National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

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RIVM report 2022-0001

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E. Honig (author), RIVM
J.A. Montfoort (author), RIVM
R. Dröge (author), TNO[1]
B. Guis (author), CBS[2]
K. Baas (author), CBS [2]
B. van Huet (author), Rijkswaterstaat [3]
O.R. van Hunnik (author), Rijkswaterstaat [3]

1 Netherlands Organisation for Applied Scientific Research (TNO), P.O. Box 80015, NL-3508 TA Utrecht
2 Statistics Netherlands (in Dutch: 'Centraal Bureau voor de Statistiek', CBS), P.O. Box 24500, NL-2490 HA Den Haag
3 Rijkswaterstaat, P.O. Box 2232, NL-3500 GE Utrecht

Contact:
Margreet van Zanten
Milieu en Veiligheid\Centrum Milieukwaliteit\Stoffen Monitoring & Onderzoek Stikstof
margreet.van.zanten@rivm.nl

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Synopsis

Methodology for the calculation of emissions to air from the sectors Energy, Industry and Waste

Every year, the Netherlands reports, both nationally and internationally, on the quantities of substances that are emitted to the air by the industry sector and energy generation and waste processing sector (ENINA). This entails all the substances that are listed in the Netherlands Pollutant Emission Register and are relevant for ENINA, including greenhouse gases, acidifying substances and substances that cause large-scale air-pollution.

RIVM has updated and described the methods with which the emissions are calculated. These methods are adjusted every year according to the most recent scientific insights. Emission estimates are performed based on the international guidelines.

The emission data is available to the public via the website emissieregistratie.nl. It is used for reports that are mandatory under international treaties such as the Kyoto Protocol, the EU Emission ceilings (NEC Directive) and the Convention on Long-range Transboundary Air Pollution (CLRTAP). These reports also form the basis for the international reviewers who validate the Dutch reports to the EU and UN.

Keywords: emission, industry, greenhouse gases, air pollution

Publiekssamenvatting

Methodiek om Industriële emissies naar lucht te berekenen van de sectoren Energie, Industrie en Afval

Nederland rapporteert elk jaar nationaal en internationaal hoeveel stoffen door de sectoren Industrie, Energieopwekking en Afvalverwerking (ENINA) worden uitgestoten naar de lucht. Het gaat om alle stoffen die in de Emissieregistratie voorkomen en relevant zijn voor ENINA. Denk aan broeikasgassen, verzurende stoffen en stoffen die grootschalige luchtverontreiniging veroorzaken.

Het RIVM heeft de methoden waarmee de uitstoot wordt berekend, geactualiseerd en beschreven. De methoden worden elk jaar bijgesteld volgens de meest actuele wetenschappelijke inzichten. De emissieberekeningen worden uitgevoerd op basis van internationale richtlijnen.

De emissiegegevens zijn openbaar via de website emissieregistratie.nl. De gegevens worden gebruikt voor de rapportages die vanwege internationale verdragen verplicht zijn, zoals het Kyoto-protocol, de EU-Emissieplafonds (NEC-Directive) en de Convention on Long-range Transboundary Air Pollution (CLRTAP). De rapportage is ook de basis voor de (internationale) reviewers die de Nederlandse rapportages aan de EU en VN valideren.

Kernwoorden: emissie, industrie, broeikasgassen, luchtverontreiniging.

Contents

1 Introduction and scope

Industrial combustion and industrial processing cause atmospheric emissions. Combustion of fuels, with natural gas being the most used fuel in the Netherlands cause emissions of GHG and acidifying substances like SO_2 and NO_x. Industrial processes, like iron and steel production and crude oil refining and many other processes cause emissions of many substances like PM, metals, PAH and hydrocarbons.

The ENINA Taskforce is responsible for annually compiling and managing emission data on a national scale in the Netherlands of all stationary combustion sources and process emissions in the energy, industry and waste disposal sectors.
ENINA (acronym: ENergie (energy), INdustrie (industry), Afvalverwijdering (waste disposal)) is part of the Dutch Pollutant Release and Transfer Register (PRTR). The URLs to access the data are www.prtr.nl/ (English version) and www.emissieregistratie.nl/ (Dutch version). The emission data concern substances categorised as greenhouse gases, acidifying substances, toxic substances (including volatile organic compounds, metals, dioxins) and other substances that have been prioritised in environmental policy.

This report deals exclusively with atmospheric emissions; emissions to water are accounted for and entered into the PRTR by another PRTR taskforce (see www.emissieregistratie.nl).

The purpose of this report is to provide a clear description of the methods followed for assessment of air emissions originating in the energy and industry sectors in the Dutch PRTR.
The report is divided into two sections, each one dealing with two separate main methods:

- 'Air IPCC', the methods for calculating greenhouse gas (GHG) emissions prescribed by the Intergovernmental Panel on Climate Change (IPCC, 2006) is described in section 2. These calculations are used for international reporting obligations under UNFCCC, Kyoto Protocol, EU Monitoring Mechanism Regulation (MMR) and EU Effort Sharing Decision (ESD).
- 'Air actual' the method followed by the Dutch PRTR for other reporting obligations is described in section 3. These calculations are used for international reporting obligations under CLRTAP and the NEC Directive. These calculations are also used for Dutch emission maps.

Section 1.1 explains the difference between the two main methods. The subsequent sections contain general descriptions of the emission calculations, i.e. calculation quality (section 4), changes in comparison to the previous version of the Method Report (section 5), emission dispersal characteristics (section 6) and geographical distribution of emissions (section 7).

The PRTR uses a subdivision of combustion and process emissions based on emission sources related to the various economic activities

(NACE2008-harmonized SBI codes; see https://www.cbs.nl/nl-nl/onze-diensten/methoden/classificaties/activiteiten/sbi-2008-standaard-bedrijfsindeling-2008) to facilitate the reporting of Dutch emissions in accordance with several international agreements. The present report is based on this classification. Annex 1 contains a complete list of the emission sources including a reference to the section in this report where the method is described. Emission data from the emission sources listed are available on www.emissieregistratie.nl.

1.1 Methods: Air IPCC and Air Actual

The main difference between methods Air IPCC and Air Actual is the data used as input for the calculations. The calculation for the Air Actual method is based on emissions of individual companies and a supplemental estimate for remaining companies. The calculation according to Air IPCC uses data mainly derived from national energy consumption statistics and production output statistics, in some instances improved with individual company data (if this improves the emission estimate).

Greenhouse gases are calculated in both methods. The calculation methodology is the same for some sectors, but for other it differs. The reason for this is that the greenhouse gas emissions from both methodologies are used for different purposes. The greenhouse gas emissions calculated according to the IPCC methodology are used for international reporting obligations under UNFCCC, Kyoto Protocol, EU Monitoring Mechanism Regulation (MMR) and EU Effort Sharing Decision (ESD). Emissions are calculated following the UNFCCC Reporting Guidelines.
The greenhouse gas emissions calculated according to the Air Actual methodology are amongst others used for emission maps of the Netherlands. It is expected that the emissions according to the Air Actual method are more accurate for preparing the Dutch emission maps. For example, emissions from road transport in the Air Actual method are calculated based on the amount of fuel used in the country, while emissions from road transport in the Air IPCC method are calculated based on the amount of fuel sold. The first methodology will provide more accurate emission maps, while the second methodology is in line with the UNFCCC Reporting Guidelines.
Also, the two methodologies can be compared as a quality check.

1.2 Preliminary and final emission figures

In annual cycles the emission data are established twice a year (for both the Air IPCC and the Air Actual methods).
1. In June, the preliminary emission figures of the previous year are established using preliminary statistics. The preliminary emission figures are used for preliminary GHG reports. In September each year preliminary figures are published on the public website (www.emissieregistratie.nl/, national level).
2. In December the final emission figures of the previous year are established using the final energy and production statistics, as well as the emission data from the eAER. The final emission figures are used to ensure compliance with international reporting requirements, such as those pursuant to the NEC Directive, UNFCCC reporting Guidelines, etc.

The final figures are also geographically distributed and the resulting data are used as input for model calculations of air quality in so called large-scale concentration maps (GCN). In April of the next year the final figures are published on the public web site (national level and geographically distributed emissions).

2 Emission calculations according to the IPCC method

This section describes how GHG emissions are calculated using the IPCC method for the CRF categories 1 (excluding 1A3), 2 and 5. The calculated emissions are divided into four categories:

- Combustion emissions (section 2.1)
- Process emissions (section 2.2)
- Emissions from waste processing (section 2.3)
- Emissions from the extraction, transportation and distribution of oil and gas (section 2.4)

The following table shows the link between the CRF categories and the emission sources used in the Netherlands (including the relevant section describing the method). Part of the emissions in the CRF categories 1, 2 and 5 is not described in this methodology report. These emission sources are also indicated in the table, including a link to the methodology report where these sources are described.

Table 1 Allocation of CRF codes to emission sources, including a reference to the corresponding section describing the method.

CRF	Section	ES CODE	EMISSION SOURCE	Comment
1.A.1.a Public electricity and heat production	2.1	8920400	NACE 35: production and distribution of electricity and gas	
		8921800	NACE 38.1/38.2 (partly): waste-incineration plants	
		8930401	NACE 35: decentral production of electricity, general	
		8930410	NACE 35: production of electricity, heat	
	2.3	8921804	NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	
		E401200	Solid waste disposal on land: managed disposal	Emissions from combustion of landfill gas for energy recovery are allocated to CRF category 1A1a. Combustion of landfill gas for flaring and other emissions from solid waste disposal on land are allocated to CRF category 5A1
1.A.1.b Petroleum refining	2.1	8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products	Process emissions from petroleum refining are allocated to sector 1B2a4 and combustion emissions are allocated to sector 1A1b
1.A.1.c Manufacture of solid fuels and other energy	2.1	8912500	NACE 19.202: manufacture of refined petroleum products - not oil refineries	
		8924102	NACE 19.1: manufacture of coke oven products (ACZ)	Process emissions from coke production are allocated to sector

CRF	Section	ES CODE	EMISSION SOURCE	Comment
industries				1B1b and combustion emissions are allocated to sector 1A1c
		8924103	NACE 19.1: production of coke, coke factory Corus	Process emissions from coke production are allocated to sector 1B1b and combustion emissions are allocated to sector 1A1c
	2.4	0020400	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore	
		0020502	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities	
		8120001	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore	
1.A.2.a Iron and steel	2.1	8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Process emissions from the iron and steel industry are allocated to sector 2C1, combustion emissions are allocated to sector 1A2a and the use of lubricants is allocated to sector 2D1
1.A.2.b Non-ferrous metals	2.1	8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	Process emissions from carbon electrodes are allocated to sector 2C3 and combustion emissions are allocated to sector 1A2b
1.A.2.c Chemicals	2.1	8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process emissions from ammonia production are allocated to sector 2B1 and combustion emissions are allocated to sector 1A2c
		8901100	NACE 20.1: manufacture of basic chemicals	Process emissions from the chemical industry are allocated to sector 2B8 and sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
		8901702	NACE 22: manufacture of rubber and plastic products	
		8913700	NACE 20.2-20.5: chemical products industry	Process emissions from the chemical industry are allocated to sector 2B8 and sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1

CRF	Section	ES CODE	EMISSION SOURCE	Comment
1.A.2.d Pulp, paper and print	2.1	8900600	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	
		8900700	NACE 18/58: publishing, printing and reproduction of recorded media	
1.A.2.e Food processing, beverages and tobacco	2.1	8900200	NACE 10-12: manufacture of food products, beverages and tobacco	
1.A.2.f Non-metallic minerals	2.1	8914600	NACE 23: construction material and glass industry	
1.A.2.g.i Manufactu-ring of machinery	2.1	8902200	NACE 28: manufacture of machinery	
1.A.2.g.ii Manufactu-ring of transport equipment	2.1	8902400	NACE 29: motor-industry	
		8908100	NACE 30: manufacture of other transport equipment	
1.A.2.g.iii Mining and quarrying	2.1	8922701	NACE 08: other quarrying and mining	
1.A.2.g.iv Wood and wood products	2.1	8912101	NACE 16: manufacture of wooden products	
1.A.2.g.v Construction	2.1	0020401	NACE 41-43: construction and building industies	
1.A.2.g.vi Textile and leather	2.1	8900300	NACE 13/14: manufacture of textiles and textile apparel	
		8900400	NACE 15: leather industry and fur preparation	
1.A.2.g.vii Off-road vehicles and other machinery	--	0401102	Exhaust gas, mobile machinery - building & construction	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
		0401103	Exhaust gas, mobile machinery - industry	
1.A.2.g.viii Other	2.1	8900601	NACE unknown: other industry	
		8902100	NACE 25: manufacture of metal structures and parts of structures	
		8902301	NACE 26/28: manufacture of machinery and electronic apparatus	
		8902303	NACE 27: manufacture of electrical	

CRF	Section	ES CODE	EMISSION SOURCE	Comment
			apparatus	
		8902304	NACE 26: manufacture of computers and electronic and optical apparatus	
		8908000	NACE 31/32: manufacture of furniture and other goods	
		8915300	NACE 26/31/32: manufacture of electronic apparatus and furniture	
		N339000	NACE 06-33: Industry not specified	
1.A.3.a Domestic aviation	--	E301201	Exhaust gas, aviation, national	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
1.A.3.b Road transpor-tation	--	0100100	Exhaust gas, passenger cars	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
		0100400	Exhaust gas, vans	
		0100700	Exhaust gas, heavy vehicles	
		0100800	Exhaust gas, busses	
		0100805	Exhaust gas, motorcycles and mopeds	
1.A.3.c Railways	--	0200400	Exhaust gas, rail traffic	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
1.A.3.d Domestic navigation	--	0230006	Exhaust gas, inland shipping national	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
		0230101	Exhaust gas, inland navigation	
		0230302	Exhaust gas, inland navigation	
		0500100	Exhaust gas, pleasure craft	
1.A.3.e.i Other transpor-tation - pipeline transport	2.4	6800100	Gas transport network	Combustion emissions of CO2 and N2O are allocated to sector 1A3ei gaseous, other emissions are allocated to sector 1B2b4
1.A.4.a.i Commercial/ institutional Stationary combustion	2.1	0020500	Commercial and governmental institutions	Emissions from all fuels except lubricants are allocated to sector 1A4a. Emissions from lubricants are allocated to sector 2D1
		8916000	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	
		8920500	NACE 36: collection, purification and distribution of water	
		8922000	NACE 38.1/38.2 (partly): landfill	

CRF	Section	ES CODE	EMISSION SOURCE	Comment
			gas companies	
	2.3	E400109	NACE 37: collection and treatment of sewage	
1.A.4.a.ii Commercial/ institutional Off-road vehicles and other machinery	--	0401105	Exhaust gas, mobile machinery - trade, service sector, government	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
1.A.4.b.i Residential – Stationary combustion	2.1	0012100	Residential combustion	
		0012101	Residential combustion, appliances, gas leakage before ignition	
	--	0801801	Charcoal use for barbecuing	Method is described in the WESP methodology report (WESP, 2022)
		T012200	Residential combustion, wood stoves and fire places	
1.A.4.b.ii Residential – Off-road vehicles and other machinery	--	0401104	Exhaust gas, mobile machinery - consumers	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
1.A.4.c.i Agriculture/ forestry/ fishing - Stationary	2.1	0401200	NACE 0: other agriculture, hunting and services to agriculture and hunting	
		0401201	Combustion in agricultural buildings	
1.A.4.c.ii Agriculture/ forestry/ fishing - Off-road vehicles and other machinery	--	0401100	Exhaust gas, mobile machinery - agriculture	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
1.A.4.c.iii Agriculture/ forestry/ fishing - Fishing	--	0240105	Exhaust gas, fisheries	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
1.A.5.b Other – Mobile – Military use	--	0240100	Exhaust gas, militairy fuel consumption in ships and airplanes	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
1.B.1.a Coal mining and handling	--			Not occuring
1.B.1.b Solid	2.2	8912800	NACE 20.14: manufacture of	

CRF	Section	ES CODE	EMISSION SOURCE	Comment
fuel transfor-mation			inorganic basic chemicals, charcoal production	
		8924102	NACE 19.1: manufacture of coke oven products (ACZ)	Process emissions from coke production are allocated to sector 1B1b and combustion emissions are allocated to sector 1A1c
		8924103	NACE 19.1: production of coke, coke factory Corus	Process emissions from coke production are allocated to sector 1B1b and combustion emissions are allocated to sector 1A1c
1.B.1.c Other	--			Not occuring
1.B.2.a.1 Oil exploration	2.4	0020502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities	Included in 1A1C
1.B.2.a.2 Oil production	2.4	0020400	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore	Combustion emissions included in 1A1C, other emissions included in 1.B.2.c.1.iii
		8120001	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore	
1.B.2.a.3 Oil transport	2.4	8120503	NACE 495: Transport of oil via pipelines	
1.B.2.a.4 Oil refining/ storage	2.2	8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products	Process emissions from petroleum refining are allocated to sector 1B2a4 and combustion emissions are allocated to sector 1A1b
		8924204	NACE 19.201: manufacture of refined petroleum products	
1.B.2.a.5 Distribution of oil products	--			Not estimated
1.B.2.a.6 Oil - Other	--			Not estimated
1.B.2.b.1 Natural gas exploration	2.4	0020502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities	Included in 1A1C
1.B.2.b.2 Natural gas production	2.4	0020400 8120001 8120002 8120502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore NACE 06/09.1: Extraction of crude	Combustion emissions included in 1A1c, other emissions included in 1.B.2.c.1.iii

CRF	Section	ES CODE	EMISSION SOURCE	Comment
			oil and natural gas and services to extraction of crude oil and natural gas, offshore	
1.B.2.b.3 Natural gas processing	2.4	0020400 8120001 8120002 8120502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore	Combustion emissions included in 1A1c, other emissions included in 1.B.2.c.1.iii
1.B.2.b.4 Natural gas transmission and storage	2.4	6800100	Gas transport network	Combustion emissions of CO_2 and N_2O are allocated to sector 1A3ei gaseous, other emissions are allocated to sector 1B2b4
1.B.2.b.5 Natural gas distribution	2.4	0800200	Gas distribution network	
1.B.2.b.6 Natural gas - Other	--			Included in 1.B.2
1.B.2.c.1.i Venting - Oil	--			Included in 1.B.2.c.1.iii
1.B.2.c.1.ii Venting - Gas	--			Included in 1.B.2.c.1.iii
1.B.2.c.1.iii Venting - Combined	2.4	8120002	NACE 06: extraction of crude oil and natural gas, venting, offshore	
		8120502	NACE 06: extraction of crude oil and natural gas, venting, onshore	
1.B.2.c.2.i Flaring – Oil	--			Included in 1.B.2.c.2.iii
1.B.2.c.2.ii Flaring – Gas	--			Included in 1.B.2.c.2.iii
1.B.2.c.2.iii Flaring - Combined	2.4	8120000	NACE 06: extraction of crude oil and natural gas, flaring, offshore	
		8120500	NACE 06: extraction of crude oil and natural gas, flaring, onshore	
1.D.1.a Avitation bunkers	--	T000000	Bunkers: aviation	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
1.D.1.b Marine bunkers	--	T000001	Bunkers: marine	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
		T000002	Bunkers: marine, inland	
		T000003	Bunkers: marine, maritime	
2.A.1 Cement production	2.2	8914300	NACE 23.6: manufacture of articles of concrete, plaster and	

CRF	Section	ES CODE	EMISSION SOURCE	Comment
			cement	
2.A.2 Lime production	--			Included in 1.A.2.e
2.A.3 Glass production	2.2	8914000	NACE 23.1: manufacture of glass and glassware	
2.A.4.a Ceramics	2.2	8914101	NACE 23.32: manufacture of ceramic products for the building industies	
2.A.4.b Other uses of soda ash	2.2	8912702	NACE 20.13: manufacture of inorganic basic chemicals, soda consumption (PBL)	
2.A.4.c Non-metal-lurgical magnesium production	--			Not occuring
2.A.4.d Other process uses of carbonates	2.2	0834000	NACE 35.11: production of electricity, flue gas desulphurization	
		8924400	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, consumption of lime (PBL)	
		N340000	Limestone application in NACE 45: road construction	
2.B.1 Ammonia production	2.2	8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process emissions from ammonia production are allocated to sector 2B1 and combustion emissions are allocated to sector 1A2c
2.B.2 Nitric acid production	2.2	8919514	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals), production of nitric acid (PBL)	
2.B.3 Adipic acid production	--			Not occuring
2.B.4.a Caprolactam production	2.2	8919512	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals), production of caprolactam (PBL)	
2.B.4.b Glyoxal production	--			Not occuring
2.B.4.c Glyoxylic acid production	--			Not occuring
2.B.5.a Silicon	--			Included in 2.B.8.g

CRF	Section	ES CODE	EMISSION SOURCE	Comment
carbide production				
2.B.5.b Calcium carbide production	--			Not occuring
2.B.6 Titanium dioxide production	--			Included in 2.B.8.g
2.B.7 Soda ash production	2.2	8912704	NACE 20.13: manufacture of inorganic basic chemicals, production of soda ash (CBS)	
2.B.8.a Methanol production	--			Included in 2.B.8.g
2.B.8.b Ethylene production	--			Included in 2.B.8.g
2.B.8.c Ethylene dichloride and vinyl chloride monomer production	--			Not occuring
2.B.8.d Ethylene oxide production	--			Included in 2.B.8.g
2.B.8.e Acrylonitrile production	--			Included in 2.B.8.g
2.B.8.f Carbon black production	--			Included in 2.B.8.g
2.B.8.g Other petrochemical and carbon black production	2.1	8913000	NACE 20.13: manufacture of inorganic basic chemicals	Process emissions from the chemical industry are allocated to sector 2B8g, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
2.B.9.a.i	2.2	8913005	NACE 20.16: manufacture of plastics in primary forms (production of HCFK 22)	

CRF	Section	ES CODE	EMISSION SOURCE	Comment
2.B.9.a.ii	--			Not occuring
2.B.9.b.i	--			Not occuring
2.B.9.b.ii	--			Not occuring
2.B.9.b.iii	2.2	8913002	NACE 20.16: manufacture of plastics in primary forms, handling of F-gasses	
2.B.10 Other	2.2	8901100	NACE 20.1: manufacture of basic chemicals	Process emissions from the chemical industry are allocated to sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
	2.2	8912700	NACE 20.13: manufacture of inorganic basic chemicals, production of active carbon	Process emissions from the chemical industry are allocated to sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
		8912900	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	Process emissions from the chemical industry are allocated to sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
2.C.1.a Steel production	2.2	8924402	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	
2.C.1.b Pig iron production	--			Included in 2.C.1.f
2.C.1.c Direct reduced iron production	2.2	8924401	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, anode use with production of electrosteel	
2.C.1.d Sinter production	--			Included in 2.C.1.f
2.C.1.e Pellet production	--			Included in 2.C.1.f
2.C.1.f Other iron and steel production	2.2	8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Process emissions from the iron and steel industry are allocated to sector 2C1, combustion emissions are allocated to sector 1A2a and the use of lubricants is allocated to sector 2D1
2.C.3 Aluminium	2.1	8920100	NACE 24.4/24.53/24.54: manufacture and casting of light	Process emissions from carbon electrodes are allocated to sector

CRF	Section	ES CODE	EMISSION SOURCE	Comment
production			and other non-ferrous metals	2C3 and combustion emissions are allocated to sector 1A2b
	2.2	8914700	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	
2.C.4 Magnesium production				Not occuring
2.C.5 Lead production				Not occuring
2.C.6 Zinc production				Not occuring
2.C.7 Other metal industry				Not occuring
2.D.1 Lubricant use	2.1	N339000	NACE 06-33: Industry not specified	Combustion emissions are allocated to 1A2 and the use of lubricants is allocated to sector 2D1
	2.2	0020500	Commercial and governmental institutions	Emissions from all fuels except lubricants are allocated to sector 1A4a. Emissions from lubricants are allocated to sector 2D1
		8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Process emissions from the iron and steel industry are allocated to sector 2C1, combustion emissions are allocated to sector 1A2a and the use of lubricants is allocated to sector 2D1
		N091100	Use of lubricants, railways	
		N091200	Use of lubricants, road traffic	
		N091300	Use of lubricants, inland navigation	
		N091400	Use of lubricants, air traffic	
2.D.2 Paraffin wax use	--	0801000	Burning of candles	Method is described in the WESP methodology report (WESP, 2022)
2.D.3 Other use of non-energy products from fuels and solvents	--	0100204	Exhaust gas, passenger cars (diesel SCR)	Method is described in the transport methodology report (Geilenkirchen et al., 2022)
		0100504	Exhaust gas, vans (diesel SCR)	
		0100704	Exhaust gas, heavy vehicles (diesel SCR)	
		0100804	Exhaust gas, busses (diesel SCR)	
2.E.1 Integrated circuit or semi-conductor	2.2	8924509	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, production of semi-conductors	

CRF	Section	ES CODE	EMISSION SOURCE	Comment
2.E.2 TFT flat panel display	--			Not occuring
2.E.3 Photo-voltaïcs	--			Not occuring
2.E.4 Heat transfer fluid	--			Not occuring
2.E.5 Other electronics industry	--			Not occuring
2.F.1 Refrigeration and air conditioning	2.2	8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary	
2.F.1.a Commercial refrigeration	2.2	8924504	Solvent and other product use: Commercial refrigeration	
2.F.1.c Industrial refrigeration	2.2	8924505	Solvent and other product use: Industrial refrigeration	
2.F.1.d Transport refrigeration	2.2	8924507	Solvent and other product use: Transport refrigeration	
2.F.1.e Mobile air -conditioning	2.2	0120000	Solvent and other product use: air conditioning equipment, mobile	
2.F.1.f Stationary air -conditioning	2.2	8924508	Solvent and other product use: Stationary air-conditioning	
2.F.2 Foam blowing agents	--			Included in 2F6
2.F.3 Fire protection	--			Included in 2F6
2.F.4 Aerosols	--			Included in 2F6
2.F.5 Solvents	--			Included in 2F6
2.F.6 Other product uses as substitues for ODS	2.2	8924502	Solvent and other product use: other	
2.G.1 Electrical	--			Included in 2.G.2

CRF	Section	ES CODE	EMISSION SOURCE	Comment
equipment				
2.G.2 SF6 and PFCs from other product use	2.2	8924502	Solvent and other product use: other	
2.G.3.a N_2O from medical applications	--	9310100	Solvent and other product use: anaesthesia	Method is described in the WESP methodology report (WESP, 2022)
2.G.3.b N_2O from aerosol cans	--	0811301	Solvent and other product use: sprays	Method is described in the WESP methodology report (WESP, 2022)
2.G.4 Other product manufacture and use	--	0801700	Fireworks at new year	Method is described in the WESP methodology report (WESP, 2022)
		0850000	Degassing of groundwater, production of drinking water	
2.H.1 Pulp and paper	--			Not occuring
2.H.2 Food and beverages industry	2.2	8910600	NACE 10.9: manufacture of prepared animal feeds	
5.A.1 Managed waste disposal sites	2.3	E402200	Solid waste disposal on land: managed disposal	Emissions from combustion of landfill gas for energy recovery are allocated to CRF category 1A1a. Emissions from flaring of landfill gas and other emissions from solid waste disposal on land are allocated to CRF category 5A1
5.A.2 Unmanaged waste disposal sites	--			Not occuring
5.A.3 Uncategorized waste disposal sites	--			Not occuring
5.B.1 Composting	2.3	E400313	Digesting of organic waste from households	This does not include installations that treat manure. Emissions from installations that treat manure are described in the methodology report for agriculture (Van der Zee et al., 2021).
		E400314	Composting of organic waste from households	
		E400315	Digesting of organic horticultural waste	This does not include installations that treat manure. Emissions from installations that treat manure are described in the methodology

CRF	Section	ES CODE	EMISSION SOURCE	Comment
				report for agriculture (Van der Zee et al., 2021).
		E400316	Composting of organic horticulture waste	
5.C.1 Waste incineration	--			Incineration in Waste-to-Energy plants included in 1A1a.
5.C.2 Open burning of waste	--			Method is described in the WESP methodology report (WESP, 2021)
5.D.1 Domestic wastewater treatment and discharge	2.3	E400107	NACE 90.01: collection and treatment of sewage	
		E400108	NACE 90.01: collection and treatment of sewage	
		E400102	Anaerobic waste water treatement plants, other industries	
		E400103	Anaerobic waste water treatement plants, waste treatment plants	
5.D.2 Industrial wastewater treatment and discharge	2.3	E400104	Anaerobic waste water treatement plants, paper industries	
		E400105	Anaerobic waste water treatement plants, food industries	
		0444900	Indirect related to waste water	
		E400106	Discharges of domestic waste water: septic tanks, anaerobic processes	
5.D.3 Other: Septic tanks; Wastewater effluents	2.3	N000400	Indirect CO2 from NMVOC: energy	
		N000401	Indirect CO2 from NMVOC: traffic & transport	
Indirect emissions: 1. Energy	2.2	N000402	Indirect CO_2 from NMVOC: refineries	
		N000403	Indirect CO_2 from NMVOC: consumers	
		N000404	Indirect CO_2 from NMVOC: commercial and governmental institutions	
Indirect emissions: 2. Industrial processes and product use	2.2	N000405	Indirect CO_2 from NMVOC: industry	
		N000406	Indirect CO_2 from NMVOC: construction and building industries	
		N000407	Indirect CO_2 from NMVOC: agriculture	
				Not occuring
Indirect	2.2	N000408	Indirect CO_2 from NMVOC: waste	

CRF	Section	ES CODE	EMISSION SOURCE	Comment
emissions: 3. Agriculture				
Indirect emissions: 4. LULUCF	--			Not occuring
Indirect emissions: 5. Waste	2.2			
Indirect emissions: 6. Other	--			

2.1 Combustion emissions from stationary combustion (CRF 1A, excluding transport and part of CRF 2)

This section describes the method for calculating the emissions of CO_2, CH_4 and N_2O from stationary combustion sources based on fuel consumption. These emissions are reported in CRF categories 1A1, 1A2 and 1A4. Table 2 lists all CRF categories and emission sources. Calculation methods for emissions from mobile combustion are described in Geilenkirchen et al. (2022) and emissions from residential activities are described in WESP (2022).

