Gasoline	PM ₁₀	0.04	0.01	3	15	15.3	0	-68.55	<0.005						
1 A 3 c Railways: Liquid Fuels	PM ₁₀	0.05	0.02	5	10	11.18	0	-53.07	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	PM ₁₀	0.2	0.21	3.14	26.26	26.45	0.01	6.53	<0.005		22	34			
1 A 3 d Domestic Navigation: Residual Oil	PM ₁₀	0.26	0.1	15	40	42.72	0.01	-63.23	<0.005	30		33			
1 A 3 e Other Transportation: Diesel Oil	PM ₁₀	0.26	0.08	5	30	30.41	0	-71.22	<0.005	28		28			
1 A 4 a Commercial/Institutional: Biomass	PM ₁₀	0.11	0.24	9.6	9.97	13.84	0	126.35	<0.005		17	22			

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

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1 A 4 a Commercial/Institutional: Diesel Oil	PM ₁₀	0.12	0.09	5	30	30.41	0	-25.14	<0.005						
1 A 4 a Commercial/Institutional: Gaseous Fuels	PM ₁₀	0	0	9.7	9.7	13.72	0	169.75	<0.005						
1 A 4 a Commercial/Institutional: Gasoline	PM ₁₀	0.03	0.05	5	30	30.41	0	72.44	<0.005						
1 A 4 a Commercial/Institutional: Liquid Fuels	PM ₁₀	0.3	0	15.4	9.8	18.25	0	-98.36	<0.005	26		21			
1 A 4 a Commercial/Institutional: Other Fuels	PM ₁₀	0	0	10	100	100.5	0		<0.005						
1 A 4 b Residential: Biomass	PM ₁₀	5.4	4.88	10	65	65.76	30.65	-9.61	0.03	3	2	5	2	2	5
1 A 4 b Residential: Gaseous Fuels	PM ₁₀	0	0	9.15	59.47	60.17	0	-16.79	<0.005						
1 A 4 b Residential: Liquid Fuels	PM ₁₀	0.72	0.22	2.86	27.27	27.42	0.01	-69.57	<0.005	14	21	16	13		22
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	PM ₁₀	0.03	0.67	7.98	28.39	29.49	0.12	2022.35	<0.005		11	9		15	13
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels	PM ₁₀	0	0	10	30	31.62	0	-41.16	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	PM ₁₀	0.94	0.4	2.43	14.73	14.93	0.01	-57.11	<0.005	11	14	18	24		
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	PM ₁₀	0.12	0					-100				32			
1 A 5 b Mobile: Liquid Fuels	PM ₁₀	0.09	0.02	5.6	19.19	19.99	0	-81.22	<0.005						
1 B 1 c Flaring of gas: Solid Fuels	PM ₁₀	0.33	0.22	5.99	19.97	20.85	0.01	-32.41	<0.005	23	20				
1 B 2 a Oil	PM ₁₀	0.07	C	0.03	19.8	19.8	0	C	<0.005						
1 B 2 c Venting and flaring	PM ₁₀	0.06	0	17.5	100	101.52	0	-97.96	<0.005						
1 D International Aviation: Jet kerosene	PM ₁₀	0.01	0.02	10	20	22.36	0	62.49	<0.005						
2 A 1 Cement Production	PM ₁₀	0.71	0.09	2	30	30.07	0	-86.97	<0.005	15		12	21		16
2 A 2 Lime Production	PM ₁₀	0.3	0.08	5.2	49.96	50.23	0	-73.95	<0.005	25		24			25
2 A 3 Glass Production	PM ₁₀	0.26	0.04		100	100	0.01	-83.52	<0.005	29		23	17		15
2 B 10 Other	PM ₁₀	0.03	0.01		170	170	0	-80.12	<0.005						
2 B 5 Carbide production	PM ₁₀	0.11	0.14	10	50	50.99	0.02	28.92	<0.005						
2 C 1 Iron and Steel Production	PM ₁₀	4	0.67	3.44	28.03	28.24	0.11	-83.27	0.01	4	10	3	7	16	7
2 C 2 Ferroalloys production	PM ₁₀	0.08	0.07	5	40	40.31	0	-18.73	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

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2 C 3 Aluminium production	PM ₁₀	0.32	0.14	2	40	40.05	0.01	-57.67	<0.005	24		31			
2 C 7 Other	PM ₁₀	0.22	0.03	4	40	40.2	0	-86.55	<0.005	33		26			
2 D 3 Other	PM ₁₀	0.02	0.02	0.13	211.17	211.17	0.01	11.86	<0.005						
2 G 4 Other	PM ₁₀	0.33	0.23	10.67	47.14	48.33	0.04	-28.26	<0.005	22	18		23		
2 H Other	PM ₁₀	10.24	3.16	3.55	27.85	28.07	2.34	-69.16	0.04	2	3	2	4	6	2
3 B 1 Dairy cattle	PM ₁₀	0.24	0.2	20	150	151.33	0.26	-17.83	<0.005	32	23		14	11	
3 B 1 Non-dairy cattle	PM ₁₀	0.15	0.15	20	150	151.33	0.16	5.7	<0.005		27		20	14	20
3 B 3 Swine	PM ₁₀	0.66	0.39	20	150	151.33	1.06	-40.08	<0.005	16	15		9	7	21
3 B 4 Goats	PM ₁₀	0	0	20	200	201	0	27.59	<0.005						
3 B 4 Horses	PM ₁₀	0.07	0.08	20	200	201	0.08	14.92	<0.005					18	24
3 B 4 Poultry	PM ₁₀	0.64	1.53	13.77	122.48	123.25	10.66	139.24	0.06	19	5	6	11	4	1
3 B 4 Sheep	PM ₁₀	0.01	0.02	20	200	201	0	78.19	<0.005						
3 D c Farm-level agricultural operations	PM ₁₀	2.56	2.18	35	150	154.03	33.49	-14.98	0.05	5	4	11	1	1	6
5 A Solid waste disposal	PM ₁₀	0	0	10	379	379.13	0	-76.25	<0.005						
5 C 1 Waste Incineration	PM ₁₀	0	0	4.68	606.46	606.48	0	50.76	<0.005						
5 C 2 Open burning of waste	PM ₁₀	0	0.22	75	100	125	0.23		<0.005		19	19		12	11
5 E Other	PM ₁₀	0.65	0.52	50	100	111.8	1.03	-18.96	<0.005	17	13	30	10	8	19
Total		56.35	38.22			15.16	100	-32.17	5.23						

Table A1-16 Summary of the key source and uncertainty analysis of Se emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	Se	0.03	0.13	1.98	99.36	99.38	0.09	262.11	0.72	9	3	3			4
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	Se	0.02	C	1.49	86	86.01	0	C	0.03	12		11			
1 A 1 a Public Electricity and Heat Production: Other Fuels	Se	0.01	0.02	1.99	434.13	434.13	0.05	338.79	0.51		7	13			5
1 A 1 a Public Electricity and Heat Production: Peat	Se	0.05	0	2.02	100	100.02	0	-93.21	0.33	7		5	5		6
1 A 1 a Public Electricity and Heat Production: Solid Fuels	Se	0.08	C	1.13	100	100.01	0	C	0.85	5		2	4		3
1 A 1 b Petroleum refining: Liquid Fuels	Se	0	C	9.65	90.96	91.47	0	C	<0.005						
1 A 2 a Iron and Steel: Biomass	Se	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	Se	0.01	C	4.07	97.33	97.42	0	C	<0.005	18		19			
1 A 2 a Iron and Steel: Solid Fuels	Se	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	Se	0	C	3.47	82.38	82.45	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	Se	0	0					-100							
1 A 2 c Chemicals: Biomass	Se	0	0	3.04	30.46	30.61	0	48.23	<0.005						
1 A 2 c Chemicals: Liquid Fuels	Se	0	0	8.89	93.25	93.68	0	-56.19	<0.005						
1 A 2 c Chemicals: Solid Fuels	Se	0	C	2.38	73.41	73.44	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	Se	0.08	C	4.33	39.9	40.13	0.01	C	<0.005	4	4	21			
1 A 2 d Pulp, Paper and Print: Liquid Fuels	Se	0.03	0.01	3.5	99.14	99.2	0	-77.23	0.1	10	12	6			
1 A 2 d Pulp, Paper and Print: Solid Fuels	Se	0.01	C	4.42	37.71	37.97	0	C	<0.005	16		17			
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	Se	0	0	4.09	30.99	31.26	0	343.87	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	Se	0.01	0	3.06	84.22	84.28	0	-90.78	0.01	17		18			

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	Se	0	C	5	40	40.31	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	Se	0	C	9.52	38.1	39.27	0	C	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	Se	0.01	0.01	8.51	73.16	73.65	0	2.31	<0.005	19	13				
1 A 2 f Non-metallic minerals: Solid Fuels	Se	0.04	0.02	9.28	37.12	38.26	0	-44.45	0.01	8	8	8			
1 A 2 g vii Off-road vehicles and other machinery: Biomass	Se	0	0	4.98	99.7	99.82	0		<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	Se	0	0	4.92	98.33	98.45	0	31.55	<0.005						
1 A 2 g viii Other: Biomass	Se	0.05	0.04	9.9	39.62	40.84	0	-29.17	0.01	6	6	7			
1 A 2 g viii Other: Liquid Fuels	Se	0.02	0	11.13	79.01	79.79	0	-78.79	0.02	14		12			
1 A 2 g viii Other: Solid Fuels	Se	0	C	9.36	37.39	38.55	0	C	<0.005		10	16			
1 A 3 b i Road Transportation, Cars: Biomass	Se	0	0	3.54	70.87	70.96	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	Se	0	0	5	100	100.12	0	823.29	<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	Se	0	0	3	100	100.04	0	-43.38	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Biomass	Se	0	0	4.77	95.49	95.61	0		<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	Se	0	0	5	100	100.12	0	762.24	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	Se	0	0	3	100	100.04	0	-80.03	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	Se	0	0	3.9	77.98	78.07	0	11272.27	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	Se	0	0	4.33	86.58	86.68	0	10.23	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	Se	0	0	3	100	100.04	0	-63.57	<0.005						
1 A 3 c Railways: Liquid Fuels	Se	0	0	5	95	95.13	0	-53.07	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 d Domestic Navigation: Gas/Diesel Oil	Se	0	0	4.06	78.17	78.28	0	-44.9	<0.005						
1 A 3 d Domestic Navigation: Residual Oil	Se	0	0	15	100	101.12	0	-63.23	<0.005						
1 A 3 e Other Transp.: Biomass	Se	0	0	5	100	100.12	0		<0.005						
1 A 3 e Other Transp.: Diesel Oil	Se	0	0	5	100	100.12	0	7.57	<0.005						
1 A 4 a Commercial/Institutional: Biomass	Se	0	0	9.6	39.4	40.55	0	129	<0.005						
1 A 4 a Commercial/Institutional: Diesel Oil	Se	0	0	5	100	100.12	0	-12.02	<0.005						
1 A 4 a Commercial/Institutional: Ethanol	Se	0	0	5	100	100.12	0		<0.005						
1 A 4 a Commercial/Institutional: FAME	Se	0	0	5	100	100.12	0		<0.005						
1 A 4 a Commercial/Institutional: Gasoline	Se	0	0	5	100	100.12	0	10.72	<0.005						
1 A 4 a Commercial/Institutional: Liquid Fuels	Se	0.02	0	15.4	100	101.18	0	-98.53	0.05	13		10			
1 A 4 b Residential: Biomass	Se	0.09	0.09	9.99	39.96	41.19	0.01	8.09	0.02	3	5	15	6		
1 A 4 b Residential: Liquid Fuels	Se	0.02	0	6.3	71	71.28	0	-91.01	0.02	11		9			
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	Se	0	0.01	7.4	30.03	30.93	0	2704.35	<0.005		11	14			
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	Se	0.01	0	5.67	51.51	51.82	0	-9.32	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	Se	0.01	0					-100				20			
1 A 5 b Mobile: Liquid Fuels	Se	0	0	5	100	100.12	0	-36.23	<0.005						
1 B 1 b Coke production	Se	0.02	0.02	5	900	900.01	0.15	8.16	0.04	15	9		3		
2 A 3 Glass Production	Se	0.14	0.23		493	493	7.33	69.43	10.47	2	2	4	2	2	2
2 C 1 Iron and Steel Production	Se	0.23	0.46	4.88	878.51	878.52	92.35	98.31	247.27	1	1	1	1	1	1
5 C 1 Waste Incineration	Se	0	0	6.06	587.36	587.39	0	136.61	0.01						
5 C 2 Open burning of waste	Se	0	0	75	200	213.6	0		<0.005						
Total		0.98	1.2			348.61	100	21.6	161.39						

Table A1-17 Summary of the key source and uncertainty analysis of SO₂ emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	SO ₂	1.54	1.5	1.93	18.86	18.95	2.57	-2.6	<0.005	20	3	4		9	13
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels	SO ₂	0.02	0					-100							
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	SO ₂	3.45	C	1.54	17.48	17.55	0.06	C	<0.005	12	19	16	20		
1 A 1 a Public Electricity and Heat Production: Other Fuels	SO ₂	0.92	0.7	2.06	51.27	51.31	4.07	-24.83	<0.005	27	7	13		7	10
1 A 1 a Public Electricity and Heat Production: Peat	SO ₂	2.41	0.33	2.02	20	20.1	0.14	-86.11	<0.005	16	12	32	24	23	
1 A 1 a Public Electricity and Heat Production: Solid Fuels	SO ₂	8.39	C	1.12	25.37	25.39	0.13	C	<0.005	2	17	3	9	25	8
1 A 1 b Petroleum refining: Liquid Fuels	SO ₂	1.94	C	9.65	45.91	46.91	0.26	C	<0.005	18	21	27	11	19	25
1 A 1 c Manufacture of Solid fuels and Other Energy Ind.: Solid Fuels	SO ₂	0.4	C	4.19	64.19	64.33	0.17	C	<0.005		27			22	
1 A 2 a Iron and Steel: Biomass	SO ₂	0	0					-100							
1 A 2 a Iron and Steel: Gaseous Fuels	SO ₂	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	SO ₂	1.31	C	4.07	63.69	63.82	0.32	C	<0.005	23	24		16	17	
1 A 2 a Iron and Steel: Solid Fuels	SO ₂	0.3	C	3.57	59.67	59.78	0.88	C	<0.005		14	22		13	18
1 A 2 b Non-ferrous metals: Gaseous Fuels	SO ₂	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	SO ₂	0.14	C	3.47	50.67	50.79	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	SO ₂	0.03	0					-100							
1 A 2 c Chemicals: Biomass	SO ₂	0.02	0.05	3.04	45.47	45.57	0.02	131.02	<0.005						
1 A 2 c Chemicals: Gaseous Fuels	SO ₂	0.01	0					-100							
1 A 2 c Chemicals: Liquid Fuels	SO ₂	0.67	0.11	8.89	48.61	49.41	0.1	-83.27	<0.005	30	28				
1 A 2 c Chemicals: Other Fuels	SO ₂	0.02	C	10	70	70.71	0.32	C	<0.005		25	28		18	22
1 A 2 c Chemicals: Solid Fuels	SO ₂	0.43	C	2.38	52.01	52.06	0.04	C	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 d Pulp, Paper and Print: Biomass	SO ₂	2.06	C	4.33	49.62	49.81	6.23	C	<0.005	17	5	14	12	4	11
1 A 2 d Pulp, Paper and Print: Gaseous Fuels	SO ₂	0	0					-100							
1 A 2 d Pulp, Paper and Print: Liquid Fuels	SO ₂	4.98	0.24	3.5	68.61	68.7	0.89	-95.12	<0.005	6	18	10	2	12	4
1 A 2 d Pulp, Paper and Print: Other Fuels	SO ₂	0.27	C	10	70	70.71	0.1	C	<0.005						
1 A 2 d Pulp, Paper and Print: Solid Fuels	SO ₂	1.01	C	4.42	60.57	60.73	0	C	<0.005	25		26	21		21
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	SO ₂	0.01	0.03	4.09	49.94	50.11	0.01	130.79	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Gaseous Fuels	SO ₂	0.01	0					-100							
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	SO ₂	1.33	0.06	3.06	51.83	51.92	0.03	-95.73	<0.005	22		24	15		23
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	SO ₂	0.03	C	10	70	70.71	0.01	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	SO ₂	0.35	C	5	70	70.18	0.02	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	SO ₂	0	C	9.52	53.41	54.26	0	C	<0.005						
1 A 2 f Non-metallic minerals: Gaseous Fuels	SO ₂	0	0					-100							
1 A 2 f Non-metallic minerals: Liquid Fuels	SO ₂	0.82	0.18	8.51	66.23	66.78	0.45	-78.28	<0.005	28	22		23	16	
1 A 2 f Non-metallic minerals: Solid Fuels	SO ₂	1.53	0.27	9.28	52.46	53.28	0.68	-82.17	<0.005	21	16		17	14	
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	SO ₂	1.08	0	4.8	19.22	19.81	0	-99.71	<0.005	24		23			
1 A 2 g viii Other: Biomass	SO ₂	0.96	0.34	9.9	68.69	69.4	1.8	-64.25	<0.005	26	11	25	19	10	19
1 A 2 g viii Other: Gaseous Fuels	SO ₂	0	0					-100							
1 A 2 g viii Other: Liquid Fuels	SO ₂	3.08	0.28	11.13	50.22	51.44	0.64	-91.08	<0.005	14	15	20	8	15	16
1 A 2 g viii Other: Other Fuels	SO ₂	0	C	10	70	70.71	0.02	C	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 g viii Other: Solid Fuels	SO ₂	0.33	C	9.36	59.04	59.78	4.18	C	<0.005	8	12		5	7
1 A 3 a Domestic Aviation: Aviation Gasoline	SO ₂	0	0	10	50	50.99	0	-75.47	<0.005					
1 A 3 a Domestic Aviation: Jet Kerosene	SO ₂	0.05	0.03	10	50	50.99	0.01	-37.77	<0.005					
1 A 3 b i Road Transp., Cars: Diesel oil	SO ₂	0.52	0.01	5	20	20.62	0	-98.02	<0.005					
1 A 3 b i Road Transp., Cars: Gasoline	SO ₂	0.8	0.04	3	20	20.22	0	-94.86	<0.005	29	31			
1 A 3 b ii Road Transp., Light duty trucks: Diesel oil	SO ₂	0.19	0	5	20	20.62	0	-98.15	<0.005					
1 A 3 b ii Road Transp., Light duty trucks: Gasoline	SO ₂	0.05	0	3	20	20.22	0	-98.19	<0.005					
1 A 3 b iii Road Transp., Heavy duty trucks: Diesel oil	SO ₂	4.47	0.01	4.33	17.32	17.85	0	-99.76	<0.005	8	7	18		17
1 A 3 b iii Road Transp., Heavy duty trucks: Gasoline	SO ₂	0	0	3	20	20.22	0	-96.7	<0.005					
1 A 3 b iv Road Transp., Motorcycles: Gasoline	SO ₂	0	0	3	20	20.22	0	-79.68	<0.005					
1 A 3 c Railways: Liquid Fuels	SO ₂	0.12	0	5	20	20.62	0	-99.93	<0.005					
1 A 3 d Domestic Navigation: Gas/Diesel Oil	SO ₂	1.76	0.08	4	32	32.25	0.02	-95.46	<0.005	19	21	22		24
1 A 3 d Domestic Navigation: Residual Oil	SO ₂	3.3	0.04	15	40	42.72	0.01	-98.72	<0.005	13	11	10		12
1 A 3 e Other Transportation: Diesel Oil	SO ₂	0.31	0	5	20	20.62	0	-99.77	<0.005					
1 A 4 a Commercial/Inst.: Biomass	SO ₂	0.01	0.02	9.6	70.81	71.45	0	139.36	<0.005					
1 A 4 a Commercial/Inst.: Diesel Oil	SO ₂	0.11	0	5	20	20.62	0	-99.81	<0.005					
1 A 4 a Commercial/Inst.: Gaseous Fuels	SO ₂	0	0					-100						
1 A 4 a Commercial/Inst.: Gasoline	SO ₂	0.01	0	5	20	20.62	0	-89.96	<0.005					
1 A 4 a Commercial/Inst.: Liquid Fuels	SO ₂	4.01	0.04	15.4	70	71.67	0.03	-99.01	<0.005	11	8	5		2

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

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1 A 4 a Commercial/Inst.: Other Fuels	SO ₂	0	0.01	10	70	70.71	0		<0.005						
1 A 4 b Residential: Biomass	SO ₂	0.42	0.45	10	75	75.66	3.68	6.46	<0.005		10	17		8	9
1 A 4 b Residential: Gaseous Fuels	SO ₂	0	0					-100							
1 A 4 b Residential: Liquid Fuels	SO ₂	7.09	0.09	18.59	68.25	70.74	0.12	-98.78	0.01	3	31	5	1	26	1
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	SO ₂	0	0.09	7.98	53.38	53.97	0.08	4368.75	<0.005		30	33			
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels	SO ₂	0	0					-100							
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	SO ₂	2.76	0.2	9.7	35.1	36.42	0.17	-92.64	<0.005	15	20	18	26	21	20
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	SO ₂	0.63	0					-100		31		30	25		
1 A 5 b Mobile: Liquid Fuels	SO ₂	0.6	0.06	7.29	36.18	36.91	0.02	-89.91	<0.005	32					
1 B 1 b Coke production	SO ₂	0.08	0.02	5	50	50.25	0	-74.47	<0.005						
1 B 1 c Flaring of gas: Solid Fuels	SO ₂	0.01	0.02	50	50	70.71	0.01	56.61	<0.005						
1 B 2 a Oil	SO ₂	4.19	0.75		47.9	47.9	4.08	-82.21	<0.005	10	6		7	6	
1 B 2 c Venting and flaring	SO ₂	0.01	0	17.5	70	72.15	0	-96.03	<0.005						
1 D International Aviation: Jet kerosene	SO ₂	0.04	0.06	10	50	50.99	0.03	29.5	<0.005						
2 A 1 Cement Production	SO ₂	5.26	0.1	2	20	20.1	0.01	-98.01	<0.005	5	29	6	13		14
2 A 2 Lime Production	SO ₂	0.09	0.31	5.14	19.98	20.63	0.13	257.98	<0.005		13	19		24	
2 A 3 Glass Production	SO ₂	0.26	0.16		30	30	0.08	-36.24	<0.005		23	29			
2 B 10 Other	SO ₂	5.89	0.57		31.59	31.59	1.05	-90.25	<0.005	4	9	15	6	11	15
2 C 1 Iron and Steel Production	SO ₂	4.26	1.45	3.36	67.46	67.54	30.78	-65.85	<0.005	9	4	9	4	1	3
2 C 2 Ferroalloys production	SO ₂	0.3	0.05	5	30	30.41	0.01	-84	<0.005						
2 C 3 Aluminium production	SO ₂	0.24	0.12	2	30	30.07	0.04	-48.25	<0.005		26				
2 C 7 Other	SO ₂	4.92	3.05	4	20	20.4	12.39	-37.89	<0.005	7	2	1	14	3	5
2 G 4 Other	SO ₂	0	0	15	50	52.2	0	32.39	<0.005						
2 H Other	SO ₂	12.82	4.11	5	20	20.62	22.94	-67.93	<0.005	1	1	2	3	2	6
5 C 1 Waste Incineration	SO ₂	0.05	0.01	4.47	710.74	710.76	0.18	-79.88	<0.005					20	
Total		105.48	19.21			9.21	100	-81.78	1.5						

Table A1-18 Summary of the key source and uncertainty analysis of TSP emissions 1990 and 2015, submission 2017.