The emissions are calculated using fuel consumption data in the Dutch Energy Balance Sheet (CBS, 2019). The total emissions are calculated by multiplying fuel consumption by default IPCC emission factors or country specific emission factors (see Table 3). For several energy intensive industries, emission figures from annual environmental reports (AERs; Dutch accronym: eMJV) of companies are used, as well as emission data reported under the ETS framework (in the Netherlands ETS data is collected by the Dutch Emissions Authority (NEa)). This extra refinement is also applied to companies using fuels with potentially non-standard emission factors, such as waste gases, and companies with significant emissions using fuels with a variable emission factor (e.g. coal). (see paragraph 2.1.3.3). The resulting calculation is a combination of Tier 2 and Tier 3 methods.

2.1.1 Emission sources

The following table lists the emission sources described in this document.

Table 2 Allocation of CRF codes to combustion emission sources classified according to NACE 2008

CRF category	ES CODE	EMISSION SOURCE
1.A.1.a	8920400	NACE 35: production and distribution of electricity and gas
	8921800	NACE 38.1/38.2 (partly): waste-incineration plants
	8930401	NACE 35: decentral production of electricity, general
	8930410	NACE 35: production of electricity, heat
1.A.1.b	8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products
1.A.1.c	8912500	NACE 19.202: manufacture of refined petroleum products - not oil refineries
	8924102	NACE 19.1: manufacture of coke oven products (ACZ)
	8924103	NACE 19.1: production of coke, coke factory Corus
1.A.2.a	8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel
1.A.2.b	8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals
1.A.2.c	8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds
	8901100	NACE 20.1: manufacture of basic chemicals
	8901702	NACE 22: manufacture of rubber and plastic products
	8913700	NACE 20.2-20.5: chemical products industry
1.A.2.d	8900600	NACE 17.1/17.2: manufacture of pulp, paper and paperboard
	8900700	NACE 18/58: publishing, printing and reproduction of recorded media
1.A.2.e	8900200	NACE 10-12: manufacture of food products, beverages and tobacco
1.A.2.f	8914600	NACE 23: construction material and glass industry
1.A.2.g.i	8902200	NACE 28: manufacture of machinery
1.A.2.g.ii	8902400	NACE 29: motor-industry
	8908100	NACE 30: manufacture of other transport equipment
1.A.2.g.iii	8922701	NACE 08: other quarrying and mining
1.A.2.g.iv	8912101	NACE 16: manufacture of wooden products
1.A.2.g.v	0020401	NACE 41-43: construction and building industies
1.A.2.g.vi	8900300	NACE 13/14: manufacture of textiles and textile apparel
	8900400	NACE 15: leather industry and fur preparation
1.A.2.g.viii	8900601	NACE: unknown industry
	N339000	NACE 06-33: Industry not specified
	8902100	NACE 25: manufacture of metal structures and parts of structures
	8902301	NACE 26/28: manufacture of machinery and electronic apparatus
	8902303	NACE 27: manufacture of electrical apparatus
	8902304	NACE 26: manufacture of computers and electronic and optical apparatus
	8908000	NACE 31/32: manufacture of furniture and other goods
	8915300	NACE 26/31/32: manufacture of electronic apparatus and furniture

CRF category	ES CODE	EMISSION SOURCE
1.A.4.a.i	0020500	Commercial and governmental institutions
	8916000	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap
	8920500	NACE 36: collection, purification and distribution of water
	8922000	NACE 38.1/38.2 (partly): landfill gas companies
	E400109	NACE 37: collection and treatment of sewage
1.A.4.b.i	0012100	Residential combustion
	0012101	Residential combustion, appliances, gas leakage before ignition
1.A.4.c.i	0401200	NACE 0: other agriculture, hunting and services to agriculture and hunting
	0401201	Combustion in agricultural buildings

Emissions from oil and gas extraction are calculated by RIVM and are described in chapter 2.4. Emissions from waste incineration are calculated by the Department of Public Works and Water Management (Rijkswaterstaat) and are described in chapter 2.3.

2.1.2 *Calculation method of preliminary emission figures*

The preliminary emissions are calculated as follows, using the preliminary energy statistics data:

*Preliminary emission = preliminary energy consumption / energy consumption t-1 * emissions t-1*

Where:

Preliminary emissions	=	Emissions of last year (kg)
Emissions t-1	=	Emissions of the year before last year (kg)
Preliminary energy consumption	=	Energy consumption of last year (GJ)
Energy consumption t-1	=	Energy consumption of the year before last year (GJ)

Additional adjustment may be required if literature shows an emission source has changed.

2.1.3 *Calculation method of final emission figures*

2.1.3.1 Introduction

The calculation is based on the fuel consumption figures from the energy statistics and the data reported by companies in the AER or under the ETS framework.

The emissions of GHGs CO_2, CH_4 and N_2O are calculated using the following formula:

Emission = fuel consumption * emission factor

2.1.3.2 Activity data

Emissions are caused by fuel combustion. The CBS Energy Statistics provides a comprehensive overview of energy consumption (expressed in PJ) in the Netherlands.

Two files are provided by CBS Energy Statistics:

- The energy consumption of individual companies, obtained by CBS through a survey.
- Fuel consumption as published by CBS in the energy statistics (file data subdivided by company group and fuel type, including supplemental estimates of consumption, not covered by CBS survey).

These files are combined in one emission calculation database including energy statistics of individual companies and energy statistics of supplemental estimates. This results in a file containing the total energy consumption in the Netherlands including the data of individual companies covering all reporting years, allowing company-specific calculations to be made.

Some biogas is added to the Dutch natural gas network. The Energy Statistics reports the data of natural gas including biogas. The total amount of added biogas in the Netherlands is also reported.
However, in the emission report, the natural gas and the biogas are reported separately. To do this, the amount of natural gas from the Energy Statistics shall be reduced by the amount of biogas. The biogas is distributed proportionately among the different CRF categories and the emission factors used are equal to the factors of natural gas.The emissions of mobile equipment are covered by the calculation of emissions from mobile sources as described in the methodology report for transport (Geilenkirchen et al., 2022).

2.1.3.3 Emission factors

The standard emission factors (EFs) based on the Dutch fuel list are included in the file (see Table 3).
The translation between the fuel names from the energy statistics and the Dutch fuel list are included in Table 9.

Table 3 List of standard emission factors, (kg/TJ)

Fuel typein the energy statistics	**EF_CO_2 (source: Zijlema, 2022)**	**EF_N_2O (source: IPCC, 2006)**	**EF_CH_4 (source: Scheffer *et al.*, 1997)**
Coal and coal briquettes (coke oven)	95400	1.5	0.44
Coal and coal briquettes (blast furnaces)	89800	1.5	0.44
Coal and coal briquettes	94700	1.5	0.44
Lignite	101000	1.5	4.4
Coal cokes	106800	1.5	44.4
Coke oven gas	42800	0.1	2.8
Blast furnace gas	247400	0.1	0.35
Coal aromatics	73300	0.6	1.6
Coal bitumen	80700	0.6	1.6
Crude oil	73300	0.6	1.4
Natural gas condensate	64200	0.6	1.9

Fuel typein the energy statistics	**EF_CO_2 (source: Zijlema, 2022)**	**EF_N_2O (source: IPCC, 2006)**	**EF_CH_4 (source: Scheffer *et al.*, 1997)**
Other crude oil raw materials	73300	0.6	1.4
Refinery gas	67000	0.1	3.6
Chemical waste gas	62400	0.1	3.6
LPG, propane, butane	66700	0.1	0.7
Naphthas	73300	0.6	3.4
Crude oil aromatics	73300	0.6	3.4
Aviation fuel	72000	0.6	3.4
Jet fuel (kerosene base)	71500	0.6	3.4
Petrol / gasoline	72000	0.6	3.4
Other light oils	73300	0.6	3.4
Petroleum	71900	0.6	3.4
Gas-oil, diesel oil, heating oil < 15cSt	74300	0.6	3.4
Heavy heating oil >= 15cSt	77400	0.6	1.6
Lubricating oils and fats	73300	0.6	1
Bitumen	80700	0.6	1.6
Mineral turpentine	73300	0.6	3.4
Mineral waxes	73300	0.6	1.5
Raw materials for carbon black	73300	0.6	1.6
Petroleum cokes	97500	1.5	3.8
Total anti-knock preparations	73300	0.6	7.5
Additives for lubricants	73300	0.6	7.5
Other crude oil products H27	73300	0.6	3.4
Other products (not H27)	73300	0.6	3.4
Natural gas (2015)	56500	0.1	5.7
Fermentation gas	90800	0.1	5
Sewage gas	84200	0.1	5
Landfill gas	100700	0.1	5
Industrial fermentation gas	84200	0.1	5
Biomass, liquid	71200	4	30
Biomass, solid	109600	4	30
Wood	109600	4	30 / 300

Notes:
CO_2 emission factors for natural gas vary yearly and are presented in Table 5. CH_4 emission factors for natural gas are only valid for natural gas not combusted in gas engines. For gas engines, the emission factors are presented in Table 6.
CH_4 emission factors for wood are 30 kg/TJ for CRF categories 1A1 and 1A2 and 300 kg/TJ for CRF category 1A4.
Residential gas leakage before ignition in cooking, hot water and space heating are not included in the CH4 emission factor for natural gas; these are separately estimated to be 35 g / GJ.

The standard emission factor cannot be used for all fuels for every year. Table 4 and Table 5 contain different emission factors for different years.

Table 4 Different CO2 emission factors, (kg/TJ), (source: Zijlema, 2022)

Fuel type	**EF_CO2 1990-2012 (source: Vreuls, 2013)**	**EF_CO2 from 2013 (source: Zijlema, 2022)**
Coal cokes	111900	106800
Coke oven gas	41200	42800
Refinery gas	66700	67000
Chemical waste gas	66700	62400

Table 5 CO_2 emission factors for natural gas, (kg/TJ), (source: Zijlema, 2022)

Years	**EF CO_2**
1990-2006	56800
2007-2008	56700
2009-2010	56600
2011-2013	56500
2014	56400
2015	56500
2016	56500
2017	56600
2018	56600
2019	56600
2020	56400

Measurements indicate that CH_4 emissions from gas engines are higher than in small-scale plants due to incomplete combustion. Therefore, a higher emission factor for CH_4 applies when a gas engine is used (see Table 6). The consumption of natural gas in gas engines is based on data provided by CBS.

Table 6 CH_4 emission factors for natural gas used in gas engines, (kg/TJ)

Year	**EF CH_4 gas engines in agriculture**	**EF CH_4 gas engines in other sectors**
1990	305	305
1991	305	305
1992	305	305
1993	305	305
1994	305	305
1995	305	305
1996	305	305
1997	305	305

Year	EF CH_4 gas engines in agriculture	EF CH_4 gas engines in other sectors
1998	294	294
1999	283	283
2000	272	272
2001	261	261
2002	250	250
2003	250	250
2004	268.9	250
2005	301.5	250
2006	354.6	250
2007	382.3	250
2008	395.3	250
2009	403.9	250
2010	410.1	250
2011	416.0	250
2012	421.8	250
2013	427.0	250
2014	431.7	250
2015	436.5	250
2016	441.3	250
2017	446.1	250
2018	450	250
2019	450	250
2020	450	250

Company specific emission factors
The CO_2 emission of a select number of companies as reported in their AERs is added to the database to refine the calculation. This refinement is mainly applied for companies using fuels with potentially non-standard emission factors (e.g. waste gases) and companies with significant emissions (e.g. coal combustion).

In practice, this concerns:
- Coal consumption in the base metal industry and power plants.
- Residual gases in refineries, the chemical industry and the base metal industry.

The company specific CO_2 emission factor for fuel types with non-standard emission factors is calculated as follows:
1. First, the CO_2 emission of the fuels with known EFs is calculated by multiplying the fuel consumption with standard CO_2 emission factor (from Table 3).
2. Second, the CO_2 emission from the specific fuel is calculated by subtracting the CO_2 emissions of the other fuels (as calculated in

step 1) from the total CO_2 emission of the company (as reported in ETS or the AER).
3. Then the company specific emission factor is calculated by dividing the fuel specific CO_2 emission with the fuel consumption from energy statistics.

This is described in the following formulas:
CO_2 emissions Refinery gas = total emission (AER/ETS) – CO_2 emissions natural gas - CO_2 emissions petroleum gas

EFCO_2 Refinery gas = CO_2 emissions Refinery gas / consumption Refinery gas

This approach provides the company-specific emission factor for the relevant fuel of that company.

Table 7 Example of basic data. Because this is not public energy data of a company, for fuel quantities are fictive values recorded.

source	**plant**	**CO_2 emissions (kg)**	**fuel type**	**consumption (TJ)**
AER	Oil refinery X	2145614210		
energy statistics	Oil refinery X		Refinery gas	15000
energy statistics	Oil refinery X		Petroleum cokes	6000
energy statistics	Oil refinery X		Natural gas	10000

Table 8 Example of calculation

	consumption (TJ)	**EF_CO_2 (kg/TJ)**	**CO_2 emissions (kg)**	**Emission factor description**
Total emission (AER)			2145614210	
Natural gas	10000	56500	565000000	Standard EF for natural gas (see Table 3)
Petroleum cokes	6000	97500	585000000	Standard EF for petroleum cokes (see Table 3)
Refinery gas	15000	66374	995614210	Company specific EF is calculated by dividing the CO_2 emissions by the fuel consumption

Company specific emission factors have been derived for the following years:
- Refinery gas: Since 2002, company-specific EFs have been derived for all companies and are used in the emissions inventory. For the years prior to this, EFs from the Netherlands' list of fuels (Zijlema, 2022) are used.
- Chemical waste gas: Since 1995, company-specific EFs have been derived for a selection of companies. For the remaining companies, the default EF is used. In 2014, this selection of companies consisted of ten companies (more than in previous years). If any of these companies was missing, then a company-specific EF for the missing company was used (derived in 1995).

For the period 1990–1994, a country-specific EF based on an average EF for four companies has been used.

- Blast furnace gas: Since 2007, company-specific EFs have been derived for most companies. Since blast furnace gas is produced only at the single iron and steel company in the Netherlands, it is assumed that all blast furnace gas has the same content and the derived EF is used for all companies using blast furnace gas. For previous years, EFs from the Netherlands' list of fuels (Zijlema, 2022) are used.
- Coke oven gas: Since 2007, company-specific EFs have been derived for most companies. Since coke oven gas is produced only at the single iron and steel company in the Netherlands, it is assumed that all coke oven gas has the same content and the derived EF is used for all companies that use coke oven gas. For previous years, EFs from the Netherlands' list of fuels (Zijlema, 2022) are used.
- Phosphor gas: Since 2006, company-specific EFs have been derived for the single company and are used in the emissions inventory. For previous years, EFs from the Netherlands' list of fuels (Zijlema, 2022) are used.
- Coal: Since 2006, company-specific EFs have been derived for most companies and for the remaining companies the default EFs is used. For previous years, EFs from the Netherlands list of fuels (Zijlema, 2022) are used.
- Coke oven/gas coke: Since 2006, a company-specific EF has been derived for one company. For the other companies, a country-specific EF is used. For the years prior to this, a country-specific EF is used for all companies.

The criteria and choice for application of either AER or ETS data in historic years are explained here below.
The CO_2 emissions from coal used by power companies are taken from the ETS reported data. However, since the ETS in some cases does not have a complete coverage of all CO_2 emissions, the specific factors of the other companies are calculated using emission data from the AER. The total amount of CO_2 emitted from refineries is taken from the AER. The data from the base metal and the chemistry sectors in the AER is used.

Note: Since the ETS definitions have been adjusted, CO_2 emissions are completely monitored in the Dutch ETS reporting. A report data consistency check also shows CO_2 emissions are completely included in the Dutch ETS reporting. This allows from 2014 and later the usage of exclusively ETS reporting for calculation of specific emission factors.

Since 2013 all company specific emission factors have been derived from the ETS reported data. From ETS we received more detailed emission company information from these years.

Tata steel is the single iron and steel company in the Netherlands and there are the only Coke Plant and blast furnace located.
The calculation method used by ETS for CO2 emissions from Tata Steel is based on a carbon mass balance for the entire company. Fugitive CO2 emissions are determined on the basis of information from the company

that about 1% of the input from coking coal is lost. The other 99% of the reported CO2 emissions are assumed to be released from fuel combustion.
When calculating the specific emission factors of Tata-Steel to arrive at the CO2 emissions of this company reported by the ETS, all energy flows from Statistics Netherlands energy statistics are considered energetic.
In the blast furnace and in the coking plant, the EF for solid fuels at N2O is 0.27 kg / TJ (based on reported emissions from Tata Steel) and for CH4 0.44 kg / TJ (standard EF for other bituminous coal).
To determine whether a particular emission factor should be used or not, for chemical companies the natural gas consumption of the company is examined. If the difference between the energy statistics from CBS and the amount of natural gas reported in AER is more than 2%, it is assumed that company definition is not the same in both datasets and the specific emission factor cannot be determined. In that case the emissions are calculated using the standard emission factor from Table 3.

In refineries and base metal industries this check is not applied because the consumption of natural gas is relatively small compared to the total energy consumption. For these companies the company boundaries are clear. Therefore it is sure that in both the energy statistics and the AER the same data is included.

Both the energy data from individual companies in the energy statistics and energy data from ETS and AER reports are confidential.

2.1.3.4 Aggregation

Aggregate emission file by fuel names and NACE level to prepare data for PRTR processing.

Table 9 Aggregated fuels

Fuel code	Fuel type in the energy statistics	Dutch fuel list
10110	Coal and coal briquettes (coke oven)	Coking Coal (used in coke oven)
10110	Coal and coal briquettes (blast furnaces)	Coking Coal (used in blast furnaces
10110	Coal and coal briquettes	Other Bitumiuus Coal
10120	Lignite	Lignite
10200	Coal cokes	Coke Oven/ Gas Coke
10300	Coke oven gas	Coke Oven gas
10400	Blast furnace gas	Blast furnace gas
10910	Coal aromatics	Other oil
10920	Coal bitumen	Bitumen
20100	Crude oil	Crude oil
20200	Natural gas condensate	Natural Gas Liquids
20300	Other crude oil raw materials	Other Petroleum Products
30100	Refinery gas	Refinery Gas
30200	Chemical waste gas	Chemical Waste Gas
30300	LPG, propane, butane	Liquefied Petroleum Gas

Fuel code	Fuel type in the energy statistics	Dutch fuel list
30400	Naphthas	Naphta
30500	Crude oil aromatics	Other oil
30600	Aviation fuel	Aviation gasoline
30800	Jet fuel (kerosene base)	Jet kerosene
30900	Petrol / gasoline	Gasoline
31000	Other light oils	Other oil
31100	Petroleum	Other kerosene
31200	Gas-oil, diesel oil, heating oil < 15cSt	Gas/Diesel oil
31300	Heavy heating oil >= 15cSt	Residual Fuel oil
31400	Lubricating oils and fats	Lubricants
31500	Bitumen	Bitumen
31910	Mineral turpentine	Lubricants
31920	Mineral waxes	Lubricants
31930	Raw materials for carbon black	Other Petroleum Products
31950	Petroleum cokes	Petroleum Coke
31960	Total anti-knock preparations	Other Petroleum Products
31970	Additives for lubricants	Other Petroleum Products
31980	Other crude oil products H27	Other Petroleum Products
31990	Other products (not H27)	Other Petroleum Products
40100	Natural gas	Natural Gas (dry)
40400	Fermentation gas	Gas Biomass
40410	Sewage gas	Wastewater biogas
40420	Landfill gas	Landfill gas
40430	Industrial fermentation gas	Industrial organic waste gas
40510	biomass, liquid	Other liquid biofuels
50520	biomass, solid	Solid biomass
50530	wood	Solid Biomass

2.1.4 *Reference Approach*

This chapter describes the methodology for determining CO_2 emissions caused by fuel combustion, according to the so-called Reference Approach. The Reference Approach is used to verify the emission data from combustion emissions in the Sectoral Approach (quality check, part of the QA/QC).
Fossil fuels are used in the Netherlands as both fuel and as raw material (feedstock). When used as a fuel, almost all the carbon is converted into CO_2, while when fossil fuels are used as feedstock, part of the carbon can be stored in products.
The Reference Approach (RA) determines the total emissions using the apparent domestic consumption of fuels as its starting point. This means that the total available amount of carbon in the Netherlands is first determined per fuel type, and then the amount stored in products is

deducted from this total. The CO_2emissions are calculated by multiplying the amount of C in this amount by the molecular weight of CO_2.
In addition to the emissions from fossil fuels, the Reference Approach also includes (for informational purposes) emissions from the use of biomass.

This paragraph describes how the apparent consumption is determined and how emissions are calculated.

Determining apparent consumption
Production + import – export – bunkers + stock change = apparent domestic consumption.

CBS Energy Statistics are used to determine the activity data. For gasoline and gas/diesel oil, the activity data is slightly modified. The CBS energy statistics of gasoline and gas/diesel oil contain both the fossil part and the biogenic part of the fuels. The biogenic part of the gasoline and gas/diesel oil is subtracted from the total gasoline and gas/diesel oil statistics. The energy statistics only contain biogenic gasoline and gas/diesel oil consumption and no data on the production, import, export and stock change. Therefore, the consumption of biogenic gasoline and gas/diesel oil is included in the Reference Approach as “import”.

Calculating emissions
The emissions are calculated using the following four steps:

Step 1: Calculating the carbon content
The carbon content is calculated per fuel, by multiplying the apparent energy consumption by the fuel specific carbon content. This fuel specific carbon content is taken from the national fuels list (Zijlema, 2022).

Step 2: Determining the amount of carbon for feedstock and non-energy use of fuels
The CBS Energy Balance provides the data on the non-energetic use of fuels. This is the same as that submitted to the IEA. The non-energetic use is multiplied by the carbon content of the fuel. Similar to Step 1, this factor is taken from the national fuels list (Zijlema, 2022). The result of this multiplication is the amount of carbon stored per fuel.

Step 3: calculating net carbon emissions
The net carbon emissions are calculated by deducting the carbon stored (step 2) from the carbon content (step 1).

Step 4: calculating the actual CO_2 emissions
The CO_2 emissions are calculated by multiplying the amount of C by the conversion factor of 44/12.
The CO_2 emissions from the Sectoral Approach are compared to the CO_2 emissions from the Reference Approach. Statistical differences are taken into account in the comparison. The results of the comparison are reported in the NIR.

In 2018, a peer review on the Reference Approach calculation was performed by CE Delft. This resulted in a few improvements in the NIR and the methodology report:

- Coal has been split up between other bituminous coal, anthracite and coking coal.
- Description in the NIR and the methodology report has been improved.

2.2 Process emissions (CRF 2 and part of CRF 1))

2.2.1 Emission sources

Process emissions are released by many different emission sources. The calculation of these emissions is explained in the following sections. Table 10 shows the emission sources with a reference to the sections in which they are described.

Table 10 Allocation of CRF codes to process emission sources classified according to NACE 2008 with reference to paragraph of method description.

CRF	Paragraph	ES CODE	EMISSION SOURCE
1.A.1.b	2.2.3.1	8924200	NACE 19.2: Manufacture of refined petroleum products
1.B.1.b	2.2.3.1	8924102	NACE 19.1: manufacture of coke oven products (ACZ)
1.B.1.b	2.2.3.1	8924103	NACE 19.1: Production of coke, coke factory Corus
1.B.1.b	2.2.3.2	8912800	NACE 20.14: Manufacture of inorganic basic chemicals, charcoal production
1.B.2.a.4	2.2.3.1	8924200	NACE 19.2: Manufacture of refined petroleum products
1.B.2.a.4	2.2.3.1	8924204	NACE 19,201: Manufacture of refined petroleum products
2.A.1	2.2.3.2	8914300	NACE 23.6: manufacture of articles of concrete, plaster and cement
2.A.2	2.2.3.2	8900205	NACE 10.810 sugar production, lime production
2.A.3	2.2.3.2	8914000	NACE 23.1: manufacture of glass and glassware
2.A.4.a	2.2.3.2	8914101	NACE 23.32: manufacture of ceramic products for the building industies
2.A.4.b	2.2.3.2	8912702	NACE 20.13: Manufacture of inorganic basic chemicals, soda consumption
2.A.4.d	2.2.3.2	0834000	NACE 35.11: Production of electricity, flue gas desulphurization
2.A.4.d	2.2.3.2	8924400	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel, consumption of lime
2.A.4.d	2.2.3.2	N340000	Limestone application in NACE 45: road construction
2.B.1	2.2.3.1	8900900	NACE 20.15: Manufacture of fertilisers and nitrogen compounds
2.B.2	2.2.3.3	8919514	NACE 20,149: Manufacture of organic basic chemicals (no petrochemicals), production of nitric acid
2.B.4.a	2.2.3.4	8919512	NACE 20,149: Manufacture of organic basic chemicals (no petrochemicals), production of caprolactam
2.B.7	2.2.3.1	8912704	NACE 20.13: Manufacture of inorganic basic chemicals, production of soda ash (CBS)
2.B.8.g	2.2.3.1 and 2.2.3.2	8913000	NACE 20.13: manufacture of inorganic basic chemicals

CRF	Paragraph	ES CODE	EMISSION SOURCE
2.B.9.a.1	2.2.3.2	8913005	NACE 20.16: Manufacture of plastics in primary forms, production of HCFK 22
2.B.9.b.3	2.2.3.1	8913002	NACE 20.16: Manufacture of plastics in primary forms, Others (mainly handling F-gases)
2.B.10	2.2.3.2	8901100	NACE 20.1: manufacture of basic chemicals
2.B.10	2.2.3.1	8902302	NACE 26/27: Electrotechnical industry
2.B.10	2.2.3.1	8912700	NACE 20.13: Manufacture of inorganic basic chemicals, production of active carbon
2.B.10	2.2.3.1	8912900	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)
2.C.1.a	2.2.3.2	8924402	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel
2.C.1.f	2.2.3.2	8924401	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel, anode use with production of electrosteel
2.C.3.a	2.2.3.7	8914700	NACE 24.4/24.53/24.54: Manufacture and casting of light and other non-ferrous metals
2.D.1	2.2.3.1	0020500	Commercial and governmental institutions (use of lubricants)
2.D.1	2.2.3.1	8901100	NACE 20.1: manufacture of basic chemicals
2.D.1	2.2.3.1	8915005	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, metallic products, (electrical) appliances, instruments, parts
2.D.1	2.2.3.1	8924407	NACE 24.1-24.3/24.51/24.52: Base metal: iron and steel
2.D.1	2.2.3.1	N091100	Use of lubricants, railways
2.D.1	2.2.3.1	N091200	Use of lubricants, road traffic
2.D.1	2.2.3.1	N091300	Use of lubricants, inland navigation
2.D.1	2.2.3.1	N091400	Use of lubricants, air traffic
2.E.1	2.2.3.8	8924509	NACE 25-33/95: Metal-electronic industry, production of semi-conductors
2.F.1.	2.2.3.9	8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary
2,F,1,a	2,2.3.9	8924504	Solvent and other product use: Commercial refrigeration
2,F,1,c	2,2.3.9	8924505	Solvent and other product use: Industrial refrigeration
2,F,1,d	2,2.3.9	8924507	Solvent and other product use: Transport refrigeration
2,F,1,e	2,2.3.10	0120000	Solvent and other product use: air conditioning equipment, mobile
2,F,1,f	2,2.3.9	8924508	Solvent and other product use: Stationary air-conditioning
2.F.6	2.2.3.11	8924502	Solvent and other product use: other (HFCs)
2.G.1	2.2.3.12	8924502	SF_6 emissions from the high-voltage power industry
2.G.2.	2.2.3.13	8924502	Solvent and other product use: other (SF_6)
2.H.2	2.2.3.1	8910600	NACE 10.9: Manufacture of prepared animal feeds
1	2.2.3.14	N000400	Indirect CO2 from NMVOC: energy
1	2.2.3.14	N000401	Indirect CO2 from NMVOC: traffic & transport

CRF	Paragraph	ES CODE	EMISSION SOURCE
1	2.2.3.14	N000402	Indirect CO2 from NMVOC: refineries
2	2.2.3.14	N000403	Indirect CO2 from NMVOC: consumers
2	2.2.3.14	N000404	Indirect CO2 from NMVOC: Commercial and governmental institutions
2	2.2.3.14	N000405	Indirect CO2 from NMVOC: industry
2	2.2.3.14	N000406	Indirect CO2 from NMVOC: construction and building industies
3	2.2.3.14	N000407	Indirect CO2 from NMVOC: agriculture
5	2.2.3.14	N000408	Indirect CO2 from NMVOC: waste

In the Netherlands, many industrial processes take place in only one or two companies. Because of the sensitivity of data from these companies, only the total emissions are reported (according to the Aarhus Convention). Emissions at installation level and production data are, unless a company has no objection to publication, confidential information. All the confidential information is available for the inventory compilation. The taskforce ENINA has direct access to this confidential data. ENINA can provide the confidential information to official review teams (after signing a confidentiality agreement).

2.2.2 Calculation method of preliminary emission figures

The calculation method of preliminary emission figures is identical to the calculation method of final emission figures. Only the input data for the calculations are different. As far as final (activity) data is not available, preliminary data is used. Sometimes final data is available already when preliminary figures should be presented, so then the final emission figures can be calculated and presented already. See paragraph 2.2.3 for the calculation method.

2.2.3 Calculation method of final emission figures

2.2.3.1 Fossil process emissions (part of CRF 1B and CRF 2)

This paragraph describes the methodology for determining the fossil process emissions of CO2 and CH4.The CO_2 and CH_4 process emissions described in this paragraph are subdivided into two main groups:

A. emissions resulting from conversion losses when converting from one fuel to another:
   1. Solid fuel transformation – (CRF code 1.B.1.b)
   2. Production of charcoal – (CRF 1.B.1.b)
   3. Petroleum refining – (CRF codes 1.A.1.b and 1.B.2.a.4)

B. emissions directly relating to non-energetic fuel consumption:
   1. Ammonia production – (CRF code 2.B.1)
   2. Soda ash production – (CRF code 2.B.7)
   3. Chemical industry: Petrochemical and carbon black production – (CRF code 2.B.8.g)
   4. Manufacture of basic chemicals (CRF code 2.B.10)
   5. Food and beverages industry - (CRF code 2.H.2)
   6. Lubricants use – (CRF code 2.D.1)

The CO_2 emissions resulting from the use of fossil fuels as feedstocks for the production of silicon carbide, carbon black, ethylene and methanol are included in the Energy sector (CRF 1.A.2.c).