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	TSP	0.86	1.14	1.95	19.51	19.61	0.12	31.89	<0.005	15	7	13		17	22
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels	TSP	0	C	2	99.95	99.97	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	TSP	0.13	C	1.6	32.38	32.42	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	TSP	0.12	0.15	2.07	89.32	89.35	0.04	26.56	<0.005						
1 A 1 a Public Electricity and Heat Production: Peat	TSP	0.71	0.01	2.02	20	20.1	0	-98.66	<0.005	19		14			21
1 A 1 a Public Electricity and Heat Production: Solid Fuels	TSP	1.1	C	1.13	53.82	53.83	0	C	<0.005	11		8	21		9
1 A 1 b Petroleum refining: Gaseous Fuels	TSP	0	C	2	100	100.02	0	C	<0.005						
1 A 1 b Petroleum refining: Liquid Fuels	TSP	1.64	C	9.65	92.81	93.31	0.08	C	0.02	7	26	6	8	19	4
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels	TSP	0.83	C	4.19	74.65	74.77	0.06	C	<0.005	16	25	16	12		11
1 A 2 a Iron and Steel: Biomass	TSP	0	0					-100							
1 A 2 a Iron and Steel: Gaseous Fuels	TSP	0	C	5	100	100.12	0	C	<0.005						
1 A 2 a Iron and Steel: Liquid Fuels	TSP	0.13	C	4.07	91.01	91.1	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	TSP	0.03	C	3.57	71.31	71.4	0	C	<0.005						
1 A 2 b Non-ferrous metals: Gaseous Fuels	TSP	0	C	5	100	100.12	0	C	<0.005						
1 A 2 b Non-ferrous metals: Liquid Fuels	TSP	0.01	C	3.47	72.44	72.52	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	TSP	0.01	0					-100							
1 A 2 c Chemicals: Biomass	TSP	0.04	0.03	3.04	73.66	73.72	0	-7.09	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 c Chemicals: Gaseous Fuels	TSP	0	0	5	100	100.12	0	-7.51	<0.005						
1 A 2 c Chemicals: Liquid Fuels	TSP	0.07	0.02	8.89	60.41	61.06	0	-73.96	<0.005						
1 A 2 c Chemicals: Other Fuels	TSP	0.01	C	10	100	100.5	0	C	<0.005						
1 A 2 c Chemicals: Solid Fuels	TSP	0.06	C	2.38	72.83	72.87	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	TSP	2.47	C	4.33	98.95	99.04	3.44	C	0.01	5	6	11	4	6	7
1 A 2 d Pulp, Paper and Print: Gaseous Fuels	TSP	0	0	5	100	100.12	0	-53.56	<0.005						
1 A 2 d Pulp, Paper and Print: Liquid Fuels	TSP	0.22	0.03	3.5	97.89	97.95	0	-85.08	<0.005			30	22		20
1 A 2 d Pulp, Paper and Print: Other Fuels	TSP	0.07	C	10	100	100.5	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Solid Fuels	TSP	0.13	C	4.42	87.6	87.72	0	C	<0.005						27
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	TSP	0.02	0.04	4.09	77.46	77.56	0	171.51	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Gaseous Fuels	TSP	0	0	5	100	100.12	0	-21.02	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	TSP	0.06	0.01	3.06	75.35	75.41	0	-90.76	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	TSP	0.01	C	10	100	100.5	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	TSP	0.04	C	5	100	100.12	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	TSP	0.01	C	9.52	70.96	71.59	0	C	<0.005						
1 A 2 f Non-metallic minerals: Gaseous Fuels	TSP	0	0	10	100	100.5	0	67.8	<0.005						
1 A 2 f Non-metallic minerals: Liquid Fuels	TSP	0.05	0.01	8.51	92.6	92.99	0	-74.64	<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	TSP	0.24	0.06	9.28	79.75	80.29	0.01	-72.8	<0.005			32			25

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	TSP	0.89	0.82	4.96	29.77	30.18	0.15	-8.07	<0.005	13	10	23	19	14	
1 A 2 g viii Other: Biomass	TSP	1.56	0.68	9.9	99.05	99.55	1.12	-56.41	<0.005	8	11	15	7	7	8
1 A 2 g viii Other: Gaseous Fuels	TSP	0	C	9.99	99.94	100.43	0	C	<0.005						
1 A 2 g viii Other: Liquid Fuels	TSP	0.19	0.03	11.13	70.29	71.16	0	-83.22	<0.005			33			
1 A 2 g viii Other: Other Fuels	TSP	0	C	10	100	100.5	0	C	<0.005						
1 A 2 g viii Other: Solid Fuels	TSP	0.05	C	9.36	93.56	94.02	0.04	C	<0.005						24
1 A 3 a Domestic Aviation: Aviation Gasoline	TSP	0	0	10	20	22.36	0	-81.93	<0.005						
1 A 3 a Domestic Aviation: Jet Kerosene	TSP	0.02	0.01	10	20	22.36	0	-54.16	<0.005						
1 A 3 b i Road Transportation, Cars: Biomass	TSP	0	0	5	15	15.81	0		<0.005						
1 A 3 b i Road Transportation, Cars: Diesel oil	TSP	0.37	0.17	5	15	15.81	0	-52.87	<0.005	24					
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	TSP	0	0	10	15	18.03	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	TSP	0.28	0.07	3	15	15.3	0	-75.6	<0.005	31		28			
1 A 3 b i Road Transportation: Automobile road abrasion	TSP	23.08	28.74		15	15	45.61	24.52	0.06	1	1	1	2	1	2
1 A 3 b i Road Transportation: Automobile tyre and brake wear	TSP	1.25	1.56		15	15	0.13	24.52	<0.005	10	4	10	24	15	23
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	TSP	0.24	0.19	5	15	15.81	0	-22.81	<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	TSP	0.03	0	3	15	15.3	0	-86.83	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	TSP	0	0	5	15	15.81	0	496.27	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	TSP	2.39	0.3	4.33	12.98	13.68	0	-87.36	<0.005	6	19	4	17		14
1 A 3 b iii Road Transportation, Heavy duty trucks: Gaseous Fuels	TSP	0	0	10	15	18.03	0	4944.18	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b iv Road Transportation, Motorcycles: Gasoline	TSP	0.04	0.01	3	15	15.3	0	-68.55	<0.005						
1 A 3 c Railways: Liquid Fuels	TSP	0.05	0.02	5	10	11.18	0	-53.07	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	TSP	0.2	0.21	3.14	26.26	26.45	0.01	6.53	<0.005		24				
1 A 3 d Domestic Navigation: Residual Oil	TSP	0.26	0.1	15	40	42.72	0	-63.23	<0.005	33					
1 A 3 e Other Transportation: Diesel Oil	TSP	0.28	0.08	5	30	30.41	0	-71.22	<0.005	32		31			
1 A 4 a Commercial/Institutional: Biomass	TSP	0.11	0.24	9.6	9.96	13.83	0	126.47	<0.005		22	25			
1 A 4 a Commercial/Inst.: Diesel Oil	TSP	0.13	0.09	5	30	30.41	0	-25.14	<0.005						
1 A 4 a Commercial/Inst.: Gaseous Fuels	TSP	0	0	9.7	9.7	13.72	0	169.75	<0.005						
1 A 4 a Commercial/Inst.: Gasoline	TSP	0.03	0.05	5	30	30.41	0	72.44	<0.005						
1 A 4 a Commercial/Inst.: Liquid Fuels	TSP	0.3	0	15.4	9.8	18.25	0	-98.36	<0.005	29		20			
1 A 4 a Commercial/Inst.: Other Fuels	TSP	0	0	10	100	100.5	0		<0.005						
1 A 4 b Residential: Biomass	TSP	5.4	4.88	10	65	65.76	25.24	-9.61	0.02	4	2	7	1	2	6
1 A 4 b Residential: Gaseous Fuels	TSP	0	0	9.15	59.47	60.17	0	-16.79	<0.005						
1 A 4 b Residential: Liquid Fuels	TSP	0.72	0.23	2.85	27.32	27.47	0.01	-68.34	<0.005	18	23	18	15		26
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	TSP	0.03	0.67	7.98	27.78	28.9	0.09	2045.58	<0.005		12	9		18	15
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels	TSP	0	0	10	30	31.62	0	-41.16	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	TSP	0.99	0.42	2.43	14.79	14.99	0.01	-57.21	<0.005	12	16	19	25		
1 A 4 c Agric./Forestry/Fisheries: Solid Fuels	TSP	0.24	0					-100				22			

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (kt)	Year 2014 emissions or removals (kt)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 5 b Mobile: Liquid Fuels	TSP	0.09	0.02	5.6	19.19	19.99	0	-81.22	<0.005						
1 B 1 c Flaring of gas: Solid Fuels	TSP	0.78	0.54	5.99	19.98	20.86	0.03	-30.9	<0.005	17	13				
1 B 2 a Oil	TSP	0.07	C	0.02	19.86	19.86	0	C	<0.005						
1 B 2 c Venting and flaring	TSP	0.06	0	17.5	100	101.52	0	-97.96	<0.005						
1 D Int. Aviation: Jet kerosene	TSP	0.01	0.02	10	20	22.36	0	62.49	<0.005						
2 A 1 Cement Production	TSP	0.88	0.1	2	30	30.07	0	-88.42	<0.005	14		12	20		17
2 A 2 Lime Production	TSP	0.33	0.09	5.2	49.96	50.23	0	-73.95	<0.005	27		27			
2 A 3 Glass Production	TSP	0.29	0.05		100	100	0.01	-83.52	<0.005	30		24	18		16
2 B 10 Other	TSP	0.09	0.03		39.59	39.59	0	-63.81	<0.005						
2 B 5 Carbide production	TSP	0.12	0.15	10	50	50.99	0.02	28.92	<0.005						
2 C 1 Iron and Steel Production	TSP	5.69	0.84	3.35	27.12	27.32	0.13	-85.18	0.01	3	9	3	6	16	5
2 C 2 Ferroalloys production	TSP	0.09	0.07	5	40	40.31	0	-22.37	<0.005						
2 C 3 Aluminium production	TSP	0.34	0.14	2	40	40.05	0.01	-57.67	<0.005	25					
2 C 7 Other	TSP	0.26	0.03	4	40	40.2	0	-87.68	<0.005	34		26			
2 D 3 Other	TSP	0.11	0.12	0.03	544.55	544.55	1.04	11.85	<0.005				13	8	13
2 G 4 Other	TSP	0.34	0.25	10.74	42.83	44.16	0.03	-26.5	<0.005	26	21		26		
2 H Other	TSP	12.47	4.14	2.85	38.18	38.29	6.17	-66.76	0.06	2	3	2	3	4	1
2 I Wood processing	TSP	0.67	0.35	15	20	25	0.02	-47.02	<0.005	20	17	29	23		
3 B 1 Dairy cattle	TSP	0.52	0.43	20	150	151.33	1.03	-17.92	<0.005	23	15		10	9	
3 B 1 Non-dairy cattle	TSP	0.32	0.34	20	150	151.33	0.64	5.52	<0.005	28	18	34	14	11	18
3 B 3 Swine	TSP	1.47	0.88	20	150	151.33	4.39	-39.92	<0.005	9	8	21	5	5	12
3 B 4 Goats	TSP	0	0	20	200	201	0	27.59	<0.005						
3 B 4 Horses	TSP	0.15	0.17	20	200	201	0.3	14.92	<0.005				16	13	19
3 B 4 Poultry	TSP	0.64	1.53	13.77	122.48	123.25	8.77	139.24	0.03	22	5	5	11	3	3
3 B 4 Sheep	TSP	0.02	0.04	20	200	201	0.02	78.19	<0.005						
5 A Solid waste disposal	TSP	0	0	10	377	377.13	0	-76.25	<0.005						
5 C 1 Waste Incineration	TSP	0	0	4.61	626.61	626.63	0	48.78	<0.005						
5 C 2 Open burning of waste	TSP	0	0.3	75	100	125	0.34		<0.005		20	17		12	10
5 E Other	TSP	0.65	0.52	50	100	111.8	0.84	-18.96	<0.005	21	14		9	10	
Total		74.64	54.33			11.75	100	-27.22	4.78						

Table A1-19 Summary of the key source and uncertainty analysis of Zn emissions 1990 and 2015, submission 2017.

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 1 a Public Electricity and Heat Production: Biomass	Zn	5.47	13.47	1.92	90.73	90.75	0.39	146.44	0.22	8	5	3		3	4
1 A 1 a Public Electricity and Heat Production: Liquid Fuels	Zn	0.15	C	1.49	83.33	83.34	0	C	<0.005						
1 A 1 a Public Electricity and Heat Production: Other Fuels	Zn	0.01	0.04	1.99	807.68	807.69	0	338.79	<0.005						
1 A 1 a Public Electricity and Heat Production: Peat	Zn	0.33	0.14	2.02	100	100.02	0	-56.34	<0.005						
1 A 1 a Public Electricity and Heat Production: Solid Fuels	Zn	0.32	C	1.13	100	100.01	0	C	<0.005						
1 A 1 b Petroleum refining: Liquid Fuels	Zn	0.04	C	9.65	90.89	91.4	0	C	<0.005						
1 A 2 a Iron and Steel: Biomass	Zn	0	0					-100							
1 A 2 a Iron and Steel: Liquid Fuels	Zn	0.05	C	4.07	96.75	96.83	0	C	<0.005						
1 A 2 a Iron and Steel: Solid Fuels	Zn	0	0					-100							
1 A 2 b Non-ferrous metals: Liquid Fuels	Zn	0.01	C	3.47	79.91	79.98	0	C	<0.005						
1 A 2 b Non-ferrous metals: Solid Fuels	Zn	0	0					-100							
1 A 2 c Chemicals: Biomass	Zn	0.28	0.41	3.04	30.44	30.59	0	47.93	<0.005						
1 A 2 c Chemicals: Liquid Fuels	Zn	0.02	0.01	8.89	92.19	92.61	0	-56.07	<0.005						
1 A 2 c Chemicals: Other Fuels	Zn	0	0					-100							
1 A 2 c Chemicals: Solid Fuels	Zn	0.01	C	2.38	137.1	137.12	0	C	<0.005						
1 A 2 d Pulp, Paper and Print: Biomass	Zn	18.14	C	4.33	39.89	40.12	0.18	C	0.04	3	1	5		5	7
1 A 2 d Pulp, Paper and Print: Liquid Fuels	Zn	0.25	0.06	3.5	98.94	99.01	0	-76.98	<0.005						
1 A 2 d Pulp, Paper and Print: Other Fuels	Zn	0.03	0					-100							
1 A 2 d Pulp, Paper and Print: Solid Fuels	Zn	0.03	C	4.42	500.5	500.52	0	C	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Biomass	Zn	0.13	0.53	4.09	30.99	31.26	0	310.02	<0.005						

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels	Zn	0.07	0.01	3.06	81.78	81.84	0	-90.48	<0.005						
1 A 2 e Food Processing, Beverages and Tobacco: Other Fuels	Zn	0.01	0					-100							
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels	Zn	0.01	C	5	700	700.02	0	C	<0.005						
1 A 2 f Non-metallic minerals: Biomass	Zn	0.04	C	9.52	38.1	39.27	0	C	<0.005	12	9				
1 A 2 f Non-metallic minerals: Liquid Fuels	Zn	0.05	0.03	8.51	69.77	70.29	0	-36.62	<0.005						
1 A 2 f Non-metallic minerals: Solid Fuels	Zn	0.12	0.07	9.28	649.63	649.7	0	-44.45	<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Biomass	Zn	0	0.13	4.98	99.7	99.82	0		<0.005						
1 A 2 g vii Off-road vehicles and other machinery: Liquid Fuels	Zn	0.3	0.39	4.92	98.33	98.45	0	31.55	<0.005						
1 A 2 g viii Other: Biomass	Zn	11.49	8.14	9.9	39.62	40.84	0.03	-29.17	<0.005	6	6	10			
1 A 2 g viii Other: Liquid Fuels	Zn	0.14	0.03	11.13	76.23	77.04	0	-78.34	<0.005						
1 A 2 g viii Other: Solid Fuels	Zn	0.01	C	9.36	653.55	653.62	0	C	<0.005						
1 A 3 b i Road Transportation, Cars: Biomass	Zn	0	0.99	3.38	65.86	65.95	0		<0.005	13	12				
1 A 3 b i Road Transportation, Cars: Diesel oil	Zn	0.25	2.27	5	100	100.12	0.01	823.29	0.01	11	8				
1 A 3 b i Road Transportation, Cars: Gaseous Fuels	Zn	0	0.03	10	100	100.5	0		<0.005						
1 A 3 b i Road Transportation, Cars: Gasoline	Zn	8.26	4.68	3	100	100.04	0.06	-43.38	<0.005	7	8		5	7	
1 A 3 b i Road Transportation: Automobile tyre and brake wear	Zn	15.4	19.22		1000	1000	95.84	24.79	24.33	5	2	4	1	1	1
1 A 3 b ii Road Transportation, Light duty trucks: Biomass	Zn	0	0.19	4.86	97.12	97.24	0		<0.005						
1 A 3 b ii Road Transportation, Light duty trucks: Diesel oil	Zn	0.09	0.78	5	100	100.12	0	762.24	<0.005	14	14				

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 3 b ii Road Transportation, Light duty trucks: Gasoline	Zn	0.48	0.1	3	100	100.04	0	-80.03	<0.005						
1 A 3 b iii Road Transportation, Heavy duty trucks: Biomass	Zn	0	0.58	4.04	80.82	80.92	0	17430.73	<0.005		16				
1 A 3 b iii Road Transportation, Heavy duty trucks: Diesel oil	Zn	2.11	2.33	4.33	86.58	86.68	0.01	10.23	<0.005	9	10	11			
1 A 3 b iii Road Transportation, Heavy duty trucks: Gasoline	Zn	0.01	0	3	100	100.04	0	-63.57	<0.005						
1 A 3 c Railways: Liquid Fuels	Zn	0.03	0.01	5	95	95.13	0	-53.07	<0.005						
1 A 3 d Domestic Navigation: Gas/Diesel Oil	Zn	0.09	0.05	4.06	40.57	40.77	0	-44.9	<0.005						
1 A 3 d Domestic Navigation: Residual Oil	Zn	0.09	0.03	15	100	101.12	0	-63.23	<0.005						
1 A 3 e Other Transportation: Biomass	Zn	0	0.03	5	100	100.12	0		<0.005						
1 A 3 e Other Transportation: Diesel Oil	Zn	0.08	0.09	5	100	100.12	0	7.57	<0.005						
1 A 4 a Commercial/Inst.: Biomass	Zn	0.28	0.65	9.6	196.43	196.66	0	129.69	<0.005		16				
1 A 4 a Commercial/Inst.: Diesel Oil	Zn	0.03	0.03	5	100	100.12	0	-12.02	<0.005						
1 A 4 a Commercial/Inst.: Ethanol	Zn	0	0	5	100	100.12	0		<0.005						
1 A 4 a Commercial/Inst.: FAME	Zn	0	0.01	5	100	100.12	0		<0.005						
1 A 4 a Commercial/Inst.: Gasoline	Zn	0.06	0.07	5	100	100.12	0	10.72	<0.005						
1 A 4 a Commercial/Inst.: Liquid Fuels	Zn	0.15	0	15.4	100	101.18	0	-98.27	<0.005						
1 A 4 b Residential: Biomass	Zn	15.61	16.86	9.99	199.89	200.14	2.95	8.04	0.55	4	3	6	3	2	3
1 A 4 b Residential: Liquid Fuels	Zn	0.24	0.12	2.8	88.96	89.01	0	-47.09	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Biomass	Zn	0.08	2.38	7.66	149.15	149.34	0.03	2737.71	0.03		9	7			
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels	Zn	0.37	0.36	2.85	56.13	56.21	0	-1.04	<0.005						
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels	Zn	0.36	0					-100							

SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 2017
Informative Inventory Report Sweden 2017 - Annexes

IPCC Source Category	Substance	Base year emissions or removals (t)	Year 2014 emissions or removals (t)	Activity data uncertainty in 2015 (%)	Emission factor uncertainty in 2015 (%)	Combined uncertainty in 2015 (%)	Contribution to variance in 2015 (%)	Inventory trend for 2015 with respect to base year (%)	Uncertainty introduced into the trend (%)	Level in base year	Level in 2015	Trend	Level in base year (Approach 2)	Level in 2015 (Approach 2)	Trend (Approach 2)
1 A 5 b Mobile: Liquid Fuels	Zn	0.02	0.01	5	100	100.12	0	-36.23	<0.005						
2 A 3 Glass Production	Zn	0.01	0		50	50	0	-87.63	<0.005						
2 C 1 Iron and Steel Production	Zn	78.1	14.94	0.77	79.05	79.05	0.36	-80.87	1.76	1	4	1	2	4	2
2 C 2 Ferroalloys production	Zn	1.21	0.59	5	50	50.25	0	-51.45	<0.005						
2 C 7 Other	Zn	33.65	6.62	4	50	50.16	0.03	-80.33	0.13	2	7	2	4		5
2 G 4 Other	Zn	0.28	0.35	14.56	679.21	679.37	0.01	25.29	<0.005						
2 H Other	Zn	2.01	0.26	4.7	47.09	47.32	0	-87.02	<0.005			13			
5 C 1 Waste Incineration	Zn	0.13	0.63	9.81	883.18	883.23	0.08	389.08	0.06					6	6
5 C 2 Open burning of waste	Zn	0	0.66	75	200	213.6	0.01		0.01		15	15			
Total		196.98	121.47			161.65	100	-38.34	52.11						

2 Annex 2: Detailed discussion of methodology and data for estimating emissions from fossil fuel combustion.

2.1 Sources for activity data in NFR 1A and parts of NFR 1B

Activity data used in the energy sector is mainly based on statistics on fuel consumption. In the sections below, the various energy surveys, produced by Statistics Sweden and other data sources are described. For stationary combustion within the Other sector, activity data from the annual energy balances is used in order to ensure that all activities are covered and no activities are double-counted. The energy balances are based on a number of surveys, which are all described below.

A number of activity data sources are used and the UNFCCC ERT has asked for the rationale for choosing a certain data source, an explanation of how these sources are deemed accurate or inaccurate, and how time series consistency is ensured. In numerous development projects during the last ten years, several of them quoted in IIR section 3, different data sources have been compared and checked against each other, and in some of these projects industrial facilities have been contacted by phone or e-mail to verify data. Generally, the quarterly fuel statistics is considered to be more complete than the industrial energy statistics, because the industrial energy survey has not always included all back pressure power. In recent years, the main reason for choosing the quarterly fuel statistics is that the annual industrial energy survey is not ready in time for the emission inventory. On an aggregate level, the final results for the two surveys are very coherent. In a study performed by Statistics Sweden in 2009¹, a detailed comparison between the quarterly fuel statistics, the annual industrial energy survey and the energy balances was made. This study showed some differences between the two surveys, but the differences did not indicate systematic errors in any of the surveys, and hence it gave no reason to believe that the quarterly fuel statistics would not be of sufficient quality.

Environmental reports are often a good source for emission data, but generally they do not contain sufficient activity data for the energy sector, and facilities with small emissions are not obliged to submit environmental reports. The EU ETS system has very good coverage of the trading facilities, but presently it is not possible to use as main data source due to several reasons. Firstly, the database is not adapted

¹ Statistics Sweden, 2009

to automated data processing, and secondly, some facilities only report carbon balances. Furthermore, to produce correct estimates for the non-trading facilities, one must be able to separate trading facilities from non-trading ones in the energy statistics, and this is currently not possible due to different definitions of administrative units in the energy statistics and the ETS, respectively.

For the Other sector, energy balances are used because none of the underlying surveys covers all emission sources in the different sub-sectors, but in the energy balances, complementary calculations are made in order to obtain full coverage and avoid double counting. Data for NFR 1A4 has been verified against the underlying surveys described in the sections below, and the coherence was good for biomass fuels and oils, whereas the coverage of use of e.g. LPG was considered to be better in the energy balances.

2.1.1 Quarterly fuel statistics

Quarterly fuel statistics are used as follows:

- All years for data on stationary combustion in the NFR sector 1A1a.
- 1990-1996 for information on in-house (own-produced) fuels in NFR 1A1b-c and 1A2 since the statistics of energy use in manufacturing industry did not cover own-produced fuels during these years.
- 1997-1999 and 2003 and all following years for stationary fuel-related emissions in NFR 1A2 and minor parts of 1A1b and 1A1c.
- 2000-2002 for data on fuel combustion for back pressure power in NFR 1A2c-e, both sold and consumed at the producing plant. This is due to that the industrial energy statistics (which is the main data source for industries 2000-2002) was found not to cover fuel consumption for back pressure power in those years.

Quarterly fuel statistics are carried out as a postal (in later years web based) sample survey sent to all working units.² The sample to the quarterly fuel statistics is based on the sample for the yearly statistics of energy use in manufacturing industry, except for electricity and heat production for which the quarterly fuel statistics is a total survey. Data are collected from all companies in electricity and heat production and all companies in the manufacturing industry with more than nine employees and annual fuel combustion of more than 325 t oil equivalents.

The survey should cover all fuel consumption, both own-produced and purchased fuels. However, in some cases it has been noted by the inventory staff that not all in house fuels are covered. In those cases supplementary data has been collected to

² A company may consist of several working units, that is could be located in several places (factories).

assure complete time series. In the survey form, respondents are also asked to specify whether fuels are used as raw materials or for energy purposes.

The sample frame is updated annually based on the latest results of the Energy use in manufacturing industry (ISEN). The response rate to the quarterly fuel statistics is almost 100 % for ISIC 40 (that is, NFR 1A1a) and about 90 % for manufacturing industries. The non-respondents among the industries are often small companies, which means that much more than 90 % of consumed energy is covered in responses to the survey. To compensate for companies not included in the sample and companies not responding to the survey, all fuel consumption is raised with a factor which is produced from information on the line of business, number of employees and business volume from the most recent year when the statistics on energy use in manufacturing industry was a total survey (as discussed above). By definition, the survey does not cover energy consumption in working units with less than ten employees. The energy consumption in these “small industries” is estimated with a calculation model and published in the energy balances. This estimate covers all industrial branches and the fuel consumption and emissions are reported under NFR 1A2g.