Calculation method and emission
During the 2017 in country review recommendations were made to improve the transparency of the emissions from the iron and steel plant TATA Steel. After some consultations between the company (Tata Steel) and the Dutch PRTR these recommendations were followed and resulted in the reallocation of emissions within and between the following categories:

- o 1.A.1.c i Manufacture of solid fuels;
- o 1.A.2.a Energy Iron and Steel;
- o 1.B.1.b Solid fuel transformation;
- o 2.A.4.d Other process uses of carbonates;
- o 2.C.1 Iron and steel production.

Overall CO2 emissions did not change.
More information can be found in A1 of this paragraph and in paragraph 2.2.3.2 (2.A.4.d and 2.C.1.a).

A1. **Solid fuel transformation (cokes) - (CRF code 1.B.1.b).**
Fugitive emissions of CO2 and CH4 from this category refer to coke manufacture. The Netherlands currently has only one coke production facility at the iron and steel plant of Tata Steel. A second independent coke producer in Sluiskil discontinued its activities in 1999. CH4 emissions are determined by multiplying the activity data (transformation figures) by the emission factor. To calculate the emission of CH4 from coke production the standard IPCC value of 0.1 kg CH4 per ton of coke is used
CO2 emissions related to transformation losses from coke ovens are only a small part of the total emissions from the iron and steel industry in the Netherlands. Until the 2018 submission the figures for emissions from transformation losses were based on national energy statistics of coal inputs and of coke and coke oven gas produced and a carbon balance of the losses. Any non-captured gas was by definition included in the net carbon loss calculation used for the process emissions. Because of the uncertainty in the very large input and output volumes of the coke oven the amount of fugitive emissions calculated with the used method was unrealistically high. Therefore, from this year on the CO2-emission factor for fugitives is determined on the basis of the conservative assumption that about 1% of the coke oven input is lost in the form of fugitive emissions.

A2. **Production of charcoal - (CRF 1.B.1.b)**
With respect to fugitive CH_4 emissions from 'charcoal production', the Netherlands had one large production location until 2009 that served most of the Netherlands and also occupied a large share of the market for neighbouring countries. The production at this location stopped in 2010.
In 1998 the operator changed from traditional production to Twin retort system (Charcoal production with reduced emissions),
Charcoal production figures are taken from IEA Renewable Information 2011.
The following emission factors have been used:

- 1990-1997: 0.03 kg CH4/kg charcoal. The IPCC 1996 Guidelines (IPCC 1996, Reference Manual, Energy, pg 1.46, Table 1-14) provide an emission factor of 1000 kg CH4/TJ charcoal.

Combined with a heating value of 30 MJ/kg charcoals these results in an emission factor of 0.03 kg CH4/kg charcoal.
- 1998-2010: 0.0000111 kg CH4/kg charcoal (Reumermann e.a., 2002).

A3. **Petroleum refining – (CRF codes 1.A.1.b and 1.B.2.a.4).**
Until the 2007 submission all the CO_2 emissions from refineries were included in CRF code 1.A.1.b. From the 2007 submission, the process emissions of CO_2 from a hydrogen plant of a refinery (about 0.9 Tg CO_2 per year) are reported in 1.B.2.a.4. Refinery data specifying these fugitive CO_2 emissions are available from 2002 onwards (environmental reports from the plant) and re-allocated from 1.A.1.b to 1.B.2.a.4 from 2002 onwards. CO_2 Emissions are determined by multiplying the activity data(transformation figures) by the emission factors. The CH4 process emissions are taken from the individual company figures in the annual environmental report.

B1**. Ammonia production – (CRF code 2.B.1).**
Natural gas is used as feedstock for ammonia production. CO_2 is a by-product of the chemical separation of hydrogen from natural gas. During the process of ammonia (NH3) production, hydrogen and nitrogen are combined and react together. A method equivalent to IPCC Tier 3 is used to calculate CO_2 emissions from ammonia production in the Netherlands. The calculation is based on the consumption of natural gas and a country-specific EF. Data on the use of natural gas is obtained from Statistics Netherlands. Because there are only two ammonia producers in the Netherlands (three until 2000), the consumption of natural gas and the country specific EF are confidential information. A part of the CO_2 is emitted, and a part is stored in the urea produced. According to the IPCC-Guidelines, this CO_2 stored in the product should be subtracted from the production emissions. Emissions occurring in the sectors where the urea is applied (agriculture, car-SCR, melamine production), should be allocated to those sectors. Up to the 2020 NIR submission, this subtraction was not performed, so the CO_2 stored in the urea was allocated to Ammonia production (2B1). From NIR submission 2021 on the method was adapted.

Stored and emitted CO_2 are calculated as follows:
- In urea: production figures of the two production plants (and for 1990-2000 also for the third plant) are obtained by confidential information of those producers. Stored CO_2 is calculated by using the Guidebook factor: 44.0095 kg CO_2 for 60,05526 kg urea.
- Melamine produced from urea: production figures of the only melamine production plant in the Netherlands are obtained by confidential information. Urea used for the melamine production is calculated using the factor 360/126, and the stored CO_2 using the factor shown above. This amount is assumed to be emitted for 50% and stored in the melamine for 50%.
- Urea used for fertilizer in agriculture: from fertilizer sales expressed in nitrogen, the amount of urea is calculated by atom weigths: 60/28. CO_2 emitted by fertilizer application is calculated using the default emission factor of 0,2 kg C per kg of urea and atom weights 44/12.

- Urea used for Selective Catalytic Reduction in personal cars: CO_2 emission is calculated by figures taken from national traffic schemes.

CO_2 emissions are allocated as follows:
- *2B1:* CO_2 stored as calculated above are subtracted from the production emissions, the rest is emitted
- *2B8g:* CO_2 emissions from melamine production are allocated to 2B8g
- CO_2 emitted by fertilizer application is allocated to Agriculture (3H)
- CO_2 emission from car SCR is allocated to Traffic (2D3).

As the Netherlands is a net exporter of fertilisers, the by far largest amount of the stored CO2 is exported, and emitted abroad by application. CO2 emissions from Ammonia production (2B1) in the Netherlands are covered by the scope of EU ETS. For ETS reporting, the CO2-storage should not be subtracted.

B2**. Soda ash production – (CRF code 2.B.7).**
CO2 emissions are related to the non-energy use of coke. Before the closure in 2010 of the only soda ash producer, CO2 emissions were calculated on the basis of the non-energy use of coke and the IPCC default EF (0.415 t/t), assuming the 100% oxidation of carbon. The environmental report was used for data on the non-energy use of coke. To avoid double counting, the plant-specific data on the non-energy use of coke is subtracted from the non-energy use of coke and earmarked as feedstock in national energy statistics.
The Netherlands has included the notation code NO in the CRF tables (from 2010 onwards) as soda ash production stopped.

B3**. Chemical industry: Petrochemical and carbon black production - (2B8).**
Ethylene oxide production - (2B8d): CO2 emissions are estimated on the basis of capacity data by using a default capacity utilization rate of 86% (based on Neelis et al., 2005) and applying a default EF of 1.79 kg CO_2 /t ethylene oxide. As there is no real activity data available at this moment in the Prodcom database from EUROSTAT, the Netherlands cannot verify this assumption on the activity data for ethylene oxide production.

Titanium dioxide production – (CRF code 2B6): CO2 emissions arise from oxidation of coke as reductant. 2B6 (Titanium dioxide production): Activity data is confidential. Only emissions are reported by the company.
Silicon carbide production - (2B5a): Petrol cokes are used during the production of silicon carbide; the volatile compounds in the petrol cokes form CH4. The activity data (petcoke) is confidential, so the IPCC default EF was used to calculate CH4 emissions.

Methanol - (2B8a), Ethylene - (2B8b), Acrylonitrile - (2B8e) and Carbon black - (2B8f) production CH4: The CH4 process emissions from these sources are calculated by multiplying the specific EF by the annual production.

Acrylonitrile - (2B8e): Since the 2019 submission this *previously unknown N2O source is included. The N2O emissions from 2017 are based on* *measurements. For the period 1990-1994 and the period 2010-2016 the emissions are calculated with the help of the emission and the production level in 2017 and the production levels in both periods. Emissions for the period 1995–2009 have been determined by interpolation between 1994 and 2010. Because it is not possible to include N2O emissions from this source in 2.B.8.g in the CRF table, the N2O emissions from this source are included in 2.B.10 in the CRF table.*

Melamine - (2B8g): See above under 2B1.

B4. **Manufacture of basic chemicals - (2B10).**
The aggregated CO2 emissions included in this source category are not identified as a key source. Because no IPCC methodologies exist for these processes, country-specific methods and EFs are used. These refer to:

- *The production of industrial gases:* With natural gas as input (chemical feedstock), industrial gases, e.g. H2 and CO, are produced. During the gas production process CO2 is emitted. Until the 2020 NIR submission, emissions were calculated by assuming that CO2 is stored in the product. An oxidation fraction of 20% (80% storage) was derived from Huurman (2005). From the two producers in the Netherlands, the total amount of carbon stored in the industrial gases produced and the total carbon content of the natural gas used as feedstock was derived from the AERs. These data resulted in a storage factor of 80%. The storage factor was determined by dividing the total amount of carbon stored in the industrial gases produced by the carbon content of the natural gas used as feedstock.
  From the 2021 NIR-submission on, the method was changed by using data from the ETS emission reports to the NEa, that was available since 2012. From that, it appeared that there is no storage at all. Process emission data from 2012 on is taken directly from the ETS-reports.
- *Production of carbon electrodes (Anode production):* CO2 emissions are estimated on the basis of fuel use (mainly petcoke and coke). A small oxidation fraction (5%) is assumed, based on data reported in the AERs.

B5. **Food and beverages industry - (CRF code 2.H.2).**
This category comprises CO2 emissions related to Food and drink production (2H2) in the Netherlands. CO2 emissions in this source category are related to the non-energy use of fuels. Carbon is oxidized during these processes, resulting in CO2 emissions.
The methodology used to estimate the GHG emissions complies with the IPCC 2006 Guidelines, volume 3. CO2 emissions are calculated on the basis of the non-energy use of fuels by the food and drink industry as recorded by Statistics Netherlands in national energy statistics on coke consumption, multiplied by an EF. The EF is based on the national default carbon content of the fuels, on the assumption that the carbon is fully oxidized to CO2.

B6**. Lubricants use – (CRF code 2.D.1).**
The CO2 emissions reported in category 2D1 stem from direct use of specific fuels for non-energy purposes, which results in partial or full oxidation during use (ODU) of the carbon contained in the products.

A Tier 1 method is used to estimate emissions from lubricants using an IPCC default EF and an ODU factor of 20%.
The activity data is based on fuel use data from Statistics Netherlands.

Emission factors
CO_2 emission factors are taken from the standard national fuels list (Zijlema, 2022). The emission factors from oil refining are not known, but an implied emission factor can be calculated per ton of oil input.

In 2004 the storage factors were redefined for the entire period 1990-2003. In Table 11 the sector-specific storage factors are shown whereby a limited use was made of the AER (Huurman, 2005). In other situations that concern non-energetic use, all fuels are assumed to be stored entirely (storage factor = 1), with the exception of lubricating oils and fats, where the storage factor is set to 0.8.

Table 11 Sector-specific storage factors for situations where emissions are determined directly from non-energetic use

NACE code	Sector description	Fuel	Storage factor
23	Cement and concrete	Petroleum coke	0
26	Other electrical equipment	Petroleum coke	0.95
20.1	Residual base chemicals	Natural gas	0.8
20.1	Residual base chemicals	Petroleum coke	0.3
10-12	Other foodstuffs	Coke	0
20.1	Inroganic base chemicals (excl gas, pigments)	Coke	0
20.15	Fertiliser industry	Natural gas	0
23	Cement and concrete	Lubricant	0
24.1/24.3	Base metal: iron and steel	Coke	0
24.1/24.3	Base metal: iron and steel	Lubricant	0
24.4/24.5	Base metal: non-ferrous	Petroleum coke	0.95
10-12	Meat	Coke	0
23	Glass	Petroleum coke	0
23	Glass	Lubricant	0
23	Glass	Diesel	0

The following CH_4 emission factors from the 2006 IPCC Guidelines (IPCC, 2006: Volume 3; Chapter 4, page 4.26 / Chapter 3, paragraphs 3.6 and 3.9) are used:

- coke production: 0.1 kg CH_4 per ton coke;
- silicon carbide: 11.6 kg CH_4 per ton silicon carbide;
- carbon black: emission factor 28.8 kg CH_4 per ton product;
- ethene: CO_2 emissions are estimated on the basis of capacity data by using a default capacity utilization rate of 86% (based on Neelis et al., 2005) and applying a default EF of 3 kg CH_4 per ton product;
- methanol: emission factor 2.3 kg CH_4 per ton product.

Activity data
Activity data on the usage of fuels are obtained from the Dutch energy balance sheet (CBS).

2.2.3.2 Non-fossil process emissions (part of CRF 2)
In addition to CO_2 emissions from the combustion or non-energetic use of fossil fuels, relatively small amounts of CO_2 emissions are also caused by the acidification of limestone and dolomite (i.e. CaCO3 and CaCO3.MgCO3) respectively, plus other minerals that contain carbonate, from carbon in iron ore and the use of soda ash. In the Netherlands this concerns the following sources, listed according to the IPCC guidelines:

- Manufacture of articles of concrete, plaster and cement (CRF 2.A.1);
- Sugar production, lime production (CRF 2.A.2);
- Manufacture of glass and glassware (CRF 2.A.3);
- Manufacture of ceramic products for the building industries (CRF 2.A.4.a);
- Manufacture of inorganic basic chemicals, soda consumption (CRF 2.A.4.b);
- Production of electricity, flue gas desulphurization (CRF 2.A.4.d);
- Base metal industry, processing and manufacture of iron and steel, consumption of limestone and dolomite (CRF 2.A.4.d);
- Limestone application in NACE 45: road construction (CRF 2.A.4.d).

The following other direct CO_2 process emissions are also included:

- Manufacture of inorganic basic chemicals, production of active carbon (CRF 2.B.10);
- Manufacture of inorganic basic chemicals, production of acrylonitrile (CRF 2.B.8.e);
- Base metal industry, processing and manufacture of iron and steel, (2.C.1.a);Base metal industry, processing and manufacture of iron and steel, anode use with production of electro-steel (2.C.1.f);
- Manufacture and casting of light and other non-ferrous metals, anode use (CRF 2.C.3).

Calculation method and emission factors
Manufacture of articles of concrete, plaster and cement (CRF 2.A.1)
The CO_2 process emissions during cement production occur when limestone is used to produce cement clinker. Cement is only produced by one company in the Netherlands (ENCI).

Because of changes in raw material composition over time, it is not possible to estimate reliably CO2 process emissions on the basis of clinker production activity data and a default EF. For that reason, the only cement producer in the Netherlands (closed since June 2020) has chosen to base the calculation of CO2 emissions on the carbonate content of the process input. From 2002 onwards, the Process emissions from Clinker production are calculated as follows:

$$Em = AD * Rf * C * 44/12$$

Where:

Em = Process Emissions (ton);
AD = amount of raw material (incl organic fraction) in ton;
Rf = Recirculation factor (calculated via vowel viewing);
C = Total C content of the raw material in ton C/ton raw material (Determined weekly).

The CO2 emissions from the raw material are calculated on a monthly basis by multiplication of the amount of raw material (incl. organic fraction) and a derived process EF. The content of organic carbon in the raw material is < 0.5%. From every batch in a month, a sample is taken just before the raw material is fed into the kiln. The process EF and composition of the batch are determined in a laboratory. The EF is determined by measuring the weight loss of the sample. The monthly EF is set as the average of all sample EFs determined that month.
As a result, the total yearly process emissions of the company are the sum of all monthly CO2 emissions.

This methodology is also included in a monitoring plan applied to emissions trading. This plan has been approved by the Dutch Emissions authority (NEa), the government organization responsible for the emissions trading scheme (ETS) in the Netherlands. This organization is also responsible for the verification of the data reported by this company. The verified CO2 emissions are also reported in its AER.
For the years prior to 2002, only total CO2 emissions from the AER are available, so that it is not possible to allocate the total CO2 emissions to fuel use and the above mentioned subsources. Therefore, for that period, CO2 process emissions have been calculated by multiplying the average IEF of 2002 and 2003 by the clinker production. Clinker production figures are obtained from the AERs.
CO2 process emissions from the AERs are related to clinker production figures to give the annual CO2 IEF for clinker production. Over the period 2002-2018 this IEF varies between 0.48 and 0.54 ton CO_2 / ton clinker.

Lime production (2.A.2)
CO2 emissions occur in two plants of the sugar industry, where limestone is used to produce lime. The lime in the sugar process is used for the sugar juice purification. Lime production does not occur in the paper industry in the Netherlands. The limestone use depends on the beet sugar production. Approximately 375 kg of limestone is required for each ton of beet sugar produced (SPIN, 1992)
The emissions are calculated using the standard IPCC EF of 440 kg CO2 per ton of limestone (IPCC default).

Manufacture of glass and glassware (CRF 2.A.3)
The use of limestone, dolomite, soda ash and other substances during glass production results in CO_2 emissions.
Until the 2015 submission the CO_2 emissions were based on plant-specific emission factors (default IPCC emission factors were not available) and the gross glass production. Plant-specific EFs have been used for the years 1990 (0.13 t CO_2/t glass), 1995 (0.15 t CO_2/t glass) and 1997 (0.18 t CO_2/t glass). For other years in the time series, there were not enough data available to calculate country -specific EFs. For

the years 1991–1994 and 1996, EFs have been estimated by interpolation. Because no further measurement data are available, the EF for 1998–2012 was kept at the same level as the EF of 1997 (0.18 t CO_2/t glass). Because no reliable data regarding the growth in the use of recycled scrap glass (cullet) used in the glass production sector are available for the period 1997-2012, the estimation of CO_2 emissions did not take into account the growth in the use of recycled scrap glass (cullet) used in glass production. Activity data (gross glass production) were based on data from Statistics Netherlands (CBS) and the trade organization.

From the 2015 submission, the emissions are based on the emissions from the verified EU ETS Emission Reports of the glass production companies and the emissions as estimated in earlier submissions for the year (“old 1990” emissions). Verified EU ETS Emission Reports are available from 2005 onwards. For the CO_2 emission calculation from the use of limestone, dolomite and soda ash default IPCC emission factors are used and for the other substances the C-content is multiplied by 44/18. The consumption of limestone, dolomite, soda ash and other substances are confidential information to the public.

Due to the lack of information on the use of recycled scrap glass (cullet) the emissions for the period 1991- 2005 have been determined via interpolation. For this calculation the “old 1990” emissions has been used as starting point.

Manufacture of ceramic products for the building industries (CRF 2.A.4.a)

Ceramics include the production of bricks,roof tiles, floor tiles. wall tiles, refractory products and other ceramic products.
Process-related CO_2 emissions from ceramics result from the calcination of carbonates in the clay.
The calculation of CO_2 emissions by the manufacture of ceramic products in the Netherlands complies with the Tier 1 method as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 2, pg. 2.34).

$$CO_2\ Emissions = Mc \bullet (0.85EFls + 0.15EFd)$$

Where:
- Mc = mass of carbonate consumed (tonnes)
- 0.85 = the default fraction Limestone
- 0.15 = the default fraction Dolomite
- EF ls = emission factor limestone (0.440 ton CO_2/ton Limestone)
- EF d = emission factor dolomite (0.477 ton CO_2/ton Dolomite)

The mass of carbonate consumed (Mc) is determined as follows:

$$Mc = Mclay * cc$$

Where:
Mclay = the amount of clay consumed; this is calculated by multiplying the national production data for bricks and roof tiles, vitrified clay pipes, and refractory products with a default loss factor of 1.1.

cc = the default carbonate content of clay (0.1)

Use of soda ash (CRF 2.A.4.b)
The use of soda ash can be calculated from the net domestic consumption: production + import – export. The production figures are not published annually and, in the CBS statistics for foreign trade, the import figures prior to 1996 and the export figures prior to 2001 are considered confidential (CBS, Statline, Trade with other countries and types of goods, 1996-2002). The only available source for estimating production is Struker (NEEDIS report 1994), which mentions a production capacity of 400 ktonnes. For the years 2001 and 2002, the net domestic consumption is estimated by taking the aforementioned production figure of 400 ktonnes as a basis, and then adding the import figures and deducting the export figures for the relevant year. For the years before 1990 through 2000 and the year 2003 and later, these figures are estimated by extrapolating from the figures for 2001 and 2002. This extrapolation uses the trend in chemical production, since this is an important user of soda ash. The emissions are calculated using the standard IPCC factor of 415 kg CO2 per ton of soda ash (Na2CO3), (2006 IPCC guidelines, Volume 3, Chapter 2, Table 2.1):

CO_2 = soda ash use (Gg) * EF CO_2 (kg/Gg)

In order to prevent double input – because soda ash is also used in glass production – the CO_2 emissions from soda ash usage for glass production should be subtracted from the above, because these are reported integrally. However, this procedure has not been implemented in the figures delivered so far, due to lack of data and because the small amount of CO_2 emissions estimated as being associated with soda ash use contain a considerable margin of uncertainty.

Production of electricity, flue gas desulphurization (CRF 2.A.4.d)
Until the 2005 submission the CO2 process emissions from flue-gas desulphurisation installations (FGDIs) at coal-fired power plants were determined (through lack of a more accurate method), via the gypsum production from FGDIs, based on the gypsum production and the stoichiometric relationship between limestone (CaCO3), FGD-gypsum (CaSO4) production and CO2 with a molecule mass of 100, 136 and 44 respectively:
CO2 limestone = amount of FGD-gypsum * ZF * EF

Where:
ZF = purity factor = 1/1.08
EF = MMCaCO3 /MMCaSO4 * ZF * EFlimestone = 100/136 * 1/1.08 * 440

Where:
EF limestone = 440 kg CO2/ton pure limestone with a multiplication factor of (ZF * EF) = 4.044

The gypsum production (calcium-sulphate, CaSO4) was based on annual reports by the Fly-ash Association (Fly-Ash Association, 2005).

From the 2005 submission onwards the CO2 emissions are obtained from Annual Emission Reports of the coal-fired power plants.
After checking the emissions with the limestone use (4 plants) and coal use (2 plants) the sum of the CO2 emissions from the AERs of the 6 coal fired power plants are included in the National Inventory.

Base metal industry, processing and manufacture of iron and steel, consumption of limestone and dolomite (CRF 2.A.4.d);
Until the 2018 submission only CO2 emissions from the use of limestone were included in 2.A.4.d. From the 2018 submission also the CO2 emissions from the use of dolomite are includes in 1.A.4.d.
From 2000 onwards, data of the used limestone and dolomite and the determined CO2 emissions are obtained from the company.
For the period 1990–2000, CO2 emissions were calculated by multiplying the average IEF per ton of crude steel produced over the 2000–2003 period by the crude steel production.

Limestone application in NACE 45: road construction (CRF 2.A.4.d);
Dolomite is used to produce agricultural lime and acts as filler for asphalt in the road-construction sector (DWW, the agency for road and hydraulic engineering, 2005).
Until the 2005 submission the CO_2 emissions were calculated as follows:

(Total net dolomite use – Dolomite use in agriculture) * EF dolomite

Where:
EF dolomite = 477 kg CO_2/ton pure dolomite and the dolomite use was obtained from the National Statistics (CBS).

Because the National Statistics (CBS) does not register the dolomite use since 2003 and there are no other sources registering dolomite use, the CO_2 emissions has not been updated since 2003.

Manufacture of inorganic basic chemicals, production of active carbon (CRF 2.B.10);
Production of activated carbon: Norit is one of world's largest manufacturers of activated carbon, for which peat is used as a carbon source, and CO2 is a by-product.
Until the 2013 submission CO2 emissions were estimated based on the production data for Norit and by applying an EF of 1 t/t Norit. The used EF was derived from the carbon losses from peat use reported in the AERs. As peat consumption is not included in national energy statistics, the production data since 1990 has been estimated on the basis of an extrapolation of the production level of 33 Tg reported in 2002.

From 2013 onwards, CO2 emissions from activated carbon production in the Netherlands were included in the European Emission Trading Scheme (EU-ETS).
So, from the 2015 submission, the figures are based on the verified EU ETS Emission Reports of the activated carbon producer.
For the years 2004 and 2005 peat use data have been obtained from the AERs and the emissions were calculated with the help of the C-content of the peat in 2013. For the years before 2003 no peat use and

C-content data are available. Therefore, the emissions for the period 1990-2002 are kept equal to the emissions of 2004. The emissions for the period 2005-2012 have been determined by extrapolation between 2004 and 2013.

Manufacture of inorganic basic chemicals, production of Acrylonitrile (CRF 2.B.8.g);
Acrylonitrile is only produced by one company in the Netherlands. The CO_2 emissions are calculated by multiplying the specific EF by the annual production.
Because of the confidentiality of data from this company and some other companies only the sum of the CO_2 emissions from acrylonitrile, Ethylene oxide and Titanium dioxide production are reported in 2.B.8.g.

Base metal industry, processing and manufacture of iron and steell (2.C.1.a);
Until this submission a part of the CO2 emissions from the use of coke as reduction agent were included in 2.C.1. From the 2018 submission onwards these emissions are includes in 1.A.1.c.
CO2 produced during the conversion of pig iron to steel are reported in this category.
The data necessary to calculate the net CO_2 emissions for converting iron ore into steel are taken from the manufacturers' carbon balance, which were first reported in the year 2000. For the years 1990-1999 the CO_2 emissions are estimated using the average CO_2 emissions per ton of raw steel for 2000-2003 and the production of raw steel in the particular year.

Base metal industry, processing and manufacture of iron and steel, anode use with production of electro-steel (2.C.1.f);
During the steel production in electric arc furnaces CO_2 is created through oxidation of carbon anodes. The CO_2 emission can be calculated as follows:

CO_2 (Year t) (in Gg) = Steel Production (year t) (in Mg = ton) * EF anode use

Where:
EF = 3.5 kg CO_2/ton steel produced (IPCC 2006, Volume 3, `
Chapter 4, sector 4.2.2.5, page 4.29)

Manufacture and casting of light and other non-ferrous metals, anode use (CRF 2.C.3);
CO_2 is created through oxidation of the carbon anodes. This emission can be calculated from the stoichiometric ratio (3/4) that results from the basic reaction comparison: Al2O3 + 3/2C -> 2Al + 3/2 CO_2. Because extra CO_2 is formed through the reaction with oxygen in the air (IPCC 2006: Volume 3, Chapter 4, 4.4), a slightly higher value is used for the emission factor compared to the aluminium production, indicated by 'F'. The F = factor for stoichiometric ratio (3/4) plus extra CO_2 formed through the reaction with oxygen in the air. The 2006 IPCC guidelines therefore give a higher value as default: the IPCC default value for Prebake Anode is 1.6 t CO_2/t aluminium. The country-specific emission factor is based on recent information from the Greenhouse Gas Protocol

Initiative (GHG Protocol) of the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) which, with typical industrial values of 0.4 ton carbon use per ton of aluminium and (for impurities in the anode) use a default value of F x 44/27 = 1.43, are 17% higher than the stoichiometric value of 1.22, but slightly lower than the IPCC default value. There are indications that the default value 'average' has dropped by 5% over the years, but this could not be substantiated through additional (Netherlands) information concerning the 0.4 ton carbon use per ton aluminium and the impurities in the anode. A fixed factor for F x 44/27 has therefore chosen of 1.45, with an uncertainty margin of + 5%. The emissions calculations for oxidation of the carbon anodes are thus:

CO_2 (year t) (in Gg) = Primary aluminium production (year t) (in Gg = kt) x (F x 44/27) x 1000 (CO_2)

Where:
F = factor for stoichiometric ratio (3/4) plus extra CO_2 formed through reaction with oxygen in the air, and value of F x 44/27 = 1.45 (+/- 5%).

Activity data
CO2 process emissions
The following information is supplied to the secretariat of the ENINA task force (i.e. Agricultural/Sinks for limestone/dolomite use in the agricultural sector), and also shows which organisation supplied this information:
- Cement clinker production and CO2 emissions: eAER submitted by ENCI;
- Limestone and dolomite use and the carbon balance Tata Steel: submitted by the company;
- FGD-gypsum production plants: Fly Ash Association annual report;
- KNB annual reports: national production data for bricks: Share brick production in the manufacture of ceramic products is 92.4 % (Huizinga, 1995);
- Amount of Steel produced in electric arc furnaces (EAF): Steel Statistical Yearbooks; (http://www.worldsteel.org/statistics/statistics-archive/yearbook-archive.htmlSteel Statistical Yearbooks);
- Aluminium production: eAERs submitted by the two (former) companies;
- Glass production: VNG or the index for sheet-glass production (CBS, Statline);
- Total use of dolomite: Until the 2005 submission the dolomite usage was obtained from Statistics Netherlands (CBS).

2.2.3.3 N_2O emissions from nitric acid production (CRF 2.B.2)
This paragraph describes the method and working processes for determining the emissions of nitrous oxide (N_2O) that are released during the industrial production of nitric acid in the Netherlands (IPCC category 2.B.2). This concerns two production locations.
The production of caprolactam also forms an important industrial source of N_2O emissions in the Netherlands, but the monitoring of these emissions is described in a separate paragraph. In the Netherlands,

nitric acid is used in the production of fertilisers (e.g. lime ammonia nitric acid). Nitric acid production starts by converting (combusting) ammonia (NH_3) with air into nitrogen monoxide (NO), under the influence of a platinum alloy catalyst. This continues with further oxidation into nitrogen dioxide (NO_2) and absorption in water, thus producing nitric acid (HNO_3). N_2O is created as an unwanted by-product during the catalytic oxidation of ammonia with oxygen. The amount of N_2O formed primarily depends on the temperature and the time spent in the reactor, because N_2O is unstable at high temperatures (850-950°C). In most nitric acid plants the process gases are cooled after combustion, with heat-recovery techniques being used to recover the heat released. The reactor time at high temperatures (850-950°C) is therefore relatively short (Infomil, Novem 2001).
Since the platinum alloy catalyst becomes less efficient over time, the amount of N_2O produced fluctuates continually. These platinum alloys are very active when new (i.e. little N_2O produced), but this efficiency is gradually reduced while the catalyst deteriorates, so that the amount of N_2O increases and the platinum alloys will eventually need to be replaced (production stop).
There are several measures that can reduce N_2O emissions from nitric acid plants. In 2007,technical measures were implemented at all nitric acid plants in the Netherlands. These measures has resulted in an emission reduction of 90% in the current situation.

Calculation methods
This section describes the methods used to determine N_2O emissions.

Method 1
For the period 1990-1998 no plant specific N_2O emission factors are available. N_2O emission measurements, made in 1998 and 1999, have resulted in a country specific (CS) N_2O emission factor of 7.4 kg N_2O/ton nitric acid for the total nitric acid production. Because no measures haven been taken and the operation conditions did not change during the period 1990-1998, the country specific emission factor was used to calculate the emissions for that period as follows:

*N_2O emissions (ktonnes) = CS emission factor (kg N_2O/ton HNO_3) * Total production (ktonnes HNO_3)*
Note: The production of nitric acid is expressed in ton HNO_3 100%.

The results of above mentioned measurements are confidential information and can be viewed at the company’s premises.

Method 2
Since 1998 the calculation of N_2O emissions by the nitric acid industry in the Netherlands is based on the following formula:

*N_2O emissions (kg/year) = Specific emission factor (kg N_2O/ton nitric acid) * Production (ton nitric acid/year) * (1– (N_2O Destruction factor * Corporate time factor))*

The aforementioned formula is applied per plant, using the plant-specific measurement data.

The sum of the emissions from the various plants equals the total national N_2O emissions by the nitric acid industry. However, it should be noted that the aforementioned calculation is based on measurement data from the (cleaned) exit gas flow. The effects of the N_2O emission-reduction measures, plus the corporate time factor, are therefore included in the specific emission factor for N_2O. Data concerning the efficiency of N_2O emission-reducing measures are therefore not included in the calculation, but are certainly used for information purposes. The aforementioned formula can thus be simplified to:
*N_2O emissions (kg/year) = Specific emission factor (kg N_2O/ton nitric acid) * Production (ton nitric acid/year)*
Note: The production of nitric acid is expressed in ton HNO_3 100%.

Comparison with IPCC method
Method 1 complies with the Tier 2 method and method 2 with the Tier 3 method as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 3, paragraph 3.3). For the first Method a country specific emission factor has been used and for the second Method plant specific emission factors are used.

Emission factors
The manufacturer determines the specific emission factor per plant by multiplying the following elements (apart from any conversion factors that may be required):

- Concentration of N_2O in the exhaust gas from the plant (mg N_2O/Nm^3);
- Specific flow factor (Nm^3/ton nitric acid).

The specific emission factor is calculated as follows:
$EFspecific = CN_2O * Fpa * Fvm$
CN_2O: average N_2O emissions in the exhaust gas (ppm)
Fpa: conversion factor from nitric acid production to exhaust gas flow (Nm^3/ton acid)
Fvm: conversion factor from volume to mass (ton/Nm^3 gas)

The annual N_2O emissions can then be calculated by multiplying the specific emission factor by the annual nitric acid production. The specific emission factor for each plant is considered as confidential information. The data are reported and archived by the manufacturer. The N_2O concentration in the plant's exhaust gas increases during a normal production schedule (i.e. the period between replacing the platinum alloy catalyst). In order to determine the actual N_2O concentration, a measurement is taken every 2-3 weeks from the exhaust gas flow of the plant, during these normal production runs. At least 10 concentration measurements are taken over the course of each production run. The trend line is used to establish the average concentration throughout the production period.

Activity data
Production data are confidential to the public

2.2.3.4 N_2O emissions from caprolactam production (CRF 2.B.4.a)
This paragraph describes the methods and working processes for determining the emissions of nitrous oxide (N_2O) that are released

during the industrial production of caprolactam in the Netherlands (IPCC category 2.B.4.a). This concerns the NACE industrial code 201499. Caprolactam is produced in the Netherlands as part of the production cycle for nylon materials, and is manufactured (since 1952) by only one company. This emission source is therefore responsible for the entire (100%) nitrous oxide emissions by the caprolactam industry in the Netherlands. The production capacity increased from 200 ktonnes in 1990 to 250 ktonnes in 2005. Caprolactam is manufactured from raw materials such as phenol, ammonia, hydrogen, sulphur dioxide, ammonium nitrite and oleum. The company consists of a number of installations, several of which release N_2O emissions, primarily the:

- HPO plant (Hyam Phosphate Oxime);
- HSO plant (Hyam Sulphate Oxime);
- Nitrite plant.

Both the HPO and HSO plants use cyclohexanon as one of the raw materials when preparing cyclohexanon-oxime. The oxime is processed into lactam in a so-called 'diversion', after the final product is formed via purification and concentration. A nitrite solution is produced in the nitrite plant, which then forms a raw material for the HSO.

Nitrous oxide is formed in two ways within the aforementioned processing plants:

1. When preparing the hyam, in the HPO and HSO.
2. As a result of the catalytic combustion of ammonia in the nitrite plant and HPO.

Currently there are no measures available to limit nitrous oxide emissions. The caprolactam manufacturer is currently researching the effects and feasibility of several ideas aimed at reduction of emissions.

Calculation method
The first (indicative) N_2O measurements for the caprolactam industry were taken during the period 1995-1996. Before this period not all sources of N_2O emissions were monitored. The first reference value for 1990 is based on these initial measurements. A monitoring programme that resulted in more reliable figures was started in 2003. So the emissions from 2003 onwards are based on measurements.
Until the 2008 submission the emissions were presumed to be constant for the period 1990-2002. Before that period the 1990 reference value (1,240 Gg CO_2-eq) was used.
Based on the recommendations by the Review in August 2007 N_2O emissions for the period 1990-2002 were recalculated while emissions were presumed to be constant before. From the 2003 and 2004 measurements and the production-indices (real production data are confidential business information) of 2003 and 2004 an average IEF has been derived. With this average IEF and the production-index range for the period 1990-2002 the new calculation was implemented.
During the period 2005-2010 the annual emissions were based on only a few emissions measurements per point per year. In comparison with the 1990-2004 period the emissions were much lower. As a result of additional measurements after 2010 the 2011-2013 period showed increased emissions compared to the 2005-2010 period.

In 2014 the N_2O emission measurement program has been updated and improved. So, from 2015 onwards, the N2O emissions are based on the updated and improved measurement program in 2014. For the period 2005-2014 a recalculation was done with the help of the new insights of the updated and improved N2O emission measurement program.
The recalculation for the period 1990-2004 was done by using the “new” average IEF 2005-2014.

Emission factors
Emission factors are confidential.

Activity data
Only a production-index series is available (real production data are confidential business information).

2.2.3.5 HFC 23 emissions during HCFC 22 production (CRF 2.B.9.a.1)
This paragraph describes the methodology and working processes for calculation of HFC 23 (trifluoromethane, CHF3) emissions that are released during the industrial production of HCFC 22 (chlorodifluoromethane, CHC1F2). These emissions are reported under IPCC category 2E1, and relate to NACE (industrial) code 2011. HFC 23 is a well-known by-product of HCFC 22 production. It is also known that emissions from this source amount to 4% of the production of HCFC 22, if no reduction measures are taken. HCFC 22 is primarily used as an intermediate product during the manufacture of synthetic polymers and, in some cases; a blend may be used as cooling agent or cleaner. The Netherlands has only one manufacturer of HCFC 22, which produces as a raw material for the manufacture of fluoropolymers (Teflon) and also sells HCFC 22 as a cooling agent. The latter was phased out in 2010 and from that date HCFC 22 only was produced for the company’s internal manufacturing processes.

Since 1998 the HFC 23 emissions produced as a result of HCFC 22 production have been reduced by using a Thermal Converter (TC), which consists of a combustion chamber, a quench chamber and a rinsing tower. The TC is not used throughout the entire year due to necessary maintenance to the combustion chamber. During maintenance work the untreated HFC 23 emissions are released freely into the atmosphere. Since 2001 these maintenance tasks to the combustion chamber have been reduced through technical improvements, thus increasing the removal percentage of the untreated HFC23 emission. In 2003 a reserve combustion chamber was also installed, thus better guaranteeing that the increased removal percentage can be maintained.

Calculation method
The following formula is used to calculate HFC 23 emissions by the HCFC22 industry in the Netherlands:

HFC 23 emissions = HFC 23 load in untreated flow - amount of untreated HFC23, destroyed in the TC.

The HFC-23 load in the untreated flow is determined by a continuous flow meter in combination with an in-line analysis of the composition of the stream.

The amount of HFC23, destroyed in the TC is registered by the producer.

The aforementioned method complies with the tier 3a method as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 10, 3.10.1).

Data
Supplying data via the AER/MJV
The following data are reported in the AER/MJV for each plant:
The calculated annual emissions for HFC 23 (kg HFC 23/year) (public information). The company reports the HFC23 emissions for two installations as part of its annual environmental report. The sum of the HFC-23 emissions of both installations is the HFC-23 emission as a result of HCFC-22 production. The environmental report is submitted to the competent authority for the respective plant before 1 April in the year following the reporting year.

Confidential information
The following information is confidential:
- HFC 23 load in the untreated flow (kg HFC 23/year).
- Amount of untreated HFC 23, destroyed in the TC (kg HFC 23/year).

2.2.3.6 Other, mainly HFC emissions from handling (CRF 2.B.9.b.3)
This paragraph describes the methodology and working processes for determining HFC (hydrofluorocarbon) emissions that are released when repackaging HFCs from large to small packaging units (IPCC code: 2.B.9.b.3). This concerns the NACE code 2011 (manufacture of industrial gases). Until the end of 2005 there were two companies in the Netherlands that, among their other commercial activities, also repackage HFCs from large units (e.g. containers) into smaller units (e.g. cylinders). One company was closed in 2005. Small amounts of HFCs can be released during this process. For example, after filling these smaller units a small residue is left behind in the coupling, which is then released when uncoupling the unit.

Calculation methods
The methods used to define emissions are country-specific.

1. The first company (closed in 2005) has used the following formula for calculating emissions:

   *HFC emission = emission factor HFC (g/repackaged ton of HFC) * amount of repacked HFC (ton)*

2. The second company uses a different calculation method, depending on the type of repackaging activities undertaken:
   - Level measurements are taken when repackaging from a bulk tank to smaller containers.
   - Emissions are determined via a mass balance when repackaging from containers to smaller cylinders. The contain ners and cylinders are weighed before and after filling, with the difference being equal to the emission.

The methodology for determining these emissions is not specifically described in 2006 IPCC Guidelines.

Emission factors
Only the first company has used an emission factor, which is confidential and was determined by the company in 1999.

Activity data
Corporate annual environmental reports.
Companies report emissions as part of their annual environmental reports, which must be submitted to the competent authority for each plant before 1 April in the year following the reporting year.

Confidential information
Production data are confidential.

2.2.3.7 PFC emissions from primary aluminium production (CRF 2.C.3)

This paragraph describes the monitoring of the PFC (perfluorocarbon) emissions (CF4 and C2F6) that were released during the primary industrial production of aluminium (IPCC code 2.C.3). This concerns the industrial SBI code 2442 (aluminium production).

The Netherlands had two primary aluminium smelters: Zalco, previously Pechiney (closed at the end of 2011) and Aldel (closed at the end of 2013). By the end of 2014 Aldel made a restart under the name Klesch Aluminium Delfzijl. So at this moment, the Netherlands has one aluminium manufacturer.
Several types of PFCs are emitted during primary aluminium production, e.g. (80-90%) tetrafluoromethane (CF_4) and, to a lesser extent, (10-20%) hexafluoroethane (C_2F_6). Other PFCs are also mentioned in the literature, e.g. C_3F_8, which can also be released during the production process, though in much smaller quantities. PFCs are formed during the so-called ‘anode effect’, when the concentration of aluminium-oxide in the electrolyte smelt bath is too low. The anode effect produces sparks whereby the temperature increases so much that PFCs are formed. The frequency and duration of the anode effect depends on the type of process used (Søderberg or Prebake), the method of dosing the alumina, and the extent of the process automation.

Anode effects and related PFC emissions can both be prevented by dosing the alumina as steadily as possible. Using an alumina dosing system from the centre, the so-called central input of Centre Worked Prebaked (CWPB), PFC emissions are 95% less than when using a dosing system that inputs the alumina from the side (Side Worked Prebaked, or SWPB). Both Dutch aluminium manufacturers use(d) Prebake anodes, and both originally used the SWPB dosing system. However, the first company (Aldel) switched to central dosing (CWPB) in 1999, and the second company (Zalco) also began using this system in 2003.
Calculation method
The two aluminium manufacturers in the Netherlands each use(d) their own methodology for calculating PFC emissions.

Company 1
Emissions from company 1 are calculated using the following formulas:

EmissionCF4 = Emission factorCF_4 ** Production / 1000*

Emission C2F6 = Weight fraction C_2F_6,/ CF_4 *** *Emission*CF_4

Where:
Emissions CF4 / C2F6: emissions of CF4 or C2F6 (ton/year)
Emission factor CF4: emission factor for CF4 (kg/ton aluminium)
Weight fraction C2F6/ CF4: up to 1999 (for side feed) this amounted to 0.10; after 1999 (for centre feed) this figure is 0.121.

The emission factor for CF4 is therefore calculated as follows:

*Emission factorCF4 = SlopeCF4 * AEF * AED*

Where:
SlopeCF4: The ‘slope’ of CF4 refers to a technology-specific value for CF4 (IPCC 2006: Volume 3, Chapter 4, 4.4). Company 1 uses its own specific value.
AEF: number of anode effects per day (anode effects/oven/day)
AED: duration of the anode effects (minutes).

The method used by Company 1 complies with the Tier-3 method, as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 4, 4.4).

Company 2
The emissions of the second company have been calculated with the following formulas:

EmissionCF_4 = *Emission factor*CF_4 ** Production / 1000*

Emission C_2F_6 = *Emission factor*C_2*F6 * Production / 1000*

The emission factors were determined by the Overvoltage method:

Emission factorCF_4 = *Overvoltage_coefficient*CF_4 ** AEO / CE*

Emission factorC_2F_6 = *Overvoltage_coefficient*C_2F_6 ** AEO / CE*

Where:
Emission factorCF_4 / C_2F_6: the emission factor for CF_4 or C_2F6 (kg/ton aluminium).
Overvoltage coefficient: this is a technology-specific value per ton of aluminium per mV per oven/day.
AEO: anode effect over-voltage (mV/oven day).
CE: current efficiency of the aluminium production (as fraction).

The method used by Company 2 complies with the tier 2 method as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 4, 4.4).

2.2.3.8 SF_6, NF_3 and other PFC emissions from the semiconductor industry (CRF 2.E.1)

This section describes the method and working processes used to calculate the emissions figures for SF_6 (sulfur hexafluoride), NF_3 and other PFCs (perfluorocompounds) as a result of the use of these gases in the semiconductor industry. This concerns the NACE codes 261109, 2612 and 331301.
The monitoring procedures for SF_6 emissions during the production of semiconductors and during the manufacture and use of electromicroscopes, double glazing and high-voltage installations, are described in other paragraphs.
F-gases (SF_6, NF_3 and other PFCs) are used in the semiconductor industry to clean process rooms and to etch the semiconductors. F-gases are emitted during these processes. The Netherlands has only one semiconductor manufacturer, using only one production location.

Emissions of individual PFCs resulting from application in the manufacture of semiconductors are aggregated into a single figure (PFCs Other) and reported under the CRF category 2.E.1 'Integrated circuit or semiconductor'. This is due to the confidentiality of the individual PFC figures. If reporting is not implemented in this way, then production information can be immediately deduced from the individual PFC emission figures.

SF_6 emissions resulting from application in the manufacture of semiconductors, plus the high-voltage electricity sector, double glazing and electromicroscopes are aggregated into a single figure and reported under CRF category 2.G.2 'Other'. This is due to the confidentiality of the figures. If reporting is not implemented in this way, then production information from the (former) Netherlands high-voltage manufacturer, the test laboratory for high-voltage installations, the semiconductor and electromicroscope manufacturers can be immediately deduced from the emission figures, activity data and implied emission figures.

Calculation method
Annual emissions resulting from the use of PFCs consist of emissions of the PFCs itself plus emissions of CF_4, C_2F_6 and C_3F_8 created as by-products during use of PFCs. The emissions are calculated using the following formulas:

Emissions for each PFC used:

*Emission PFC $_i$ in kg = PFC $_i$ *(1-h)*(1-C $_i$)* (1-A $_i$)*

Where:
h = fraction of gas $_i$ remaining in container (heel)
PFC $_I$ = purchases of gas $_i$ in kg
C $_i$ = average utilization factor of gas $_i$ (average for all etch and CVD processes)
= 1-EF $_i$
EF $_i$ = average emission factor of gas $_i$ (average for all etch and CVD processes)
A $_i$ = fraction of PFC $_i$ destroyed by abatement = $a_{i,j}$ * Va
$a_{i,j}$ = average destruction efficiency of abatement tool $_j$ for gas $_i$

Va = fraction of gas $_i$ that is fed into the abatement tools

Emissions created as by-products (BPE):

$$BPE\ CF_4 = PFC_i * (1-h) * B_i * (1- ACF_4)$$

Where:
B $_i$ = mass of CF_4 created per unit mass of PFC $_i$ transformed
ACF_4 = fraction of PFC $_i$ converted to CF_4 and destroyed by abatement
= a CF_4* Va
a CF_4 = average destruction efficiency of abatement tool $_j$ for CF_4
Va = fraction of gas i that is fed into the abatement tools

$$BPE\ C_2F_6 = PFC_i * (1-h) * B_i * (1- AC_2F_6)$$

Where:
B $_i$ = mass of C_2F_6 created per unit mass of PFC $_i$ transformed
AC_2F_6 = fraction of PFC $_i$ converted to C_2F_6 and destroyed by abatement
= a C_2F_6 * Va
a C_2F_6 = average destruction efficiency of abatement tool $_j$ for C_2F_6

$$BPE\ C_3F_8 = PFC_i * (1-h) * B_i * (1- A\ C_3F_8)$$

Where:
B $_i$ = mass of C_3F_8 created per unit mass of PFC $_i$ transformed
AC_3F_8 = fraction of PFC $_i$ converted to C_3F_8 and destroyed by abatement
= a C_3F_8 * Va
a C_3F_8 = average destruction efficiency of abatement tool $_j$ for C_3F_8

After estimating all these emissions, the emissions per individual PFC are summed and converted into CO_2-eq by multiplying them with the associated Global Warming Potential (GWP). Finally, the sum of the CO_2-eq represents the total emission in CO_2-eq.

Comparing with IPCC methods
The method used to determine the annual emission of F-gases (SF_6, NF_3 and other PFCs) by the semiconductor industry complies with the Tier 2a method as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 6, p. 6.9-6.11).

Emission factors
The Netherlands semiconductor manufacturer uses the standard values from the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 6).

Activity data
Until 2008 annual emissions per gas (PFCs, SF_6 and NF_3) in kg were reported by the company to the competent authority. The competent authority supplied this AER to the ER's (Emissions Registration) ENINA task force. Since 2008 the AER and the annual emissions per gas (PFCs, SF_6 and NF_3) in kg have directly been reported by the company to the ER's (Emissions Registration) ENINA task force. Both the AER and the annual emissions per gas are confidential.

The following company-specific information is used by the Netherlands semiconductor manufacturer to calculate these emissions:

Purchase PFC_i:
Purchase and sale of gases (in kg CF_4, C_2F_6, C_3F_8, c-C_4F_8, CHF_3, NF_3 and SF_6)
The purchase figures for SF_6, NF_3 and other PFCs are determined by the Netherlands semiconductor manufacturer and are verified by the gas supplier.
Va = fraction of gas $_i$ that is fed into the abatement tools.

2.2.3.9 HFC emission from stationary cooling (CRF 2.F.1)
This paragraph describes the methodology and working processes for determining the HFC (hydrofluorocarbon) emissions that are released during the assembly, usage and disposal phases of stationary cooling equipment in the Netherlands. This concerns NACE codes 10/11/12 (the manufacture of foodstuffs and snacks), 52102 (storage in cold stores etc.), 8299.1 (auctions of agricultural, horticultural and fish products).

The stationary cooling situation in the Netherlands includes cargo-bays in refrigerated lorries as well the air conditioning systems in buses, coaches and trains (as per IPCC) due to the size of the equipment and the techniques applied (IPCC category 2.F.1).

The monitoring of emissions from comfort cooling in smaller vehicles (air conditioning systems up to 3 kg in cars, small vans and lorry cabs, tractors and various equipment) is described in the following paragraph.

In the past Stationary cooling plants in the Netherlands used fluor-based gases such as CFC (chlorofluorocarbon) and HCFC (hydrochlorofluorocarbon).Since 1995 HFC (hydrofluorocarbon), plus the ‘alternatives’ such as propane, butane and ammonia (NH_3) are used. Since July 2001 some success has also been booked with natural cooling agents (CO_2) in industrial freezing plants. The use of non-fluor-based coolants is still limited, for example because there are strict safety criteria attached to the use of ammonia. There are no manufacturers of cooling installations established in the Netherlands, although the (larger) cooling plants are assembled there.

Calculation methods
For the annual determination of the HFC emissions from stationary cooling installations in the Netherlands, formerly the stock model-method has been used for the period 1990-2012. This method was based on HFC sales figures, but since a few years these are no more available. Therefore a new calculation method was developed, based on the use of the ‘Refrigerants registration system’ from 2013 onwards. From inspection bodies data is obtained: HFC-volumes from (re)filling and dismantling the equipment, re-use and leakage.
This system is the result of a European obligation, whereby building owners are required to register: Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006.

In the old method it was not possible to divide into the IPCC-sectors (only totals), but now emissions can be represented per sector:

- Commercial sector
- Industry
- Stationary airconditioning
- Freigt transport cooling

2.2.3.9.1 Old calculation method: Stock model

This starts with the determination per source, followed by the determination of the total emissions.

Refrigerant management of containers

E tr(t) = V tr(t) * v/100

Where:
E tr(t) = emissions during the refrigerant transfers from bulk containers down to small disposable cans/small containers and also from the remaining quantities in year (t);
V tr(t) = the volume of refrigerant transferred in year(t);
v = percentage lost during the transfers of the refrigerants, expressed as a % of V tr(t)

Filling of (new) installations

E nw(t) = V nwv * v/100

Where:
E nw(t) = emissions during the filling of the (new) installations in year (t);
V nwv(t) = the volume of refrigerant used in (new) installations in year(t);
v = percentage lost during the filling, expressed as a % of V nwv(t)

Emissions from working systems

E sys(t) = (V sys(t-1) + (Vnw(t) * 0.5) - (Vafg(t) * 0.5)) * lk/100

Where:
E sys(t) = emissions from working systems in year(t);
V sys(t-1) = original volume at 31 Dec (t-1) of working systems;
V nw(t) = volume of refrigerant refilled in (new) installations in year(t);
V afg(t) = original volume of dismantled installations in year(t);
Lk = leakage percentage during operation;
0.5 = because both the filling of new and dismantling of old installations takes place throughout the year, it is assumed that each new and dismantled installation are operational for an average of six months in year (t).

Losses from dismantling installations

E afg (t) = V afg(t) * v/100

Where:
E afg(t) = (emission) losses that occur during dismantling of installations;
V afg(t) = original volume of dismantled installations in year(t);
v = percentage lost during dismantling of old installations.

Finally, the total emission of HFCs by stationary cooling installations is determined each year using the following formula:

Annual Emission = E tr(t) + E nw(t) + E sys(t) + E afg(t)

The method used conforms to the tier-2a method described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, p. 7.49-7.51.

Emission factors
The lost during the filling of new-retrofit installations is set at 0.5% (= between IPCC range 0.1 – 3 %). This percentage is also used for the lost during transferring from bulk to smaller storage.
In 2001 a national study into coolant flows (NOKS) was conducted for the year 1999 (De Baedts et al., 2001), which concluded the average leakage percentage for working systems to be 5% per year. The leakage percentage of 5% is the average of the leakage percentages from CFCs, CFC+H(C)FC blends, HFCs and unspecified stocks from “Annual leak rates from surveys (Baedts et al., 2001)”. Because the composition of the unspecified part of the stock is unknown and H(C)FC blends often contain HFCs, the decision has been taken to use the average leakage percentage of 5% (unrounded number is 4.8%) The leakage percentage for 1994 is based on a study from 1996(Matthijsen and Kroeze, 1996) and expert judgement. Between 1994 and 1999 the leakage percentages have been extrapolated, from 2001 onwards the following leakage percentages for working systems have been used:
1990-1993: Not occurring
1994 11%
1995 9.8%
1996 8.9%
1997 7.4%
1998 6.2%

In 2016 a review conducted by the European Commission resulted in a recalculation of the HFC emissions from Stationary refrigeration (2F1) for the period 1994-2014. In this recalculation a leakage percentage of 5.8% has been used instead of 5%.

Also in the 2017 and 2018 submission the leakage percentage of the HFC part of the stock, 5.8%, from “Annual leak rates from surveys (Baedts et al., 2001)” has been used.
Because of this change the leakage percentages for the period 1995-1998 have been changed too. From 2017 onwards the following leakage percentages for working systems are used:
1990-1993: Not occurring
1994 11%
1995 10%
1996 8.9%
1997 7.9%
1998 6.8%

from 1999 onwards 5.8%

The percentage lost during dismantling of old installations is set at 5% of the original filling.

Activity data

Annual sales

The relevant activity data is taken from the sales figures of individual HFCs to the total cooling sector in the Netherlands, which are available annually via the Handelsstromenonderzoek (trade flow study) by PWC (multiple years). The data are gathered using surveys completed by manufacturers, traders and users of HFCs (and HCFCs). The annual sales are equal to the sum on the annual re-filling of existing installations and the filling of new installations.

Refilling existing installations / Filling new installations

During the period 1990-2012 the trade flow study has been used to gather information on the annual sales figures (Verk(t)), but this was not sufficiently reliable to be split into the annual filling of new installations (V nw(t)) and the refilling (Bijv(t)) of existing installations.

The decision has therefore been made to set up a stock model to show the refilling (Bijv) of existing installations. This stock model uses the following starting points:

The starting year is the year in which a certain HFC is used for the first time.

During this starting year there is no refilling (Bijv=0) of existing installations, only filling of new installations. Therefore, the filling of new installations during this first year is equal to the annual sales, minus any losses during the filling process.

During the following years, refilling is defined as:

*Bijv(t) = Emission(t-1) at 31 Dec (t-1) for working systems * - (V afg(t+1) * Lk)*

Where:

Vafg(t+1) = the original volume of the installations to be dismantled in year(t+1); these will no longer be refilled

Lk = leakage percentage during the operation.

The filling of new installations (V nw(t)) can therefore be determined using the annual sales (Verk(t)) and the refilling (Bijv(t)) figures as:

V nw(t)) = Verk(t) – Bijv(t) – filling losses

Dismantled installations

The coolants that installers remove from dismantled installations[1] are offered to approved collectors. These companies are authorized to destroy or regenerate the coolants, so that they can be reused. There is very little information concerning dismantled installations, destroyed coolants and regeneration of HFCs. This is why the emission calculations

[1] Since 1 January 1993 only STEK-authorised companies are allowed to handle CFCs, HCFCs and HFCs in cooling equipment, including the extraction of these substances from dismantled installations. Extracted HFCs are considered commercial waste, and are transported to authorised collectors.

during this phase are based on an average lifespan for the installations of 15 years, and 5% during the dismantling of the installation. This means that, in year (t), the installations are dismantled that in year (t-15) were noted as new installations. The original volume of these amounts to (V afg).

2.2.3.9.2 New method: Registration system

The new method uses figures from the 'Refrigerants registration system' to calculate emissions. In this system, data about leakages, filling of installations (new and as a result of leakage during operation), dismantling, etcetera are collected from commercial-, industrial- and transport refrigeration and stationary air-conditioning. Leakages, filling of (new) installation, dismantling, etcetera are not calculated but taken directly from the system, as follows:

- data at plant level are registered continuously by mechanics of the installation companies;
- the control of the figures happens once every two years by the inspection authorities;
- after approval, the figures are aggregated and delivered to the Dutch Integral Pollutant Release and Transfer Register (PRTR);
- hereafter, the Dutch PRTR can start with the emission calculations.

Because the system is working in this way, it takes more time before the data comes available. This means that in a year t, definitive figures will be provided up to and including (t-4). The (t-3) and (t-2) figures will be kept equal to the year (t-4). In the year (t+1), the (t-3) figures from the year (t) will be overwritten by the definitive figures for (t-3).

This new method provides more accurate data than the stock-model method. All equipment with a content >= 5000 kg CO2-eq is covered by the 'Refrigerants registration system'. This makes it the best source we have and as complete as possible. In addition, the emissions calculated with the new method are lower than those calculated with the old stock-model method. That the stock-model gave higher emissions was probably due to the assumption that the usage figures were the same as the sales figures and that a fixed leakage percentage of 5.8% was used, while according to the new method the average leakage rate for example during the period 2013-2015 was approximately 4%.

The following data are obtained from the "Refrigerants registration system":

- the volume of refrigerant used in new installations
- the volume of refrigerant to fill operating installations (as a result of leakage)
- the volume of refrigerant won back from retrofit or maintenance
- the volume of dismantled installations.

Composition of refrigerants

There are lots of different refrigerants used for stationary cooling, each of them being a blend of one or more HFCs. For example: refrigerant R134a consists of only HFC134, but R404a consists of three different HFCs. The fractions of HFCs in each refrigerant are listed below (source:

EPA). Some refrigerants contain also HCFKs, therefore fractions do not always sum up to 100%.

Refrigerant	%HFC125	%HFC134a	%HFC143a	%HFC23	%HFC32
R134a		100			
R23				100	
R404a	44	4	52		
R407a	40	40			20
R407c	24	52			24
R407f	30	40			30
R410a	50				50
R413a	88				
R417a	47	50			
R422a	85	12			
R422d	65	32			
R437a	20	79			
R438a	45	44			9
R448a	26	21			26
R449a	25	26			25
R453a	20	54			20
R507	50		50		
R508b				46	

These fractions are used to calculate the volume of each HFC, by adding over all refrigerants the product of the volume of each refrigerant and the corresponding fraction for that HFC from the table:

$$E\ HFC(x) = \sum_{n=1}^{N} V\ refr(n) * Fr(n)$$

Where:

E HFC(x) = emissions of HFC x

V refr(n) = the volume of refrigerant n

Fr(n) = fraction of HFC(x) in refrigerant n

The table lists 18 refrigerants, so N=18.
For example: the volume of HFC143 is equal to 52% of the volume of refrigerant R404a plus 50% of the volume of R507.