The quarterly fuel statistics for each year are compiled and ready for use at approximately the end of March the year after. This gives enough time to process the data for the greenhouse gas inventory.

In the inventory, data on plant level and by fuel type is used. The properties of the quarterly fuel statistics are summarized in Table A2-1.

Table A2-1. Summarised properties of quarterly fuel statistics used in the inventory

Year	Type of survey	Coverage	Adjustments	Quality
1990-1996	Quarterly sample survey to companies with more than 9 employees consuming more than >325 toe within manufacturing industries and to all companies in energy industries and pulp and paper industries	Working units in energy industries and manufacturing industries, all fuel combustion of in-house fuels	Raising to reach the level of industrial energy statistics	Good
1997-	Quarterly sample survey to companies with more than 9 employees consuming more than >325 toe within manufacturing industries and to all companies in energy industries	Working units in energy industries and manufacturing industries, all fuel combustion	Raising to reach the level of industrial energy statistics	Good

2.1.2 Annual statistics on energy use in manufacturing industry

The statistics on energy use in manufacturing industry are used for emissions from stationary combustion in the NFR sectors 1A1b, 1A1c and 1A2 1990-1996 and 2000-2002. The data material used for these years did not include fuel consumption for back pressure power, because data on that activity is collected via a different survey, (Electricity supply, district heating and supply of natural and gasworks gas (AREL)).

Since submission 2005, for calculation of emissions in 2003 and later years, energy use in manufacturing industry statistics are not used as a base for estimating emissions in the inventory. This is, as discussed above, mainly because the inventory must be submitted before the energy use in manufacturing industry statistics are completed. The energy use in manufacturing industry statistics is only used to verify or correct data for single plants if errors are suspected in the quarterly fuel statistics.

The energy use in manufacturing industry statistics is based on an annual survey of manufacturing companies. In 1990-1996, 2000 and from 2004, all companies with more than 9 employees are included. In 1997-1999 and in 2001-2003 it was conducted as a sample survey to companies with less than 50 and more than 9 employees, and as a total survey to all companies with more than 50 employees. In 1990-1996, only purchased fuels were surveyed but, since 1997, information on all fuel consumption has been collected.

The response rate to the energy use in manufacturing industry statistics in the years for which this survey is used in the GHG emission inventory was about 85 %. To compensate for non-response, fuel consumption is raised with a raising factor based on the line of business, number of employees and business volume. There is no adjustment for manufacturing industries with less than 10 employees.

A special form is sent to electricity producing companies within manufacturing industries, where the amounts of fuels used for electricity production and manufacturing purposes are specified. All manufacturing industries with electricity production are included in the survey every year. In the inventory, all data used are on plant level and by fuel type. An overview of the industrial energy statistics used in the inventory for 1990-2002 is given in Table A2-2.

Table A2-2 Summarised properties of industrial energy statistics used in the inventory.

Year	Type of survey	Coverage	Adjustments	Quality
1990-1996	Annual total survey to all companies with more than nine employees	Working units, purchased fuels, quantity and economic value of purchased fuels	Raising to represent all companies with more than 9 employees	Not so good quality for quantity, good quality for economic value
1997-1999	Annual total survey to all companies with at least 50 employees and a stratified sample of companies with 10-49 employees	Working units purchased and own-produced fuels	Raising to represent all companies with more than 9 employees	Good on national level and on coarse branch level, poor for single fuel types and single branches
2000	Annual total survey to all companies with more than nine employees	Working units, purchased and own-produced fuels	No adjustments	Excellent
2001-2002	Annual total survey to all companies with at least 50 employees and a stratified sample of companies with 10-49 employees	Working units, purchased and own-produced fuels	Raising to represent all companies with more than 9 employees	Good

2.1.3 One- and two-dwelling statistics

One- and two-dwelling statistics are, together with holiday cottages statistics and multi-dwelling statistics, the main data sources for biomass combustion in households in the energy balances, which in turn are used to calculate emissions from stationary combustion in households, NFR 1A4b i.

This sample survey is conducted annually to collect data on the use of electricity and heat for a total of 7,000 one- and two-dwellings. Until 1999, the survey has a random sample from a real estate assessment, which includes all dwellings with a value higher than 50,000 SEK (about 5,600 €). From 2000, all dwellings used as permanent dwelling are included in the sample. Every third year, a postal survey collects data from agricultural properties. The sample in this sector is 3,000 objects. Activity data in the inventory is taken from annual reports prepared by Statistics Sweden.³ Data is on national level by fuel type and considered to be of relatively good quality. To make sure that all emissions from households are included and that no double-counting occurs, activity data is taken from the annual energy balance sheets. However, the fuel consumption reported under the household category in the energy balance is based on the surveys described here.

³ Statistics Sweden EN20SM, 1990-2013.

2.1.4 Holiday cottages statistics

Holiday cottages statistics, together with one- and two-dwelling statistics and multi-dwelling statistics, is used to calculate emissions from stationary combustion in households, NFR 1A4b. As described above, an aggregate from the energy balances is used as activity data for stationary combustion in NFR 1A4b i.

Holiday cottages are defined as residences with no permanent residents. Energy consumption in holiday cottages has been surveyed with large time intervals, i.e. in 1976, 2001 and 2012. In 2012, Statistics Sweden carried out a stratified sample survey to house owners, covering 4,500 of the 589,525 objects in the sample frame. The net sample, excluding over coverage, included 4024 objects and the response rate was 44%. Because of difficulties regarding classification, houses with type codes other than recreational dwellings were also included in the sample frame. The questionnaire form used in 2012 was based on the one used in 2002. Results show that electricity and biomass combustion are the two predominating heating sources in holiday cottages, both in 2001 and 2011.⁴

2.1.5 Multi-dwelling statistics

Multi-dwelling statistics, together with one- and two-dwelling statistics and holiday cottages statistics, is used to calculate emissions from stationary combustion of biomass in households, NFR 1A4b.

This is a sample survey carried out each year, sent to the owners of 7,000 multi-dwelling buildings, covering the use of electricity and heat. The survey is based on a random sample from a real estate assessment. The real estate assessment includes all dwellings with an economic value higher than 50,000 SEK (about 5,600 €). Activity data in the inventory is taken from reports prepared by Statistics Sweden³. Data is on national level by fuel type and of relatively good quality. Statistics on biomass consumption in multi-dwelling buildings was not included in the survey until 2001. However, the time series for 1A4b indicates that this data gap does not lead to any significant under-estimation as biomass use in multi-dwellings is sparse compared to the consumption in one- and two-dwellings.

2.1.6 Premises statistics

Premises statistics are used to calculate emissions from stationary combustion in the commercial and institutional sector, NFR 1A4a i.

This survey is a sample survey carried out each year, covering the use of electricity, heat and fuel combustion for heat production of about 8,000 premises. Premises situated in an industrial area are not covered in the dataset. Some of these premises

⁴ES 2012:03

Biomass consumption in holiday cottages accounted for about 6 % of the total consumption of biomass in CRF 1A4b in 2001.

are covered in the annual industrial energy statistics as well as in the quarterly fuel statistics and are reported in Manufacturing Industries and Construction (NFR 1A2). To get full coverage, supplementary calculations are made for the energy balance, which is the activity data source for NFR 1A4a⁵. Data is on national level by fuel type and of relatively good quality. Statistics on biomass consumption in premises was not included in the survey until 2001.

2.1.7 Statistics on the supply and delivery of petroleum products

Statistics on the supply and delivery of petroleum products are used to calculate emissions from mobile combustion. Data from the survey is used at national level and by fuel type. Emissions are reported in NFR 1A2gii, 1A3a-e, 1A4bii, 1A4cii, 1A4ciii, 1A5b, 1B2a v and 1D.

In the monthly postal survey, data is collected from all oil companies and other sellers who have stocks of petroleum products and coal. The survey also collects stock data from companies with a large consumption of oil in the manufacturing industries and energy industries. All 70 companies are included in the survey. Fuels used for domestic and international navigation are separated. The only fuels not covered are waste and peat.

All figures are double-checked by both Statistics Sweden and all wholesale dealers. The results are published by Statistics Sweden⁶.

2.1.8 Statistics on the delivery of gas products

Statistics on the delivery of gas products are used to calculate emissions from natural gas and biogas from road transport (NFR 1A3b), pressure levelling losses of natural gas (NFR 1A5a) and transfer losses of gas works gas (NFR 1B2avi). Annual questionnaires are sent to all companies in Sweden that deliver natural gas, biogas and gasworks gas (less than ten companies). Consumption purposes are specified in the survey. Results of this survey are published by Statistics Sweden⁷.

2.1.9 Other statistics from Statistics Sweden

Data used in the inventory for stationary fuel consumption in the construction sector, in all companies with less than 10 employees (NFR 1A2g) and stationary combustion in NFR 1A4a-1A4c is taken from the annual energy balances⁸. Data is on national level and by fuel type. Total consumption for these sectors is checked

⁵ Statistics Sweden EN20SM, 1990-2014

⁶ Statistics Sweden. *Monthly fuel, gas and inventory statistics*. http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/Energy/Energy-supply-and-use/Monthly-fuel-gas-and-inventory-statistics/

⁷ Statistics Sweden. *Deliveries of motor fuel gas*. http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/Energy/Energy-supply-and-use/Deliveries-of-motor-fuel-gas/

⁸ Statistics Sweden 1990-2012, EN0202

against fuel deliveries, so that possible errors only occur in the allocation between these sectors.

Data on fuel consumption for the construction sector 1990-2003 is based on a survey from 1985,⁹ adjusted according to the number of working hours for each year. The fuel consumption for the construction sector 2004 and later is based on a survey from 2005.¹⁰ Data on fuel consumption in the agricultural sector is based on two intermittent surveys, for gardening¹¹ and agriculture.¹² The first survey is a sample survey that collects data on energy use in greenhouses and has been carried out for 1990, 1993, 1996, 1999, 2002 and 2008. Data for intermediate years is estimated using number of working hours. The second sample survey collects data for energy use in the other parts of the agricultural business and has been performed for 1994, 2002 and 2007 (fuel consumption in households in the agricultural sector is not included here but is included in the one- and two-dwellings statistics). Data for intermediate years is estimated using annual changes in value added.

Fuel consumption in the forestry sector has been studied thoroughly in 1985 and 2007¹³. Estimates for the years before 2005 are upgraded from the 1985 study with available statistics on the annual felling volume 1990-1995 and from 1996 value added are used.

Fuel consumption in small companies (9 employees or less), reported in the annual energy balances, is estimated using a model for the years 1990-2010. Fuel consumption for companies with 10-49 employees is taken from the industrial energy statistics and the average use of fuel per employee is calculated. The two information sources are combined to estimate the fuel consumption in small companies. In 2012, the annual statistics on energy use in manufacturing industries (ISEN) for the reference year 2011 included a sample survey to small companies as well. The results were not published in ISEN but in the annual energy balance for 2011, which was published in 2013 and used in submission 2014 as activity data source for small enterprises.

2.1.10 European Union Emission Trading Scheme (ETS)

Data from the European Union Emission Trading Scheme (ETS) is used since submission 2007 and emission years 2005 and later for oil refineries (NFR 1A1b, 1B2a and 1B2C21), as a SMED study during 2006¹⁴ showed that this is the most

⁹ Statistics Sweden, 1986

¹⁰ Statistics Sweden, 2005

¹¹ Statistics Sweden JO36SM, 1991, 94, 97, 2000, 2003, 2006, 2010

¹² Statistics Sweden JO63SM, 1995, 2003, 2008

¹³ ER 2007:15. Energianvändningen inom skogsbruket 2005

¹⁴ Backman & Gustafsson, 2006

accurate data source for these facilities. In addition, ETS data is used for the three cement producing facilities 2008 and onwards, one plant in NFR 1A2e for 2006 and one plant in NFR 1A2c for 2008 and onwards, since the ETS data contains more detailed information on fuel types for these facilities. ETS data is also used for verification of other data sources, e.g. energy statistics and environmental reports. For example, energy statistics for large facilities within the chemical industry and the steel producing industry are regularly compared with ETS data, and if major differences should be discovered, further investigations will be made. As mentioned above, for technical reasons, it is not possible to use ETS data as major source of activity data. Another reason not to use ETS data as the main data source is that in some facilities, only some of the installations within the facility are included in the trading scheme, and the definition of which installations that should be included has changed between the first and second trading periods.

2.1.11 Environmental reports

Before the EU ETS was launched, data on fuel consumption in refineries, NFR 1A1b and 1.B.2.c.2.i, was often collected from environmental reports in cases when the data sources mentioned above (i.e. various energy surveys) were not considered to be accurate. For one refinery, environmental reports are the only data source for the years 2002-2007. For earlier years, environmental reports are also an important data source for fuel consumption in chemical industries, NFR 1A2c. For 2007, environmental report data was partly used for one plant in the primary steel industry, NFR 1A2a.

2.1.12 Contacts with operators

For earlier years, i.e. 2005 and before, data on fuel consumption in refineries, NFR 1A1b, and chemical industries, NFR 1A2c, was in many cases collected by means of direct contacts with the operators, as activity data was not sufficiently covered in regular surveys or administrative sources. Operators are sometimes also contacted to verify or correct data that is suspected to contain errors. Since submission 2010, the largest iron and steel company has been involved in the improvements in methodology and data for these sectors (1A1c, 1A2a, 1B1b, 1B1c, 2C1).

2.1.13 Other data sources for mobile combustion

For emissions from mobile combustion, NFR 1A2g, 1A3, 1A4b-c and 1A5, data from the Swedish National Rail Administration, the Swedish National Road Administration (SNRA), the Swedish Biogas Association, the Swedish Civil Aviation Authority (SCAA), the Swedish Armed Forces and several official reports is used.

2.2 Net calorific values

Unless otherwise stated, NCVs for each fuel type are produced by Statistics Sweden based on information from energy surveys. All NCVs refer to net calorific values (NCV) as recommended by the IPCC Guidelines. All NCVs are shown in . Most NCVs are calculated on basis of chemical qualities and are considered to be of good quality. When possible, the same NCVs are used in the Reference and Sectoral approaches. However, in the reference approach, it is normally not possible to use specific NCVs for each reporting company. Instead, the national NCV:s recommended by the Swedish Energy agency, which are also used in the energy balances, are used for all parameters in the reference approach, which can cause minor differences between the reference and sectoral approaches. For some fuels, e.g. crude oil, NCVs are not provided by the Swedish Energy Agency. For these fuels, default values from IPCC 2006 Guidelines are used.

In the inventory, activity data for 1990-2006 on many fuel types are reported in tonne oil equivalents (toe), which is an energy unit. For these fuels the conversion factor of 41.87 GJ/toe is applied. In the energy surveys done by Statistics Sweden, these fuels are reported in mass unit/volume unit as well as the energy content (due to that the NCV often varies a lot for these fuel types). To facilitate data processing, Statistics Sweden calculates the energy content in toe from this information and the result is then used in the greenhouse gas inventory. This implies that the energy content of fuels concerned is very precise.

For 2007 and later years, energy data are taken directly from energy statistics data bases, enabling the use of facility specific NCVs in the GHG inventory without performing the calculation of toe. NCVs for 2007 and later years are considered to be of excellent quality. The time series is considered to be consistent, since the conversions to toe made 2006 and earlier, made use of the same information that is used to calculate energy amounts 2007 and onwards. The only difference is that prior to 2007, the energy statistics department made these calculations, and 2007 and later, the calculations are made by the GHG inventory staff.

Fuels that are standardized products, such as for instance residual fuel oil or liquefied petroleum gas (LPG) have calorific values that do not change between years. In submission 2010 some revisions were made. In earlier submissions, the NCV for biogas used for transports (this amount increases each year) was not known and therefore the NCV for natural gas was used for this fuel. In a SMED study¹⁵ performed in 2009, a correct NCV for biogas was provided from the biogas supplier AGA. The same study also resulted in revision of the NCVs for ethanol (new NCV taken from Handbook of Chemistry and Physics) and Fatty Acid Methyl Ester (FAME).

¹⁵ Paulrud et al. 2010

An overview of NCVs used is shown below in Table A2-3. For all mobile combustion, and for standard fuels for stationary combustion, national emission factors are used. For non-standard fuels, median, maximum and minimum NCVs are shown.

Table A2-3 Thermal values (NCV) used in submission 2017.

Fuel type	Unit	Median	Min	Max	Remark
Blast furnace gas	GJ/1000m3	2.87	2.73	3.36	
Coke	GJ/tonne	28.05	27.86	31.03	
Coke oven gas	GJ/1000m3	17.87	16.75	18.15	
Coking coal	GJ/tonne	27.21	23.46	30.71	
Diesel Oil	GJ/m3	35.36	34.33	35.87	
Domestic Heating Oil	GJ/m3	35.82	34.8	35.87	
Gas works gas	GJ/1000m3	16.75	16.75	16.75	Gas works gas 1990-2010, based on naphtha
Gas works gas	GJ/1000m3	20.8	20.8	20.8	Gas works gas 2011 and later, based on LNG
Kerosene	GJ/m3	34.5	34.33	34.5	
LPG	GJ/tonne	46.05	45.8	47.2	
Landfill gas	GJ/1000m3	17.64	8.04	29.38	
Natural Gas	GJ/1000m3	*	*	*	Year specific NCV:s, see separate table
Other biomass	GJ/m3	32.62	0.94	44.75	
Other biomass	GJ/tonne	34.21	3.98	43.61	
Other non-specified	GJ/1000m3	3.02	2.99	27.61	20-99 observations 1990-2014
Other non-specified	GJ/tonne	21.23	5.55	42.48	
Other petroleum fuels	GJ/m3	13.92	5.35	35.03	20-99 observations 1990-2014
Other petroleum fuels	GJ/tonne	29.39	12.65	40.79	20-99 observations 1990-2014
Peat	GJ/tonne	10.80	3.53	18.43	
Petroleum coke	GJ/tonne	34.80	30.09	34.80	20-99 observations 1990-2014
Refinery oil	GJ/m3	38.16	38.16	38.16	
Refinery oil	GJ/tonne	41.60	38.16	44.50	20-99 observations 1990-2014
Residual Fuel Oil	GJ/m3	38.16	37.40	38.34	
Solid waste (fossil and biogenic)	GJ/tonne	10.78	7.99	21.60	
Steel converter gas	GJ/1000m3	7.23	7.07	8.24	20-99 observations 1990-2014
Tall oil	GJ/m3	37.01	32.28	40.16	
Wooden fuels	GJ/m3	2.59	0.81	19.19	
Wooden fuels	GJ/tonne	16.92	5.90	19.44	
Gasoline	GJ/m3	32.78			Mobile combustion, all sources
Biogas	GJ/1000 m3	35.3			Mobile combustion, all sources
Diesel oil	GJ/m3	35.28			Railways
Gas/diesel oil (marine distillates)	GJ/m3	36.64			Navigation
Diesel oil	GJ/m3	*			Year specific NCV:s, see separate table
Residual fuel oil	GJ/m3	39.53			Navigation
Ethanol	GJ/m3	21.2			Road traffic
FAME	GJ/m3	33			Road traffic
Aviation Gasoline	GJ/m3	31.45			Aviation
Aviation Kerosene	GJ/m3	35.28			Aviation
Jet Gasoline	GJ/m3	32.7			Aviation

Note: refinery gas and petrochemical by product gases are reported in various units and plant specific NCV:s are used.

2.2.1 Liquid fuels

For diesel oil the NCV used in the inventory shows a decreasing trend. In Sweden, this fuel type is separated into three different fuel classes; diesel of environmental

classes (EC) 1-3. EC 1 has the best environmental qualities, for instance lower content on aromatic hydrocarbons. EC 1 also has a lower NCV. EC 3 affects the environment most and has a higher NCV.¹⁶ In 1990, EC 3 was the most common type of diesel. Over the years, the use of environmental class 3 has decreased and instead environmental class 2 and 1 are more common. In the inventory the mix of environmental class 1-3 used each year is taken into account when calculating a NCV, which is appropriate for each year. Year specific NCVs for diesel are shown in Table A2-4.

Table A2-4 Thermal values (NCV) for diesel except navigation and railways.

Years	NCV (GJ/m3)
1990	35.82
1991	35.69
1992	35.55
1993	35.40
1994	35.43
1995	35.44
1996	35.36
1997	35.34
1998	35.33
1999-2000	35.31
2001-2006	35.29
2007-2014	35.28

NCVs for different oils (except oils used in navigation) are based on information from the Swedish Petroleum and Biofuel Institute (SPBI), which in turn is based on information from oil companies and is crosschecked with Swedish standards for calculating NCVs. NCVs for marine diesel oil, marine gas oil and residual fuel oil used for navigation are based on SMED study from 2004.¹⁷

NCVs for refinery gases and other oils in refineries are specific for each operator and fuel. Data on consumption of fuels in t (or sometimes m³) and corresponding NCVs are collected. Activity data for these fuels, used by refineries and chemical industries, is for 2007 and later mainly taken from the EU ETS system, and in most cases plant specific NCVs of excellent quality are also reported and used in the GHG inventory. In other cases, NCVs from the environmental reports are used.

In submission 2010, the NCVs for gasoline, aviation kerosene and aviation gasoline were revised following a SMED Study. The conclusion of the study was that NCVs used for these fuels before submission 2010 were not well documented. NCVs according to the 2006 IPCC Guidelines are now used, since the NCVs used earlier for these fuels were concluded to be of questionable quality. There is no

¹⁶ <http://www.spi.se/produkter.asp?art=48> , 2005-10-17.

¹⁷ Cooper & Gustafsson, 2004.

indication that carbon content or NCV for aviation kerosene and aviation gasoline solid in Sweden should differ from international standards. The properties of aviation fuels are normally the same in all countries, and hence it is appropriate to use the values recommended by IPCC. The NCV for gasoline used since submission 2010 is from SPBI and relies on fuel analyses.¹⁸

The NCV for petroleum coke is based on information from consumers taken from the different energy surveys done by Statistics Sweden and is therefore considered to be of good quality. The NCV for diesel used for stationary combustion is according to SPI likely approximately the same mix of environmental classes as mobile diesel for each year. Using the same NCVs as for mobile diesel therefore give correct time series.

In 1990-2010, naphtha was used as raw material for production of gas works gas. Since 2011, liquefied natural gas is used instead. However, the gas is mixed with air and the quality of the gas delivered to the transmission net (in terms of methane content and NCV) is stated to be similar to how it was before the change of feed-stock¹⁹. Hence, the same NCVs and emission factors are used for gas works gas for 2011 as for earlier years. Since natural gas liquids are allocated to liquid fuels in the CRF reporter in table 1.Ab, we have chosen to allocate the gas works gas consumed in 2011 to liquid fuels also in the sectoral approach.

2.2.2 Solid fuels and peat

For coke oven gas, blast furnace gas and steel converter gas the NCVs change between years, but there is no trend in the changes, just annual fluctuations due to the quality of used primary fuels each year. NCVs used in the inventory are based on annual information from the consumers (quite few) on actual energy content, and the quality of the NCV is considered to be very good.

For carbon products such as coal and coke, it is difficult to establish the NCV due to lack of information on energy content in imported fuels. For 2007, NCVs reported from the consumers are used when available. Slightly more than half of the reported observations of combusted coal in the energy statistics include specific NCVs. For coke, this share is about 75 %.

Where no NCV is reported, the standard NCV provided from the Swedish Energy Agency is used.

2.2.3 Gaseous fuels

Natural gas is a non-processed primary fuel, and hence the NCV changes between years, however without any trend. All natural gas consumed in Sweden is imported

¹⁸ Paulrud et al. 2010

¹⁹ Stockholm Gas, 2012

from Denmark. Statistics Sweden receives annual information on current NCVs for natural gas from the Danish Energy Authority. NCVs for 2001 and later years are according to information from the Danish Energy Authority. NCVs for 1990-2000 are taken from the Danish NIR submission 2004. During 2010, the Danish NIR submission 2010 was checked and it turned out that these NCVs were also received from the Danish Energy Authority. Hence, the time series is considered to be consistent. From 2010 and onwards, annual averages of the NCVs measured at the import point are used.²⁰ The NCVs used are shown below in Table A2-5.

²⁰ Swedegas, 2014

Table A2-5 Net calorific values (NCV) for natural gas, all consumption.

Years	NCV (GJ/m ³)
1990-92	39.00
1993-96	39.30
1997	39.60
1998	39.90
1999	40.00
2000	40.15
2001	39.97
2002	40.03
2003	39.94
2004	39.77
2005	39.67
2006	39.54
2007	39.59
2008	39.49
2009	39.46
2010	39.45
2011	39.50
2012	39.55
2013	39.04
2014	39.45

2.2.4 Biomass

Data for 2006 and earlier for wood, black liquor, tall oil, landfill gas and other biomass, other petroleum fuels, other solid fuels and other not specified fuels is reported to Statistics Sweden by surveyed consumers in toe, and the conversion factors are thereby set to 41.87 GJ/toe for these fuels. For 2007 and later years, this is true for NFR 1.A.4. For the other sectors, only black liquor is reported in toe. Other biomass is reported in several different units, e.g. t, m³ or MWh, and thermal values are often reported together with the quantity. These NCVs are considered to be accurate.