Emission calculations
Now we have calculated the volume of HFCs that are won back, filled and leaked, the emissions that are caused by that can be calculated. Emissions occur during refrigerant management of containers, filling of installations, dismantling of systems, and leakage from working systems. Calculations are done as follows:

Filling of (new) installations:

Leakages occur during filling installations: new and working (as a result of leakage).

$$E\ nw(t) = V\ nw(t) * \frac{100}{100 - v} - V\ nw(t)$$

Where:
E nw(t) = emissions during the filling of the (new) installations in year (t);
V nwv(t) = the volume of refrigerant used in (new) installations in year(t);
v = percentage lost during the filling, expressed as a % of V nwv(t).

Emissions from working systems:

E sys(t) : Leakage emissions from working systems are obtained from the 'Refrigerants registration system'.
V fill(t): Mechanics of the installation companies register the volume that they have to add to working systems during maintenance.

Losses from dismantling installations:
Leakage occurs during dismantling, retrofit and maintenance of systems.

$$E\ dis(t) = V\ dis(t) * \frac{100}{100 - v} - V\ dis(t)$$

Where:
E dis(t) = (emission) losses that occur during dismantling of installations;
V dis(t) = original volume of dismantled installations in year(t);
v = percentage lost during dismantling of old installations.

Refrigerant management of containers:
Emissions occur during the refrigerant transfers from bulk containers down to small disposable cans/small containers, and also from the remaining quantities.

$$E\ tr(t) = V\ used(t) * \frac{100}{100 - v} - V\ used(t)$$

Where:
E tr(t) = emissions during the refrigerant transfers in year (t);
V used(t) = used refrigerants: V nwt(t) + V fill(t)
v = percentage lost during the transfers of the refrigerants
Total emission:

Finally, the total emission of HFCs by stationary cooling installations is determined each year using the following formula:

Annual Emission = E nw(t) + E sys(t) + E dis(t) + E tr(t)

These calculation steps are done for commercial-, industrial- and transport refrigeration and stationary air-conditioning. The method used conforms to the tier-2a method described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, p. 7.49-7.51.

Example: results for 2017
The table below shows the results for the emission of R134a (HFC134) from, for example, stationary cooling the commercial sector in the Netherlands for the year 2017.

Source	**Emission of R134a in kg**
Refrigerant management E tr(t)	440
Filling of (new) installations E nw(t)	301
Leakage from working systems	27.749
dismantling installations E afg (t)	172
Total emissions in kg	**28.662**
Total emissions in Mton CO_2-eq	*0,04*

As can be seen from the table, leakage emissions form the major part of emissions from stationary cooling. Emissions from refrigerant management, filling and dismantling are nearly negligible.
To place total HFC emissions from stationary cooling in the Netherlands in perspective: sum of emissions of alle HFCs from all sectors (commercial, Industry, Stationary airconditioning, Freigt transport) is 1,0 Mton CO2-eq, which is less than 1% of total greenhouse gas emissions in the Netherlands in 2017 (193,7 Mton).

Emission factors
The loss percentage during the filling of new-retrofit installations is set at 0.5% (from IPCC 2006, between IPCC range 0.1 – 3 %). This percentage is also used for the lost during transferring from bulk to smaller storage.
The percentage lost during dismantling of old installations, and winning back during retrofit or maintenance, is set at 5% of the original filling. This percentage is based on a national study into coolant flows (NOKS) was conducted for the year 1999 (De Baedts et al., TNO, 2001). This study concluded the average leakage percentage for working systems to be 5,8% per year.

Time series consistency
For the stock-model method, the only input variables were the sales figures from HFCs to the total cooling sector. Furthermore a fixed leakage percentage has been used. The other parameters were calculated using the model.

The new method uses figures from the 'Refrigerants registration system' to calculate emisions. In this system data about leakages, filling of (new) installations, dismantling, are not calculated but taken directly from the system.
This new method provides more accurate data to calculate emission figures. In addition, the emissions calculated according to the new method are lower than calculated according to the stock-model method.

Because of the complexity of the system, there is a time-lag for getting the data available. This means that in the NIR submission with emission year t, final figures are provided up to and including year t-2. The t and t-1 figures are kept equal to last year for which figures are available (t-2). In the submission with emission year t+1, the t-1 figures from that submission will be replaced by the final figures for t-1.
As a result of (EU) review comments, IPCC extrapolation methods (Trend Extrapolation or Surrogate Data) were investigated to prevent over- or underestimation in the last two years. However, the Trend extrapolation is not recommended if the trend is fluctuating. This is the case, because the mix of high- and lower-GWP refrigerants is very random throughout the years: a trend cannot be detected. Also the Surrogate Data technique is not appropriate, because no data can be found that has any correlation with the random-like use of refrigerants with different GWP's. So the overall conclusion is the an extrapolation cannot be performed, therefore the emissions from the last 2 years are kept at the same level.

2.2.3.9.3 Time series synthesis of both methods

The two methods are completely different. The old method uses default leakage percentages, whereas the new method is based on real refrigerant use schemes. Therefore both series are on a different level, so in order to construct a consistent time series for the whole period 1990-2016 and later, the Overlap splicing technique from the IPCC Guidelines (Volume 1, chapter 5) was used. The overlap period used is 2013-2015, and this formula is used:

EQUATION 5.1
RECALCULATED EMISSION OR REMOVAL ESTIMATE COMPUTED USING THE OVERLAP METHOD

$$y_0 = x_0 \bullet \left(\frac{1}{(n-m+1)} \bullet \sum_{i=m}^{n} \frac{y_i}{x_i} \right)$$

Where:

y_0 = the recalculated emission or removal estimate computed using the overlap method

x_0 = the estimate developed using the previously used method

y_i and x_i are the estimates prepared using the new and previously used methods during the period of overlap, as denoted by years m through n

For this case, y_0, x_0, y_i and x_i are the HFC emisions, m is the first year of the overlap period (2013) and n is the last year of that overlap period (2015).

Based on the new method, real leakage percentages appear lower than the default guidebook factors. This is the reason why the old time series is higher than the new one, and with the Overlap splicing technique the emissions from 1990 tot 2012 are lowered to fit on the 2013-2019 series.

2.2.3.10 HFC emissions from automotive comfort cooling (CRF 2.F.1)
This paragraph describes the estimates of HFC (hydrofluorocarbon) emissions from automotive comfort cooling (IPCC code 2.F.1.e). For the situation in the Netherlands, this includes only air-conditioning units up to 3 kg in cars, small vans and the cabins of lorries, tractors and various other vehicles/equipment. Conform the IPCC guidelines, the cooling of cargo holds in lorries and the air conditioning in buses, trains and coaches are reported under the stationary cooling (transport cooling) sector, due to the size of the equipment and the techniques used.
This paragraph applies to the companies in categories 29,45, 309102 and 4730 of the 1995 Chamber of Commerce company index (BIK95): Production of cars and trailers and Trade and repair of cars and motorbikes. In the past, air-conditioning units containing R12 were sold throughout the industry, and a number of these cars are still on the road today. However, since 1995 all air-conditioning units for private cars are filled at the factory with R134a coolant. According to the figures from the RAI Association, 289 tons of pre-filled R134a were supplied in 1999, of which 271 tons were used in cars, 9 tons in delivery vans and 9 tons in cabin air conditioners for lorries (De Baedts et al., 2001).

Car emissions have been drastically reduced over the past few years due to better sealing, and thus fewer leaks. However, the number of cars with air conditioning has also increased considerably, resulting in the rise in total emissions from 1995 onwards.
In the 2019 submission it is assumed that all automotive comfort cooling systems in cars, constructed in 2017 and later, are not filled with R134a as coolant. Most of the automotive comfort cooling systems in cars, constructed in 2017 and later, are filled with the refrigerant R1234yf.

Calculation method
HFC134a emissions during the transferring (from bulk to smaller storage), initial filling, usage and demolition phases are calculated using the following formula:

Annual emissions =
(Total transfer emissions in year t) +
(Total first-fill emissions in year t) +
*(Total stock (capacity) in car airco units in year of construction t) * L(t) +*
*(Total stock (capacity) in car airco units in year of construction t-1) * L(t-1) +*
*(Total stock (capacity) in car airco units in year of construction t-2) * L(t-2) +*
……………………………………………etc
*+ ((Original capacity * F) –(destroyed + recycled R134a) from scrapped cars with air conditioning)*

Where:
L(t-..) represents the leakage percentage of the stock of the number of cars of year of construction.
F represents the percentage of the Original capacity still present.

The method used conforms to the tier-2a method described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, p. 7.49-7.51.). Both country-specific and default emission factors (tier 2) are used. For reasons of confidentiality, the detailed figures are not included in this report and the NIRs, but can be made available for review purposes. Emission factors.

Transfer emissions
The emissions during the refrigerant transfers from bulk containers down to small disposable cans/small containers and also from the remaining quantities in year (t) are calculated by multiplying the percentage lost during transferring by the annual amount of transferred refrigerants.
The percentage lost during the transfers of the refrigerants is set at 0.5% (see also 2.F.1.c).

First-fill emissions
Since 2006 the first-fill emissions are obtained from the Annual Environmental Reports submitted by the concerning companies. For the period 1990–2000 the emissions have been calculated by multiplying the average IEF of 2006–2010 by the number of first-fill airco's.

Leakage percentages (L)
Up to the year 2000 the leakage percentages (L) for airco usage were taken from the literature (Matthijsen and Kroeze, 1996).
During the period 2000-2009 the percentages from the NOKS study (De Baedts et al., 2001) were used (see also Table 12). Based on other studies (Yu and Clodic, 2008 and Minnesota Pollution Control Agency, 2010) for cars for model years 2004 and 2009 lower leak rates (8,2 and 4.3%) have been determined. Therefore, from 2010 onwards the NOKS leak rates are applied up to the year 2003 and for 2004 and later on leaking % per year of construction are applied. Table 12 shows the leaking %.

Table 12 Leaking % passenger cars / vans / truck cabins. Emissions do not occur in the period 1990-1993.

Year of construction	**Leaking %**	**Reference**
2016 and later	4.3	Minnesota Pollution Control Agency, 2010)
2015	4.3	
2014	4.3	
2013	4.3	
2012	4.3	
2011	4.3	
2010	4.3	
2009	4.3	
2008	5.1	Via interpolation between 2004 and 2009
2007	5.9	
2006	6.7	
2005	7.4	
2004	8.2	Yu and Clodic, 2008
2003	9.0	De Baedts, E.E.A. et al., 2001
2002	9.0	
2001	9.0	
2000	9.0	
1999	9.0	
1998	13.0	
1997	13.0	
1996	13.0	
1995	13.0	
1994	13.0	

Activity data
Number of present and scrapped cars
The number of cars, delivery vans and lorries (per year of construction) and the number of scrapped cars (per year of construction) are obtained from Statistics Netherlands (CBS, Statline).

Number of cars with air conditioning
A single study that was implemented by NOKS (national research into coolant flows) for the year 1999 (De Baedts et al., 2001), which covered both stationary cooling and mobile air conditioning. With this study and the import figures for new cars the penetration rate for air conditioning is determined by the RAI Association for three categories: cars, small delivery vans and cabin air conditioners for lorries. The number of cars containing air conditioning is determined, as well as the average capacity thereof. Up to the end of 2002 the RAI Association determined the number of cars with air conditioning. Thereafter, this figure is

estimated based on the total number of cars sold, and an expert evaluation of the airco penetration rate.

Demolition phase

With the number of scrapped cars (per year of construction) and the number of cars containing air conditioning (per year of construction) the annual number of cars with air conditioning can be determined. The amounts of destroyed and recycled coolants from scrapped cars are obtained from ARN's Annual Environmental Report.

Also the percentage of coolant that is still present in a car to be scrapped is obtained from ARN. Up to 2019 a rest percentage of 75% is used for all car ages, but as a result of new insights form ARN from 2019 on we still use this percentage for cars newer than 2010, 45% for cars from building year 205-2010, 20% for years 1995-2005. The percentage of cars with airco older than 1995 is ignorable, therefore it is set to zero.

2.2.3.11 HFC emissions from other use (CRF 2.F.6)

This section concerns the methodology and working processes for determining HFC (hydrofluorocarbon) emissions that result from Other Use, which includes the following sectors:

- Foam blowing agents (IPCC category 2.F.2);
- Fire protection (IPCC category 2.F.3);
- Aerosols (IPCC category 2.F.4);
- Solvents (IPCC category 2.F.5).

In the Netherlands, many processes related to the use of HFCs takes place in only one or two companies. Because of the sensitivity of data from that companies, the HFC emissions of the 2F2-2F5 sectors are aggregated into a single figure and included in 2F6 (HFCs Other).

Foam blowing agents (2.F.2)

This concerns the determining of HFC245fa, HFC227ea and HFC365mfc emissions that result from the production, usage and demolition phases of PUR (polyurethane) hard foams for the construction sector (2.F.2.a). The large PUR hard foam manufacturers in the Netherlands are members of the NVPU (Netherlands association of polyurethane hard foam manufacturers). PUR hard foams are primarily used in the Dutch construction sector as an insulation material. Smaller amounts are used to insulate refrigerators and freezers. Since pentane is used almost exclusively for this application within the European Union, and there is no production of refrigerator foams in the Netherlands, this application is not included in this part of this paragraph.

Prior to 2003, HFCs were not used in PUR hard foams. However, from 2003 onwards, limited amounts mainly have been used. in the production, application and use in-situ foams. In 2002, for example, 1351 tons of HCFC-141b was used to manufacture PUR hard foams in the Netherlands (KPMG, multiple years).

The European directive concerning greenhouse gases (no. 2037/2000) was published on 29 June 2000, and included limitations in the use of HCFCs (hydro chlorofluorocarbons) for the production of plastic foams. The ban on using HCFCs has not lead to a one-to-one replacement by HFCs, partly due to the high costs involved. In June 2006 the European

F-Gas Directive came into force, including regulations for the use of F-gases.

Fire Extinguishers (2.F.3)
Since 2003, HFK227ea has been used on a small scale in fixed fire extinguishers in the Netherlands. These are mainly used to protect electronic equipment. Emissions occur during the filling, usage and disposal phase and leakages of the system.

Aerosols (2.F.4)
This section concerns the determining of HFC emissions that result from the use of aerosols. The NAV (Dutch aerosol association) represents the majority of the country's aerosol industry. Most manufacturers use propane and dimethyl ether (DME) as propellant, while a small part (<10%) of the companies use HFC134a in their products. One of the manufacturers also uses very small amounts of HFC152a as propellant, which has a much lower GWP (global warming potential). The GWP for HFC134a is 1430, while that of HFC152a is only 124.

HFCs are used in aerosols as a propellant. These are split into PUR-foam (2.F.4.b) in spray cans (OCF: one component foam) and technical aerosols (2.F.4.a). OCF is also used in the construction sector as a sealant. The technical aerosols include, for example "Metered dose inhalers (MDI) for asthma patients"(no production in the Netherlands).

Solvents (2.F.5)
In the Netherlands, HFC43-10mee is used in cleaning processes, such as cleaning of various metals and electronics. Emissions occur during the use of the solvents.

Calculation method
This section covers the general method applied to calculate emission from HFCs per IPCC category. As from 2015, no consumption data of HFCs (foam-blowing agents, aerosols, fire protection and solvents) are available anymore. Therefore, an alternative approach is introduced for determining the emissions from these sources from 2015 onwards. First, the calculation method for the period 1990-2014 is described, after which the alternative approach for the period from 2015 onwards is described.

2.2.3.11.1 Method until 2014
Foam blowing (2.F.2)
HFCs were first used in hard foam production in 2003. HFC emissions from hard foams are calculated as follows:

HFC emission from PUR foams in year t-2 =
(extent of HFC use in new PUR foams in year t-2 x (emission factor production + emission factor installation)) +
(HFCs in recycled foam that was used in year t-2 x emission factor installation) +
(HFC in existing stock of PUR foams[2] x annual emission factor) +

[2] Existing stock = (new stock 1st year of application - annual emissions) + (new stock 2nd year of application - annual emissions over stock years 1 and 2) + ….etc…..+ (new stock year t-1 - annual emissions over stock years 1 through t-2) - amount destroyed by demolition.

(HFC in PUR waste foam from construction in year t-2[3] x emission factor demolition phase)

The following assumptions and starting points have been used:

- When determining HFC emissions in the Netherlands it is important to have both production and usage data available for the Dutch situation. It is not known how many (HCF-based) products have been exported and imported. When calculating emissions it is therefore assumed that the use of hard foam products within the Netherlands is entirely due to domestic production.
- Foams taken from the construction sector are generally incinerated during the demolition phase, whereby the HFCs are destroyed (Vehlow et al., 1995); otherwise they are recycled. This recycled portion is also included in the formula.
- The report Emissies van CFKs uit PUR-isolatieschuim in de keten van slopen tot verwerken (CFC emissions from PUR insulation foam in the chain from demolition to processing) (Tauw et al., 2001) assumes a usage phase of 50-60 years for residences, 45 years for non-residential buildings, and 40 years for bituminous roofing. However, this does not include any intermediate demolition. The usage phase for the construction sector is assumed to be 40 years for plates/panels and mouldings. Usage is assumed to be 25 years for materials that are already installed (Kräling et al., 2000).

This calculation method complies with that described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.4). This concerns a tier 2 method with country-specific emission factors.

Fire Extinguishers (2F3)
This section describes the annual determination of the HFC emissions from Fire Extinguishers in the Netherlands. This method corresponds with the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.6). This concerns the Tier 1b method (with default emission factors).

The calculation starts with the determination per source, followed by the determination of the total emissions.

Filling of (new) installations:

*E nw(t) = V nwv * v/100*

Where:

E nw(t)	= emissions during the filling of the (new) installations in year (t);
V nwv(t)	= the volume of HFC used in (new) installations in year(t);
v	= percentage lost during the filling, expressed as a % of V nwv(t).

[3] Deduced from the usage period of the foams: foams used in year t are assumed to be destroyed in the coming years (t + usage period).

Emissions from working systems:

*E sys(t) = (V sys(t-1) + (Vnw(t) * 0.5) - (Vafg(t) * 0.5)) * lk/100*

Where:

E sys(t)	= emissions from working systems in year(t);
V sys(t-1)	= original volume at 31 Dec (t-1) of working systems;
V nw(t)	= volume of HFC refilled in (new) installations in year(t);
V afg(t)	= original volume of dismantled installations in year(t);
Lk	= leakage percentage during operation;
0.5	= because both the filling of new and dismantling of old installations takes place throughout the year, it is assumed that each new and dismantled installation are operational for an average of six months in year (t).

Losses from dismantling installations:

*E afg (t) = V afg(t) * v/100*

Where:

E afg(t)	= (emission) losses that occur during dismantling of installations;
V afg(t)	= original volume of dismantled installations in year(t);
v	= percentage lost during dismantling of old installations.

Finally, the total emission of HFCs by Fire Extinguishers is determined each year using the following formula:

Annual Emission = E nw(t) + E sys(t) + E afg(t)

Further information on the activity data and emission factors used is available in the corresponding sections of this emission source.

Aerosols (2.F.4)
HFC emissions from aerosols are determined using the following formula:

HFC emissions in year t = ((Amount in products sold in year t) x 50%) + ((Amount in products sold in year t-1) x 50%)

This formula should be used for each individual chemical substance. In addition to HFC134a, this subsector uses very small amounts of HFC152a.
The aforementioned method conforms to the calculation method required for HFC emissions from aerosols (tier 2a), as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.3)
The largest part of the Dutch production is exported, but it is not known how many products containing HFCs are imported and exported. Emission calculations assume that the use of aerosols in the Netherlands originate entirely from domestic aerosol production until more information is available.

Solvents (2.F.5)
The HFC emissions from solvents and cleaning agents are determined in the same way as in aerosols (2.F.4).
Emission factors
The emission factors introduced in the calculation method section are explained in this section.

Foam blowing (2.F.2)
The extent of foam blowing emissions in the various phases varies according to the foam application. Emission percentages per application and per phase are shown in the following table. The following sources provided data:

1. LCA (life cycle analysis) report by Krähling et al., (2000), contains information concerning HFC emissions in the production and usage phases of the applications 'continuous plates/panels' and 'in situ'.
2. Since the aforementioned report contains no emission percentages for 'discontinuous forms', this information was taken from the Crystal Globe (2000) report and the 'CFC emissions from PUR insulation foam, from demolition to processing' report by Tauw et al. (2001). These emissions data concern CFCs used as propellant, though these are expected to be similar to HFCs. Krähling also assumes that emission percentages depend on the type of propellant used. Percentages for the dismantling/demolition phase are taken from the Tauw et al. (2001) report, because this phase is not included in the Kräling report. Tauw also includes emissions data for plates/panels and for 'in situ' applications, which are similar to those covered by Krähling.

Table 13 Emission percentages of three PUR hard foam applications in the various life phases

	1. Continuous, plates/panels [1)]	**2. Discontinuous, forms [2)]**	**3. In situ [1)]**
Production and installation	5%	0.5%	15%
First year usage	-	0.1%	5%
Usage in following years	0.2% per year	0.1% per year	1.2% per year
Dismantling/demolition phase[3)]	1%	-	2-90%

1) Data taken from Krähling (2000).
2) Data taken from Tauw (2001) and Crystal Globe (2002).
3) Data taken from Tauw (2001); percentages concern the dismantling and associated processes for the foams; it is assumed that the foams are then incinerated so that the remaining propellants are destroyed. The 'in situ' emissions largely depend on the material to which the foam is attached and the treatment used: 2% for sorted (attached to wood), 10% for dismantled (attached to stone), 90% for crushed rubble (attached to stone).

Fire Extinguishers (2.F.3)
For this sector the IPCC default values from the the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.6) are used.

Aerosols (2.F.4)
Emissions occur every time an aerosol is used. It is assumed that aerosols are used within two years after production, whereby 50% of the propellant is emitted in the first year and 50% in the second year.

This 50% conforms to the default value used in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.3).

Solvents (2.F.5)
See Aerosols (2.F.4).

Activity data
All activity data described in this section covers all emission causes (foam blowing, fire extinguishers, aerosols and solvents).
Until the 2016 submission consumption data of HFCs (stationary refrigeration, foam-blowing agents, aerosols, fire protection and solvents) was obtained from the annual reports by PriceWaterhouseCoopers.

The extent of HFC use in these sectors was determined annually via the project 'Use of HCFCs, HFC, and related substances in the Netherlands' (also known as the 'Handelsstromenonderzoek' or trade flow study) which was conducted annually (up to 2003 by KPMG (KPMG, multiple years), from 2004 onwards by PWC consultants (PWC, multiple years)) on behalf of the Ministry of Infrastructure and the Environment. Because of the sensitivity of data only the sum (expressed in CO2-eq) of the use of HFC245fa, HFC227ea and HFC365mfc for the production of hard foams was available from the trade flow study.
Differentiation between PUR-foam and technical aerosols is made since the year 2000.

2.2.3.11.2 Alternative approach (from 2015 onwards)
Due to the fact that the annual reports by PWC about the emissions of these sources are not available anymore, a new calculation method has been introduced to determine the emissions of these categories from 2015 onwards, as long as the sources remail unavailable. This alternative approach is based on the total emissions in these subcategories from surrounding countries Germany and Belgium. First, a comparison of the emission trends over the period 2010-2014 in the Netherlands and Germany/Belgium was made to check the trend comparability over these years. These similar trends in 2010-2014 show that the emissions in Germany and Belgium give a good indication for the emission trends from these sources in the Netherlands.

To calculate the emissions from 2015 onwards for the categories 2F2-2F5, the emissions from these sources in the neighbouring countries Germany and Belgium are taken as a starting point. A yearly growth factor for the Netherlands is determined by the growth factor of emissions in these two countries, with a weighted average based on GDP. These growth factor was used to calculate the emissions from these sources for the Netherlands from 2015 onwards. For the most recent year, surrogate data (data from Germany and Belgium) was used and forward extrapolated (see 5.3.3.2. ' surrogate data' and 5.3.3.4. 'trend extrapolation' in chapter 5 ' time series consistency' of the 2006 IPCC guidelines). The average growth factor from 2015 to the most recent year was taken to extrapolate the emission from these sources for the most recent year.

Until last submission, the emissions in these categories were kept constant as from 2014. With this alternative approach, the emissions in the categories 2F2-2F5 are recalculated for the years from 2015 onwards.

2.2.3.12 SF6 emissions from the high-voltage power industry (CRF 2.G.1)
This section describes the method used to determine SF_6 emissions during the production, installation and demolition phases of medium- and high-voltage capacity circuit breakers (insulation and arc extinguishers), including the testing of installations by independent laboratories. This concerns NACE codes 261, 27, 3313,3314, 3323, 3324 and 35.

SF_6 emissions as a result of using SF_6 in the high-voltage power industry, production of semi-conductors, double glazing and electromicroscopes are all aggregated into a single figure and reported under CRF category 2.G.4 ‘Other’. This is due to the confidentiality of the data.
Production data by the (former) Netherlands high-voltage manufacturer, the test laboratory
for high-voltage installations, the semiconductor and electromicroscope manu-facturers could otherwise be deduced directly from the emissions figures, activity data and implied emission figures under the subcategories of the main 2G group.

SF_6 is used in high-voltage and medium-voltage installations as insulation and/or circuit breaker/arc extinguisher. The gas in the installation is used to prevent voltage arcs between the various electricity potentials. Although air is a fairly good insulator, voltage arcs can still be created if the distance is too short and voltage differences too high. If SF_6 is used (under pressure) then the chance of voltage arcs and short-circuit leakage is considerably reduced. SF_6 can also be used as a so-called ‘extinguisher gas’ for overvoltage protection installations.

High-voltage installations refer to units in excess of 36 kV, while medium-voltage refers to those less than 36 kV. Compared to high-voltage installations (hundreds of kilos of SF_6), medium-voltage installations use much smaller quantities of SF_6 (only a few kilos). High-voltage installations are used by electricity generation companies, electricity network operators and several large corporations with their own electricity facilities (including Netherlands Railways). The major companies account for around 5% of the total consumption at high-voltage power plants. The number of Dutch users is therefore limited. However, the number of users with medium-voltage installations is greater, as large corporations also use this type of system.

Emissions
The aforementioned types of installations can emit SF_6 during the production, installation, usage and demolition phases. Since almost all medium-voltage installations are ‘sealed for life’ (a trend that began around halfway through the 1980s), emissions during the usage phase are practically zero.

When manufacturing high-voltage components, products are tested in a real production environment. During this test phase, which takes place during production as well as ‘on site’, the medium-voltage and high-voltage components are filled with SF_6 under working pressure. The components are then emptied until they reach a pressure of 0.05 bars. The remainder is thus released.
Up to around 2003, the Netherlands had only one manufacturer of high-voltage installations. This manufacturer focused primarily on the international market. Most of the (large) users of medium-voltage and high-voltage circuit breakers, the network managers and electricity generation companies (i.e. around 90%) are members of EnergieNed, the Federation of Energy Companies in the Netherlands. In addition, there are also a limited number of industrial users of high-voltage equipment in the Netherlands.

The Netherlands also has one international test laboratory for power switches, where high-voltage and medium-voltage installations are tested, with or without SF_6 as insulation and/or arc extinguishers.

Calculation method
This section describes the methods used to determine SF_6 emissions.

Method 1
This method is based on data on SF_6 usage and losses during the various process steps. The following formula was used to calculate SF_6 emissions from the high-voltage power sector:

> *SF_6 emissions = production-emission (6% of purchase volume)*
> *+ emissions from installations in NL (6% of increase)*
> *+ emissions through leakage and handling on-site in NL (4% of total banked)*
> *+ emissions through discarded installations in NL (0.2 tonnes in 199x – dismantled installation in Hoogeveen)*
> *+ emissions when testing installations (6% of use1).*

The total banked amount of SF_6 includes the SF_6 in high-voltage installations at electricity Companies and network managers and at several large industrial corporations with their own power facilities and at s well as in medium-voltage installations.
The first inventory of all installations at companies belonging to EnergieNed (Dorrepaal, 2001) was made in 2000/2001 (status 1999). For the 1995-1999 period and beyond annual changes were estimated on the basis of economic developments and extrapolation. This method was applied for the period before 2006.

Method 2
According to this method, SF_6 emissions were derived from the annual input and output of SF_6 at company level (Van der Stoep and Verhaart, 2007), as follows:

*SF_6 emissions = (C – (B - A) – D) * 100/95 kg*
+ emissions from testing installations (6% of use).

Where:
A: stock at t-1 (start of measurement period)

B: stock at t (end of measurement period)
C: input t (during measurement period)
D: output t (during measurement period)
100/95: This incremental factor is used for determining total emissions, including those from several large industrial users (approx. 5% of total emissions).
The intervening years (2000 to 2005) were recalculated via interpolation, using new 2006 emission data on 2006, as well as historical data on 1999.

This method was applied for the 2006-2008 period.

Method 3
Since 2011(2009 emissions), SF6 emissions have been derived from the annual report of Netbeheer Nederland (KEMA, 2010 onwards). The SF6 emissions are calculated as follows:

*SF_6 emissions = The annual input of SF_6 in all installations * 100/95 kg + emissions from testing installations*

Where:
Factor 100/95: This incremental factor is used for determining total emissions, including those from several large industrial users (approx. 5% of total emissions).

Comparison with IPCC method
Method 1 complies with the Tier 2 method. Method 2 and Method 3 correspond to the Tier 3 mass-balance approach. A description of all methods can be found in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 8, p. 8.9-8.11).

The calculations for the Netherlands are slightly different, because they also includes SF_6 emissions from large industrial users (approx. 5% of the total) and from testing installations in an independent laboratory.

Emission factors
The following country-specific emission factors are used:
- The production emission amounts to 6% of the purchase volume (Capiel, 2001).
- The annual of SF6 emission from testing installations are provided by DNVKEMA and is confidential.

Activity data
Manufacturing installations
Corporate information regarding SF_6 power:
- Amount of SF_6 purchased each year for production purposes.
- Amount exported in installations sold to other countries.

The above information was registered until around 2003. This was a flow of confidential information used for external reviews that, under the UNFCCC, could be accessed via the ER’s work package leader.

Total banked amount of SF_6

The first inventory of all installations at companies belonging to EnergieNed (Dorrepaal, 2001) was made in 2000/2001 (status 1999). Since 2006, the total banked amount of SF_6 has been derived from an annual report of EnergieNed (Van der Stoep and Verhaart, 2007) and the annual report of Netbeheer Nederland (KEMA, 2007 onwards). These reports are confidential.

2.2.3.13 SF6 emissions from other use (CRF 2.G.2)

This section describes the methodology and working processes used to determine the SF_6 emission figure for the production, use and end-of-lifespan activities for sound-insulated glazing (2.G.2.c) and for the minor source "production of electron microscopes".

Emissions by the Netherlands as a result of using SF_6 are reported as a single figure under CRF (common reporting format) category 2.G.4. Such emissions by the high-voltage sector, production of semiconductors, double glazing and electron microscopes are all aggregated into a single figure and reported under CRF category 2.G.4 "SF_6 from Other Use".

The contributions from remaining other sources are currently not considered substantial (< 0.2 ton SF_6/year, DHV, 2000), and are therefore not included in the determination of total SF6 emissions.

Calculation method

Double Glazing (2.G.2)

SF_6 emissions during production and use of sound-insulated double glazing have been calculated using the following formulas:

*Emissions during production = 0.33 * Production capacity (1)*
*Emissions resulting from leakage in year t = 0.01 * stock of SF_6 in glazing in NL (2)*
*Emissions during dismantling phase = amount remaining in glazing * (1-recovery factor) (3)*
Total emissions = sum of (1), (2) and (3)

Where:

- Emissions: in ton SF_6 in year t
- EF_p : Emission factor during production = 0.33 (per year)
- Production capacity = amount of SF_6 used by the sector (in ton SF_6)
- EF_g : Emission factor during use = 0.01 (per year)
- Stock of SF_6 in glazing within the Netherlands (NL) in year t = B_t (in ton SF_6)
  $= B_{(t-1)} – B_{(t-25)} + C + D$
  $= B_{(t-1)} – B_{(t-25)} + 1.33\ D$
  - $B_{(t-1)}$: existing amount of SF_6 in glazing within NL
  - $B_{(t-25)}$: amount remaining in glazing in dismantling phase year t (lifespan is approx. 25 years)
  - C : import = 0.33 * D
  - D : domestic turnover by NL manufacturers: (1- EF_p) A * 0.96 = 0.67 A * 0.96
  - Annual new domestic turnover by NL manufacturers: 96% (4% export)

- Amount remaining in glazing during dismantling in year t = $B_{(t-25)}$ (lifespan is approx. 25 years)
- Recovery factor: recovery of the gas remaining in the glass at dismantling/demolition phase =0

The aforementioned method complies with the method described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 8, p. 8.31).

Electron microscopes (2G2)
The emission of this minor source is annually obtained from the only producer in the Netherlands.

Emission factors
Double Glazing (2G2)

Emission factor during production
EF_p : Emission factor during production = 0.33 (per year)
This emission factor is taken from the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 8, p. 8.31).

Emission factor during use
EF_g : Emission factor during use = 0.01 (per year)

It is assumed that around 1% of the gas will leak out each year throughout the lifespan of the glazing. This includes the percentage for breakages. With an average lifespan of 25 years, this means that at the end of the lifespan there will still be around 78% of the original filling in the glass. This emission factor is also taken from the the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 8, p. 8.31).

Recovery factor
There is currently no method of recovering the gas (recovery factor =0) remaining at the end of the glazing lifespan (demolition).

Electron microscopes (2G2)
Not applicable.

Activity data
Double Glazing (2G2)
The datasets required for emission calculations are as follows:
- Production capacity: Annual amounts of SF_6 used by the sector (in ton SF_6).
- Stock in glazing (within the Netherlands): annual new turnover in the Netherlands

  = B_t (in ton SF_6)
  = $B_{(t-1)} - B_{(t-25)} + C + D$
  = $B_{(t-1)} - B_{(t-25)} + 1.33\ D$

- $B_{(t-1)}$: existing amounts of SF_6 in glazing within NL
- $B_{(t-25)}$: amounts remaining in glazing during demolition in year t (lifespan is approx. 25 years)
- C : import = 0.33 * D

- D : domestic turnover by NL manufacturers: (1- EF_p) A * 0.96 = 0.67 A * 0.96
  - Annual new domestic turnover by NL manufacturers: 96% (4% exports)

Assumptions: it was assumed that 96% of the aforementioned production capacity focuses on the market in the Netherlands and the other 4% was exported to foreign countries. It was also assumed that 25% of the annual stock increase is derived from foreign products (primarily from Germany),

- Stock at demolition: this is derived from the range of existing glazing stock, taking into account a 25-year lifespan and a remaining gas stock in the glazing of 78%.

Sources:

- Until 2006 (production has stopped after 2005), the aforementioned information was annually provided by the double glazing manufacturers to the work package leader of the Task Force delivered ENINA
- Individual company statistics concerning SF_6 usage, production capacity, domestic turnover and import of SF_6 are all competitor-sensitive figures and are therefore treated as confidential information. Reviewers/audit team may access this information via the work package leader.

Electron microscopes (2G2)
Not applicable.

2.2.3.14 Indirect CO2 emissions from NMVOC (CRF Sectors 1, 2, 3 and 5)

This section describes the methodology and working processes used to determine the CO_2 emissions from NMVOC use. Indirect CO_2 emissions originate from the use of NMVOC in the following sectors:

1. Energy (Energy, Traffic & transport and Refineries);
2. IPPU (Consumers, Commercial and governmental institutions, Industry and Construction and building industries);
3. Agriculture;
5. Waste.

Until the 2014 submission country-specific carbon contents of NMVOC emissions (C-factors) have been used to calculate the indirect CO_2 emission from NMVOC use. Because these C-factors are dated and no recent country specific C-factors are available Netherlands has switched to the use of the IPCC default C content from the 2015 submission onwards.

Calculation method
Per sector, the indirect CO_2 emissions from NMVOC use are calculated as follows:

CO_2 (in Gg) = NMVOC emission (in Gg) x C x 44/12

Where:
- C = default IPCC carbon content (C) of 0.6;
- NMVOC emissions data from the use of NMVOC.

The Activity data
NMVOC emissions data per sector are obtained from the Dutch PRTR.

2.3 Emissions from waste (CRF 1A1a and CRF 5)

Emissions from waste are linked to the emission sources listed in *Table 14. This section describes the emissions from these sources.*

Table 14 CRF categories and corresponding emission sources (including a reference to the section describing the method)

CRF	Section	ES CODE	EMISSION SOURCE
1.A.1.a	2.3.1.1 and 2.3.2.1	8921804	NACE 38.2/84.1: Treatment of waste, including communal waste-incineration plants
	2.3.1.2 and 2.3.2.2	E401210	Solid waste disposal on land: managed disposal
5.A.1	2.3.1.2 and 2.3.2.2	E401220	Solid waste disposal on land: managed disposal
	2.3.1.2 and 2.3.2.2	E402200	Solid waste disposal on land: managed disposal
5.B.1	2.3.1.3 and 2.3.2.3	E400313	Digesting of organic waste from households
		E400314	Composting of organic waste from households
	2.3.1.3 and 2.3.2.3	E400315	Digesting of organic horticultural waste
		E400316	Composting of organic horticultural waste
5.D.1	2.3.1.4 and 2.3.2.4	E400107	NACE 90.01: collection and treatment of sewage
	2.3.1.4 and 2.3.2.4	E400108	NACE 90.01: collection and treatment of sewage; venting of biogas
5.D.2	2.3.1.4 and 2.3.2.4	E400102	Anaerobic waste water treatment plants, other industries
	2.3.1.4 and 2.3.2.4	E400103	Anaerobic waste water treatment plants, waste processing industries
	2.3.1.4 and 2.3.2.4	E400104	Anaerobic waste water treatment plants, paper industries
	2.3.1.4 and 2.3.2.4	E400105	Anaerobic waste water treatment plants, food industries
5.D.3	2.3.1.4 and 2.3.2.4	0444900	Indirect N_2O related to waste water
	2.3.1.4 and 2.3.2.4	E400106	Discharges of domestic waste water: septic tanks, anaerobic processes

For Incineration CO_2, CH_4 and N_2O are calculated, also HCB and PeCB for the period 1990-2004.
For landfilled waste CH_4 is calculated. Also non GHG emissions of combustion of land fill gas (Total hydrocarbons, CO, PM, CO_2, NO_x and dioxins) are calculated here but are not part of Air IPCC.
For composting CH_4, NH_3, N_2O, NO_x and SO_2 are calculated.

2.3.1 Calculation method of preliminary emission figures

2.3.1.1 Waste Incineration Plants (CRF 1.A.1.a)

In the summer of each year the preliminary emission values are established. These are the preliminary figures for the emission of the year preceding the year in which the preliminary figures are reported.

For work package 66 the preliminary values are the final values of the previous year. This means that the final data of 2017 serve as the preliminary data for 2018. This applies to both the emissions and the activity data.
When it is time to establish the preliminary values, the basic values for the year in question are not yet known, i.e. there is no other information available to base the preliminary figures on except the final figures of the previous year.

2.3.1.2 Landfill sites (CRF 5.A.1)

The calculation method of preliminary emissions of last year is identical to the method that is applied for the calculation of definite emission of the year before last year being the so called final emissions. See the description in section 2.3.2.2.
Calculation of preliminary emissions from landfill sites is identical to the method for final emissions. At the time the preliminary emissions are due to be submitted not all data are available, i.e. data related to extracted landfill gas and its methane content. These values are estimated based on the basis of the historical trends.

2.3.1.3 Composting (CRF 5.B.1)

The calculation method of preliminary emissions of last year is identical to the method that is applied for the calculation of definitive emission of the year before last year being the so called final emissions. See the description in section 2.3.2.3.

2.3.1.4 Sewer systems and water treatment (CRF 5.D.1, 5.D.2, 5.D.3)

2.3.1.4.1 Emission sources

Activities related to sewer systems and water treatments involve a number of process emissions of the GHGs methane and nitrous oxide. Conversion processes in the tanks of waste water treatment plants produce nitrous oxide. Small quantities of methane are also released under anaerobic conditions, e.g. in the intake cistern of waste water treatment plants. Small quantities of methane escape into the atmosphere during the processing and fermentation of sewage sludge. Biogas is occasionally vented into the air, which also causes methane emissions. Small quantities of methane are produced by the treatment of waste water by dwellings with a septic tank.
In a number of industries, including the food, chemical, paper and waste processing industries, anaerobic treatment plants are used. In these installations leakage of small quantities of methane occurs during the capturing of the biogas.
The IPCC category Sewer systems and waste water treatment concerns the following emission sources:

Table 15 Emission sources in the Sewer systems and waste water treatment category

ES CODE	EMISSION SOURCE
E400107	NACE 90.01: Collection and treatment of sewage
E400108	NACE 90.01: Collection and treatment of sewage; venting of biogas
E400106	Discharges of domestic waste water: septic tanks, anaerobic processes
E400102	Anaerobic waste water treatment plants, other industries
E400103	Anaerobic waste water treatment plants, waste processing industries

ES CODE	EMISSION SOURCE
E400104	Anaerobic waste water treatment plants, paper industries
E400105	Anaerobic waste water treatment plants, food industries
0444900	Indirect N_2O related to waste water

2.3.1.4.2 Emissions from the collection and treatment of sewage

Because no new activity data are available when the preliminary emissions are calculated the N_2O and CH_4 emissions from this emission source are copied from final emissions of the previous year, but corrected for treatment plants that were taken out of service. See section 2.3.2.4.2 for the calculation method of the final emissions.

2.3.1.4.3 Methane emissions from biogas discharge (venting) (CRF 5.D.1)

Through the collective request for energy data of waste water treatment plants preliminary activity data become available in late May about the volumes of biogas occasionally vented by WWTPs. The calculation method of preliminary CH4 emissions is the same as for final emissions and is described in section 2.3.1.4.3.

2.3.1.4.4 Discharges of domestic waste water: septic tanks, anaerobic processes (CRF 5.D.3)

For methane emissions from septic tanks the preliminary data are calculated using new activity data. The method is described in section 2.3.2.4.4.

2.3.1.4.5 Methane emissions from anaerobic industrial waste water treatment plants (CRF 5.D.2)

Because no new activity data are available when the preliminary emissions are calculated the CH_4 emissions from this emission source are copied from final emissions of the previous year. See section 2.3.2.4.5 for the calculation method of the final emissions.

2.3.1.4.6 Indirect nitrous oxide emissions from nitrogen discharges via effluents (CRF 5D1)

Because no new activity data are available when the preliminary emissions are calculated the N_2O emissions from this emission source are copied from final emissions of the previous year. See section 2.3.2.4.6 for the calculation method of the final emissions.

2.3.2 Calculation method of final emission figures

2.3.2.1 Waste Incineration Plants

The final emissions are reported in the autumn of the next year to which the emission data pertain. This section describes how GHG emissions are established for the WIPs, including the calculation method of both the activity data and the actual emissions.

Background information

The emissions released from the incineration of waste in dedicated plants are referred to as Waste Incineration Plants (WIPs). These are the plants that are exclusively or largely fed with residual household waste or similar waste. This only concerns the plants included in the reports of the Working Group on Waste Registration (WAR) under ‘Incineration’.

The waste incineration plants process a small portion of hazardous waste compared to municipal waste. Examples are certain organic liquids from the chemical industry, cleaning cloths contaminated with oil and/or solvents and oil filters. Other hazardous waste is incinerated abroad (mainly in Northwestern Europe) in rotary kilns. Hospital waste is almost always incinerated in a special facility, see Appendix C-5 of the aforementioned report. This installation processes approximately 10 kilotonnes of hospital waste yearly.
The dedicated plants in which sludge or paper are incinerated as well as biomass power plants are not covered by this work package. The most important measure WIPs employ to restrict emissions is the flue gas scrubber system after the incineration chamber.

Part of the data established for WIPs on the basis of this method report are also used to monitor renewable energy in the Netherlands, the Dutch list of energy carriers and default CO_2 emission factors (Most recent version at publication Zijlema 2022), also known as the fuel list, and other reports. This method report describes for waste incineration plants all the calculation methods for these reports. In this way, method incongruence is prevented.
Renewable energy monitoring focuses on establishing the proportion of renewable energy in the energy production of WIPs. Renewable energy monitoring is described in the 'Protocol Monitoring Hernieuwbare Energie (herziening)' (RVO/CBS, 2015) (Protocol on Monitoring Sustainable Energy). The protocol will refer to this method report regarding the monitoring of WIPs. This proportion of renewable energy is also used to establish the percentage of renewable electricity of the WIPs as described in section 14(2) of the Renewable Energy Guarantees of Origin scheme.

The data in the fuel list is used to as reference values for companies for completing their eAER. For waste used as fuel an updated value is given each year based on the data calculated using the method described here.

Which data are to be used for the Protocol on Monitoring Sustainable Energy, the fuel list, and establishing the percentage of renewable electricity has been explained in a number of places in the following text about Waste incineration.

Modification of the WIP method
Future modifications to the method will need to be aligned to renewable energy monitoring, because a single model is used to respond to several monitoring questions. Consultations with the industry and other stakeholders are an integral part of any modification of renewable energy monitoring. This means that the industry must be consulted prior to any modification of the method.

2.3.2.1.1 Calculation method of activity data

Activity data
There are two activity rates: 'Waste incinerated Non-org (TJ)' (non-biomass energy) and 'Waste incinerated Org (TJ)' (biomass energy), both measured in TJ. Together these activity rates provide the total

energy content of the incinerated waste. These activity rates apply to all GHG emissions.
The purpose of having two activity rates for Air IPCC is to be able to distinguish between biogenic and fossil CO_2. Biogenic CO_2 is a memo item in the NIR report.

The activity rates have been established taking account of the transfer of foreign waste to WIPs in the Netherlands. This has only been in use since the monitoring year 2012. In 2012, Dutch WIPs processed a significant amount of foreign waste. In previous years, very little or no foreign waste was processed and is assumed not occurring. The reason for the method modification is described in Rijkswaterstaat (2013).

Calculating the amounts of biomass and non-biomass energy produced by WIPs involves seven steps, which are described below. These steps are summarised in Table 16, which also references the information sources for the different waste flows in each of the steps.

Table 16 Steps in the calculation of (biomass) energy from waste incineration

Step	**Description**	**Residual household waste***	**Foreign waste**	**Other waste**
1	Amount per flow	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)
2	Component composition	Sorting analyses	Waste shipment permit (Regulation (EC) No 1013/2006) (WSR)	This ENINA method report
3	Energy amount per component	This ENINA method report	This ENINA method report	This ENINA method report
4	Proportion of biogenic energy per component	This ENINA method report	This ENINA method report	This ENINA method report
5	Total energy from incinerated waste			
6	Amount of biogenic energy from incinerated waste			
7	Amount of non-biogenic energy from incinerated waste			

* The portion of municipal waste (EURAL 20.03.01) produced by households

The steps are described separately for residual household waste, foreign waste and other waste.

Residual household waste
A number of waste flows are equated with residual household waste as regards composition and NCV, as shown in Table 17.

Step 1
The Working Group on Waste Registration (WAR) produces an annual report about the amounts of incinerated residual household waste (WAR,

multiple years). This is done in the summer and always concerns the previous calendar year. For residual household waste this concerns the residual household waste that is part of the municipal waste flow as defined in European Waste List code 20.03.01.

Step 2
The composition of residual household waste is established on the basis of sorting analyses. For these analyses, representative samples are taken annually from the residual household waste from 1100 addresses. This waste is sorted by component and the total is considered to be a representation of the average composition of residual household waste in the Netherlands. The result is included in the annual reports by Rijkswaterstaat entitled “Samenstelling van het huishoudelijk restafval” (Composition of residual household waste) (Rijkswaterstaat, multiple years). In the present report, a three-year average is used. This is normally used in reporting of the composition of residual household waste, as this give a more reliable outcome. This means that for the year 2018 the average of 2017 is used, i.e. the average of the years 2016, 2017 and 2018. As the three-year average for 2018 is not yet available at the time the statistics are established, the sorting analyses are one year behind relative to the amounts. Table 17 shows how the components in the different studies are linked. The proportions for components in the sorting analyses have been established for residual household waste originating directly from households. A portion of certain components is removed from the residual household waste through post-collection separation. This will lead to changes in the ratio of component proportions. As plastics is the most important component that is removed from residual household waste through post-collection separation this is taken into account. The amount is yearly known from the reporting for the extended producer responsibility for packaging. The yearly report gives the amount of plastics separated (Afvalfonds verpakkingen, multiple years).

Step 3
For the NCV (Net Calorific Value, i.e. energy content) of residual household waste the component proportions is multiplied by the NCV of the relevant component and these figures are counted up. This is the average NCV of Dutch residual household waste for a certain year. Table 18 shows the NCV of individual components, as well as the proportion of total organic carbon and biogenic carbon. The source of this data is SenterNovem 2008, table 4.5.

Step 4
For the NCV of the total biomass, the component proportion is first multiplied with the NCV of the component and the proportion of biomass of the NCV. Then, all contributions of the components are added up. This is the part of the NCV attributable to biomass in Dutch residual household waste for a certain year.

Foreign waste
Foreign waste fed info Dutch WIPs mainly consists of municipal waste or municipal waste that has been sorted.

Step 1
The amount of foreign waste that is processed in Dutch WIPs is monitored for the import ceiling. This means that the total amount of waste shipments bound for the WIPs registered in the context of the Waste shipment regulation(Regulation (EC) No 1013/2006) is established based on the registered amounts received or processed by the WIPs. The monitoring is undertaken by Rijkswaterstaat. The data concerning individual waste shipments are not public. Only the total waste amount imported to WIPs can be included in the model. The total amount of foreign waste is reported in WAR (multiple years).

Step 2
Each waste flow shipped to WIPs must be accompanied by a decision confirming permission for the shipment. The composition of the waste must be included in the application for a decision for each waste flow. Based on this composition and data of waste shipments, an average composition of the total foreign waste amount can be calculated. The underlying data related to an order application, including composition-related data, are not made public. Only the average composition can be included in the model. There is no source in which this data is published.

Step 3
For the NCV (Net Calorific Value, i.e. energy content) of foreign waste the component proportions is multiplied by the NCV of the relevant component and this is counted up. Table 18 shows the NCV of individual components, as well as the proportion of total organic carbon and biogenic carbon. The source of this data is SenterNovem 2008.
The components of foreign waste are equated to the components of Dutch residual household waste, based on the assumption that most of the foreign imported waste is residual household waste with components reasonably similar to those of Dutch residual household waste. Another reason for his approach is the lack of more comprehensive information.

Step 4
For the NCV of the total biomass, the component proportion is first multiplied with the NCV of the component and the proportion of biomass of the NCV. Then, all contributions of the components are added up. This is the part of the NCV attributable to biomass in foreign waste for a certain year.

Other waste
Step 1
The Working Group on Waste Registration (WAR) produces an annual report about the amounts of incinerated waste (WAR, multiple years) in the year following the report year. The proportion of foreign waste in each waste flow is also known. Other waste is the waste reported in the WAR that is not residual household (Dutch) waste or foreign waste.
Step 2
The various waste flows are divided across 6 standard substance categories about which data is available. The standard substance categories are paper/cardboard, organic, wood, plastic, other, and non-combustible. The division is shown in Table 19.

Step 3
The NCV per waste flow is the sum per waste flow of the proportions of standard substances multiplied by the NCV of the standard substances. Table 20 shows the NCV of the standard substances. This is the average NCV of the waste flow.

Step 4
The biomass NCV per waste flow is the sum per waste flow of the proportions of standard substances multiplied by the biomass NCV of the standard substances. Table 20 shows the biomass NCV of the standard substances.

Total waste
Step 5
For the total energy content, the NCV of each waste flow is multiplied by the amount of the waste flow. The results are added up. The energy content of the residual household waste is also factored in.

Step 6
For the total biomass energy content, the NCV of each waste flow is multiplied by the amount of the waste flow. The results are added up.

Step 7
The amount of non-biomass energy can be established by subtracting the amount of biomassenergy from the total amount of energy produced by waste incineration.

Renewable Energy Monitoring Protocol
This data can be used to establish the proportion of renewable energy produced by WIPs. The ratio between the biomassenergy content of all waste combined and the total energy content of the waste is used to calculate the percentage of renewable energy generated by waste incineration. The NCV of incinerated waste is the total energy content of incinerated waste divided by the total mass of incinerated waste.

Sustainable energy percentage
The sustainable energy percentage of the WIPs is equal to the proportion of renewable energy referred to above.

Fuel list
The calorific value for waste for the fuel list is calculated by dividing the total energy amount by the total waste amount. The biogenic percentage of the calorific value is equal to the proportion of biomassenergy referred to above.

Table 17 Conversion table component sorting analysis to component weight and energy

Weight and energy Components	**Sorting analysis components**
Biodegradable waste	=biodegradable total - or
Or (ondefinieerbare rest (undefinable residue)	=Or
Paper (excl. diapers)	=Paper total - diapers
Diapers	=diapers
Plastics	=plastics total
Glass	=glass total
Ferro	=ferro total
Non-ferro	=non-ferro total
Textile	=textile
HHW	=HHW
Wood	=other wood
Other, residual	=other residual
Other, EEA (electric and electronic equipment)	=other EEA
Other, stony	=other stony
non-combustible	*n/a*

Table 18 NCV for residual household waste components (source: SenterNovem 2008, table 4.5)

Sorting fractions	**NCV (MJ/kg)**	**NCV biomass (MJ/kg)**	**Moisture content (weight%)**
Biodegradable waste	5.8	5.1	50.9
Or	3.8	3.4	47.9
Paper (excl. diapers)	10.2	8.9	38.8
Diapers	7.1	3.6	59.2
Plastics	23.0	4.6	17.7
Glass	0.0	0.0	0.0
Ferro	0.0	0.0	0.0
Non-ferro	0.0	0.0	0.0
Textile	15.9	7.5	18.5
HHW	0.0	0.0	0.0
Wood	14.2	13.2	22.8
Other, residual	7.4	0.0	4.5
Other, EEA	16.4	0.0	13.5
Other, stony	0.0	0.0	0.0

Table 19 Division of standard components by waste category

		Combustible (weight %)					non-combustible (weight %)
	waste category	**paper, cardboard**	**wood**	**organic**	**plastics**	**other**	
Mixed urban waste	mixed urban waste	Equal to rhw					
Residual household waste	residual household waste (rhw)	Annually via sorting analysis					
	bulky waste	4	28	11	16	14	27
Business waste	business waste	25	4	34	12	15	10
	agricultural waste					100	
	industrial waste, non-hazardous	25	4	34	12	15	10
	specific hospital waste, non-hazardous					100	0
Residual substances post-separation	shipments from abroad	Annually via orders					
	residual substance separation	Equal to rhw					
Other waste	car tyres			30	70		
	construction and demolition waste, other	8	55	0	14	23	0
	sanitation service waste	9	2	80	9	0	0
	composting/fermentation waste			60	0	0	40
	residual substances WIPs, non-hazardous	25	4	34	12	15	10
	residual substances post-treatment			64	0	0	36
	shredder waste, total	35	10	20	20	7	8
	sewage sludge from communal WWTPs			64	0	0	36
	other waste	Equal to rhw					
Hazardous waste	other waste or non-specified, hazardous					100	0
	residual substances WIPs, hazardous					100	0
	specific hospital waste, hazardous					100	0

Table 20 NCV for standard components and biomass proportion (Rijkswaterstaat 2013)

	combustible					non-combustible
	paper, cardboard	**wood**	**organic**	**plastics**	**other**	
NCV (MJ/kg)	10	14	3	33	15	0
of which biomass	100%	100%	100%	0%	50%	0%
biomass proportion by weight	100%	100%	100%	0%	50%	0%

Table 21 Database codes of AD for Air IPCC

ES code	Process_description	Activity data
8921804	NACE 90022/75: Waste treatment, WIPs	Waste incinerated Non-org (TJ)
8921804	NACE 90022/75: Waste treatment, WIPs	Waste incinerated Org (TJ)

Activity data for amount of waste

For the CRF the amount of incinerated waste must be included. This amount can only be included in the database (the national database for parties to upload data) as an activity rate. The data is divided between biomass and non-biomass (Waste incinerated Non-org (kt) and Waste incinerated Org (kt)). For an explanation of the calculation method please see the emission calculation method for N_2O. Because an Activity Rate cannot be included in the database without being linked to an emission, it is linked to CH_4. CH_4 was chosen because there are no CH_4 emissions.
These activity data cannot be linked as activity data for N_2O because the activity rate of N_2O must be energy amounts for the national database. (See further Rijkswaterstaat 2013).

The data about the division of biomass and non-biomass is also used in other national reports

The corresponding codes in the database for these activity data are listed in Table 22.

Table 22 Database codes of activity data for the amount of incinerated waste

ES code	Process_description	Activity data
8921804	NACE 90022/75: Waste treatment, WIPs	Waste incinerated Non-org (kt)
8921804	NACE 90022/75: Waste treatment, WIPs	Waste incinerated Org (kt)

2.3.2.1.2 Emission calculation method

The emissions of the three greenhouse gases for work package 66 are calculated for the Netherlands as a whole. There are distinct calculation methods for the different emissions.

- CO_2 is calculated based on the carbon content of the incinerated waste.
- N_2O is calculated based on the weight of the incinerated waste.
- CH_4 is calculated based on the energy content of the incinerated waste.

The emissions are divided between the two activity data for Air IPCC. For CO_2 and N_2O this is based on the ratio of the respective biogenic to non-biogenic of carbon content and the biomass and non-biomass weight, and for CH_4 on the ratio of biomass to non-biomass of the energy content.

CO_2, carbon dioxide
Establishing the biomass proportion by weight and energy content and the biogenic proportion in the carbon content for a waste incineration plant is complex due to the inhomogeneity of the fuel. Complicating factors include the lack of a usable protocol for sampling and sample analysis. However, because the composition of residual household waste in the Netherlands is known from years of research, it has been decided to use the data resulting from this research to establish the energy and carbon content as well as the corresponding biomass and biogenic proportions of the waste flows incinerated in the waste incineration plants (WIPs).

The CO_2 emissions have been established taking account of the transfer of foreign waste to WIPs in the Netherlands. This has only been in use since the monitoring year 2012. In 2012, Dutch WIPs processed a significant amount of foreign waste. In previous years, very little or no foreign waste was processed and is assumed not occurring. The reason for the method modification is described in Rijkswaterstaat (2013).

Calculating the CO_2 emissions for both the biogenic and the non-biogenic portion comprises seven steps, which are described below. These steps are summarised in Table 23, which also references the information sources for the different waste flows in each of the steps.

Table 23 Steps in the calculation of CO2 from waste incineration

Step	**Description**	**Residual household waste**	**Foreign waste**	**Other waste**
1	Amount per flow	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)
2	Component composition	Sorting analyses	Waste shipment permit (Regulation (EC) No 1013/2006) (EVOA)	This ENINA method report
3	Carbon content per component	This ENINA method report	This ENINA method report	This ENINA method report
4	Proportion of biogenic carbon per component	This ENINA method report	This ENINA method report	This ENINA method report
5	Total emissions of CO_2 from incinerated waste			
6	Amount of biogenic CO_2 from incinerated waste			
7	Amount of non-biogenic CO_2 from incinerated waste			

The steps are described separately for household waste, foreign waste and other waste.

Residual household waste

Step 1

The Working Group on Waste Registration (WAR) produces an annual report (WAR, multiple years) about the amounts of incinerated waste by weight. This is done around the summer and always concerns the previous calendar year. For residual household waste this concerns the flow of mixed urban waste (only household waste) as defined in European Waste List code 200301.

Step 2

The composition of residual household waste is established on the basis of sorting analyses. For these analyses, representative samples are taken annually from the residual household waste from approx. 1100 addresses. This waste is sorted by component and the total is considered to be a representation of the average composition of residual household waste in the Netherlands. The result is included in the annual reports by Rijkswaterstaat[4] entitled “Samenstelling van het huishoudelijk restafval” (Composition of residual household waste) (Rijkswaterstaat, multiple years). In the present report, a three-year average is used. This is normally used in reporting of the composition of residual household waste, as this give a more reliable outcome. This means that for the year x the average of (x-2), (x-1) and x is used.