The net calorific value for ethanol is provided by SPBI²¹ and is 21.2 GJ/m³ or 26.9 MJ/kg.

2.2.5 Other fuels

Data for waste and other not specified fuels is reported to Statistics Sweden through a survey to consumers in toe, and the conversion factors are thereby set to 41.87 GJ/toe for these fuels. In 2007 and later, waste was combusted within NFR 1A1a only and the reporting units used were t and MWh. The NCVs for waste reported by the consumers are considered to be accurate, and thus these thermal values were used for 2007 and later. For other not specified fuels the reporting units vary, and reported NCVs are used (sometimes, the fuel quantities are reported in an energy unit, e.g. MWh).

²¹ Swedish Petroleum and Biofuel Institute. www.spbi.se

2.3 Emission factors

Emission factors for SO₂ depend on the content of sulphur in the fuels and on the efficiency of existing emission abatement equipment, for instance if scrubbers are used.

Other emission factors depend on area of consumption and/or the combustion technique used. The efficiency of emission control in the plant is also important. Therefore, these emission factors change over the years as ovens, combustion technique and emission control used becomes better. All emission factors used in stationary combustion in submission 2014 are published on Swedish EPA's website²²

The spread sheets also contain implied emission factors for mobile combustion. Emission factors for selected substances and years are also shown in tables in the following section.

2.3.1 Stationary combustion and fugitive emissions

National emission factors used in Submission 2004 and earlier were calculated by the Swedish EPA for 1990-1995. For 1996-2002, the same emission factors as for 1995 were applied. The emission factors were used for emissions from stationary combustion (and for fugitive emissions where no other sources were available). They are based on results of measurements and national studies as well as studies of international emission factors and judgements of their relevance to national conditions. Emission factors depend on the type of fuel, and the type of plant and abatement equipment.

During 2004, an inventory and review of emission factors for stationary combustion was conducted. The basis for this inventory was reported data from different national sources, such as the company's environmental reports, research reports etc. The study focused on common fuel types where the existing emission factors were uncertain or known to be inaccurate. The study is published in a SMED report.²³ The primary aim was to revise emission factors for stationary combustion for 1996-2002, but in a few cases it was necessary to revise emission factors for the early 1990s as well, to avoid inconsistencies. It was not possible to study existing emission factors for 1990-1995 in more detail since documentation and/or data sources were insufficient for these years.

In a study conducted by SMED in 2006²⁴, new specific emission factors for refinery gas and refinery oil were developed for the whole time series 1990-2004, which are applied since submission 2007.

²² www.naturvardsverket.se

²³ Boström et al. 2004

²⁴ Nyström & Skärman, 2006

For some fuels, no specific emission factors are available and thus emission factors from similar, more common fuels are used. Fuels concerned are specified in Table A2-6. For all substances, the emission factors for combustion of solid waste are the same for the biogenic and the fossil fraction.

Table A2-6 Fuel types for which specific emission factors are not available in the inventory.

Fuel type	Emission factor used
Kerosene	Gas/diesel oil
Landfill gas	Natural gas
Other biomass	Wood
Other petroleum fuels	Swedish default for "other fuels"
Other solid fuels	Swedish default for "other fuels"
Other not specified fuels	Swedish default for "other fuels"
Refinery gases	Swedish default for "other fuels" except for SO ₂ and NO _x where national values are used

NMVOC

During 2002, an inventory and review of emission factors for NMVOC, 1988-2001, was conducted. For stationary combustion and fugitive emissions within the energy sector, emission factors were derived and used together with activity data from the official national energy statistics to calculate emissions. The emission factors developed for conditions during 1990-2001 are based on knowledge on the technical development and the general effects of that, as mentioned above. The known effects of this general development has been combined with information from companies legal Environmental Reports, where actual emission factors can be derived, and information from trade associations where experts have contributed their specific knowledge on the different sectors where combustion occurs. The study is published in a SMED report.²⁵ Resulting emission factors have been used since submission 2003. Emission factors used in submission 2014 are shown below in Table A2-7 (selected years). Emission factors for small scale biomass combustion in households are shown in a separate table (Table A2-16).

²⁵ Kindbom et al., 2003.

Table A2-7 Emission factors for NMVOC (kg/GJ), stationary combustion.

Fuel type	Sector	1990	1995	2000-2014
Blast furnace gas	Power plants, distr.heating, industry (1A1-2)	0.002	0.002	0.002
Coke	Industry (1A2)	0.008	0.008	0.008
Coke	Other consumption (1A4)	0.1	NO	NO
Coke oven gas	Power plants, distr.heating, industry (1A1-2)	0.002	0.002	0.002
Coal	District heating (1A1a)	0.008	0.008	0.008
Coal	Publ. electricity and power plants (1A1a)	0.005	0.005	0.005
Coal	Industry (1A2)	0.008	0.008	0.008
Coal	Other consumption (1A4)	0.1	0.1	NO
Domestic heating oil	Power plants and district heating (1A1a)	0.002	0.002	0.002
Domestic heating oil	Industry (1A2)	0.002	0.002	0.002
Domestic heating oil	Other consumption (1A4)	0.003	0.006	0.006
Gas works gas	All consumption (1A1, 1A2, 1A4)	0.002	0.001	0.001
Kerosene	Power plants, distr.heating, industry (1A1-2)	0.002	0.002	0.002
LPG	District heating (1A1a)	0.002	0.001	0.001
LPG	Industry (1A2)	0.002	0.001	0.001
LPG	Other consumption (1A4)	0.001	0.001	0.001
LPG	Publ. electricity and power plants (1A1a)	0.002	0.002	NO
Landfill gas	District heating (1A1a)	NO	0.001	0.001
Landfill gas	Industry (1A2)	NO	0.001	0.001
Landfill gas	Publ. electricity and power plants (1A1a)	NO	0.002	0.002
Methane etc.	Industry (1A2)	0.002	0.001	0.001
Natural gas	District heating (1A1a)	0.002	0.001	0.001
Natural gas	Industry (1A2)	0.002	0.001	0.001
Natural gas	Other consumption (1A4)	0.001	0.001	0.001
Natural gas	Publ. electricity and power plants (1A1a)	0.002	0.002	0.002
Other biomass	Power plants, distr.heating, industry (1A1-2)	0.1	0.05	0.02
Other non specified	Power plants, distr.heating, industry (1A1-2)	0.002	0.002	0.002
Other p. fuels	Power plants, distr.heating, industry (1A1-2)	0.002	0.002	0.002
Other solid fuels	Power plants, distr.heating, industry (1A1-2)	0.002	0.002	0.002
Peat	Power plants, distr.heating, industry (1A1-2)	0.05	0.05	0.05
Petroleum coke	Industry (1A2)	0.008	0.008	0.008
Refinery gas	Industry (1A1b)	0.002	0.002	0.002
Refinery oil	Industry (1A1b)	0.003	0.003	0.003
Residual fuel oil	Other consumption (1A4)	0.006	0.006	0.006
Residual fuel oil	Power plants, distr.heating, industry (1A1,1A2)	0.003	0.003	0.003
Solid waste	District heating (1A1a)	0.025	0.005	0.005
Solid waste	Industry (1A2)	0.025	0.01	NO
Solid waste	Publ. electricity and power plants (1A1a)	0.005	0.005	0.005
Steel converter gas	Power plants and district heating (1A1a)	NO	NO	0.002
Tall oil	Power plants, distr.heating, industry (1-2)	0.003	0.003	0.003
Wooden fuels	District heating (1A1a)	0.1	0.05	0.02
Wooden fuels	Industry (1A2)	0.1	0.05	0.02
Wooden fuels	Other consumption (1A4)	0.3	0.3	0.3
Wooden fuels	Publ. electricity and power plants (1A1a)	0.05	0.05	0.02

EMISSION FACTORS FOR SO₂ AND NO_x FROM REFINERY OIL AND GAS

In a study conducted by SMED in 2006²⁶, new specific emission factors for refinery gas and refinery oil were developed for the whole time series 1990-2004, which are applied since submission 2007. In another SMED study in 2008²⁷, new emission factors for SO₂ from refinery oil 2005 and later and NO_x from refinery gas 2006 and later were developed. These revised values are used since submission 2011.

EMISSION FACTORS FOR SO₂, NO_x AND PARTICLES WITHIN THE PULP AND PAPER INDUSTRY (NFR 1A2D)

Normally, national emission factors for SO₂, NO_x and particles are used for stationary combustion of all fuels in NFR 1A1 and 1A2, see Table A2-8 and Table A2-9. For the pulp and paper industry, however, a study performed in 2009 showed that these emission factors give systematic overestimations of the emissions of SO₂, NO_x and particles in this industry. The study covered the years 2001-2007 and plants accounting for 80-90% of the emissions within NFR 1A2d. As there was not enough information to trace the overestimation to certain fuels, it was decided to apply "reduction factors" calculated in the study for emissions of SO₂, NO_x and particles from the pulp and paper industry for emission years 2000 and later. These reduction factors are used for all fuels and calculated as the average ratio between total combustion-related emissions from environmental reports and the corresponding emissions calculated with national emission factors. The average ratios over the period 2002-2007 are used since submission 2010 for all years 2000 and later.²⁸

Emission factors for NO_x and SO₂ used for stationary combustion are shown in Table A2-8 and Table A2-9. Emission factors for small scale biomass combustion in households are shown in a separate table (Table A2-16).

²⁶ Nyström & Skårman, 2006

²⁷ Skårman et al, 2008

²⁸ The study was never published but the results were documented in Excel files submitted to SEPA in 2009.

Table A2-8 Emission factors for NO_x (kg/GJ), stationary combustion.

Fuel type	Sector	1990	1995	2005	2010-2014
Coke	All consumption	0.15	0.15	0.15	0.15
Coal	Industry (1A2)	0.2	0.15	0.15	0.15
Coal	Lime production (part of 1A2g)	0.2	0.2	0.2	0.2
Coal	Mining industry (part of 1A2g)	NO	0.7	0.55	0.55
Coal	Other consumption (1A4)	0.2	0.15	NO	NO
Coal	Power plants and district heating (1A1a)	0.2	NO	0.08	0.08
Domestic heating oil	All consumption except Gas turbines	0.07	0.05	0.05	0.05
Domestic heating oil	Gas turbine/diesel Power generation (part of 1A1a)	0.6	0.2	0.2	0.2
Gas works gas	Other consumption (1A4)	0.05	0.05	0.05	0.05
Gas works gas	Power plants, district heating and industries (1A1, 1A2)	0.07	0.07	0.07	0.07
Hydrogen	Industry (1A2)	NO	NO	NO	0.1
Kerosene	Power plants, district heating and industries (1A1, 1A2)	0.07	0.07	0.07	0.07
LPG	Other consumption (1A4)	0.05	0.05	0.05	0.05
LPG	Power plants, district heating and industries (1A1, 1A2)	0.07	0.07	0.07	0.07
Landfill gas	All consumption	NO	0.05	0.05	0.05
Methane etc.	Industry (1A2)	0.06	0.05	0.05	0.05
Natural gas	Power- and heating plants and industries (1A1, 1A2)	NO	0.05	0.05	0.05
Other biomass	All consumption	0.12	0.11	0.11	0.11
Other non specified	All consumption	0.1	0.1	0.1	0.1
Other petroleum fuels	All consumption	0.1	0.1	0.1	0.1
Other solid fuels	All consumption	0.1	0.1	0.1	0.1
Peat	All consumption	0.19	0.1	0.07	0.07
Petroleum coke	All consumption	0.15	0.15	0.15	0.15
Refinery gas	All consumption	0.076	0.062	0.038	0.03
Refinery oil	All consumption	0.06	0.06	0.06	0.06
Residual fuel oil	Gas turbine/diesel Power generation (part of 1A1a)	0.3	0.2	NO	NO
Residual fuel oil	Mining industry (part of 1A2g)	0.65	0.65	0.65	0.65
Residual fuel oil	Other Power- and heating plants and industries (1A1, 1A2)	0.17	0.08	0.06	0.06
Residual fuel oil	Other consumption (1A4)	0.17	0.1	0.1	0.1
Solid waste	Industry (1A2)	0.09	0.09	NO	NO
Solid waste	Power plants and district heating (1A1a)	0.09	0.09	0.05	0.05
Tall oil	All consumption	0.1	0.13	0.13	0.13
Wooden fuels	Industry (1A2)	0.12	0.11	0.08	0.08
Wooden fuels	Other consumption (1A4)	0.08	0.08	0.08	0.08
Wooden fuels	Power plants and district heating (1A1a)	0.12	0.08	0.06	0.06

Table A2-9 Emission factors for SO₂ (kg/GJ), stationary combustion.

Fuel type	Sector	1990	1995	2005	2010-2014
Coke	Other consumption (1A4)	0.48	NO	NO	NO
Coke	Power plants, district heating and industries (1A1, 1A2)	0.36	0.36	0.36	0.36
Coal	Lime production (part of 1A2g)	0.1	0.1	0.05	0.05
Coal	Mining industry (part of 1A2g)	NO	0.27	0.12	0.12
Coal	Other consumption (1A4)	0.36	0.2	NO	NO
Coal	Other industries, Power plants and district heating (1A1, 1A2)	0.36	0.13	0.1	0.1
Diesel oil	All consumption	0.047	0.014	0.0005	0.0005
Domestic heating oil	Gas turbine/diesel Power generation (part of 1A1a)	0.15	0.07	0.05	0.05
Domestic heating oil	Other Power- and heating plants and industries (1A1, 1A2)	0.04	0.04	0.025	0.025
Domestic heating oil	Other consumption (1A4)	0.08	0.04	0.025	0.025
Kerosene	All consumption	0.014	0.014	0.014	0.014
Landfill gas	All consumption	NO	NA	NA	NA
Methane etc.	Industry (1A2)	0.002	NA	NA	NA
Natural gas	All consumption	0.002	NA	NA	NA
Other biomass	All consumption	0.04	0.04	0.04	0.04
Other non specified	All consumption	0.24	0.15	0.15	0.15
Other petroleum fuels	All consumption	0.24	0.15	0.15	0.15
Other solid fuels	All consumption	0.24	0.15	0.15	0.15
Peat	All consumption	0.22	0.15	0.13	0.13
Petroleum coke	All consumption	0.36	0.36	0.36	0.36
Refinery gas	All consumption	0.011	0.002	0.002	0.002
Refinery oil	All consumption	0.53	0.26	0.15	0.15
Residual fuel oil	All consumption except Gas turbines and lime production	0.24	0.18	0.09	0.09
Residual fuel oil	Gas turbine/diesel Power generation (part of 1A1a)	0.48	0.2	NO	NO
Residual fuel oil	Lime production (part of 1A2g)	NO	NO	NO	0.15
Solid waste	Industry (1A2)	0.025	0.025	NO	NO
Solid waste	Power plants and district heating (1A1a)	0.025	0.025	0.025	0.025
Tall oil	All consumption	0.14	0.14	0.1	0.1
Wooden fuels	Other consumption (1A4)	0.01	0.01	0.01	0.01
Wooden fuels	Power plants, district heating and industries (1A1, 1A2)	0.04	0.25	0.02	0.02

PARTICLES, METALS, DIOXIN

The emission factors developed by SMED for calculation of emissions of particles, metals, dioxin from stationary combustion are based on information from many different sources²⁹.

Emission factors used for the period 1980–1989, are mostly based on results from a large research program during the 80's concerning many aspects of combustion of coal for power generation, known as "Kol Hälsa Miljö" (Coal Health Environment). During that project information was compiled regarding emissions of different substances from coal combustion, but also from combustion of other fuels. Other national research programs concerning combustion of municipal waste (Energi ur Avfall, Energy from Waste), the use of peat (Torv Hälsa Miljö, Peat Health Environment) and natural gas (Naturgas Hälsa Miljö, Natural Gas Health Environment) were conducted in the same time period. RVF - The Swedish Association of Waste Management has supplied additional information concerning large scale municipal solid waste incineration, especially relating to dioxins.

The emission factors for 1990-2003 are based on knowledge on the general effects of technical development combined with information from companies' environmental reports (where actual emission factors can be derived), and information from trade associations where experts on different sectors have contributed with their specific knowledge. The emission factors from 2004 are derived through extrapolation of the 2003 values.

From approximately 1990, emissions have decreased for most stationary sources due to the technical development of abatement measures in combination with regulations and requirements from authorities. Installation of electrostatic precipitator or bag house filters, as an example, has become standard on large combustion sources. This primarily reduces the TSP emissions. Combustion of MSW also became strictly regulated, and as a consequence of that, flue gas cleaning equipment of different types was installed to reduce emissions primarily of dioxins and mercury. In the district heating sector, installation of flue gas condensation equipment has become common since the beginning of the 1990's to increase the heat output, but it also reduces emissions to air of many substances.

For the 2008 submission, reporting of BaP emissions was introduced in the Swedish inventory for 1990 and later years. Emission factors were developed by SMED³⁰ and are applied to the energy statistics since submission 2008.

In 2008, emission factors for particles from refinery oil and refinery gas were investigated in a SMED study³¹. As a result of this study, the emission factors for

²⁹ Boström et al., 2003

³⁰ Paulrud et al., 2007

TSP and PM_{2.5} for refinery oil 1990 and later years, and emission factors for TSP, PM₁₀ and PM_{2.5} for refinery gas for 1998 and later years were revised in submission 2010. The emission factors used since submission 2010 are the default factors from EMEP/EEA air pollutant emission inventory guidebook, 2009.

Emission factors for TSP, PM₁₀ and PM_{2.5} used for stationary combustion are shown in Table A2-10 to Table A2-12. Emission factors for small scale biomass combustion in households are shown in a separate table (Table A2-16).

³¹ Skårman et al. 2008

Table A2-10 Emission factors for TSP (kg/GJ), stationary combustion.

Fuel type	Sector	1990	1995	2005	2010-2014
Coke	Industry (1A2)	0.045	0.04	0.03	0.03
Coke	Other consumption (1A4)	0.14	NO	NO	NO
Coal	Industry (1A2)	0.045	0.04	0.03	0.03
Coal	Other consumption (1A4)	0.14	0.12	NO	NO
Coal	Power plants and district heating	0.035	0.03	0.02	0.02
Domestic heating oil	Other consumption (1A4)	0.007	0.005	0.003	0.003
Domestic heating oil	Power plants, district heating and industries	0.006	0.003	0.002	0.002
Gas works gas	Other consumption (1A4)	0.0005	0.0005	0.0005	0.0005
Gas works gas	Power plants, district heating and industries	0.0001	0.0001	0.0001	0.0001
Kerosene	All consumption	0.006	0.003	0.002	0.002
LPG	Other consumption (1A4)	0.0002	0.0002	0.0002	0.0002
LPG	Power plants, district heating and industries	0.0001	0.0001	0.0001	0.0001
Landfill gas	Power plants, district heating and industries	NO	0.0001	0.0001	0.0001
Methane etc.	Industry (1A2)	0.0001	0.0001	0.0001	0.0001
Natural gas	Other consumption (1A4)	0.0005	0.0005	0.0005	0.0005
Natural gas	Power plants, district heating and industries	0.0001	0.0001	0.0001	0.0001
Other biomass	Industry (1A2)	0.065	0.055	0.04	0.04
Other biomass	Power plants and district heating	NO	0.05	0.035	0.035
Other non specified	All consumption	0.06	0.05	0.035	0.035
Other petroleum fuels	All consumption	0.06	0.05	0.035	0.035
Other solid fuels	All consumption	0.06	0.05	0.035	0.035
Peat	Power plants, district heating and industries	0.065	0.05	0.035	0.035
Petroleum coke	Industry (1A2)	0.045	0.04	0.03	0.03
Refinery gas	Industry (1A1b)	0.06	0.05	0.005	0.005
Refinery oil	Industry (1A1b)	0.03	0.03	0.03	0.03
Residual fuel oil	Other consumption (1A4)	0.015	0.015	0.015	0.015
Residual fuel oil	Power plants, district heating and industries	0.01	0.01	0.01	0.01
Solid waste	Industry (1A2)	0.005	0.0014	NO	NO
Solid waste	Power plants and district heating	0.005	0.0014	0.0009	0.0009
Tall oil	All consumption	0.006	0.003	0.002	0.002
Wooden fuels	Industry (1A2)	0.065	0.055	0.04	0.04
Wooden fuels	Other consumption (1A4)	0.15	0.15	0.15	0.15
Wooden fuels	Power plants and district heating	0.06	0.05	0.035	0.035

Table A2-11 Emission factors for PM₁₀ (kg/GJ), stationary combustion.

Fuel type	Sector	1990	1995	2005	2010-2014
Coke	Industry (1A2)	0.0374	0.0332	0.0249	0.0249
Coke	Other consumption (1A4)	0.07	NO	NO	NO
Coal	Industry (1A2)	0.0315	0.028	0.021	0.021
Coal	Other consumption (1A4)	0.07	0.06	NO	NO
Coal	Power plants and district heating	0.0333	0.0285	0.019	0.019
Domestic heating oil	Other consumption (1A4)	0.007	0.005	0.003	0.003
Domestic heating oil	Power plants, district heating and industries	0.006	0.003	0.002	0.002
Ethanol	Industry (1A2)	NO	NO	NO	0.0344
Gas works gas	Other consumption (1A4)	0.0005	0.0005	0.0005	0.0005
Gas works gas	Power plants, district heating and industries	0.0001	0.0001	0.0001	0.0001
Kerosene	All consumption	0.006	0.003	0.002	0.002
LPG	Other consumption (1A4)	0.0002	0.0002	0.0002	0.0002
LPG	Power plants, district heating and industries	0.0001	0.0001	0.0001	0.0001
Landfill gas	Power plants, district heating and industries	NO	0.0001	0.0001	0.0001
Methane etc.	Industry (1A2)	0.0001	0.0001	0.0001	0.0001
Natural gas	Other consumption (1A4)	0.0005	0.0005	0.0005	0.0005
Natural gas	Power plants, district heating and industries	0.0001	0.0001	0.0001	0.0001
Other biomass	Industry (1A2)	0.05395	0.0473	0.0344	0.0344
Other biomass	Power plants and district heating	NO	0.0475	0.0333	0.0333
Other non specified	All consumption	0.06	0.05	0.035	0.035
Other petroleum fuels	All consumption	0.06	0.05	0.035	0.035
Other solid fuels	All consumption	0.06	0.05	0.035	0.035
Peat	Power plants, district heating and industries	0.05525	0.045	0.0315	0.0315
Petroleum coke	Industry (1A2)	0.03735	0.0332	0.0249	0.0249
Refinery gas	Industry (1A1b)	0.06	0.05	0.005	0.005
Refinery oil	Industry (1A1b)	0.01	0.01	0.01	0.01
Residual fuel oil	Other consumption (1A4)	0.015	0.015	0.015	0.015
Residual fuel oil	Power plants, district heating and industries	0.01	0.01	0.01	0.01
Solid waste	Industry (1A2)	0.005	0.0014	NO	NO
Solid waste	Power plants and district heating	0.0045	0.00133	0.000855	0.000855
Tall oil	All consumption	0.006	0.003	0.002	0.002
Wooden fuels	Industry (1A2)	0.05395	0.0473	0.0344	0.0344
Wooden fuels	Other consumption (1A4)	0.15	0.15	0.15	0.15
Wooden fuels	Power plants and district heating	0.0558	0.0475	0.03325	0.03325

Table A2-12 Emission factors for PM_{2.5} (kg/GJ), stationary combustion.

Fuel type	Sector	1990	1995	2005	2010-2014
Coke	Industry (1A2)	0.0315	0.028	0.021	0.021
Coke	Other consumption (1A4)	0.035	NO	NO	NO
Coal	Industry (1A2)	0.0135	0.012	0.009	0.009
Coal	Other consumption (1A4)	0.035	0.03	NO	NO
Coal	Power plants and district heating	0.0291	0.0249	0.0166	0.0166
Domestic heating oil	Other consumption (1A4)	0.007	0.005	0.003	0.003
Domestic heating oil	Power plants, district heating and industries	0.006	0.003	0.002	0.002
Gas works gas	Other consumption (1A4)	0.0005	0.0005	0.0005	0.0005
Gas works gas	Power plants, district heating and industries	0.0001	0.0001	0.0001	0.0001
Kerosene	All consumption	0.006	0.003	0.002	0.002
LPG	Other consumption (1A4)	0.0002	0.0002	0.0002	0.0002
LPG	Power plants, district heating and industries	0.0001	0.0001	0.0001	0.0001
Landfill gas	Power plants, district heating and industries	NO	0.0001	0.0001	0.0001
Methane etc.	Industry (1A2)	0.0001	0.0001	0.0001	0.0001
Natural gas	Other consumption (1A4)	0.0005	0.0005	0.0005	0.0005
Natural gas	Power plants, district heating and industries	0.0001	0.0001	0.0001	0.0001
Other biomass	Industry (1A2)	0.0455	0.0385	0.028	0.028
Other biomass	Power plants and district heating	NO	0.035	0.0245	0.0245
Other non specified	All consumption	0.06	0.05	0.035	0.035
Other petroleum fuels	All consumption	0.06	0.05	0.035	0.035
Other solid fuels	All consumption	0.06	0.05	0.035	0.035
Peat	Power plants, district heating and industries	0.0423	0.035	0.0245	0.0245
Petroleum coke	Industry (1A2)	0.0315	0.028	0.021	0.021
Refinery gas	Industry (1A1b)	0.06	0.05	0.005	0.005
Refinery oil	Industry (1A1b)	0.005	0.005	0.005	0.005
Residual fuel oil	Other consumption (1A4)	0.0125	0.0125	0.0125	0.0125
Residual fuel oil	Power plants, district heating and industries	0.0083	0.0083	0.0083	0.0083
Solid waste	Industry (1A2)	0.004	0.0012	NO	NO
Solid waste	Power plants and district heating	0.004	0.0012	0.0008	0.0008
Tall oil	All consumption	0.006	0.003	0.002	0.002
Wooden fuels	Industry (1A2)	0.0455	0.0385	0.028	0.028
Wooden fuels	Other consumption (1A4)	0.15	0.15	0.15	0.15
Wooden fuels	Power plants and district heating	0.042	0.035	0.0245	0.0245

EMISSION FACTORS FOR BLACK CARBON

An inventory of emissions of black carbon in Sweden was made for the first time in 2014. Emissions are reported for the years 2000 and later. Methods and emission factors used are described in a separate report³². BC emissions from stationary combustion were estimated according to the EMEP/EEA guidebook³³ throughout the sectors 1.A.1, 1.A.2 and 1.A.4. The general approach is to multiply the emission factor for PM_{2.5} with a fraction as specified in the guidebook.

EMISSIONS FACTORS FOR PCB, HCB AND PAH

Emission factors for PCB, HFC and PAHs were during 2015 estimated within a development project³⁴. Emission factors for PAHs were estimated according to the sum of PAH1-4. The sum of PAH-4 and benzo(a)pyrene was fractionised in benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene according to the EMEP/EEA guidebook³⁵. Thus, the emissions for the total PAHs will be the same as reported before but the fraction is now enabled. Emission factors for PCB and HFC were taken from the EMEP/EEA guidebook.

Emission factors for PCB are found in Table A2-13. New emission factors for HCB are found in Table A2-14. Emission factors for PAHs in submission 2016 are found in Table A2-15.

³² Skärman et.al., 2014

³³ EEA, 2013

³⁴ Allerup, J., Eklund, V., Szudy, M., Viklund, L. 2015.

³⁵ EEA, 2013

Table A2-13 Emission factors for PCB (µg/GJ), stationary combustion.

Fuel type	Sector	1990	1995	2005	2010-2014
Coke	Industry	170	170	170	170
Coking coal	Industry	170	170	170	170
Coking coal	Power pl. and district heating	0.033	0.033	0.033	0.033
Other biomass	Industry	0.06	0.06	0.06	0.06
Other biomass	Power pl. and district heating	NA	3.5	3.5	3.5
Other biomass	Small scale combustion	NA	NA	0.06	0.06
Other non specified	Industry	0.00034	0.00034	0.00034	0.00034
Other non specified	Power pl. and district heating	0.00034	0.00034	0.00034	0.00034
Other non specified	Small scale combustion	NA	NA	0.00034	0.00034
Other solid fuels	Industry	0.00034	0.00034	0.00034	NA
Other solid fuels	Power pl. and district heating	NA	NA	0.00034	NA
Peat	Industry	170	170	170	170
Peat	Power pl. and district heating	0.033	0.033	0.033	0.033
Tall oil	Industry	0.06	0.06	0.06	0.06
Tall oil	Power pl. and district heating	NA	3.5	3.5	3.5
Waste	Industry	0.00034	0.00034	NA	NA
Waste	Power pl. and district heating	0.00034	0.00034	0.00034	0.00034
Wooden fuels	Industry	0.06	0.06	0.06	0.06
Wooden fuels	Power pl. and district heating	3.5	3.5	3.5	3.5
Wooden fuels	Small scale combustion	0.06	0.06	0.06	0.06
Coke	Industry	170	170	170	170
Coking coal	Industry	170	170	170	170
Coking coal	Power pl. and district heating	0.033	0.033	0.033	0.033
Other biomass	Industry	0.06	0.06	0.06	0.06
Other biomass	Power pl. and district heating	NA	3.5	3.5	3.5
Other biomass	Small scale combustion	NA	NA	0.06	0.06
Other non specified	Industry	0.00034	0.00034	0.00034	0.00034
Other non specified	Power pl. and district heating	0.00034	0.00034	0.00034	0.00034
Other non specified	Small scale combustion	NA	NA	0.00034	0.00034
Other solid fuels	Industry	0.00034	0.00034	0.00034	NA
Other solid fuels	Power pl. and district heating	NA	NA	0.00034	NA
Peat	Industry	170	170	170	170
Peat	Power pl. and district heating	0.033	0.033	0.033	0.033

Table A2-14 Emission factors for HCB (µg/GJ), stationary combustion.

Fuel type	Sector	1990	1995	2005	2010-2014
Coke	Industry	0.62	0.62	0.62	0.62
Coking coal	Industry	0.62	0.62	0.62	0.62
Coking coal	Power plants and district heating	6.7	6.7	6.7	6.7
Other biomass	Industry	5	5	5	5
Other biomass	Power plants and district heating	NA	5	5	5
Other biomass	Small scale combustion	NA	NA	5	5
Other non specified	Industry	4.52	4.52	4.52	4.52
Other non specified	Power plants and district heating	4.52	4.52	4.52	4.52
Other non specified	Small scale combustion	NA	NA	4.52	4.52
Other solid fuels	Industry	4.52	4.52	4.52	NA
Other solid fuels	Power plants and district heating	NA	NA	4.52	NA
Peat	Industry	0.62	0.62	0.62	0.62
Peat	Power plants and district heating	6.7	6.7	6.7	6.7
Tall oil	Industry	5	5	5	5
Tall oil	Power plants and district heating	NA	5	5	5
Waste	Industry	4.52	4.52	NA	NA
Waste	Power plants and district heating	4.52	4.52	4.52	4.52
Wooden fuels	Industry	5	5	5	5
Wooden fuels	Power plants and district heating	5	5	5	5
Wooden fuels	Small scale combustion	5	5	5	5

Table A2-15 Emission factors for PAH (µg/GJ), stationary combustion.

Fuel type	Sector	Ben- zo(a)pyr- ene	Ben- zo(b)fl- uoran- thene	In- denopy- rene	PAH_1 _4
Coke	Industry	170	170	170	170
Coking coal	Industry	170	170	170	170
Coking coal	Power pl. and district heating	0.033	0.033	0.033	0.033
Other biomass	Industry	0.06	0.06	0.06	0.06
Other biomass	Power pl. and district heating	NA	3.5	3.5	3.5
Other biomass	Small scale combustion	NA	NA	0.06	0.06
Other non sp.	Industry	0.00034	0.00034	0.00034	0.00034
Other non sp.	Power pl. and district heating	0.00034	0.00034	0.00034	0.00034
Other non sp.	Small scale combustion	NA	NA	0.00034	0.00034
Other solid fuels	Industry	0.00034	0.00034	0.00034	NA
Other solid fuels	Power pl. and district heating	NA	NA	0.00034	NA
Peat	Industry	170	170	170	170
Peat	Power pl. and district heating	0.033	0.033	0.033	0.033
Tall oil	Industry	0.06	0.06	0.06	0.06
Tall oil	Power pl. and district heating	NA	3.5	3.5	3.5
Waste	Industry	0.00034	0.00034	NA	NA
Waste	Power pl. and district heating	0.00034	0.00034	0.00034	0.00034
Wooden fuels	Industry	0.06	0.06	0.06	0.06

Fuel type	Sector	Ben- zo(a)pyr- ene	Ben- zo(b)fl- uoran- thene	In- denopy- rene	PAH_1 _4
Wooden fuels	Power pl. and district heating	3.5	3.5	3.5	3.5
Wooden fuels	Small scale combustion	0.06	0.06	0.06	0.06
Coke	Industry	170	170	170	170
Coking coal	Industry	170	170	170	170
Coking coal	Power pl. and district heating	0.033	0.033	0.033	0.033
Other biomass	Industry	0.06	0.06	0.06	0.06
Other biomass	Power pl. and district heating	NA	3.5	3.5	3.5
Other biomass	Small scale combustion	NA	NA	0.06	0.06
Other non sp.	Industry	0.00034	0.00034	0.00034	0.00034
Other non sp.	Power pl. and district heating	0.00034	0.00034	0.00034	0.00034
Other non sp.	Small scale combustion	NA	NA	0.00034	0.00034
Other solid fuels	Industry	0.00034	0.00034	0.00034	NA
Other solid fuels	Power pl. and district heating	NA	NA	0.00034	NA
Peat	Industry	170	170	170	170
Peat	Power pl. and district heating	0.033	0.033	0.033	0.033

EMISSION FACTORS FOR COMBUSTION OF BIOMASS IN HOUSEHOLDS

In submission 2005 and earlier, only one emission factor for each gas for combustion of biomass in households was accounted for, including all technologies and all biomass fuel types. Due to the significant variation in emissions from different kinds of residential biomass systems depending on type of combustion system, type of fuel and operating conditions, studies on biomass fuel consumption and emission factors in the residential sector were performed in 2005 and 2006.

In submission 2006, time series of activity data and CH₄ emission factors were reviewed and updated.³⁶ New methane emission factors for small scale combustion of wood log, pellets and wood chips/sawdust were determined (Table A2-16) and an improved method was used to calculate the emissions. In order to match the activity data categories, the emission factors were grouped by heating system category and fuel type.

During 2006, as a follow-up of the revision of methane emission factors in submission 2006, emission factors for NO_x, CO, NMVOC, SO₂, NH₃, total suspended particles (TSP), PM₁₀, PM_{2.5}, dioxins, PAH and metals 1990-2004 for small scale combustion of biomass were reviewed and occasionally revised (Table A2-16)³⁷. Note that CH₄ is also presented in Table A2-16 to enable comparison with NMVOC/CH₄ ratio.

³⁶ Paulrud et al. 2005.

³⁷ Paulrud et al 2006.

For N_2O emission factors, no new measurement studies were carried out and no new information from the literature was found, and thus no adjustments were made.

For NO_x emission factors, data from mainly six Swedish studies was used. The emission of NO_x for pellets varied between 30-80 mg/MJ and for wood logs between 20-120 mg/MJ.

The emission factors for CO are mainly based on measured emission data from Swedish residential biomass combustion experiments in the field as well as in the laboratory. The variation in CO emissions is usually large and the levels may sometimes be very high, especially from wood log combustion (up to 23 700 mg/MJ have been registered).

The previously used value for NMVOC is high, 1975 mg/MJ, in comparison to the previously used emission factor for methane, 250 mg/MJ. According to a Swedish study³⁸, the fraction of methane in VOC (sum of methane and NMVOC) is approximately 20-40 % by weight for pellet boilers and 30-70 % by weight for wood boilers. The new emission factors are based on data from additional measurements in Swedish residential biomass combustion experiments in the field as well as in the laboratory.

In Swedish emission inventories 2005 and earlier, the SO_2 emission factors were based on an S-content of (0.07 wt % dry fuel) and the assumption that a majority of the sulphur is bound to the ash. In the 2006 study, a lower S-content was applied (0.01 wt %), but with the assumption that no sulphur is bound in the ash.

The NH_3 emissions from wood combustion are generally low and since no new information on NH_3 emission factors was found, the emission factors for NH_3 were not revised.

In the 2006 study, emission factors for particulate matter (PM) are based on results from mainly Swedish measurements in the field and the laboratory in combination with expert judgement. The results show that small scale wood combustion typically leads to particle emissions dominated by submicron particles ($< 1\mu\text{m}$) and that all particulate matter from biomass consists of particle $< 2.5\mu\text{m}$, meaning that $\text{TSP} = \text{PM}_{10} = \text{PM}_{2.5}$. Note that the Swedish emission factors are based on in-stack measurements, which generally render lower values compared to the dilution tunnel measurement method.

³⁸ Johansson, 2004.

The emission factors for dioxin from small scale combustion are based on the results from two Swedish and six international studies. The chemical content, for example the chlorine content of the fuel, is a parameter of major significance. It is assumed that most wood boilers and stoves in Sweden are fired with local wood, i.e. uncontaminated wood. The emission factors for PCDD/F varied in the range of 0.012-2.6 ng/MJ for the wood log boilers, 0.02-1.18 ng/MJ for the wood log stoves, 0.002-0.84 ng/MJ for the pellets burners, 0.003-0.11 for the wood chips boilers and 0.005-4.5 for the open fire places. Some of the combustion experiments with pellets showed surprisingly high values. There were no explanations for these high values and in the study it was assumed that combustion of pellets in general have more similar levels of PCDD/F as wood log boilers.

Emission factor revisions for metals Cr, Cu and Zn were done for the whole time series 1990-2004 based on three studies. Due to few Swedish measurements and no available data on a more detailed level, the same emission factors are used for all fuels and all technologies. For Pb and Ni, constant emission factors were introduced 1990-2006 using the previously estimated values the latest years, i.e. 0.015 mg/MJ and 0.0025 mg/MJ respectively.

PAHs are predominantly formed during incomplete combustion processes. The UNECE POPs Protocol specifies that the following 4 PAHs should be used as indicators for the purposes of emission inventories: benzo(a)pyrene (BaP), benzo(b)fluoranthene (BbF), benzo(k)fluoranthene (BkF), indeno(123cd)pyrene (Ind). The emission factors for the fractions are based on the total sum of emission factor for PAH 1-4. The emission factors are based on measured emission data from Swedish combustion experiments in the field and the laboratory. In most of the measurements for wood logs the entire firing cycle was included, sample start during ignition and stop when the wood charge had burnt out. No data for wood chips boilers could be found and therefore the same value as for wood logs in stoves was used.

Emission factors for PCB and HCB are default values from the EMEP/EEA guide-book

Table A2-16 Emission factors for 1990-2014 determined from small scale combustion of wood logs, pellets and wood chip using different combustion technologies.

Emission factor (average)	Boilers			Stoves			Open fire places		
	Wood logs	Wood chips	Pellets	Wood logs	Wood chips	Pellets	Wood logs	W C	Pel-lets
NOX (mg/MJ fuel)	80	80	65	80	80	65	80	*	*
CO (mg/MJ fuel)	4000	1000	300	2500	1000	300	4000	*	*
NM VOC (mg/MJ fuel)	300	150	6	150	150	6	200	*	*
CH ₄ (mg/MJ fuel)	254	203	3	430	344	7	318	*	*
SO ₂ (mg/MJ fuel)	10	10	10	10	10	10	10	*	*
PM (mg/MJ fuel)	150	100	30	100	100	30	150	*	*
Dioxin (mg/MJ fuel)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	*	*
Cr (mg/MJ fuel)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	*	*
Cu (mg/MJ fuel)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	*	*
Zn (mg/MJ fuel)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	*	*
Ben-zo(a)pyrene (mg/MJ fuel)	0.08	0.08	0.001	0.05	0.05	0.001	0.05	*	*
Ben-zo(b)fluoranthene (mg/MJ fuel)	0.084	0.084	0.0025	0.074	0.074	0.0025	0.074	*	*
Ben-zo(k)fluoranthene (mg/MJ fuel)	0.0319	0.0319	0.00094	0.0281	0.0281	0.00094	0.028	*	*
Indeno(1-2-3-cd)pyrene (mg/MJ fuel)	0.0539	0.0539	0.00158	0.0475	0.0475	0.00158	0.0475	*	*
PAH 1-4 (mg/MJ fuel)	0.25	0.25	0.006	0.2	0.2	0.006	0.2	*	*
HCB (µg/MJ fuel)	5	6	7	8	9	10	11	*	*
PCB (µg/MJ fuel)	0.06	0.07	0.08	0.09	0.10	0.11	0.12	*	*

Note: All data are presented as mg/MJ fuel except for PCB and HCB which are in µg/MJ fuel.

2.3.2 Mobile combustion

Emission factors used for mobile combustion calculations are both country-specific and default values from IPCC Guidelines and EMEP/EEA air pollutant emission inventory guidebook. These emission factors are further described in IIR sections 3.3.10 - 3.3.14.

2.3.3 References

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2.4 Allocation of fuels for mobile combustion

This section describes the allocation and distribution of the delivered amount of fuels on subsectors.

2.4.1 Gasoline

Data on the delivered amounts of gasoline at national level is provided by the national statistics on supply and delivery of petroleum products (2.1.7). National total delivered amounts of gasoline includes ethanol blended to the gasoline. To separate emissions from fossil fuels from emissions from bio-fuels, the ethanol added to gasoline is subtracted from the total delivered amount of gasoline and reported as biomass under NFR 1A3b. Data on the amount of ethanol admixture in gasoline is available from 2001. Today ethanol added in gasoline to gasoline accounts for 5 % of the total delivered amount of gasoline. The ethanol reported as biomass also includes the volume of ethanol used by E85 passenger cars, ethanol buses and by the Swedish armed forces (as from 2007). After subtracting the volume of ethanol added to gasoline and the reported gasoline consumption by domestic navigation³⁹, military navigation, Swedish Armed Forces⁴⁰ and the estimated fuel consumption by road traffic and working machinery (by two different models), the remaining volume of gasoline is proportionally distributed to Working machinery and off-road vehicles and civil road traffic (see Figure A2-1).

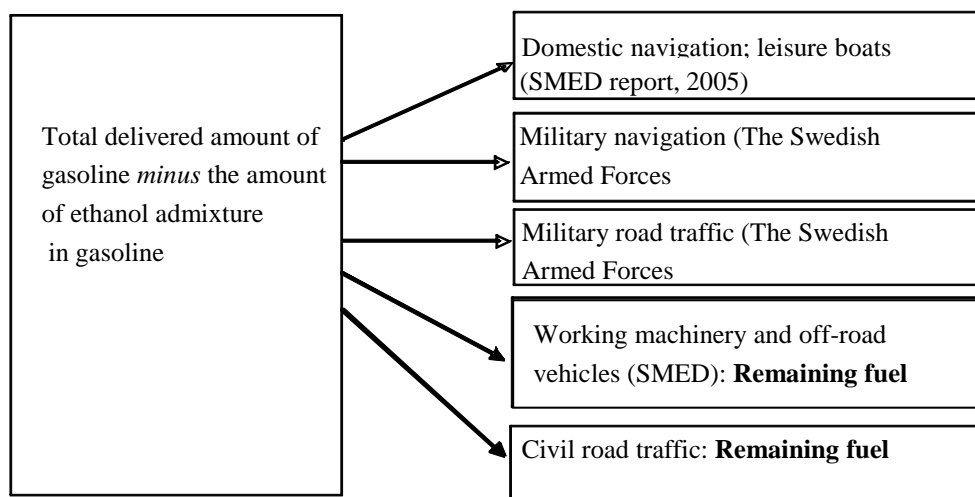


Figure A2-1 Gasoline distribution by subsector and source.

³⁹ Statistic Sweden. Monthly fuel, gas and inventory statistics. <http://www.scb.se/en/Finding-statistics/Statistics-by-subject-area/Energy/Energy-supply-and-use/Monthly-fuel-gas-and-inventory-statistics/>

⁴⁰ Data from the Swedish Armed Forces.

The consumption of gasoline by domestic navigation only consists of the consumption by leisure boats. Neither domestic ferries nor bigger ships run on gasoline, but on other oil products. The gasoline consumption by leisure boats is estimated to 32,500 m³/year for 1990-2004, based on a survey regarding leisure boat from 2004⁴¹ and a study carried out by SMED in 2005⁴². The gasoline consumption by leisure boats in 2005-2013 is estimated to 37,768 m³/year, is based on a leisure boat survey from 2010⁴³ and an assessment of the survey carried out by SMED in 2014⁴⁴. The consumption of gasoline for 2005-2009 has been estimated by interpolation.

A national model is used to estimate the consumption of gasoline by all working machinery (NFR 1A2f, 1A3e, 1A4b and 1A4c) in Sweden. The model is further described in chapter “2.6 Methodology for off-road vehicles and working machinery”. The amount of gasoline consumed by military road transport and navigation, NFR 1A5b, is provided by the Swedish Armed Forces.

The Swedish Transport Administration uses the HBEFA 3.2 road model⁴⁵ to estimate the fuel consumption by road traffic. The model is further described in chapter “2.5 The HBEFA road model”.

A comparison between the volume of gasoline allocated to the civil road traffic sector through this top-down approach and the volume of gasoline consumed according to the bottom-up HBEFA road emission model, used by the Swedish Transport Administration, indicates a good correspondence between the two estimates. The bottom-up approach estimates a slightly higher consumption in the early 90's but the difference in estimated gasoline consumption between the top-down and bottom-up approach is decreasing by time.

⁴¹ Statistics Sweden, 2005a.

⁴² Gustafsson, 2005.

⁴³ Transportstyrelsen, 2010.

⁴⁴ Eklund V. 2014.

⁴⁵ HBEFA: Handbok of Emission Factors

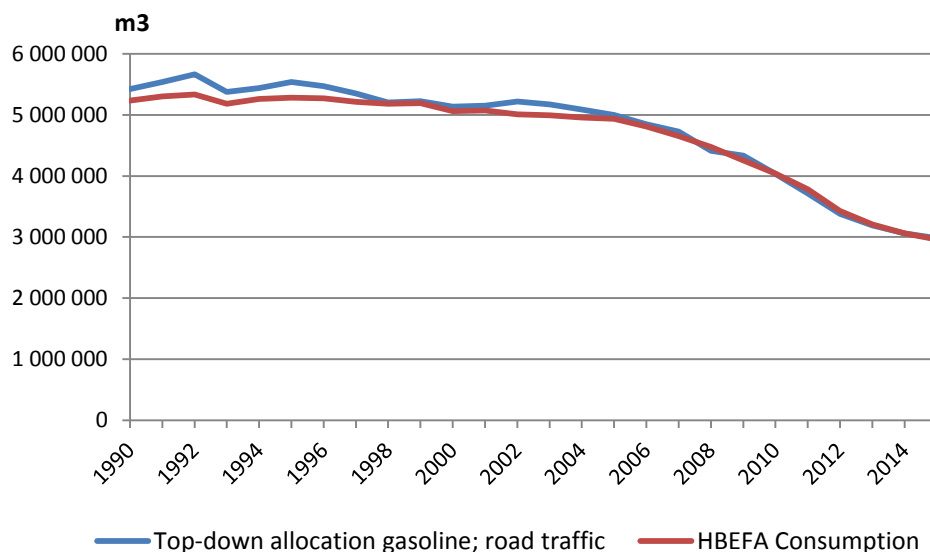


Figure A2-2 Bottom-up estimated gasoline fuel consumption versus top-down allocated gasoline consumption in 2015.

The approximate distribution of gasoline deliveries allocated to the civil road traffic to subsectors in 2014 is shown in Figure A2-3. Civil road traffic accounts for almost all gasoline consumption, followed by off-road vehicles and other machinery. Gasoline consumption by domestic navigation and military activities is relatively low.

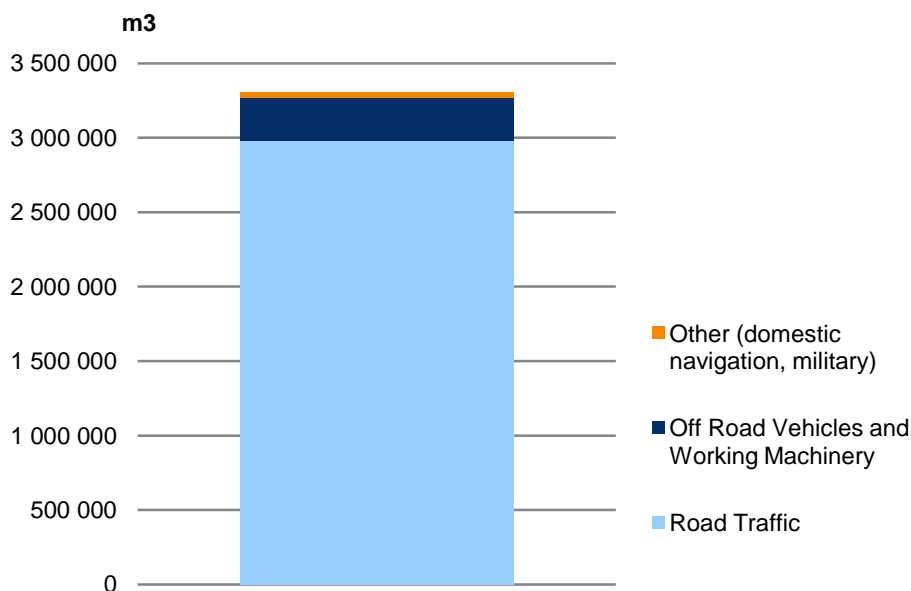


Figure A2-3 Distribution of gasoline by subsector in 2015.