Step 3

For the Total organic carbon proportion (TOC) of residual household waste the proportion of the component is first multiplied by its proportion of carbon. Then, all contributions of the components are added up. This is the average carbon proportion of Dutch residual household waste for a certain year.
The components in the sorting analysis and in the study of carbon proportions are not fully aligned. Table 24 shows how the components in the different studies are linked. The carbon proportion of the various components is shown in Table 25. The source of this data is (SenterNovem 2008, table 4.2).

Step 4

For the proportion of biogenic carbon is based on the proportion of degradable organic carbon (DOC). It is assumed that these are equal as there are no usable sources for the determination of biogenic carbon. The proportion of a component is first multiplied by its DOC (see Table 25). Then, all contributions of the components are added up. This is the average DOC of Dutch residual household waste for a certain year.

Foreign waste

Step 1

The amount of foreign waste that is processed in Dutch WIPs is monitored for the import ceiling. This means that the total amount of waste shipments bound for the WIPs registered in the context of EVOA

[4] For the years 2010 and 2011 data from NL Agency were used, and before that data from SenterNovem.

is established based on the registered amounts received or processed by the WIPs. The monitoring is undertaken by Rijkswaterstaat. The data concerning individual waste shipments is not made public. Only the total waste amount imported to WIPs can be included in the model. The total amount of foreign waste is reported in WAR (multiple years).

Step 2
Each waste flow shipped to WIPs must be accompanied by an decision confirming permission for the shipment. The composition of the waste must be included in the application for a decision for each waste flow. Based on this composition and data of waste shipments an average composition of the total foreign waste amount can be established. The underlying data related to an order application, including composition-related data, are usually not made public. Only the average composition can be included in the model. There is no source in which this data is published.

Step 3
For the carbon proportion (TOC) of foreign waste the sum of component proportions is multiplied by the carbon proportion of the relevant component. This is the average carbon proportion of foreign waste for a certain year. The components in the sorting analysis and in the study of carbon proportions are not fully aligned. Table 24 shows how the components in the different studies are linked. The carbon proportion of the various components is shown in Table 25. The source of this data is (SenterNovem 2008, table 4.2).
The components of foreign waste are equated to the components of Dutch residual household waste, based on the assumption that most of the foreign imported waste is residual household waste with components reasonably similar to those of Dutch residual household waste.

Step 4
For the proportion of biogenic carbon (DOC) the proportion of the component is first multiplied by its DOC (see Table 25). Then, all contributions of the components are added up. This is the average DOC of foreign waste for a certain year.

Other waste
Step 1
The Working Group on Waste Registration (WAR) produces an annual report about the amounts of incinerated waste by weight (WAR, multiple years). This is done in the year following the report year. The proportion of foreign waste in each waste flow is also taken into account. Other waste is the waste reported in the WAR that is not residual household waste or foreign waste.

Step 2
The various waste flows are divided across 6 standard substance categories about which data is available. The standard substance categories are paper/cardboard, organic, wood, plastic, other, and non-combustible. The division is shown in Table 19. These values have been established based on an expert judgement.

Step 3
The TOC per waste flow is the sum per waste flow of the proportions of standard substances multiplied by the TOC of the standard substances. Table 26 shows the TOC of the standard substances. This is the average TOC of the waste flow. These values have been established based on an expert judgement.

Step 4
The DOC per waste flow is the sum per waste flow of the proportions of standard substances.
Table 26 shows the DOC of the standard substances. This is the average DOC of the waste flow.

Total waste
Step 5
For the total CO_2 emissions, the TOC of each waste flow is multiplied by the amount by weight of the waste flow. The results are added up. Household waste is also factored in. This quantity is then multiplied by 44/12 for the conversion of carbon into CO_2.

In this step the amount of CO_2 that is captured (carbon capture) in WIP's and will be be subtracted from the total amount of CO2 depending on the type of usage. The deciding factor is if the carbon is fixated in an product, if it is fixated, then it will be subtracted. For the following types of usage that occur in the Netherlands is determined if it is taken into account:

- *use as growth medium in agriculture*. As most of the CO_2 will in the end be emitted to the atmosphere, this amount is not subtracted from the produced CO_2;
- *the captured CO_2 is used as raw material in the production of bicarbonate*. The captured amount is subtracted from the produced CO_2.

In the report of the WAR the amount of catured CO_2 is given with the type of usage. The carbon caprure is with reporting year 2019 taken into account. There is no guidance from IPCC on how to take usage of captured CO_2 into account in the inventory.

Step 6
For the total biogenic CO_2 emissions, the DOC of each waste flow is multiplied by the amount by weight of the waste flow. The results are added up and then multiplied by 44/12.

Step 7
The total non-biogenic CO_2 emission is calculated by subtracting the total biogenic CO_2 emissions from the total non-biogenic CO_2 emissions.

The formulas are:

$$CO2_{total} = \sum_i \sum_j mass\ waste_{waste\ stream\ i,component\ j} \times share\ carbon_{i,j} \times 44/12$$

$$CO2_{biogenic} = \sum_i \sum_j mass\ waste_{waste\ stream\ i,component\ j} \times share\ biogenic\ carbon_{i,j} \times 44/12$$

$$CO2_{fossil} = CO2_{total} - CO2_{biogenic}$$

Fuel list
The CO_2 emission factor for waste for the fuel list is calculated by dividing the total CO_2 content by the total energy content of waste. The percentage of biogenic CO_2 is established by dividing the biogenic CO_2 by the total CO_2 content.

Table 24 Conversion table component sorting analysis to component carbon list

Carbon components	**Sorting analysis components**
Biodegradable waste	=biodegradable total
Paper	=Paper total
Wood	=other wood
Plastic	=Plastic total
Glass	=glass total
Ferro	=Ferro total
Non-ferro	=Non-ferro total
Textile	=textile
Animal waste	N/A
Stone/ash	=other stony
Carpets/mattresses	=other residual * (4.67/(4.67+0.99+1.45))*
Leather/rubber	=other residual * (0.99/(4.67+0.99+1.45))*
HHW and other	=Hhw
Other	=other residual * (1.45/(4.67+0.99+1.45))*
EEA	-other EEA
non-combustible	n/a

*See Rijkswaterstaat 2013 for explanation of the calculation

Table 25 TOC and DOC per component (source: SenterNovem 2008, table 4.2)

Components	**TOC (weight %)**	**DOC (weight %)**	**Fossil (weight %)**
Biodegradable waste	21.6	19.7	1.9
Paper	27.4	24.7	2.7
Wood	39.2	37.4	1.9
Plastic	58.6	15.1	43.5
Glass	0	0	0
Ferro	0	0	0
Non-ferro	0	0	0
Textile	41	20.5	20.5
Animal waste	30	30	0
Stone/ash	0	0	0
Carpets/mattresses	30	3	27
Leather/rubber	49.9	39.9	10
HHW and other	0	0	0
EEA	37.5	0	37.5
Other	0	0	0

Table 26 TOC and DOC for standard substances (source: Rijkswaterstaat 2013)

	Combustible (Weight %)					**Non-combustible (weight)**
	Paper, cardboard	**Wood**	**Organic**	**Plastics**	**Other**	
Carbon content (wet)	30	45	20	54	32	1
Carbon content, biogenic, non-fossil (wet)	30	45	20	0	19	0
Carbon content, fossil (wet)	0	0	0	54	13	1

N_2O, nitrous oxide

The N_2O emission depends on the amount of incinerated waste by weight, the type of $DeNO_x$ plant and the contects of the waste streams. The emission factor are based on research on Dutch WIP's. The emission factor depends on the type of $DeNO_x$ the plant uses, SCR or SNCR. Table 27 shows the emission factor and its corresponding source for each $DeNO_x$ plant. The type of $DeNO_x$ plant of a WIP is known from the WAR.

Table 27 N2O Emission factor per $DeNO_x$ plant type

$DeNO_x$ plant	**Emission factor (g/ton)**	**Source**
SCR	20	Spoelstra, 1993
SNCR	100	Oonk, 1995

The total amount of incinerated waste by weight is known from the WAR. As the weight of incinerated waste only can be given divided between biomass and fossil in the used database in the Netherlands a division for the emissions of N_2O also must be made. This distinction between weight in biomass and fossil is also used for other activities. See also '*Activity data for amount of waste*' in paragraph 2.3.2.1.1

The formula for calculating de N_2O emissions is given below. This is followed by a description of the method for calculating the biomass fraction of incinerated waste by weight.
formula for N_2O is:
$N2O_{total} = [\![Mass \times (Share]\!]_{SCR} \times EF_{SCR} + (1 - Share_{SCR}) \times EF_{SNCR})$

The method for calculating fraction of biomass by weight
Establishing the biomass proportion by weight and energy content and the biogenic proportion in the carbon content for a waste incineration plant is complex due to the inhomogeneity of the fuel. Complicating factors include the lack of a usable protocol for sampling and sample analysis. However, because the composition of residual household waste in the Netherlands is known from years of research, it has been decided to use the data resulting from this research to establish the energy and carbon content as well as the corresponding biomass and biogenic proportion of the waste flows incinerated in the waste incineration plants (WIPs).

The N_2O emissions have been established taking account of the transfer of foreign waste to WIPs in the Netherlands. This has only been in use since the monitoring year 2012. In 2012, Dutch WIPs processed a significant weight of foreign waste. In previous years, very little or no foreign waste was processed and is assumed not occurring. The reason for the method modification is described in Rijkswaterstaat (2013).

Calculating the incinerated weight of waste for both biomass and non-biomass is done in five steps, which are described below. These steps are summarised in Table 28, which also references the information sources for the different waste flows in each of the steps.

Table 28 Steps in the calculation of N_2O from waste incineration

Step	**Description**	**Residual household waste**	**Foreign waste**	**Other waste**
1	Weight per flow	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)
2	Component composition	Sorting analyses	Waste shipment permit (Regulation (EC) No 1013/2006) (EVOA)	This method report
3	Biomass content per component	This method report	This method report	This method report
4	Weight of biomass in incinerated waste			
5	Biomass proportion			

The steps are described separately for residual household waste, foreign waste and other waste.

Residual household waste

Step 1

The Working Group on Waste Registration (WAR) produces an annual report (WAR, multiple years) about the amounts of incinerated waste by weight. This is done around the summer and always concerns the previous calendar year. For residual household waste this concerns the flow of mixed urban waste (only household waste) as defined in EURAL code 20.03.01.

Step 2

The composition of residual household waste is established on the basis of sorting analyses. For these analyses, representative samples are taken annually from the residual household waste from 1100 addresses. This waste is sorted by component and the total is considered to be a representation of the average composition of residual household waste in the Netherlands. The result is included in the annual reports by Rijkswaterstaat entitled "*Samenstelling van het huishoudelijk restafval*" (Composition of residual household waste) (Rijkswaterstaat, multiple years). In the present report, a three-year average is used. This is normally used in reporting of the composition of residual household waste, as this give a more reliable outcome. This means that for the year x the average of (x-2), (x-1) and x is used.

Step 3

For the biomass proportion by weight of residual household waste the proportion of the component is first multiplied by its biomass by weight. Then, all contributions of the components are added up. This is the average biomass proportion by weight of Dutch residual household waste for a certain year.
The components in the sorting analysis and in the study of biomass proportions in the NCV are not fully aligned. Table 17 shows how the components in the different studies are linked. The biomass proportion by weight of the different components is listed in Table 29. The source of this data is (SenterNovem 2008).

Foreign waste

Step 1

The weight of foreign waste that is processed in Dutch WIPs is monitored for the import ceiling. This means that the total weight of waste shipments bound for the WIPs registered in the context of EVOA is established based on the registered weight received or processed by the WIPs. The monitoring is undertaken by Rijkswaterstaat. The data concerning individual waste shipments is not made public. Only the total waste weight imported to WIPs can be included in the model. The total weight of foreign waste is reported in WAR, multiple years.

Step 2

Each waste flow shipped to WIPs must be accompanied by a decision confirming permission for the shipment. The composition of the waste must be included in the application for a decision for each waste flow. Based on this composition and data of waste shipments an average composition of the total foreign waste weight can be established. The underlying data related to an order application, including composition-related data, are usually not made public. Only the average composition can be included in the model. There is no source in which this data is published.

Step 3
For the biomass proportion by weight of foreign waste the sum of component proportions is multiplied by the biomass proportion by weight of the relevant component. This is the average biomass proportion by weight of foreign waste for a certain year. The components in the sorting analysis and in the study of biomass proportions by weight are not fully aligned. Table 24 shows how the components in the different studies are linked. The proportion by weight of the different components is listed in Table 29. The source of this data is (SenterNovem 2008, table 4.5).
The components of foreign waste are equated to the components of Dutch residual household waste, based on the assumption that most of the foreign imported waste is residual household waste with components reasonably similar to those of Dutch residual household waste. Another reason for his approach is the lack of more comprehensive information.

Other waste
Step 1
The Working Group on Waste Registration (WAR) produces an annual report about the amounts of incinerated waste by weight. This is done in the year following the report year. The proportion of foreign waste in each waste flow is also taken into account. Other waste is the waste reported in the WAR that is not residual household waste or foreign waste.

Step 2
The various waste flows are divided across 6 standard substance categories about which data is available. The standard substance categories are paper/cardboard, organic, wood, plastic, other, and non-combustible. The division is shown inTable 19. These values have been established based on an expert judgement.

Step 3
The biomass proportion by weight per waste flow is the sum per waste flow of the proportions of standard substances multiplied by the biomass proportion by weight of the standard substances. This is the average biomass proportion by weight of the waste flow. The biomass proportion by weight of the standard substances is listed in Table 30. These values have been established based on an expert judgement.

Total waste
Step 4
For the total biomass weight in incinerated waste, the biomass proportion by weight of each waste flow is multiplied by the weight of the waste flow. The results are added up.

Step 5
The total amount of incinerated waste by weight is known from the WAR. The biomass proportion by weight is established by dividing the biomass weight in incinerated waste by the total weight of incinerated waste.

Table 29 List of biomass proportions by weight per component

component	**biomass proportion (weight %)**
Biodegradable waste	88
Or	89
Paper (excl. diapers)	87
Diapers	51
Plastics	20
Glass	0
Ferro	0
Non-ferro	0
Textile	0
HHW	0
Wood	93
Other, residual	0
Other, EEA	0
Other, stony	0

Table 30 Biomass proportion of standard substances

	Combustible (Weight %)					**non-combustible (weight %)**
	paper, cardboard	**wood**	**organic**	**plastics**	**other**	
biomass proportion by weight	100	100	100	0	50	0

The N_2O emission is the sum of the emission factor of the plant type multiplied by the proportion of the plant type multiplied by the weight of incinerated waste. This is divided between the two emission explaining factors in the ratio of biomass to non-biomass of incinerated waste by weight.

The formulas are

$$N2O_{biomassgenic} = \sum_i \sum_j mass\ waste_{waste\ stream\ i,component\ j} \times share\ biogenic\ mass_{i,j}$$

$$N2O_{non-biomass} = N2O_{total} - N2O_{biomass}$$

$$N2O_{biogenic} = \sum_i \sum_j mass\ waste_{waste\ stream\ i,component\ j} \times share\ biogenic\ mass_{i,j}$$

CH_4, methane

In October 2010 the Advisory Board NIE approved an amendment of the method for establishing the CH_4 emissions of WIPs. The method amendment applies retroactively for the period up to and including 1990. The baseline year for the emissions is 1990. Around this period the legal requirements for WIPs were tightened, especially those applying to flue gas scrubbing. It can reasonably be assumed that by 1990 methane emissions from WIPs were already structurally lower than the background concentration. The new emission factor for CH_4 is 0 kg per TJ of energy content of incinerated waste. Research shows that the emission of CH_4 from WIPs is lower than the background concentration of CH_4 in the air. The background for the method amendment is described in DHV (2010) and in Rijkswaterstaat (2013).

The new method implies that the division by the emission activity rate has become superfluous. The emissions are 0 kg for both activity rates. This item will be included in the CRF as NO, because entering 0 (zero) as a value would cause processing issues in the CRF.

Work package database
The used database codes for the emissions are shown in Table 31 below.

Table 31 Database codes emissions work package 66, Air IPCC

Activity data	**substance flow type**	**Substance code**	**Substance name**
Waste incinerated Org (TJ)	6-2	204	Carbon dioxide
Waste incinerated Org (TJ)	6	205	Nitrous oxide
Waste incinerated Org (kt)	6	523	Methane
Waste incinerated Non-org (TJ)	0	204	Carbon dioxide
Waste incinerated Non-org (TJ)	0	205	Nitrous oxide
Waste incinerated Non-org (kt)	0	523	Methane

2.3.2.1.3 Comparison with IPCC emission factors

The emission factors for CO_2 and N_2O vary annually due to differences in waste composition. This section compares the emission factors for work package 66, as calculated for monitoring year 2012, to the emission factors as included in IPCC 2006.

IPCC 2006, volume 5, section 5.4.1 does not provide direct emission factors for CO_2 released from waste. Therefore the emission factors used in this work package cannot be compared to IPCC 2006.
IPCC 2006, volume 5, section 5.4.3 provides an emission factor for N_2O of 20 g/ton for the Netherlands. This is only the used emission factor in the Netherlands for WIP's with SCR. For WIP's with SNCR the emission factor is 100 g/ton. The given information in IPCC 2006 is thus incomplete. In principle the emission factor in IPCC 2006 is similar to the emission factor used in the Netherlands. These are thus comparable.
The emission factor for CH_4 used in this work package is in line with default value in IPCC 2006. In IPCC 2006, volume 5, section 5.4.2 it is good practice to apply an emission factor of zero.

Table 32 shows an overview of emission factors in IPCC 2006 and in this work package for monitoring year 2012.

Table 32 IPCC 2006 and work package 66 emission factors

Emission	IPCC 2006	NL, work package 66, 2012
CO_2	-	106,641 kg/TJ
N_2O	20 g/ton	49 g/ton
CH_4	0 kg/TJ	0 kg/TJ

2.3.2.2 Landfill sites (CRF 5.A.1)

Emissions from landfill sites are calculated for the following emission source categories:

E401210 Solid waste disposal on land: managed disposal
E401220 Solid waste disposal on land: managed disposal
E402200 Solid waste disposal on land: managed disposal

2.3.2.2.1 Introduction

This emission source category includes all waste landfill sites in the Netherlands since 1945[5], and concerns both historic and current public sites that are used to dump waste, plus waste dumped on private ground. Since it is sure that these waste sites are (or were) managed and monitored from around 1945 onwards, and are considered to be responsible for most of the methane emissions, these are reported under the IPCC category 5A1 (the so-called '*managed landfills*')[6]. Dredge material land filled in special sites, intended only for dredging materials, is not part of this work field.

Many landfill sites were situated not far from urban areas. In order to prevent odour and animals (birds and rats) the management of landfill sites has had attention since the beginning of the 20th century. A large study was conducted in 2005 that subsequently was used as further reference information. This study (NAVOS, 2005) was carried out on the older waste disposal sites in the Netherlands. This study investigated about 4,000 old landfill sites and included e.g. investigations on cover materials and layers (through in-situ investigations). This report mentioned among other that from 1930 a method based on placing the waste in defined layers and cover it with ashes, soil or sand like dirt from street sweeping became common practice. Further it was indicated that at the early seventies the waste-sector itself introduced a "code of practice" in which a method for environmental clean land filling was described. During the seventies and early eighties national legislation came into force introducing an obligation to land filled in a controlled manner. From this moment on a proper site-management is also legally obliged but this was only the result of a process that had been going on for decades.

The emission source category excludes *Unmanaged landfills* that fall under the IPCC category 5A2 and do not exist in the Netherlands. Also excluded is local storage of biodegradable waste (compostable waste from households, trade/services sector, industry and agriculture), the local/central processing of biodegradable waste (into compost and/or biogas), plus the storage and processing of contaminated soil or dredged material. These are reported under IPCC category 5A3 (*uncategorized waste disposal sites*).

This paragraph concerns the calculation procedures on behalf of the monitoring of methane emissions (CH_4) as important component of the landfill gas that is released from landfill sites under anaerobic conditions when organic substances are broken down by micro-organisms (Spakman et al., 1997). This anaerobic process continues many decades, although the amount of landfill gas formed reduces exponentially in time relative to the amount of waste dumped in a specific year.

[5] The methane emissions from landfill sites before 1945 are small enough to be negligible (Van Amstel et al., 1993).

[6] A managed landfill is a site where solid waste is dumped in a controlled manner (i.e. in a specific location, with a certain amount of controlled degassing and hotbed management) and where one of the following management systems is used: covering materials, mechanical compacting, or spreading of the waste.

The composition of landfill gas is changing in time. In the Netherlands landfill gas usually consists of around 50 percent methane and 50 percent carbon dioxide. The carbon dioxide is of organic origin and therefore does not fall under an IPCC source category. The methane content of extracted landfill gas has decreased over the past few years, particularly due to more intensive extraction activities and a change in the composition of biodegradable carbon in waste land filled (Oonk, 2011). More readily digestible components contribute to a significant higher methane production. In the Netherlands as a consequence of waste policy readily digestible components are becoming composted more and more and are less land filled anymore. This may be the explanation of the decrease in the methane concentration in the landfill gas.

The Dutch government has exerted continued political incentive to discourage the dumping of waste, and particularly to discourage the dumping of combustible waste products. The amount of waste dumped has dropped considerably, from 13.9 Mton in 1990 to only 3.1 Mton in 2019. In addition, the amount of biodegradable carbon in the waste has dropped from 130.8 kg C per ton waste in 1990, to 50.0 kg C per ton in 2018. These two developments have resulted in a clear and visible effect on the methane production by landfill sites, which has decreased by 80 percent during the forementioned period. This downward trend is expected to continue in the future.

Many companies in the waste sector are making more effort to extract landfill gas. The extracted amounts increased between 1990 and 2004 and, when these gases are combusted (either by flaring, CHP or transfer into the natural gas network) this has led to a decrease of the methane emissions. After 2004 the amounts of extracted landfill gas slowly decreases as part of the decreasing production of landfill gas. By extracting of the gases of a landfill site the methane production also is suppressed. From 2002 onwards the calculation procedure takes these aspects explicitly into account.

2.3.2.2.2 Calculation method

General

The general formula is:

$$CH_4 \text{ emissions } (t) \text{ (ktonnes)} = (CH_{4(\text{gross gas production})} (t) \text{ (ktonnes)} - CH_{4(\text{landfill gas extraction})} (t) \text{ (ktonnes)}) * (1-ox) \quad (1)$$

where:

1-ox = (1 – oxidation factor) = the fraction of methane that is not broken down in the landfill. The value 0.1 is used as the value of ox

t = number of years after dumping

The gross methane production in year t, as a result of the waste dumped in year x, is calculated using the following formula:

$$CH_{4(\text{gross gas production, waste dumped in year } x)}(t) \text{ (ktonnes)} = M_x * DOC_x * f * k_x * e^{-k_x*(t-x)} * F * 16/12 * MCF \quad (2)$$

Where:

t	= reporting year
x	= year waste was dumped
Prodx(t)	= methane production in year t as a result of waste dumped in year x
Mx	= amount of waste dumped in year x
DOCx	= fraction of biologically degradable carbon in the waste dumped in year x
f	= fraction of biodegradable organic carbon that is actually degraded
kx	= constant reaction
F	= fraction of methane in landfill gas
16/12	= molecular weight ratio CH_4 / C
MCF	= methane correction factor; the Netherlands = 1 because landfills has been managed since 1945

The total gross landfill gas production for the reporting year is calculated via the emissions from waste that was dumped in previous sequential years, i.e.

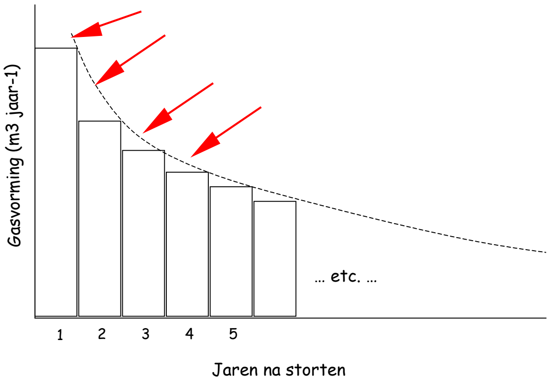
$$CH_{4(gross\ gas\ production)}\ in\ year\ t = \Sigma_{x\ (1945,\ t)}\ CH_{4(gross\ gas\ production,\ waste\ dumped\ in\ year\ x)}\ (t-x) \quad (3)$$

Emissions from the combustion of landfill gas are calculated by multiplying the amount of combusted landfill gas at landfill sites with default emission factors. The emissions factors are presented in Table 34

Comparison to IPCC method

The methane emissions in the Netherlands are calculated using a first-order degradation model, as per the IPCC 2006 Guidelines (IPCC, 2006; Vol.5, Chapter 3, p.3.8), tier-2 method. Input values are taken from specific Netherlands circumstances. This first-order degradation is used for all landfill sites together in the Netherlands, as part of the emissions determination process for the annual emissions and waste report. It is not possible to calculate emissions from individual landfill sites, because there are insufficient accurate historic data available concerning the waste composition of individual landfill sites.

The normalisation factor (A = (1-exp(-k))/k = correction factor for the sum in formula (3)) used in the tier 2 method was not previously used by the Netherlands model until 2005. The normalization factor is meant to correct a mathematical problem of the model compared to the (assumed!) first order decay. The model without the factor calculates the methane production after each year and uses this result for the whole year. This approach is mathematically not correct as is shown in the figure below. The (assumed) first-order formation is presented by the dotted line whereas the results of the model are presented by the rectangular blocks. The model leads to an underestimation of the methane production since every year the triangle between the dotted line and the rectangular block is not accounted for. The normalization factor is meant to correct this mathematical error.



In 2011 (Tauw, 2011) there was an attempt to validate the model. Due to insufficient measurements the model could not be validated. Therefore the IPPC-default values are used from 2005 onwards.

2.3.2.2.3 Emission factors

The Netherlands assumptions used in the model were first developed by Hoeks in 1983, as described in Van Amstel et al. (1993) and Coops et al. (1995), the latter also including an expansion to individual landfill sites. Table 33 shows the parameters used.

Table 33 Comparison of IPCC default values and those used in the Netherlands

Parameters used (IPCC-names)	**Parameter values**		**References**
	IPCC 2006 default (Volume 5, chapter 3)	**Netherlands situation**	
Oxidation factor (OX)	Maximum 0.1 for National Inventory	0.1 (10%)	(Coops et al., 1995)
f = fraction of degradable organic carbon (DOC_f)	0.5 (p3.13)	0.58 from 1945 through 2004, thereafter constant 0.5	(Oonk et al., 1994)
Degradable speed constant k	0.04 - 0.06 (p3.17)	0.094 from 1945 through 1989 (half-life time 7.5 yr); from 1990 reducing to 0.0693 in 1995; thereafter constant 0.0693 (half-life time 10 yr); reducing to 0,05 in 2005, thereafter constant 0,05 (half-life time 14 yr)	(Oonk et al., 1994)
$DOC_{(X)}$ = concentration of biodegradable carbon in waste that was dumped in year x	Maximum 210 kg C/ton dumped waste	132 kg C/ton dumped waste from 1945 through 1989, from 1990 linear, reducing to 125 kg C/ton in 1995. 120 kg/ton in 1996 and 1997 and after 1997 determined annually by Rijkswaterstaat.	Based on (De Jager et al., 1993), determined by (Spakman et al., 1997) and published in (Klein Goldewijk et al., 2004)
F (fraction of CH_4 in landfill gas)	0.5 (p3.15)	0.574 from 1945 through 2004; thereafter constant 0.5	(Oonk, 2016)

Parameters used (IPCC-names)	**Parameter values**		**References**
	IPCC 2006 default (Volume 5, chapter 3)	**Netherlands situation**	
MCF(x) = Methane correction factor for management	1 (p3.14)	1	
Delay Time	6 months (p3.19)	6 months	

It is assumed that, for the Netherlands, an average 10% of the methane in the non-extracted landfill gas in the top layer will be oxidised, and thus 90% will be emitted. The oxidation factor is thus set at 0.1 according to the IPCC 2006 guidelines (Volume 5, Chapter 3, p.3.15).

The value for $DOC_{(x)}$ is published annually in the National Inventory Report (NIR).

Landfill operators have been using codes from the European Waste List (EWL-codes) since 2005 to register the amounts of waste landfilled. Because it is not possible to determine an exact composition of all waste materials, the EWL-codes are subdivided into waste categories. In appendix 6 of the report "Validatie van het nationale stortgas emissiemodel" (Tauw, 2011) all EWL-codes are subdivided into 10 waste categories. Quantities of degradable carbon have been determined for each of these waste categories. Appendix 3 of the report explains the individual value of the amount of degradable carbon for a number of waste categories. A number of categories are discussed below.

Household residual waste
The composition of household residual waste is based on sorting analyzes from 2007 and chemical analyzes on sorting fractions during the period 2004-2006 (Tauw, 2011). In the chemical analyses, the proportion of biogenic carbon was determined. The results are summarized in Table A.

Tabel A Composition of household residual waste as received

Fraction	**Share**	**Dry matter**	**Biogenic carbon**	
	(% m/m)	(% m/m)	In fraction (% d.m.)	In waste (% a.r.)
Organic waste + sieve fraction < 20 mm	34	49.1	40.1	6.7
Paper and cardboard	25	61.2	40.4	6.2
Plastics	20	82.3	18.3	3.0
Glass	4.1	98.5	0	0
Metals	4.0	95.5	0	0
Textiles and shoes	3.8	87.0	34.5	1.15
Wood	3.1	77.2	48.5	1.16
Concrete and rubble	2.9	97	0	0
Electr(on)ic equipment	1.0	95	0	0
Other	2.1	90	0	0
Total	100.0			18.2

Bulky household waste
The composition of bulky household waste dates from 1990. The composition concerns collected bulky household waste and not the part that is eventually landfilled. The dry matter contents have been estimated. The main components of biogenic origin are pruning waste and wood. The results are summarized in Table B.