2.4.2 Diesel

Data on the total amount of diesel oil delivered at national level is provided by the statistics on supply and delivery of petroleum products⁴⁶. The use of diesel by international bunkers is specified as discussed in IIR section 3.2.9. The remaining volume of diesel is distributed over different subsectors following a three-step process.

The total amount of delivered diesel includes both diesel used for stationary and mobile combustion as well as FAME (biodiesel) admixture. In the first step, the volume used for stationary combustion and the volume of FAME admixture is subtracted from the total deliveries. FAME is reported as biomass under NFR 1A3b. The volume of FAME admixture in diesel has increased considerably since 2006, when it was introduced on the Swedish market.

Data on consumption of diesel by railways is supplied by the Swedish Transport Administration and the consumption of diesel by military activities is supplied by the Swedish Armed Forces. This data is considered to be accurate and is subtracted from the total deliveries of diesel in a *second step* (see Table A2-17).

Table A2-17 Subsectors with accurate and precise information on diesel consumption, by source.

Subsector	NFR	Estimation of amount of diesel consumed
Railway	1A3c	Exact amount given by the Swedish National Rail Administration
Military road transport	1A5b	Exact amount given by the Swedish Armed Forces
Military navigation	1A5b	Exact amount given by the Swedish Armed Forces
Military abroad	1A5c	Exact amount given by the Swedish Armed Forces

In the third and last step, the remaining amount of the total delivered diesel is allocated over subsectors where the estimated diesel consumption is more uncertain; fisheries, domestic navigation, off-road vehicles and other machinery and civil road traffic. The allocation is made proportionally to the estimated consumption of each subsector. The consumption estimates of each subsector are based on sources according to

⁴⁶ Statistic Sweden. Monthly fuel, gas and inventory statistics. <http://www.scb.se/en/Finding-statistics/Statistics-by-subject-area/Energy/Energy-supply-and-use/Monthly-fuel-gas-and-inventory-statistics/>

Table A2-18. Figure A2-4 gives a brief overview of the distribution of diesel among different subsectors.

Table A2-18 Subsectors with uncertain diesel consumption, by source.

Subsector	NFR	Estimation of amount of diesel consumed
Fisheries	1A4c	SMED report, 2005
Domestic navigation	1A3d	Statistics Sweden ⁴⁷
Off-road vehicles and Other Machinery	1A2g, 1A3e and 1A4a-c	Estimation model for Off-road vehicles and Other Machinery (SMED)
Civil road traffic	1A3b	HBEFA 3.1 model estimation from the Swedish Transport Administration.

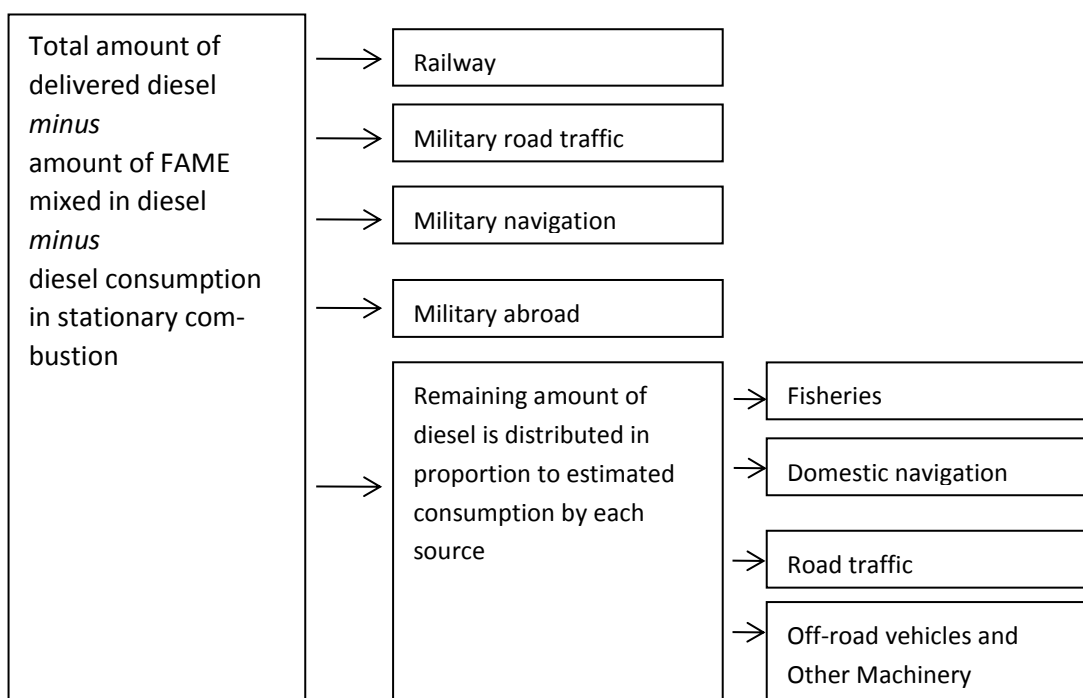


Figure A2-4 Model for allocating the total amount of delivered diesel on subsectors.

The estimate of the Swedish fishing fleet's diesel consumption is based on a survey on energy consumption within the fishing industry by SCB⁴⁸ together with data on the Swedish fishing fleet's total installed effect in kW from the Swedish Agency for Marine and Water Management (SwAM). The estimate on fuel consumption provided by SCB refer to 2005, and for the previous and following years the fuel consumptions is estimated by adjusting the 2005 value according to the development in total installed effect. The installed effect is available from 1995, for the years prior to 1995 it is estimated through extrapolation.

⁴⁷ Statistics Sweden 2014

⁴⁸ Statistics Sweden 2006

The estimate for the consumption of diesel by domestic navigation⁴⁹ (also called marine diesel oil) is provided by the statistics on supply and delivery of petroleum products⁵⁰.

The diesel consumption by leisure boats in Sweden 1990-2004 is based on a survey regarding leisure boat from 2004 and a study carried out by SMED in 2005⁵¹. The diesel consumption by leisure boats is estimated to 12,000 m³/year for the years 1990-2004 as a result of these studies. The diesel consumption by leisure boats in 2005-2013 is based on a leisure boat survey from 2010⁵² and an analysis of the result in the survey carried out by SMED in 2014⁵³. The diesel consumption is estimated to 18,172m³/year for 2010 and onwards as a result of these studies. The consumption of diesel has been estimated by interpolation for 2005-2009.

A national model is used to estimate the consumption of gasoline by all working machinery (NFR 1A2f, 1A3e, 1A4b and 1A4c) in Sweden. The model is further described in chapter “2.6 Methodology for off-road vehicles and working machinery”. The amount of gasoline consumed by military road transport and navigation, NFR 1A5b, is provided by the Swedish Armed Forces.

The Swedish Transport Administration uses the HBEFA 3.2 road model⁵⁴ to estimate the fuel consumption by road traffic. The model is further described in chapter “2.5 The HBEFA road model”. A comparison between estimated diesel consumption according to the bottom-up HBEFA 3.2 model and the top-down adjusted diesel delivery statistics approach is presented in Figure A2-5. The trend is approximately the same for the two different estimates.

⁴⁹ Except for leisure boats.

⁵⁰ Statistic Sweden. Monthly fuel, gas and inventory statistics. <http://www.scb.se/sv/Hitta-statistik/Statistik-efter-amne/Energi/Tillforsel-och-anvandning-av-energi/Manatlig-bransle--gas--och-lagerstatistik/>

⁵¹ Statistic Sweden, 2005. Gustafsson T., 2005.

⁵² Transportstyrelsen, 2010.

⁵³ Eklund V., 2014.

⁵⁴ HBEFA: Handbok of Emission Factors

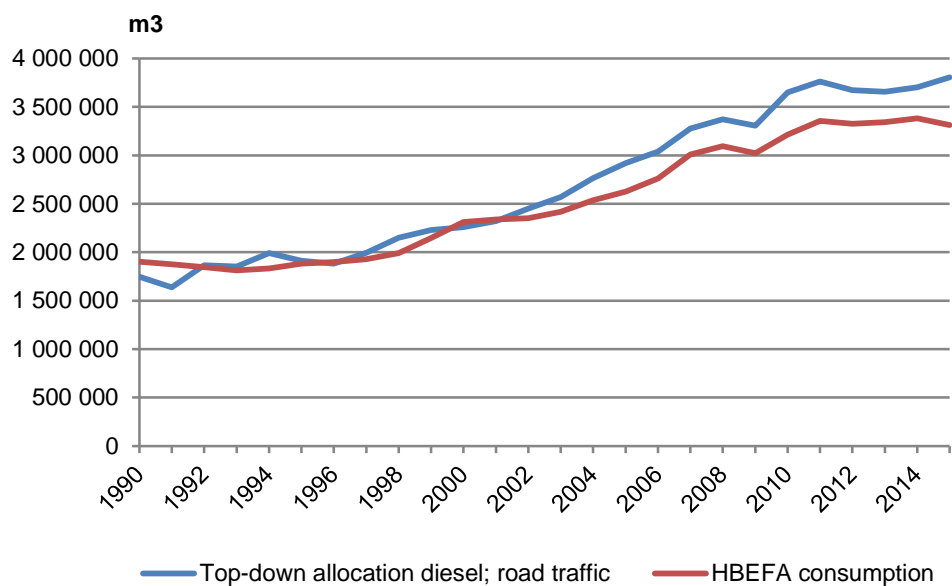


Figure A2-5 Bottom-up estimated diesel consumption versus top-down allocated diesel in submission 2017.

Figure A2-6 shows the approximate distribution of the delivered amount of diesel oil in 2013. As for gasoline, diesel from civil road traffic accounts for the majority of the consumption. However, diesel from off-road vehicles and other machinery also contributes to a considerable amount (22 %) of the total diesel consumption.

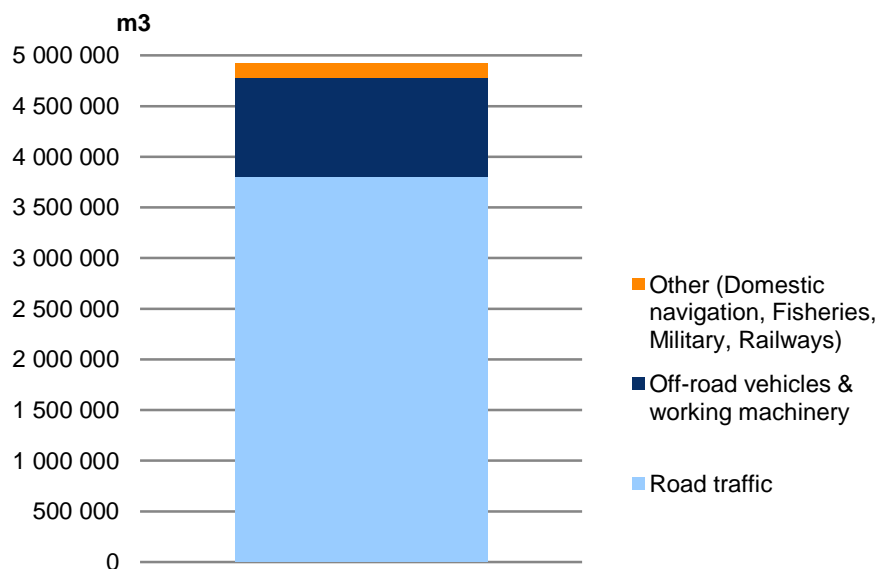


Figure A2-6 Distribution of diesel oil by subsector in 2015.

2.4.2.1 ENVIRONMENTAL CLASSES OF DIESEL OIL

Diesel oil is refined into three categories; so called environmental classes 1-3. These have been gradually introduced from 1991. Today, environmental class 1 diesel accounts for about 99 % of the total delivered amount of diesel. The shift in consumption of diesels of different environmental classes has a significant impact on the emissions.

Table A2-19 shows the characteristics for environmental class 1-3 regarding thermal values. Information on the diesel distribution on environmental classes has been collected from the Swedish National Road Administration for the years 1990-1993 and from Statistics Sweden for 1994 and later years. The Swedish Petroleum and Biofuel Institute (SPBI) has assisted with information regarding thermal values⁵⁵. SMED has calculated yearly averages of thermal values and emission factors.

Table A2-19 Impact from different environmental class diesel on NCV and emission factors for CO₂.

Diesel	NCV (GJ/m ³)	Emission factor CO ₂ (t/TJ)	Weight 1990 (%)	Weight 2000 (%)	Weight 2013 (%)
Environmental class 1	35.28	72.00	0	94	99
Environmental class 2	35.28	72.56	0	0	0
Environmental class 3	35.82	74.26	100	6	1
Average 1990	35.82	74.26			
Average 2000	35.31	72.13			
Average 2010	35.28	72.01			
Average 2013	35.28	72.01			

⁵⁵ Swedish Petroleum Institute, www.spi.se. August 2005.

2.4.3 Marine distillate fuel

Marine distillate fuel is a group name covering marine diesel oil and marine gas oil used for navigation. Emissions from these fuels are reported as gas/diesel oil in the NFR. Marine diesel oil for domestic navigation is discussed under the diesel section above. Delivered amount of marine gas oil for navigation is provided by the statistics on supply and delivery of petroleum products and the diesel consumption by leisure boats is based on two different surveys regarding leisure boats from 2004 and 2010⁵⁶ and two different studies by SMED⁵⁷. The statistics on marine distillate fuels are reported separately for domestic and international navigation. The division on areas of use for marine distillate fuels is provided by the respondents of the survey on supply and delivery of petroleum products. The amount of marine distillate fuel used for domestic navigation, NFR 1A3d, is shown in Figure A2-7. Year 2009 show a drop of Marine distillate fuels and the levels stay low also in 2010. The accuracy of this is verified by the respondents.

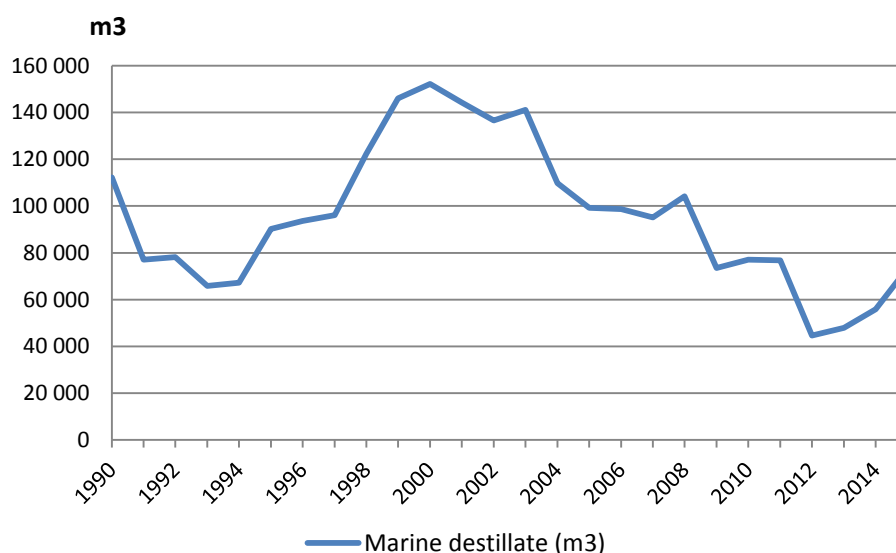


Figure A2-7 National fuel deliveries of marine diesel oil and marine gas oil (marine distillate fuel) 1990-2015.

⁵⁶ Statistics Sweden, 2005. Transportsstyrelsen. 2010.

⁵⁷ Gustafsson, T. 2005. Eklund, V. 2014.

2.4.4 Residual fuel oils

Delivered amounts of residual fuel oils for national and international navigation are provided by the statistics on supply and delivery of petroleum products and are reported separately for domestic and international navigation. Contrary to marine distillate, which shows a negative trend, the supply of residual oil for national navigation fluctuates over the years and does not show a specific trend, see Figure A2-8.

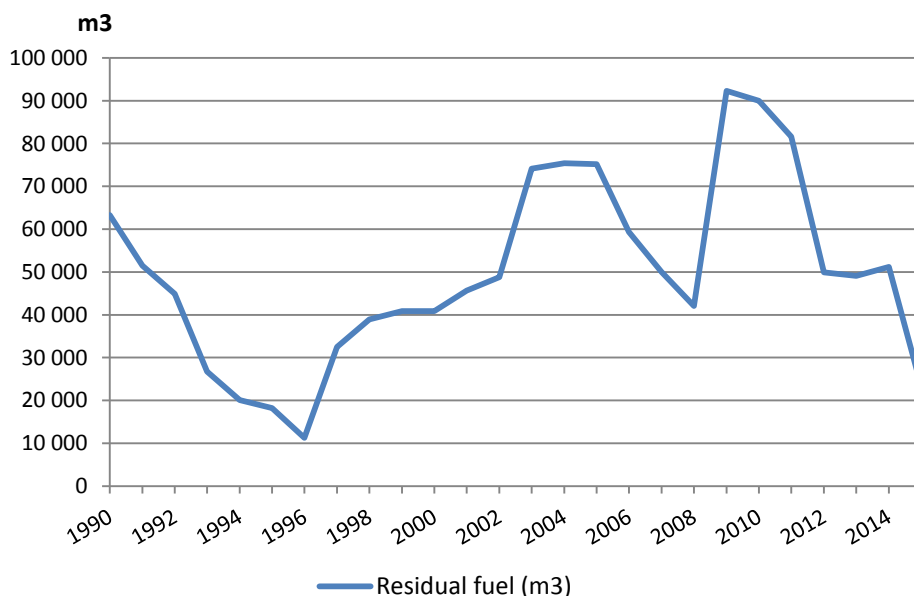


Figure A2-8 National fuel deliveries of marine Residual fuel (m3) for 1990-2015.

2.4.5 Jet kerosene, jet gasoline and aviation gasoline

All jet kerosene, jet gasoline and aviation gasoline are assumed to be used for aviation. Delivered amounts of these fuels are provided at national level by the statistics on supply and delivery of petroleum products. Delivered amounts of jet kerosene and aviation gasoline are distributed between military and civil aviation. The information on military consumption of aviation fuels provided by the Swedish Armed Forces is assumed to be correct and that the remaining amounts are allotted to civil aviation. Jet gasoline is only used by the military and has not been used after 1993.

2.4.6 Natural Gas and biofuels

Other fuels used for transport are ethanol, FAME, natural gas and biogas. All consumption is assumed to be in the road traffic sector, NFR 1A3b.

Ethanol and FAME are partly used as admixtures in gasoline and diesel, and partly used in more pure forms in bi-fuel vehicles. Information on delivered amounts of ethanol and FAME are provided at national level by the statistics on supply and delivery of petroleum products. Data on delivered amount of natural gas for transport is provided by the statistics on the delivery of gas products (see above). Data on the consumption of biogas from 1996 is provided by the Swedish Biogas Association. Data for 1990-1995 is not available.

2.4.7 References

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2.5 The HBEFA road model

The road emission model HBEFA⁵⁸ is used to estimate the emissions from road traffic in Sweden. In submission 2016 there was a transition from HBEFA 3.1 to HBEFA 3.2. The HBEFA model is based on the former ARTEMIS road model, which was used in earlier submissions (submission 2006 to submission 2011). To a large extent the two models are the same, since the HBEFA 3.1 road model was developed from a merging of the ARTEMIS road model and the former version of HBEFA – 2.1. The most prominent difference in HBEFA compared to the Artemis model, is the inclusion of the latest exhaust emission control technology.

HBEFA provides emission factors and emissions for segments and sub-segments of six main vehicle categories - passenger cars (PC), light commercial vehicles (LCV), heavy goods vehicles (HGV), urban busses, coaches, and motorcycles including mopeds (MC) - for a large number of traffic situations, as well as for average speeds⁵⁹. A segment is defined as a group of vehicles of similar size (e.g. passenger cars with swept engine volume between 1.4 and 2 litres, rigid trucks with weight between 14 and 20 t) and similar technology (e.g. petrol engines, diesel engines, biofuel, CNG/petrol engines), whereas sub-segments are defined as groups of vehicles of similar size, technology and emission concept (e.g. pre-Euro, Euro 1, 2, 3, etc.)

The emission factors are based on emission measurements according to different sets of real-world driving cycles, representative for typical European driving conditions⁶⁰. The model calculates emissions separated into hot emissions, cold start emissions and evaporative emissions. An overview of the model structure with input and output parameters is given by Figure A2-9.

The model is a bottom-up approach estimate and a basic parameter for the HBEFA -model is the vehicle-km, which is calculated through another model. This second model is based on the mileage driven by the vehicle noted at time of MOT (annual testing of the vehicle)⁶¹. A passenger car that goes through the MOT in the beginning of 2014 has been driven the most part of 2013. If the development of traffic is without interruption, this issue is not a problem for the calculations. However, if a sudden event occurs such as a drop in the economy, it will not be shown as clearly in the development of vehicle mileage as in statistics on fuel consumption.

⁵⁸ HBEFA: Handbook of Emission Factors

⁵⁹ Keller et al., 2005

⁶⁰ André, 2004

⁶¹ Ministry of Transport test (usually abbreviated to MOT test or simply MOT) is an annual test of vehicle safety, roadworthiness aspects and exhaust emissions.

HBEFA is yearly updated with new information regarding emission factors, vehicle fleet, composition of the fuel and current traffic work. Beside the yearly updates, the model has undergone other updates over the years.

Submission 2014:

- The method to estimate traffic work with regard to driving distances was updated and improved.
- The distribution of segments was updated with new activity data (AD from 1999-2012 instead of 2004) as well as the driving distance as a function of age. This resulted in a decreased average driving distance for passenger cars running on diesel, as diesel vehicles were not as common in 2004 among people driving shorter distances as they are today.

Submission 2015:

- The model was adjusted with new data regarding the fraction of trucks with trailers and the load factor for trailers. The data is based on a yearly truck survey performed by the Agency for Transport Analysis (TRAFA).
- The vehicle mileage distribution was also revised, as well as the vehicle fleet composition with regard to type of Euro class.

Submission 2016:

- A transition from HBEFA 3.1 to HBEFA 3.2.
- A change in the allocation of segments⁶²; an average distribution over time in terms of environmental requirements is used for all vehicle types, instead of an annual update.
- A redistribution of the allocation of the daily traffic; such as frequency of trips by trip distance, parking time and travel speed. This reallocation concerns only light duty vehicles (passenger cars, light trucks and motorcycles / mopeds).
- The number of vehicles in circulation is based on an average value over the year instead of previously by December 31st.

⁶² A segment is defined as a group of vehicles of similar size (e.g. passenger cars with an engine volume between 1.4 and 2 litres, rigid trucks with weight between 14 and 20 tons etc.) and similar technology (e.g. petrol engines, diesel engines, biofuel, CNG/petrol engines), whereas sub-segments are defined as groups of vehicles of similar size, technology and emission concept (e.g. pre-Euro, Euro 1, 2, 3, etc.)

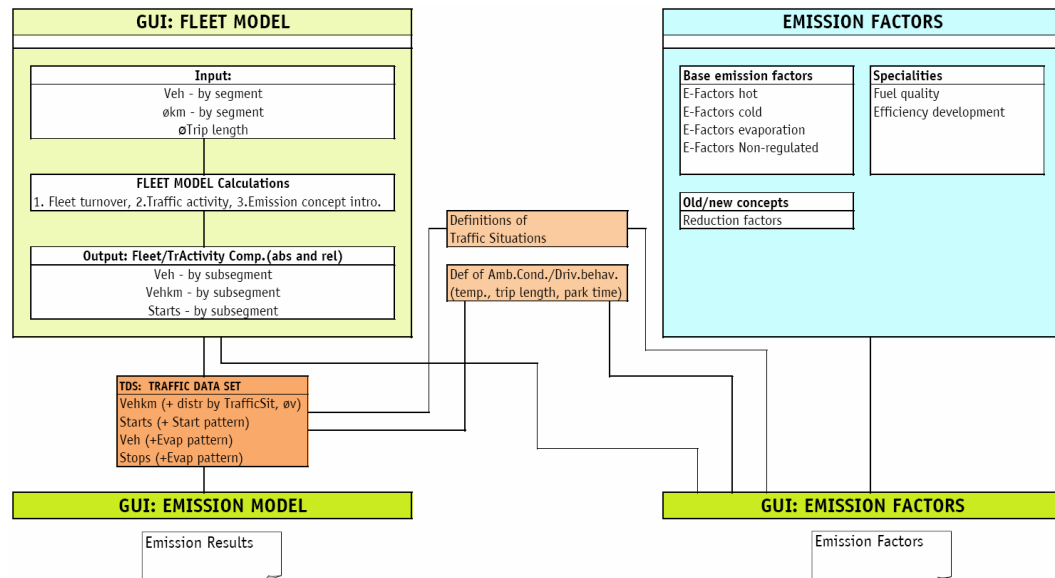


Figure A2-9 HBEFA model structure.

2.5.1 National fleet data

The Swedish road vehicle fleet for each year is described by means of the number of vehicles on category level, along with segment/sub-segment and age distributions, derived from the Swedish national vehicle register. This register is updated with new registrations and scrapped vehicles on a daily basis. Specific information on swept engine volume for passenger cars is not available from the national vehicle register. Instead, an independent fuel consumption dataset obtained from the Swedish Consumer Agency including swept engine volumes for a large number of car models available on the Swedish market, was used. This dataset has been matched with the national vehicle register, resulting in functions of swept engines volumes versus year of registration, engine power, and vehicle weight, for gasoline and diesel passenger cars separately.

The HBEFA model distinguishes between two types of busses: urban busses mainly used for urban driving, and coaches, mainly used for rural and motorway driving. Due to lack of specific information in the national vehicle register, the distinction between urban busses and coaches had to be based on the ratio p/w , where p is equal to the maximum allowed number of passengers, and w is equal to the gross vehicle weight, both available from the national vehicle register. Busses with a p/w -value above 3.75 were classified as urban busses, whereas busses with a p/w -value below 3.75 were classified as coaches.

In the HBEFA model, trucks are split into two main categories: with and without trailer, respectively. Since there is no information on the use of trailers in the Swedish national vehicle register, trucks with trailers are described by means of vehicle

transformation patterns in the model. A transformation pattern defines the mileage distributions for each weight class, with and without trailer, respectively. The truck category "with trailer" is split further into different sizes of trailers expressed as the total weight (i.e. weight range, e.g. 20-28 t) of the truck and trailer combination. The transformation patterns for Sweden were derived from traffic measurements on Swedish roads. Vehicle fleet data from Statistics Sweden is shown in Figure A2-10.

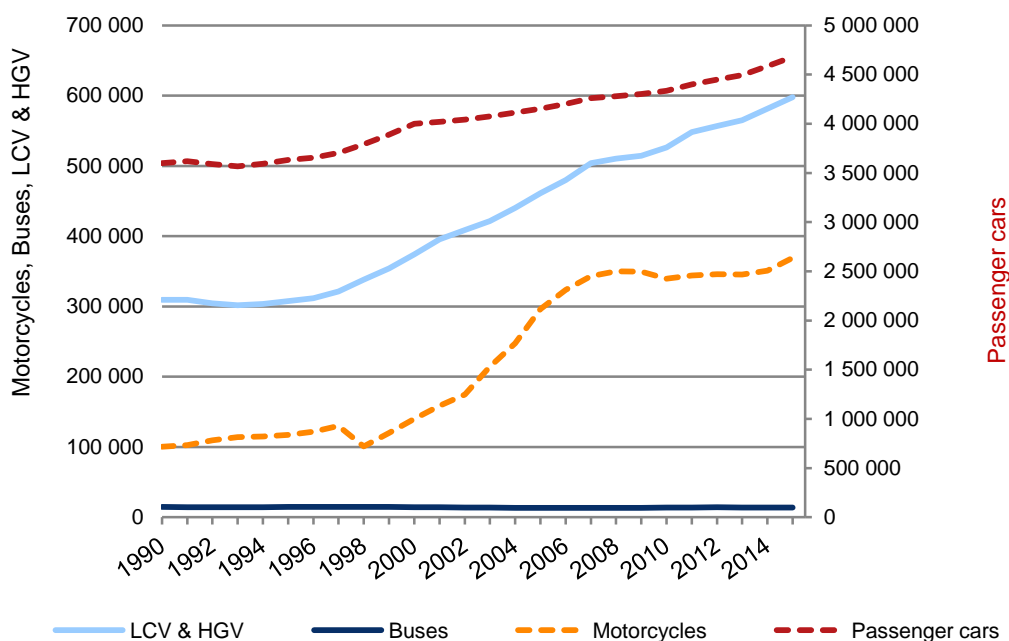


Figure A2-10 Vehicle fleet data by December 31, numbers, 1990-2015 according to the car register available at Statistics Sweden.

2.5.2 Traffic activity data

2.5.2.1 VEHICLE MILEAGES, LOADS, TRIP LENGTHS AND FUELS

The HBEFA model requires yearly mileages per vehicle category. For Sweden these are calculated by means of a national road mileage model⁶³. Important inputs to this model are the overall mileage on roads, derived from traffic measurements on Swedish roads, along with the number of vehicles in different categories. The annual mileage per vehicle category is derived by dividing the total mileage per category with the number of vehicles per category. By applying the same number of vehicles together with the derived mileage, the model will provide the same overall national mileage as the national road mileage model.

⁶³ Edwards et al., 1999

Yearly mileages per vehicle sub-segment level are used to distribute the total mileage on sub-segments. A method has been developed, which can assign all vehicles in the register an annual mileage, based on yearly odometer readings within the Swedish inspection & maintenance (I/M) programme⁶⁴. This data is used for deriving mileage both per vehicle sub-segment, and as a function of vehicle age. For heavy commercial vehicles the HBEFA model requires mileage distributions of load factors empty (0% load), half-load (50% load), and fully loaded (100% load), by vehicle segment and vehicle age. This data is derived from a major national survey from 1997 on Swedish domestic road goods transport⁶⁵, including detailed information about both truck and trailer loads.

In order to estimate evaporative and cold start emissions, information on distributions of trip lengths and parking times and on the seasonal and diurnal variation of ambient temperature is needed. Trip lengths and parking times can be derived from surveys, or from data from instrumented cars. For Sweden an average trip length according to surveys is 12 km, and according to instrumented cars 7 km⁶⁶. Instrumented cars provide the trip length from engine start to engine stop. Even if instrumented car data just represents a few vehicles and use in few families, this data set has been considered more representative than the survey data, since the information requested is the distance travelled from engine start to engine stop⁶⁷. Thus, available instrumented vehicle data was used to estimate trip lengths and parking times in Sweden.

⁶⁴ SIKa, 2003

⁶⁵ Hammarström and Yahya, 2000

⁶⁶ SNRA 1999

⁶⁷ André et al., 1999

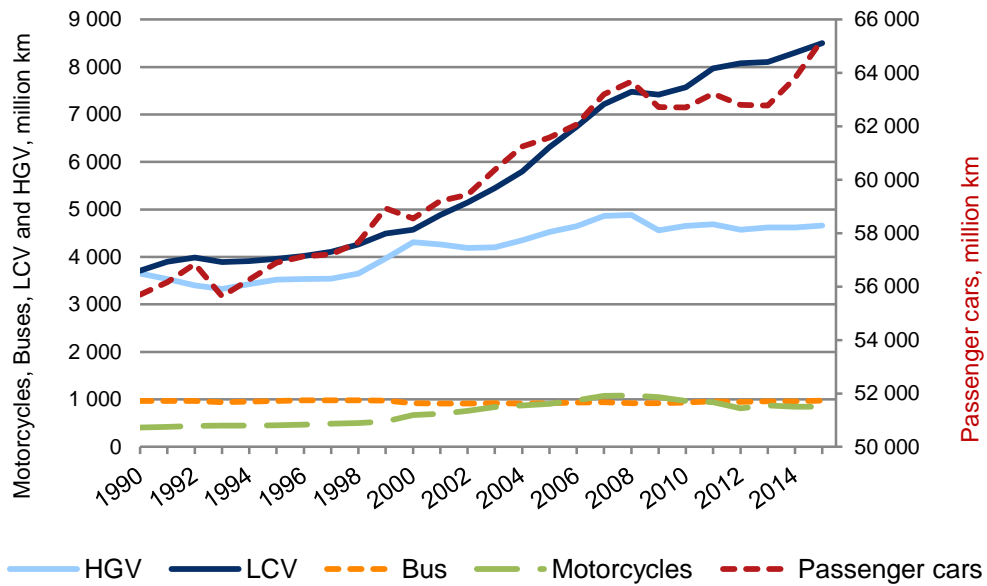


Figure A2-11 Vehicle mileages 1990-2015 according to HBEFA 3.1.

2.5.2.2 TRAFFIC SITUATIONS

The HBEFA model includes 276 traffic situations, i.e. combinations of 69 road categories and for each of those four classes of traffic conditions or "levels of service", defining how disturbed the traffic is relative to undisturbed traffic - 1) Free Flow, 2) Heavy Traffic, 3) Saturated, and 4) Stop and Go conditions (see Figure A2-12 and Table A2-20 below). Furthermore, it is possible to add different level of grade; however this is not done for Sweden.

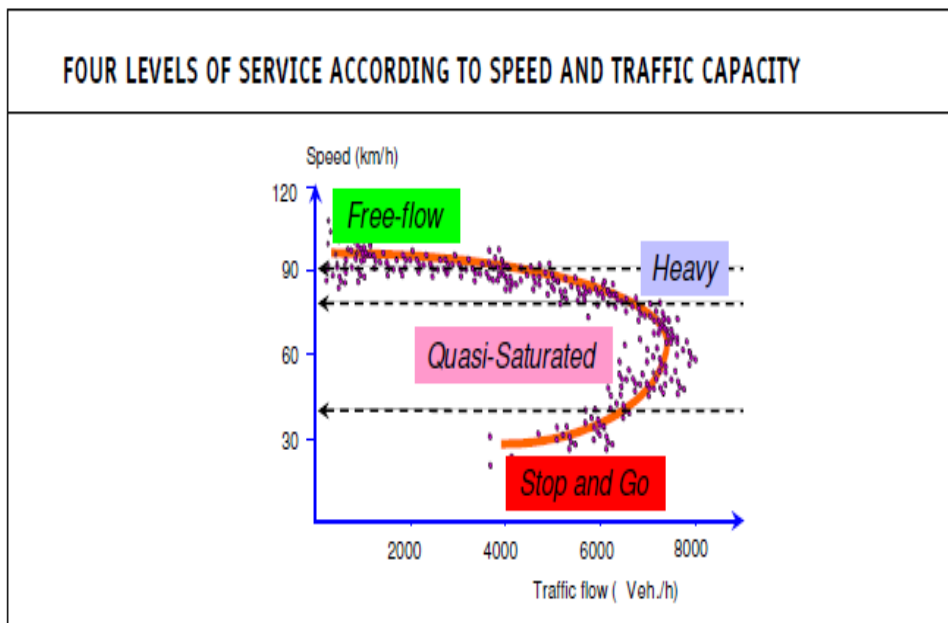


Figure A2-12 Traffic flow

Table A2-20 Definition of the four classes of traffic conditions.

Class	Definition
Freeflow	Free flowing conditions, low and steady traffic flow. Constant and quite high speed. Indicative speeds: 90-120 km/h on motorways, 45-60 km/h on a road with speed limit of 50 km/h. LOS A-B according to HCM.
Heavy	Free flow conditions with heavy traffic, fairly constant speed. Indicative speeds: 70-90 km/h on motorways, 30-45 km/h on a road with a speed limit of 50 km/h. LOS C-D according to HCM.
Saturated	Unsteady flow, saturated traffic. Variable intermediate speeds, with possible stops. Indicative speeds: 30-70 km/h on motorways, 15-30 km/h on a road with speed limit of 50 km/h. LOS E according to HCM.
Stop + go	Stop and go. Heavily congested flow, stop and go or gridlock. Variable and low speed and stops. Indicative speeds: 30-70 km/h on motorways, 15-30 km/h on a road with speed limit of 50 km/h. LOS E according to HCM.

The national vehicle mileages for year 1990, 1995, 1998, 2000 and 2004 were initially estimated by means of the national vehicle mileage model⁶⁸. Procedures were established to allocate the total vehicle mileage over 1) urban and rural roads, 2) road categories, 3) traffic conditions, and to fit the result to the traffic situations in HBEFA 3.1. Two national GIS road databases were employed. The first, VDB, contains all state road links attached with information about: length, road function, speed limit and ADT (average daily traffic) split on light- and heavy-duty vehicles. The second, NVDB, were used for municipal and private road links. NVDB contains information on road classification and road link length, but lacks information on ADT. Traffic simulations were HBEFA study was able to present new figures on the distribution of the overall vehicle mileage between urban and rural roads in Sweden: 41 % and 59 %, respectively (the distribution used earlier was 35 % and 65 %, respectively). State-owned rural and urban roads together with municipality-owned urban roads accounted for more than 90 % of the overall vehicle mileage in 2004.

Furthermore, a model for distributing the urban vehicle mileage on cities of different size was demonstrated. Cities with inhabitant number exceeding 200,000 - only three in Sweden - accounted for one fourth to almost one third of the overall vehicle mileage on urban roads. Available statistics on hourly flow conditions for different road types⁶⁹ were employed for describing the yearly variation of ADT

⁶⁸ Edwards et al., 1999

⁶⁹ Björketun et al., 2005, Jensen, 1997

(monthly, weekly, daily and hourly) on the different road types. The hours over the year were divided into groups based on their share of ADT for different road categories, entitled ranks (categories for rural roads were: share of ADT >0.12, 0.8-1.2, 0.4-0.8 and <0.04, categories for urban roads were: share of ADT >0.1, 0.07-0.1, 0.04-0.07 and <0.04). Using the available statistics, traffic flow and vehicle mileage at different rank-hours was calculated for each link of the state road network.

Similar calculations were carried out for the municipal and private road links in the four regions. The results, traffic flow per lane and hour were related to volume-delay functions, and preliminarily classified into HBEFA 3.1 traffic conditions 1-3. Hypothesis were formulated concerning the distribution of vehicle mileage for "Stop and Go"-conditions. This cannot be estimated from volume delay functions alone, since it is not possible to decide whether a flow occurring between free flow (a) and congested (b) is a case of demand exceeding capacity (Stop and Go) or if it is a lower flow (Heavy Traffic). To overcome this, two assumptions were made: Stop and Go would only occur on road links that had reached their capacity, c; and for these roads it was assumed that Stop and Go constituted a fixed share of the preliminary estimated vehicle mileage in the traffic condition "Heavy Traffic".

By studying flow over the day for individual congested roads (Figure A2-13), it could be seen that a local decrease in flow sometimes occurred within a congested period (i.e. when flow is near the capacity). This period was assumed to be a "Stop and Go"-period and calculations were made accordingly. The calculations finally resulted in a distribution of the vehicle mileage (light- and heavy-duty vehicles) over road categories and traffic conditions for the Swedish road network for the years 1990, 1995, 1998, 2000 and 2004. Swedish road categories were translated to HBEFA 3.1 traffic situations based on the description of road hierarchy, speed limit, function and design. Then it was possible to sum the vehicle mileage in Sweden over the HBEFA 3.1 traffic situations for different years.

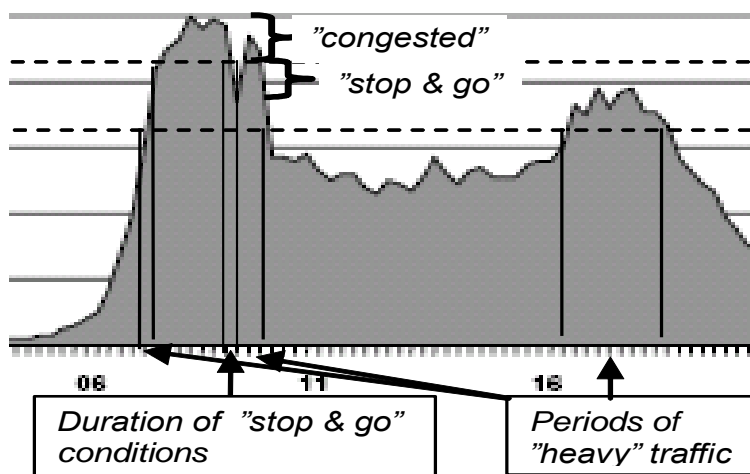


Figure A2-13 Flow over the day for individual congested roads.

Of the 276 traffic situations in HBEFA, were 115 of them identified in Sweden in 2013 representing 53 road categories, for which the traffic conditions "Free Flow" or "Heavy Traffic" were predominant. In fact, as much as 93.6 % of the overall vehicle mileage driven in Sweden was characterised by free flow conditions. The ten most abundant HBEFA 3.1 traffic situations all involved "Free Flow" conditions, and are presented in Table A2-21. The three most common road categories "Rural Distributor" (speed limits 90 and 70 km/h, respectively) and "Rural Motorway" (speed limit 110 km/h) accounted for more than 40% of the national vehicle mileage. Adding also urban road categories "Local Collector" and "Access Residential" (both with speed limit 50 km/h), and "Distributor" (speed limits 70 and 50 km/h, respectively), and two more rural categories ("Local Collector", 70 km/h, and "Trunk Road", 110 km/h), these ten most abundant road categories at free flow conditions accounted for about 66 % of the national vehicle mileage. The share of the HBEFA 3.1 "Stop and Go"-conditions of the overall mileage was as low 0.05%, and only occurred in the three major cities (having more than 200,000 inhabitants). Further details concerning the methodology and the results are reported elsewhere⁷⁰.

Table A2-21 The ten most common traffic situations in Sweden in 2013, and their share of the total vehicle mileage.

Description of traffic situations	Vehicle mileage
Rural / Distributor-DistrictConnection / SpLimit:70 / Freeflow	12,9 %
Rural / Motorway / SpLimit:110 / Freeflow	10,5 %
Urban / Distributor-DistrictConnection / SpLimit:60 / Freeflow	9,1 %
Rural / Distributor-DistrictConnection / SpLimit:90 / Freeflow	7,8 %
Rural / Distributor-DistrictConnection / SpLimit:80 / Freeflow	6,8 %
Rural / TrunkRoad / SpLimit:100 / Freeflow	5,0 %
Urban / Distributor-DistrictConnection / SpLimit:50 / Freeflow	4,2 %
Rural / TrunkRoad / SpLimit:90 / Freeflow	3,8 %
Urban / City-TrunkRoad / SpLimit:70 / Freeflow	3,1 %
Urban / Access-residential / SpLimit:40 / Freeflow	2,7 %
Total	65,9 %

Starting at 2008 there has been a change in the speed limit scheme in Sweden. Also 40, 60, 80, 100 and 120 km/h have been implemented in parallel with the old speed limits. In the model the mileage share on the different speed limits and traffic situa-

⁷⁰ Larsson and Ericsson, 2006

tions have been updated from year 2010. This includes a use of a more updated method to allocating the traffic into different traffic situations.⁷¹

2.5.3 References

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⁷¹ TU06 – New V/D-functions for urban environments – Revision of the TU71-functions
<http://www.vti.se/en/publications/tu06--new-vd-functions-for-urban-environments--revision-of-the-tu71-functions/>

2.6 Methodology for off-road vehicles and working machinery

Fuel consumption and emissions from working machinery are estimated with a model developed by SMED in 2008, which is considered to correspond to Tier 3. Working machinery in this context means mobile machinery with a combustion engine that is not used on roads, waterways or railways. Included are e.g. construction machinery, hand held garden machines and snow mobiles.

Emissions and fuel consumption are calculated in the model with the equations below:⁷²

$$E = N \times Hr \times P \times Lf \times EF_{adj} \quad (1)$$

- E = Emissions in Gg
- N = number of vehicles,
- Hr = yearly running time in hours,
- P = engine power in kW,
- Lf = load factor, and
- EF_{adj} = adjusted emission factors in g kWh⁻¹ according to equation below (applied for larger off road vehicles and snow scooters).

$$EF_{adj} = EF_l \times CAF \times TAF \times DF \times FAF \quad (2)$$

- EF_l = emission regulations according to EU legislation in g kWh⁻¹,
- CAF = adjustment factor for difference between regulation and value measured at certification,
- TAF = adjustment factor for transient (i.e. difference between static test cycle and real use of the machine),
- DF = adjustment factor for decline of the motor by increasing age, and
- FAF = adjustment factor for difference between certification fuel and Swedish diesel of type "MK1".

All variables in the equations are described as vectors with data for every model year the last 25 years.

2.6.1 Emission factors

Emissions of SO₂ are estimated using the same emission factors as for diesel and gasoline used for road traffic and are considered to correspond to Tier 2. The emission factors for SO₂ are adjusted according to fuel specifications for each year.

Emission factors for diesel machinery with an installed engine power > 37 kW are based on the emission regulations according to the EU legalisation. Emission factors for diesel machinery < 37 kW is taken from Corinair⁷³. For gasoline driven

⁷² Fridell, Jernström and Lindgren, 2008

⁷³ EEA. 2007

smaller off-road vehicles and machinery, emission factors are taken from Winther and Nielsen 2006.⁷⁴ These are based on certification measurements. Emission factors for snow mobiles are also taken from Winther and Nielsen 2006 except the emission factors for hydrocarbons, carbon monoxide and particles which are taken from USEPA (2005)⁸³.

2.6.2 Vehicle Stocks

The number of diesel machinery 37 – 560 kW of different types is mainly based on a bottom up inventory for the year 2006.⁷⁵ In submission 2014 the model was updated⁷⁶ with new information about number of machines for some of the diesel vehicles in the range of 37 kW – 560 kW. In this update also improved estimates of vehicle life time were obtained from the new data and are now used in the model.

The number of tractors per sector, model year and engine power interval are for most of the years taken from Statistics Sweden's registers. For some years where statistical data is not available, numbers are interpolated (the proportions of different vehicle types are assumed to be constant).

The number of machines >560 kW are taken from a IVL study conducted in behalf of the Swedish Transport Agency⁷⁷.

The number of machines < 37 kW are based on a bottom up inventory for the year 2002⁷⁸. Number of machines for other years are estimated on e.g. sales, estimates of lifetime or set as unchanged from 2002. Different methods are used for different types of machines.

The number of snow mobiles is taken from Statistics Sweden's register for each year.

2.6.3 Other parameters

Yearly running time, engine power and the load factor in equation (1) above are taken from Wetterberg⁷⁹ and Flodström⁸⁰. Load factors for some of the machines are from a IVL study made in 2015⁸¹. The fuel adjustment factor, FAF, and the certification adjustment factor, CAF, for larger vehicles in equation (2) are taken

⁷⁴ Winther, M., Nielsen, O.-K., 2006.

⁷⁵ Wetterberg C, Magnusson R, Lindgren M, Åström S. 2007.

⁷⁶ Jerksjö, M. 2013.

⁷⁷ Transportstyrelsen 2014

⁷⁸ Flodström, E., Sjödin, Å., Gustafsson, T. 2004.

⁷⁹ Wetterberg C, Magnusson R, Lindgren M, Åström S. 2007.

⁸⁰ Flodström, E., Sjödin, Å., Gustafsson, T. 2004.

⁸¹ Jerksjö, M., Fridell, E., Wisell, T. 2015

from Lindgren (2007).⁸² The TAF and DF factors are taken from the Non-road model⁸³.

2.6.4 Allocation to NFR-sectors

Allocation of emissions from working machinery is mainly based on a report by Flodström *et al*)⁸⁴. This is the most recent Swedish inventory including an allocation of working machinery to the different NFR-sectors. There have also been some changes of the allocation proposed in Flodström *et. al*. Most of these changes have been done by expert judgements in cases where the allocation did not seem to be accurate. Table A2-19 shows emissions of NO_x, PM 2.3 and NMVOC from all working machinery in 2013, split by sector and fuel type.

Table A2-22. Emissions of NO_x, PM_{2.5} and NMVOC from working machinery 2013.

			NO _x (Gg)	PM _{2.5} (Gg)	NMVOC (Gg)
1A2g vii	Industry	Diesel	11	0.77	1.1
1A3e ii	Other Transport	Diesel	1.6	0.088	0.13
1A4a ii	Commercial/institutional	Diesel	0.77	0.081	0.16
1A4b ii	Residential	Diesel	0.18	0.013	0.022
1A4c ii	Agriculture	Diesel	2.7	0.16	0.29
1A4c ii	Forestry	Diesel	2.8	0.15	0.24
1A2g vii	Industry	Gasoline	0.049	0.0055	0.36
1A3e ii	Other Transport	Gasoline	0	0	0
1A4a ii	Commercial/institutional	Gasoline	0.39	0.042	1.5
1A4b ii	Residential	Gasoline	1.2	0.18	7.1
1A4c ii	Agriculture	Gasoline	0.30	0.055	2.1
1A4c ii	Forestry	Gasoline	0.025	0.033	1.5
Total	Total	Total	20	1.6	15

2.6.5 Most recent updates

As described above the model has since 2008 undergone a series of improvements. The last update was done in 2015 and is described in Jerksjö *et. al*. (2015⁸⁵). The update aimed to further improve the national emission and fuel consumption estimates in several ways. The updates included adding machines with an installed

⁸² Lindgren M. 2007.

⁸³ USEPA. 2005.

⁸⁴ Flodström, E., Sjödin, Å., Gustafsson, T. 2004.

⁸⁵ Jerksjö, M., Fridell, E., Wisell, T. 2015

power >560 kW (these were not included in the model before), updated average load factors for some machines, added emission factors for Stage V machines, implementing a function for describing the relationship between engine load and fuel consumption, and some updates concerning allocation of emissions to the different NFR- sectors.

2.6.6 References

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3 Annex 3: Other detailed methodological descriptions for individual sources

Annex 3.1. Methodological issues for emissions from solvent use (in NFR sector 2D3)

In 2016 Swedish Environmental Emissions Data (SMED) in cooperation with the Swedish Chemicals Agency (Skårman et al., 2016⁸⁶), has further developed the calculation model for estimating the national emissions of NMVOC and CO₂ from use of solvents in Sweden. The model has been revised in order to meet international reporting requirements according to CLRTAP and UNFCCC as well as to support national needs. The model makes it possible to test different sets of emission factors within the solvent use sector. This function can be used to assess different actions and emission reduction potentials. Furthermore, the model can generate emissions per user category and product group. This information can be used when following-up the Swedish environmental quality objectives.

The calculation model is consumption-based with a product-related approach. Amounts of NMVOC and C in solvents and solvent-based products, produced in, imported to, used in, and exported from Sweden, was derived from the Swedish Product Register hosted by the Swedish Chemicals Agency. Emission factors from the literature have been used as far as possible, but in the case when emission factors are unavailable, country specific emission factors have been developed.

3.1.1 Definition of NMVOC

According to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006), NMVOCs are defined as:

“any non-methane organic compound having at 293.15 K a vapour pressure of 0.01 kPa or more, or having a corresponding volatility under the particular conditions of use.”

3.1.2 Substance list

A manual selection has been made in order to select each substance with vapour pressure of 0.01 kPa or more at 293.15° K according to the chosen definition of NMVOC. The final substance list for 2013 contains 427 substances defined as NMVOC. The list includes CAS-number, name, molecular formula and carbon share for each substance. The carbon share for each substance has been calculated based on the molecular formula. In some cases a mixture of substances are includ-

⁸⁶ Skårman et al., 2016. Swedish method for estimating emissions from Solvent Use. Further development of the calculation model. SMED report 192.

ed in the substance list, and for the mixtures the carbon content has been estimated by the Swedish Chemicals Agency as 85% of NMVOC, based on information in the Products Register. In cases where the carbon content cannot be derived from the Products Register, the default value of 60%, given in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, has been used

Emission of CO₂ has been calculated with the following equation:

$$\text{Emission (CO}_2\text{)} = C_{\text{quantity}} \times \text{Emission Factor} \times \frac{44}{12}$$

C_{quantity} is the carbon quantity of the solvents. 44 and 12 are the molecular weights of CO₂ and C, respectively.

3.1.3 Activity data

The substance list has been used to extract quantities of NMVOC and C in substances found in the Products Register. Data extractions have been made for each year from 1992. The extractions show for each year:

- The intended use of the product, the product type (functional code)
- Industry to which the product is sold (industry category)
- Quantity NMVOC
- Quantity C
- Number of products

When analysing the extractions from the Products Register, data for 1992-1994 showed not to be reliable to use for quantitative estimates of NMVOC and C emissions. The reason is that during this period the emissions of many substances still were reported as intervals, even if work has been done by the Swedish Chemicals Agency in order to further specify the amounts. There were also changes in the code system during this period. Therefore data from the Products Register are only used for 1995 and onwards.

Due to the two year delay in official statistics from the Products Register, activity data for the last year in the reported time series, is not published in time to be used in the latest submission and hence Sweden has chosen to equal data for the last year with data for the year before that. Estimated values for last year of one submission will always be updated with official data in the next submission.

3.1.4 Allocation

The extractions from the Products Register for 1995 and onwards have been used in order to compile a connection diagram with all combinations of "product codes" and "industry categories". For all combinations, decisions whether to include or exclude from reporting are based on expert judgements in order to avoid double-counting. If the combination should be included, it has been given a specific:

- SNAP-code (according to EMEP/EEA guidebook)
- Industry group (grouping industry categories)

- Product group (grouping of product codes)
- Use category (industry, consumer and other)

Furthermore, it has to be determined if the product is used as raw material or not. Quantities of NMVOC used as raw material have been identified and handled separately from other quantities, since most of the solvents used as raw material will not be emitted but bound in products.

In order to avoid double-counting of reported emissions within other sectors an expert judgement has been made on both industry category and product function. All industrial activities reported in other CRF-codes are excluded from the extractions from the Products Register.

The sold amount of solvent is not always identical to the amount of solvent used, i.e. stock of solvents. Therefore activity data has been recalculated using a running average over three years. This leads to the need for updating of reported emissions for the latest three years in the time series in every new submission.

3.1.5 Emission factors

Emission factors given in the literature, for example the EMEP/EEA guidebook (EEA, 2013), EU legislations and other countries IIR's, have been compiled and included in the model. Two emission factors have been developed for each activity; one for solvents used as raw material and one for the remaining quantities. The emission factors for raw material have been set very low, since most of the solvents will end up in the product and will not be emitted during production.

A new emission factor for products used diluted in water has been introduced in the new model. The new emission factor is set to 0.275 and it has been calculated based on available information given in the EMEP/EEA guidebook (EEA, 2013).

In the previous estimates these products were not treated separately and consequently the emission factor of 0.95 was used also for water diluted products. The country specific emission factors have been developed in order to adjust to the old time series 1990-2001, developed by SMED in 2002 (Kindbom et. al., 2004).

However, for some activities errors have been identified in previously reported data for 1990, and consequently those emissions have been corrected. Furthermore, application techniques, available information in the environmental reports for specific industries, as well as other pathways of release (e.g. water), have been considered when developing the country specific emission factors.

Table A3-1. Country specific emission factors for SNAP codes in NFR 2D3a “Domestic solvent use including fungicides”. Emission factor references given at the end of Annex 3.1. EFs in italic are interpolated.

Year	060408ei	060408eii	060408fi	060408fii	060408gi	060408gii	060408hi	060408hii	060408i	060411
1995	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
1996	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
1997	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
1998	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
1999	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2000	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2001	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2002	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2003	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2004	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2005	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2006	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2007	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2008	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2009	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2010	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2011	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2012	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2013	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2014	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹
2015	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.275 ²	0.95 ¹	0.95 ¹

Table A3-2. Country specific emission factors for SNAP codes in NFR 2D3d "Coating applications". Emission factor references given at the end of Annex 3.1. EFs in *italic* are interpolated.

Year	060101	060102	060103	060104	060105	060106	060107	060108	060109
1995	0.95 ¹	0.95 ¹	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.29 ¹	0.95 ¹	0.95 ¹
1996	<i>0.92</i>	<i>0.92</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.29 ¹	<i>0.93</i>	0.95 ¹
1997	<i>0.89</i>	<i>0.89</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.29 ¹	<i>0.90</i>	0.95 ¹
1998	<i>0.86</i>	<i>0.86</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.29 ¹	<i>0.88</i>	0.95 ¹
1999	<i>0.83</i>	<i>0.83</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.21 ³	<i>0.86</i>	0.95 ¹
2000	<i>0.79</i>	<i>0.79</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.83</i>	0.95 ¹
2001	<i>0.76</i>	<i>0.76</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.81</i>	0.95 ¹
2002	<i>0.73</i>	<i>0.73</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.78</i>	0.95 ¹
2003	0.70 ³	0.70 ³	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.76</i>	0.95 ¹
2004	<i>0.68</i>	<i>0.68</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.74</i>	0.95 ¹
2005	<i>0.65</i>	<i>0.65</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.71</i>	0.95 ¹
2006	<i>0.63</i>	<i>0.63</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.69</i>	0.95 ¹
2007	<i>0.61</i>	<i>0.61</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.67</i>	0.95 ¹
2008	<i>0.59</i>	<i>0.59</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.64</i>	0.95 ¹
2009	<i>0.56</i>	<i>0.56</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.62</i>	0.95 ¹
2010	<i>0.54</i>	<i>0.54</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.59</i>	0.95 ¹
2011	<i>0.52</i>	<i>0.52</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.57</i>	0.95 ¹
2012	<i>0.50</i>	<i>0.50</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.55</i>	0.95 ¹
2013	<i>0.47</i>	<i>0.47</i>	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	<i>0.52</i>	0.95 ¹
2014	0.45 ³	0.45 ³	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	0.50 ³	0.95 ¹
2015	0.45 ³	0.45 ³	0.95 ¹	0.95 ¹	0.25 ⁴	0.84 ³	0.17 ³	0.50 ³	0.95 ¹

Table A3-3. Country specific emission factors for SNAP codes in NFR 2D3e “Degreasing”, NFR 2D3f “Dry cleaning” and NFR 2D3h “Printing”. Emission factor references given at the end of Annex 3.1. EFs in italic are interpolated.

Year	060201	060203	060204	060202	060403
1995	0.61 ⁵	0.61 ⁵	0.61 ⁵	0.30 ⁶	0.65 ¹
1996	<i>0.58</i>	<i>0.58</i>	<i>0.58</i>	0.30 ⁶	<i>0.64</i>
1997	<i>0.55</i>	<i>0.55</i>	<i>0.55</i>	0.30 ⁶	<i>0.63</i>
1998	<i>0.53</i>	<i>0.53</i>	<i>0.53</i>	0.30 ⁶	<i>0.61</i>
1999	<i>0.50</i>	<i>0.50</i>	<i>0.50</i>	0.30 ⁶	<i>0.60</i>
2000	0.47 ⁵	0.47 ⁵	0.47 ⁵	0.30 ⁶	<i>0.59</i>
2001	<i>0.44</i>	<i>0.44</i>	<i>0.44</i>	0.30 ⁶	0.58 ¹
2002	<i>0.41</i>	<i>0.41</i>	<i>0.41</i>	0.30 ⁶	<i>0.55</i>
2003	<i>0.39</i>	<i>0.39</i>	<i>0.39</i>	0.30 ⁶	<i>0.53</i>
2004	<i>0.36</i>	<i>0.36</i>	<i>0.36</i>	0.30 ⁶	<i>0.51</i>
2005	0.33 ⁵	0.33 ⁵	0.33 ⁵	0.30 ⁶	<i>0.49</i>
2006	<i>0.30</i>	<i>0.30</i>	<i>0.30</i>	0.30 ⁶	<i>0.47</i>
2007	<i>0.27</i>	<i>0.27</i>	<i>0.27</i>	0.30 ⁶	<i>0.45</i>
2008	<i>0.25</i>	<i>0.25</i>	<i>0.25</i>	0.30 ⁶	<i>0.43</i>
2009	<i>0.22</i>	<i>0.22</i>	<i>0.22</i>	0.30 ⁶	<i>0.41</i>
2010	0.19 ⁵	0.19 ⁵	0.19 ⁵	0.30 ⁶	<i>0.39</i>
2011	0.19 ⁵	0.19 ⁵	0.19 ⁵	0.30 ⁶	<i>0.36</i>
2012	0.19 ⁵	0.19 ⁵	0.19 ⁵	0.30 ⁶	<i>0.34</i>
2013	0.19 ⁵	0.19 ⁵	0.19 ⁵	0.30 ⁶	<i>0.32</i>
2014	0.19 ⁵	0.19 ⁵	0.19 ⁵	0.30 ⁶	0.30 ³

Table A3-3. Country specific emission factors for SNAP codes in NFR 2D3g "Chemical products". Emission factor references given at the end of Annex 3.1. EFs in *italic* are interpolated.

Year	060305	060307	060308	060309	060311	060312	060313	060314
1995	0.30 ¹	0.004 ¹	0.004 ¹	0.004 ¹	0.004 ¹	0.03 ³	0.010 ¹	0.50 ¹
1996	0.29 ¹	<i>0.003</i>	<i>0.003</i>	<i>0.003</i>	<i>0.003</i>	0.03 ³	0.010 ¹	0.46 ¹
1997	0.29 ¹	<i>0.003</i>	<i>0.003</i>	<i>0.003</i>	<i>0.003</i>	0.03 ³	0.010 ¹	0.42 ¹
1998	0.28 ¹	<i>0.003</i>	<i>0.003</i>	<i>0.003</i>	<i>0.003</i>	0.03 ³	0.008 ¹	0.38 ¹
1999	0.28 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.008 ¹	0.33 ¹
2000	0.27 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.008 ¹	0.29 ¹
2001	0.26 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.004 ³	0.25 ¹
2002	0.26 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.004 ³	0.20 ¹
2003	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.004 ³	0.20 ¹
2004	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.004 ³	0.20 ¹
2005	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.004 ³	0.20 ¹
2006	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.004 ³	0.20 ¹
2007	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.004 ³	0.20 ¹
2008	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.003 ³	0.20 ¹
2009	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.003 ³	0.20 ¹
2010	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.003 ³	0.20 ¹
2011	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.003 ³	0.20 ¹
2012	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.003 ³	0.20 ¹
2013	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.002 ³	0.20 ¹
2014	0.25 ¹	0.003 ³	0.003 ³	0.003 ³	0.003 ³	0.03 ³	0.002 ³	0.20 ¹

Table A3-4. Country specific emission factors for SNAP codes in NFR 2D3i "Other solvent and product use". Emission factor references given at the end of Annex 3.1. EFs in italic are interpolated.

Year	060405	060406	060407	060409	060412i	060412ii
1995	0.56 ⁷	0.64 ¹	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
1996	0.56 ⁷	0.63	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
1997	0.56 ⁷	0.62	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
1998	0.56 ⁷	0.61	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
1999	0.56 ⁷	0.60	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2000	0.56 ⁷	0.59	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2001	0.56 ⁷	0.58 ¹	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2002	0.56 ⁷	0.55	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2003	0.56 ⁷	0.52	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2004	0.56 ⁷	0.50	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2005	0.56 ⁷	0.47	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2006	0.56 ⁷	0.44	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2007	0.56 ⁷	0.41	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2008	0.56 ⁷	0.39	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2009	0.56 ⁷	0.36	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2010	0.56 ⁷	0.33	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2011	0.56 ⁷	0.30	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2012	0.56 ⁷	0.28	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2013	0.56 ⁷	0.25	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²
2014	0.56 ⁷	0.22 ³	0.95 ¹	0.95 ¹	0.95 ¹	0.275 ²

¹ Skårman, T., Danielsson, H., Henningsson, E., Östman, M. 2006. Revised Method for Estimating Emissions of NMVOC from Solvent and Other Product Use in Sweden. SMED Report no 75

² EMEP/EEA air pollutant emission inventory guidebook - 2013. 2.D.3.a Domestic solvent use including fungicides.

³ Environmental reports

⁴ EMEP/EEA air pollutant emission inventory guidebook - 2013. 2.D.3.d Coating applications. Table 3-20.

⁵ EMEP/EEA air pollutant emission inventory guidebook - 2013. 2.D.3.e Degreasing. Table 3-4. Abatement efficiency from the GAINS model.

⁶ EMEP/EEA air pollutant emission inventory guidebook - 2013. 2.D.3.f Dry cleaning. Table 3-3.

⁷ EMEP/EEA air pollutant emission inventory guidebook - 2013. 2.D.3.i, 2.G Other solvent and product use. Table 3-1.

Annex 3.2. Size distribution for PM₁₀ and PM_{2.5} as fraction of TSP

Table A3-6. Size distribution for PM₁₀ and PM_{2.5} as fraction of TSP

NFR code	Fraction of TSP	
	PM ₁₀	PM _{2.5}
2A1 - Cement production	0.90	0.80
2A2 - Lime production (Carbide production)	0.90	0.80
2A2 - Lime production (Lime production plants)	0.90	0.80
2A2 - Lime production (Sugar industry)	0.90	0.80
2A2 - Lime production (Pulp and paper industry)	IE*	IE*
2A3 - Glass production	0.90	0.70
2A5a - Quarrying and mining of minerals other than coal	0.50	0.10
2A5b - Construction and demolition	0.50	0.05
2A5c - Storage, handling and transport of mineral products	IE**	IE**
2A6 - Mineral wool production	0.90	0.70
2B5 - Carbide production	0.90	0.80
2B10a - Other inorganic chemical production***	0.90	0.80
2B10a - Other inorganic chemical production***	0.38	0.02
2B10a - Other inorganic chemical production***	Based on production of phosphate fertilizers	
2C1 - Iron and steel production (secondary)	0.95	0.85
2C1 - Iron and steel production (primary)	Based on data from producers	
2C1 - Iron and steel production (iron sponge)	0.95	0.85
2C1 - Iron ore mining, dressing and concentration	0.50	0.07
2C1 - Iron ore pellets production	1.00	1.00
2C2 - Ferroalloy production	0.99	0.75
2C3 - Aluminium production	0.95	0.43
2C7c - Other metal production	0.95	0.80
2D3b - Road paving with asphalt	0.18	0.03
2D3c - Asphalt Roofing	0.90	0.85
2G - Other product use (fireworks)	0.91	0.47
2G - Other product use (tobacco smoking)	1.00	1.00
2H1 - Pulp and paper	0.95	0.75

*= Included in 2H1

**= included in respective source category

***= different EFs for different types of production

4 Annex 4: Environmental reports in Sweden

In Sweden, approximately 6,000 “environmental hazardous activities” must have a permit to operate. Such activities are conducted on a real estate and result or may result in discharges or other disturbances to the environment, e.g. water and air pollution or noise. The number includes activities regulated in EC-directives, e.g. under the Industrial Emissions Directive (IED)⁸⁷ and Seveso directive⁸⁸.

According to chapter 9 of the Environmental Code (SFS 1998:808)⁸⁹ permits must be obtained for the establishment, operation and in some cases modification of environmentally hazardous activities on a certain scale. The structures and operations for which permits must be obtained are covered by two ordinances:

- Ordinance on Environmental Assessment (SFS 2013:251)⁹⁰
- Ordinance on Environmentally Hazardous Activities and the Protection of Public Health (SFS 1998:899)⁹¹

For permitting procedures the Code divides competence between the regional administrations and the Environmental Courts. Permits are granted by the Environmental Courts and the Environmental Permitting Committees (EPC). The EPC is a special function at the County Administrative Board (CAB). There are 21 EPCs, one in each county, and five Environmental Courts. The allocation of licensing tasks between the EPCs and the Courts is regulated in the Ordinance on Environmental Assessment. For activities that entail a significant environmental impact (classified as A-activities in the list and totalling less than 400), the proponent must apply for a permit to the Court. For activities with less impact on the environment (classified as B-activities in the list and totally around 5,500) the proponent must apply for a permit to the CAB.

Rules on the operator's responsibility for self-monitoring and environmental reports are given in chapter 26 of the Environmental Code. All operations regulated by permit must return an annual environmental report. All activities and measures that require permission or notification are subject to the Ordinance on Operators' self-

⁸⁷ Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)

⁸⁸ Directive 2003/105/EC of the European Parliament and of the Council of 16 December 2003 amending Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances.

⁸⁹ SFS 1998:808. Miljöbalken

⁹⁰ SFS 2013:251, Miljöprövningsförfordning

⁹¹ SFS 1998:899, Förfordning om miljöfarlig verksamhet och hälsoskydd

monitoring (SFS 1998:901)⁹². The requirements concerning environmental reports are given in the regulation on environmental reports (NFS 2006:9)⁹³ issued by the Swedish Environmental Protection Agency (Swedish EPA). The environmental report consists of three parts:

- Administrative information about the facility.
- Text section (for example, a description of the facility and the processes, the use of energy, chemicals and raw materials, emissions and conditions in the permit).
- Emission declaration (for example, production data, fuel consumption data, emission data and, information on how emission data have been determined i.e. measured, calculated or estimated).

The data in the environmental reports often originates from measurements or mass balances. The use of default emission factors is limited. Only the operators that exceed the thresholds for the substances listed in Swedish environmental law governing environmental reports are obliged to compile the emission declaration.

All environmental reports have to be submitted electronically via the Swedish Portal for Environmental Reporting (SMP)⁹⁴.

The environmental reporting system is essential to the credibility of the self-monitoring. The authority checks the operator performance, asks for additional measures and monitoring. The operator is obliged to keep himself informed about the activity's impact on the environment. This is done by initiating studies and measurements, or by other means. The operator should also have routines for responding to new knowledge and new information, e.g. by taking appropriate counter-measures.

⁹² SFS 1998:901, Förordning om verksamhetsutövers egenkontroll

⁹³ NFS 2006:9, Naturvårdsverkets föreskrifter om miljörapport
<http://www.naturvardsverket.se/Nerladdningssida/?fileType=pdf&downloadUrl=/Documents/foreskrifter/nfs2006/nfs-2006-09-k2014-01.pdf> 2014-12-18

⁹⁴ Svenska Miljörapporteringsportalen. <https://smp.lansstyrelsen.se>

4.1 References

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5 Annex 5: Units and Abbreviations

t	1 (metric) tonne = 1 megagram (Mg) = 106 g
g	1 gram
Mg	1 megagram = 106 g = 1 tonne
Gg	1 gigagram = 109 g = 1 kilotonne (kt)
Tg	1 teragram = 1012 g = 1 megatonne (Mt)
TJ	1 terajoule
ARTEMIS	Assessment and Reliability of Transport Emission Models and Inventory Systems
EMIR	Emission database of the County Administrative Boards
CEPMEIP	Coordinated European Programme on Particulate Matter Emission Inventories, Projections and Guidance
CLRTAP	Convention on Long-Range Transboundary Air Pollution
CO	Carbon monoxide
COP	Conference of the Parties
CORINAIR	CORe Inventory of AIR emissions'. EMEP/CORINAIR Emission Inventory Guidebook - 3rd edition
CTMP	Chemo Thermo Mechanical Pulp
CV	Calorific value
EC	European Community
EC	Environmental Class
EEA	European Environment Agency
EF	Emission Factor
EU	European Union
EMV	Emission Model for Road Traffic
EMEP	Co-operative Programme for Monitoring and Evaluation of Long-Range Transmission of Air pollutants in Europe
FAME	Fatty Acid Methyl Ester (earlier called RME)
FMV	Swedish Defence Material Administration
FOI	Swedish Defence Research Agency
FORTV	Swedish Fortification Department
FRA	National Defence Radio Institute
GHG	Greenhouse gases
Good Practice Guidance	Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
	IPCC-NGGIP
HARP	Hasselrot's Reviewed Pollutions
HBEFA	The Handbook Emission Factors for Road Transport
HELCOM	The Helsinki Commission
ICAO	International Civil Aviation Organization
IE	Included Elsewhere'
IEF	Implied emission Factor
IIR	Informative Inventory Report
Industrial statistics	Industrial energy statistics
IPCC	Intergovernmental Panel on Climate Change
IVL	Swedish Environmental Research Institute Ltd
JTI	Swedish Institute of Agricultural and Environmental Engineering
Jernkontoret	Swedish Steel Producers' Association

KEMI	Swedish Chemicals Inspectorate
LD-gas	Steel converter gas
LPG	Liquefied Petroleum Gas
LTO	Landing and Take-Off
MSW	Municipal solid waste
MTC	Motor Test Center
NA	Not Applicable
NACE	Pan-European classification system grouping organisations according to their business activities
NASN	National Administration of Shipping and Navigation
NBF	National Board of Forestry
NE	Not Estimated
NFR	Nomenclature for Reporting
NH ₃	Ammonia
NMVOC	Non methane volatile organic compounds
NO	Not Occurring
NO _x	Nitrogen oxides
O ₃	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
PAH-4	Polycyclic Aromatic Hydrocarbons (4 species as defined in the Reporting Guidelines)
PIANO	Project Interactive Analysis and Optimization
PM ₁₀	Particulate matter less than 10 micrometers
PM _{2.5}	Particulate matter less than 2.5 micrometers
QA/QC	Quality assurance and Quality control
Quarterly statistics	Quarterly fuel statistics
RME	Rapeseed Methyl Ester fuel
RVF	Swedish Association of Waste Management
SCAA	Swedish Civil Aviation Authority
SJV	Swedish Board of Agriculture
SGU	Geological Survey of Sweden
SLU	Swedish University of Agricultural Sciences
SMED	Swedish Environmental Emissions Data
SMHI	Swedish Meteorological and Hydrological Institute
SNRA	Swedish National Road Administration
SO ₂	Sulphur dioxide
SPI	Swedish Petroleum Institute
SVEFF	Swedish Paint and Print Ink Makers Association
Swedish EPA	Swedish Environmental Protection Agency
TEQ	Toxic Equivalents. Used to report the toxicity-weighted masses of dioxins and furans
TIM	Times in Mode
TMP	Thermo Mechanical Pulp
TNO	The Netherlands Organisation for Applied Scientific Research
TSP	Total suspended particulate matter
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
VETO	Mechanistic model for simulations on road traffic
VTI	Swedish Road- and Transport Research Institute