Tabel B Composition of bulky household waste as received

Fraction	**Share**	**Dry matter**	**Biogenic carbon**	
	(% m/m)	(% m/m)	In fraction (% d.m.)	In waste (% a.r.)
Organic waste	21.9	65	40.1	5.7
Paper and cardboard	4.4	85	40.4	1.5
Plastics and rubber	11.5			0
Glass	1.6			0
Metals	13.2			0
Textiles	6.4	87.5	23.2	1.3
Wood	24.6	90	48.5	10.7
Concrete and rubble	13.3			0
Other	3.1			
Total	100.0			19.2

Commercial waste
For commercial waste, the composition of the residual waste in 2005 was examined. It is assumed that the relative composition of the landfilled waste is the same as that of household residual waste. No figures are known about the moisture content, but it can be assumed that industrial waste is a lot drier than household waste. The content of biogenic carbon is set to zero in plastics. The results are summarized in Table C.

Tabel C Amount and composition commercial waste in 2005 as received

Fraction	**Amount**	**Share**[1]	**Dry matter**	**Biogenic carbon**
	(kiloton)	(% m/m)	(% m/m)	In waste (% a.r.)
Organic waste + sieve fraction < 20 mm	84	6.5	49.1	1.3
Paper and cardboard	525	40.5	90	9.0
Plastics	437	33.7	0	0
Glass	58	4.5	0	0
Metals	85	6.6	0	0
Textiles	24	1.9	90	0.35
Wood	84	6.5	90	2.19
Other	639		0	0
Total	1936			12.8

1 The category ‘other’ is excluded

Fresh organic waste
For the 'fresh organic waste' category, the composition of various organic sludge flows from municipal and industrial wastewater treatment plants has been used. Table D shows the composition of municipal sewage sludge and industrial sewage sludge.

Table D Composition communal and industrial sludges as received

Parameter	Communal sludge	Industrial sludges
Dry matter (% m/m)	24.6	43.6
Organic content (% of dry matter)	66.1	65
Carbon (% a.r.)	7.5	13.1
Biogenic carbon (% a.r.)	6.0	10.4

Stabilised organic waste
For the 'stabilized organic waste' category, the composition of sorting residues from construction and demolition waste was examined. The sorting fraction is created after construction and demolition waste has been post-sorted. It is likely that further processing takes place before the sorting residue is land filled. Table E shows a composition of sorting residue from construction and demolition waste. Because it is not clear whether all the sorting residue is landfilled, a degradable carbon content of 130 kilograms per ton has been determined for the 'stabilized organic waste' category.

Table E Composition of residue of construction demolition waste as received

Fraction	Share	Dry matter	Biogenic carbon
	(% m/m)	(% m/m)	In waste (% a.r.)
Paper and cardboard	20.8	85	7.1
Plastics	32.1	0	0
Rubber/leather	1.0	0	0.3
Metals	1.5	0	0
Textiles and carpets	5.5	90	0.4
Wood	24.3	85	10.0
Concrete and rubble	14.1	0	0
Tar and other bitumen	0.9	0	0
Total	100		17.8

Little organic waste
The composition of shredder waste has been used for the 'slightly organic waste' category. This category also includes other streams containing a low content of biodegradable material. The table shows the composition of shredder waste. The dry matter content is an assumption. The results are summarized in Table F.

Table F Composition of mixed shredder waste as received

Fractie	**Share[1]**	**Dry matter**	**Biogenic carbon**
	(% m/m)	(% m/m)	In waste (% a.r.)
Organic waste + sieve fraction < 20 mm	0	0	0
Paper and cardboard	0.4	90	0.14
Plastics	26.6	0	0
Rubber	5.6	0	2.1
Metals	4.1	0	0
Textiles	3.1	90	0.64
Wood	3.5	90	1.53
Sieve residue < 10mm	55.3	0	0
Total			4.41

Summary degradable organic content

A summary of the degradable carbon fraction and the source per waste category are shown in table G.

Table G Overview of waste categories, DOC-values and source.

	Waste stream group	**DOC value (kg/ton)**	**Source**
1	Waste from households	182	Table A
2	Bulky household waste	192	Table B
3	Commercial waste	128	Table C
4	Cleansing waste	43.4	Expert judgement
5	Fresh organic waste	112	Table D, partly based on composition of sludges
6	Stabilised organic waste	130	Table E, partly based on composition of sorting residues of construction and demolition waste and expert judgement
7	Little organic waste	44	Table F, partly based on the composition of shredder waste
8	Contaminated soil	11.5	Expert judgement
9	Dredging spoils	42.4	Expert judgement
10	Inert waste	0	
11	Wood waste	430	IPCC-default value

k-value

The k-value is used for the half-life value for waste to decay to half its initial mass. The assumption is made that the majority of degradable waste landfilled in the Netherlands consists of paper, wood and textiles (slowly degrading) and not of sewage sludge or food waste (rapid degrading). Paper, wood and textiles can for example be found in

construction and demolition waste and in waste from shredding vehicles and electronic equipment.
The IPCC default value is between 0.03 and 0.06 for slowly degrading waste (wood, paper, textiles) in a wet and temperate climate zone.
In the period 1989-2004 a country-specific value for k (0.094) was determined with a validation of a landfill gas model (Oonk, 1994). Due to changing waste composition as a result of waste policies in the early 90s, the value was changed to 0.0693 for the years 1990-2004. A new attempt to validate the landfill gas model to derive improved parameters (Tauw, 2011) was unsuccessful. Therefore a IPCC-default value of 0.05 for the k-value is used in the Dutch model from 2005 onwards.
Degradable waste is not landfilled in large quantities in the Netherlands. There is still a quantity of mixed municipal waste landfilled (EWL code 200301). In theory, this code applies to several waste streams, e.g. waste from households and commercial waste. In fact, in recent years only commercial waste has been landfilled, because waste from households is incinerated.
Other waste streams that are landfilled in large quantities, such as contaminated soil (EWL code 170504) and sludges from physic-chemical treatment (EWL code 190206: in fact mainly residues from soil remediation), have a low DOC value. It is reasonable to assume that these residues contain only slowly degrading waste, because the organic content is stabilised.

Non-GHG emissions from the combustion of captured landfill gas are released both by landfill gas engines and flares. WAR (Working Group on Waste Registration) collects the data related to landfill gas capture and its distribution between landfill gas engines and flares by all operators of landfill sites.

Table 34 shows the emission factors for the combustion of landfill gas.

Table 34 Emission factors used in the combustion of landfill gas

Component	**Emission factor and unit**
Total hydrocarbons (incl. methane)	0.389763 kg/m³
CO	2.7% C flare and 3.4 g/m³ gas engines
Hydrocarbons (CxHy)	0.27% hydrocarbons flare and 6 g/m³ gas engines
Soot	0.05% hydrocarbons flare
CO_2 (biogenic)	total C minus CO minus soot
NO_x (as NO_2)	0.3 g/m³ flare and 3 g/m³ gas engines
Dioxins	0.9U-9 g/m³ flared and 0.3U-9 g/m³ gas engines
SO2 (based on all sulphur)	104 mg/m³ of landfill gas

Landfill gas contains other pollutants beside methane. Based on research (Coops et al. 1995) the following micro-pollutants. Table 35 shows the amount of pollutants in a cubic meter of emitted landfill gas.

Table 35 Emission factors used for the free emission of landfill gas

Component	**Emission factor mg/m³**
Benzene	7
Toluene	120
Trichlorofluoromethane (R-11)	5
1,1,2-Trichloro-1,2,2-trifluoroethane (R-113)	1
1,2-Dichlorotetrafluoroethane (R-114)	2
Chloropentafluoroethane (R-115)	1
Dichlorodifluormethane (R-12)	20
Dichlorofluoromethane (R-21)	10
Chlorodifluoromethane (R-22)	10
1,2-Dichloroethene	1
Dichloromethane	20
Tetrachloroethylene (Perc)	10
1,1,1-Trichloroethane	2
Trichloroethylene (Tri)	10
Chloroform (Trichloromethane)	1
Vinyl chloride (Chloroethene)	10
Methanethiol (methyl mercaptan)	10
Hydrogen sulphide	100
Other hydrocarbons	700

Particulate matter (PM) emissions are also emitted from waste handling. Table 36 shows the default emission factors from the EMEP/EEA air pollutant emission inventory guidebook - 2016 for PM. The amount of PM emitted is calculated by multiplying the amount of waste being land filled in a year by the EF.

Table 36 Emission factors used for the emission of PM at landfills

Component	**Emission factor g/Mg**
PM10	0.219
PM 2.5	0.033

2.3.2.2.4 Activity data

The input for the model consists of the following datasets:
Landfill site operators systematically monitor the amount of waste dumped (weight and composition) for each waste site. Since 1993[7] monitoring has occurred by weighing the amount of waste dumped, via weighing bridges (= legally imposed by environmental permits). Details on the historical data are provided below.

Amount of waste dumped 1945 – 1970

Between 1945 and 1970 a number of municipalities already held detailed records of the collection of waste. In addition information was available about which municipalities had their waste incinerated or composted. All other municipal waste was landfilled. Using this information in combination with data on landfilling of various sources (SVA, 1973, CBS 1988, CBS, 1989, Nagelhout, 1989) data for the years 1950, 1955, 1960, 1965 and 1970 determined and published (Van Amstel et al., 1993) while

[7] The obligation to weigh incoming waste at the landfill site started when the Dumping Decree came into force in 1993.

it was assumed that during the Second World War hardly any waste was landfilled. These data are also used in the FOD-model, while missing years (1945-1950, 1951-1954, 1956-1959, 1961-1964 and 1966-1969) are linearly extrapolated.

Amount of waste dumped 1970 - today
From 1970 on accurate data on production and waste treatment are available (Spakman et. al, 1997, electronic update, 2003). Landfill site operators systematically monitor the amount of waste dumped (weight and composition) for each waste site. Since 1993 monitoring has occurred by weighing the amount of waste dumped, via weighing bridges (= compulsory environmental permits).
Data concerning the amounts of waste dumped since 1991 are supplied by the Working Group for Waste Registration (WAR), included as part of the annual report 'Afvalverwerking in Nederland' (Waste processing in the Netherlands). Information concerning the way in which these data are gathered and the scope of the information used can be found in the annual publications 'Afvalverwerking in Nederland', available since 1991 from the WAR (Rijkswaterstaat).

Waste categorisation is usually implemented by the operator, based on the compulsory permits. Data are entered into the company's administration system. Information for the specific reporting year is supplied to the relevant authorities, e.g. to Rijkswaterstaat via the WAR (working group for waste registration) survey.

Landfill site operators (or managers of landfill gas extraction plants, if outsourced) mainly monitor the electricity production of the utility plants or the amount of natural gas produced. Data are entered into the company's administration systems. The data for the reporting year are supplied (on request) to the working group for waste registration WAR, which uses all these data to estimate the total extracted amounts of landfill gas in the Netherlands and, in turn, submits this to the ENINA task force (Rijkswaterstaat) before the third quarter of the year following the reporting year.
For historic years, data concerning amounts of extracted landfill gas were supplied (up to 1998) by the Adviescentrum Stortgas (Landfill Gas Advice Centre), which was an independent organisation from 1992-1997, when it was merged with the (former) VVAV. There are no data available concerning amounts of extracted landfill gas for the years 1999 and 2000. The amounts of extracted landfill gas for these years were estimated by the ENINA task force based on the figures from previous years.
When an operator does not fill in a questionnaire, the amount of extracted landfill gas is estimated using amount from previous years. The methane content of extracted landfill gas in this case is also estimated.

Rijkswaterstaat gathers information on the amounts and composition of a large number of waste flows, as part of its work to draw up the annual Netherlands Waste in Figures report (AgentschapNL, 2010). Information concerning these amounts of dumped waste is used. The results of several other research projects also help to determine the composition of the waste dumped. This method was used till 2004.
Since 2005 landfill operators are obliged to register their waste based on European Waste List (EWL) codes. The landfill operators use these EWL

codes also for the survey of the WAR. The WAR has a complete overview of the waste that is land filled for every waste code. For each EWL code an amount of degradable carbon is determined (Tauw, 2011). By combining the surveys from the individual landfill sites the total amount of waste land filled and the amount of degradable carbon can be calculated.
The data from the WAR is based on questionnaires filled in by operators. When an operator does not fill in a questionnaire the amount processes will be based on data of Landelijk meldpunt afvalstoffen (LMA). The LMA tracks most of the waste transport in the Netherlands. An alternative is the use of historic data.

2.3.2.3 Composting (CRF 5.B.1)

Emissions from composting are calculated for the following emission sources:

E400313 Digesting of organic waste from households
E400314 Composting of organic waste from households
E400315 Digesting of organic horticultural waste
E400316 Composting of organic horticultural waste

Emissions from the use of compost are described in the report Methodology for estimating emissions from agriculture in the Netherlands (2022).

2.3.2.3.1 Introduction

This section describes the monitoring of CH_4, N_2O, NH_3, NO_x and SO_2 emissions released from the processing of separately collected biodegradable waste (from households) into compost and/or biogas in the Netherlands (IPCC category: 5B). Emissions released during processing (composting and/or fermentation) of other organic waste, mostly generated by companies, are not included in this paragraph. This concerns NACE code: 3821 Treatment of non-hazardous waste.
Also all other composting of collected biodegradable waste is part of this section. This is waste with the specific European Waste List codes 02.01.03, 02.01.07 and 20.02.01. This is organic horticulture waste. This does not include installations that treat manure. Emissions from installations that treat manure are described in the report Methodology for estimating emissions from agriculture in the Netherlands (2022).

During composting and fermentation, biodegradable waste is converted into compost and/or biogas. These processes are carried out in enclosed facilities (halls, tunnels and/or fermentation tanks), allowing waste gases to be filtered through a biobed before being emitted to the air. The material in the biobed is renewed periodically. Emission measurements are rarely performed at the biobed.

At the present time there are no other specific measures known to reduce emissions. The expansion of the composting/fermentation of biodegradable waste is the result of compulsory separate collection of biodegradable waste that started in 1994. Various local authorities are placing more emphasis on the separate collection of garden waste, and less on the fruit and vegetable fraction. This means that biodegradable waste will not only have a coarser texture, but will also be drier. At the same time more emphasis is placed on the collection of biodegradable waste from households living in tall buildings. Since these households do not have garden waste the biodegradable waste collected from these households will be wetter.These developments may affect emission factors, and thus also the emissions.

2.3.2.3.2 Calculation

In the Netherlands, the emissions released through composting and fermentation of biodegradable waste are calculated by multiplying the processed amount per component by an emission factor for composting or an emission factor for fermentation. The amounts are based on wet weight basis for the whole time series. The calculation formulas for the individual components are as follows:

Methane (CH_4)

$$CH_{4,comp} = EF_{CH4,comp} \times T_{composting}$$

$$CH_{4,ferm} = EF_{CH4,ferm} \times T_{fermentation}$$

Definitions:

$CH_{4,comp}$:	Total methane emissions from composting biodegradable waste (in gram per year)
$EFCH_{4,comp}$:	Emission factor for methane from composting 750 grams per ton composted waste for the whole time series 850 grams per ton composted organic horticulture waste for the whole time series
\`$T_{composting}$:	Total amount of composted biodegradable waste (in ton per year)
$CH_{4,ferm}$:	Total methane emissions from fermenting biodegradable waste (in grams per year)
$EFCH_{4,ferm}$:	Emission factor for methane from fermentation 1,100 grams per ton biodegradable waste fermented
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

Ammonia (NH_3)

$$NH_{3,comp} = EF_{NH3,comp} \times T_{composting}$$

$$NH_{3,ferm} = EF_{NH3,ferm} \times T_{fermentation}$$

Definitions:

$NH_{3,comp}$:	Total ammonia emissions from composting biodegradable waste (in grams per year)
$EFNH_{3,comp}$:	Emission factor for ammonia from composting 200 grams per ton of composted biodegradable waste
$T_{composting}$:	Total amount of composted biodegradable waste (in tons per year)
$EFNH_{3,ferm}$:	Total ammonia emissions from fermenting biodegradable waste (in grams per year)
$EFNH_{3,ferm}$:	Emission factor for ammonia from fermentation =

	2.3 grams per ton of fermented biodegradable waste
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

Nitrous oxide (N_2O)

$$N_2O_{comp} = EF_{N2O,comp} \times T_{composting}$$

$$N_2O_{ferm} = EF_{N2O,ferm} \times T_{fermentation}$$

Definitions:

N_2O_{comp}:	Total nitrous oxide emissions from composting biodegradable waste (in grams per year)
$EFN_2O_{,comp}$:	Emission factor for nitrous oxide from composting 96 grams per ton of composted biodegradable waste 72 grams per ton composted organic horticulture waste for the whole time series
$T_{composting}$:	Total amount of composted biodegradable waste (in tons per year)
N_2O_{ferm}:	Total nitrous oxide emissions from fermentation of biodegradable waste (in grams per year)
$EFN_2O_{,ferm}$:	Emission factor for nitrous oxide from fermentation 46 grams per ton of fermented biodegradable waste
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

Nitric oxide (NO_x)

$$NO_{x,ferm} = EF_{NOx,ferm} \times T_{fermentation}$$

Definitions:

$NO_{x,ferm}$:	Total nitrogen oxide emissions from fermenting biodegradable waste (in grams per year)
$EFNO_{x,ferm}$:	Emission factor for nitrogen oxide from fermentation180 grams per ton of fermented biodegradable waste
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

Sulphur dioxide (SO_2)

$$SO_{2,ferm} = EF_{SO2,ferm} \times T_{fermentation}$$

Definitions:

$SO_{2,ferm}$:	Total sulphur dioxide emissions from fermenting biodegradable waste (in grams per year)
$EF_{SO2,ferm}$:	Emission factor for sulphur dioxide from fermentation 10.7 grams per ton fermented biodegradable waste
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

The aforementioned methods are country-specific. The emission factors included in the formulas are determined on the basis of the sparse literature about emissions from composting and/or fermenting separated biodegradable waste. It appears that there is hardly any monitoring conducted at the biobed reactors, or the literature cannot be considered relevant due to the clearly differing operational methods used in the Netherlands.
During the 1990s the Ministry of VROM (Housing, Spatial Planning and the Environment) organised a large-scale monitoring programme concerning the composting and fermenting of biodegradable waste. The results of this programme (emissions per processed amount of biodegradable waste) were incorporated into a report (DHV, 1999). This information was then reflected in the environmental effect report for the national waste management plan 2002-2012 (VROM, 2002) as the average emission factor (of all available sources) for the various components, for both composting and fermentation. These factors are determined based on the processing of one ton of biodegradable waste.

In 2010, DHV was commissioned by the former NL Agency (now RVO) to carry out an independent study into the emission factors (DHV, 2010). The current EF is backed up by most of the data considered relevant discussed in the 2010 study by DHV. DHV used studies of measurements that were carried out at German, Dutch and Austrian composting plants (DHV, 2010). The emission factor for methane from composting was subsequently modified.
The processed amounts of biodegradable waste in composting and fermentation plants (per year) are taken from the annual report by the Working Group on Waste Registration (WAR). The data from the WAR is based on questionnaires filled in by operators. When an operator does not fill in a questionnaire the amount processes will be based on data of Landelijk meldpunt afvalstoffen (LMA). The LMA tracks all waste transport in the Netherlands. An alternative is the use of historic data. The activity data for composting of organic horticulture waste are based on the amount of the specified waste that is known by the LMA.

2.3.2.4 Sewer systems and water treatment (CRF 5.D.1,5.D.2,5.D.3)

2.3.2.4.1 Emission sources

See section 2.3.1.4.1 for a description of the various emission sources and codes and subdivisions used.

2.3.2.4.2 Emissions from the water line and sludge line of domestic WWTP (CRF 5.D.1)

N_2O emission calculation method
The nitrification and denitrification of nitrogen compounds during the treatment process produce nitrate, nitrite and nitrogen gas, as well as small quantities of N_2O.
N_2O emissions from domestic wastewater handling are determined on the basis of the IPCC default emission factor (IPCC, 2006) and country-specific activity data for the number of capita connected including the extra fraction of industrial and commercial wastewater.

$$N_2O_{PLANTS} = PE * EF_{PLANT}$$

Definitions
PE = actual load in inventory year, expressed in Pollution Equivalents (persons)
EF_{PLANT} = emission factor, 3.2 g N_2O/person/year (IPCC, 2006)

The number of Pollution Equivalents in fact is a proxy for the total number of persons connected to the public WWTP's, including the industrial, commercial and urban run-off fraction of the incoming waste water. One P.E. equals the average amount of waste water - and degradable pollutants contained in it - from one person per day. The P.E. is implemented as national standard in Dutch waste water management and is determined at all public WWTP's on basis of measurements of (average) daily COD and Nitrogen-Kjeldahl loads in the influent. The PE is calculated as

$$PE = (COD + 4{,}57 * N_{kjeldahl})/150$$

Definitions:
COD = daily load of COD in influent of WWTP, gram COD/day
$N_{kjeldahl}$ = daily load of $N_{kjeldahl}$-N in influent of WWTP, gram $N_{kjeldahl}$-N/day
150 = gram of oxygen needed to convert degradable pollutants of one person per day

The activity data needed to calculate the PE are taken from yearly statistics on Urban Waste Water Treatment, compiled by Statistics Netherlands.

Rationale for using the Pollution Equivalent as Activity Data.
The Pollution Equivalents, as measured and reported by all UWWTP's, reflect the total amount of organic degradable matter that is treated in the plants. As the PE's are calculated from influent data on COD and N-kjeldahl, it includes also the loads from industrial and commercial activities as well as loads from urban run-off into the sewer system. In formula 6.9, box 6.1 of the 2006GL, the total PE thus can replace the terms $P*T_{PLANT}*F_{IND-COM}$. This way, the country specific activity data do comply with the standard IPCC guidelines. For example, the PE value for 2020 is 27.0 million. With an average population of 17.4 million, this means that 9.6 million PE comes from industrial and commercial sources and urban run-off. With T_{PLANT} is almost 1, $F_{IND-COM}$ in 2020 is approximately equal to 1.55.

CH_4 emission calculation method
In the treatment process small quantities of methane are emitted, both in parts of the process in the so-called water line (a) and in parts of the sludge processing line (b). These two sources are calculated separately.

a) *Methane emissions from the water line of the waste water treatment* process are calculated using a country-specific value for the Methane Correction Factor, the IPCC standard value for the methane formation capacity and country specific data for the Total Organics in Wastewater (TOW) and sludge produced.
The emission factor is calculated as:

$EF = B_o * MCF_{stp} = 0.00875$ kg CH_4/kg COD

Definitions:
B_o = methane formation capacity = 0.25 kg CH_4/kg COD converted (IPCC, 2006; Volume 5, Chapter 6, p.6.12);
MCF_{stp} = methane correction factor for advanced aerobic treatment plants = 3.5 per cent (Doorn et al., 1997, as referred to in IPCC 2006; country specific value);
The emissions are calculated with the formula (IPCC, 2006; Volume 5, Chapter 6, p.6.20):

$CH_4 = EF * (TOW-S) = 0.00875 * (TOW-S)$

Definitions:
TOW = Total organics in waste water influent, kg COD per year;
S = Total organics in sludge produced, kg COD per year.

Country specific activity data on the influent-COD as well as the amounts of sludge produced on all public WWTP's, are derived from the yearly survey conducted by Statistics Netherlands among the Water boards. Data are available for the years 1990 up till now, for every single treatment plant.
Due to a re-evaluation of the statistical programme, data on sludge produced (S) in future will only be inventoried for the even years. For odd years (starting 2017) the data of the previous year will be used as best estimate.

The COD of sludge is calculated using the conversion factor of 1.4 kg COD per kg organic solids (STOWA,2014). Organic solids are calculated from total dry solids minus the inorganic fraction, measured as ash content. Both total dry solids as well as ash content are derived from the statistical survey by Statistics Netherlands.
b) *Emissions of CH_4 from sludge digesters and related process steps* like post-thickeners are calculated using a Country Specific method, based on an emission factor per m^3 biogas produced in the sludge digesters. The emissions are calculated per waste water treatment plant with sludge digestion facilities. In 2020, 72 WWTP's were equipped with sludge digesters. The standard calculation using the DOC value of the sludge production per plant minus the sludge removal per plant is not feasible because on many of these plants also sludge of other WWTP's is digested. This results in the observation, that the real DOC of the digested sludge is higher than the DOC produced solemnly at the own plant. The standard calculation probably would lead to an under-estimation of the emissions.

Because of it is often not known how much sludge from other WWTP's is digested, in the country specific method the CH_4 emission is directly related to the biogas production, as a proxy for the DOC converted. This pragmatic method is developed by the Dutch public waste water sector itself and is used in the yearly reporting for e-PRTR. The emission factor used is based on a value for Methane Recovery (MR) of 94% from the sludge digester process installations, including post thickeners. This MR value is reported in the IPCC background document for the Good Practice Guidance (Hobson, 2001). This value means that, on top of the

recovered methane, 6% is emitted from the sludge digester process line, including post-thickeners and sludge buffer tanks.
In the 2017 submission the calculation method was improved due to a correction in the formula. For more details on this improvement see chapter 7.5.2 of the NIR 2017

The emission factor is calculated as:
$EF = (1\text{-}MR/MR) * FCH_4 = 0.028085\ kg\ CH_4/m^3$ *Biogas recovered*
Definitions:
MR = fraction of methane recovered from the digesters = 0.94 (-) (IPCC / Hobson, 2001)
FCH_4 = methane content of biogas = 440 g CH_4 / m^3 biogas (STOWA, 2014)

The emissions are calculated per plant according:

$$CH_4\ (kg) = EF^* V_{biogas} = 0.028085 * V_{biogas}$$

Definition:
V_{biogas} = Measured volume of recovered biogas in m^3/yr

Country specific activity data on volume of recovered biogas on all public WWTP's with sludge digestion are derived from the yearly survey conducted by Statistics Netherlands among the Water boards. Data are available for the years 1990 up till now, for every single treatment plant.

2.3.2.4.3 Methane emissions from biogas discharge (venting) (CRF 5.D.1)
For this emission source the calculation of the final emissions is the same as for the preliminary emissions. Final methane emissions for each WWTP are calculated as follows:

$$CH_4\ emission = Biogas\ discharge * 0.440\ (kg)$$

Definitions:
Biogas discharge = Volume of vented biogas (m^3)
0.440 = methane content of biogas (kg/m3) (STOWA, 2014)

The PRTR receives individual activity data for each WWTP via a combined questionnaire, carried out by Statistics Netherlands, RWS-RVO and the Union of Water Boards.

2.3.2.4.4 Methane emissions from septic tanks (CRF 5.D.3)
A small percentage of Dutch dwellings is not connected to the sewer system. This percentage is still shrinking. Dwellings that are not connected to the sewer system are obliged to use an individual sewage treatment system (ISTS). A commonly used type of ISTS is the septic tank (or modernised derivatives). Because there is little information about the varieties of ISTS in use and their number, the calculation of IPCC emissions is based on the assumption that all non-connected households use septic tanks.

Conversion processes occurring in septic tanks produce small quantities of methane. The total volume of these emissions depends on the percentage of the population using a septic tank. Using a number of sources (including Rioned (2001), Rioned (2009), Rijkswaterstaat (2013)) and Rioned (2016), an expert consultation process has resulted in a time series for this percentage. Combining this with the population statistics from Statistics Netherlands (CBS), results in the number of citizens using septic tanks per year. By way of illustration, Table 37 shows a time series of the number of residents using septic tanks.

Table 37 Time series of the number of citizens using septic tanks

	1990	**2000**	**2010**	**2015**	**2020**
Average population	14951510	15925513	16615394	16939923	17441500
% dwellings connected to septic tanks	4.00	1.90	0.62	0.57	0.50
Number of residents using septic tanks	598060	302585	103015	96558	87208

CH_4 emission method

Emissions of methane from septic tanks are calculated using IPCC default values for B_o and MCF and country-specific value for Total Organics in Wastewater (TOW) of 60 g BOD per connected person per day (IPCC, 2006, table 6.4). The emission factor is calculated as:

$EF_{st} = B_o * MCF_{st} = 0.3$ kg CH_4/kg BOD

Definitions:
B_o = maximum CH_4 producing capacity = 0.6 kg CH_4/kg BOD (IPCC, 2006);
MCF_{st} = methane correction factor for septic tanks = 0.5 (-) (IPCC, 2006)

Total organics in waste water (TOW) are calculated as BOD, using the following formula (IPCC, 2006):

$TOW = Pst * BOD * 0.001 * 365$

Definitions:
P_{st} = Population connected to septic tanks in inventory year, number
BOD = per capita BOD in wastewater = 60 g/person/day (IPCC, 2006)
0.001 = conversion from grams BOD to kg BOD
365 = number of days per year

Combining the two formulas, the resulting calculation formula for CH_4 emissions from septic tanks is:

$CH_4, st = EFst * TOW = 6.57$ kg $CH_4 * Pst$

2.3.2.4.5 Methane emissions from anaerobic industrial waste water treatment plants (CRF 5.D.2)

The methane emissions due to leakage from anaerobic industrial waste water treatment are calculated using the IPCC default emission factor and Country Specific value for the Total Organics in Wastewater (TOW) and Methane Recovery (MR)

For anaerobic IWWTPs, the CH_4 emission factor is calculated as:

$EF = Bo * MCF = 0.2$ kg CH4/kg COD

Definitions:
B_o = maximum CH_4 producing capacity = 0.25 kg CH_4/kg COD (IPCC, 2006)
MCF = methane correction factor (fraction) = 0.8 for anaerobic reactors (IPCC, 2006)

In the Netherlands no information is available on the actual load of TOW (as COD) that is treated in the IWWTP's. The COD load is thus determined by using statistics on the design capacity of the Industrial wastewater treatment plants and an assumed average loading rate of 80% of the design capacity (Oonk, 2004). The design capacity is expressed in a standardised value for quantifying organic pollution in industrial wastewater: the Pollution Equivalents (P.E.). One P.E. equals an amount of 40 kg COD per year. Data on the design capacity are available from Statistics Netherlands. TOW thus can be calculated as:

*TOW = P.E. * 40 kg COD/yr * 0.8 = P.E. * 32*

Definitions:
TOW = Total Organics in Wastewater influent, expressed as COD (kg)
P.E. = Total design capacity of Industrial waste water treatment, in Pollution Equivalents (-), with 1 P.E. equals 40 kg COD/yr
0.8 = average loading rate (fraction of design capacity) (Oonk, 2004)
There is no correction for sludge removal because anaerobic reactors produce very little or no excess sludge. So the method includes emissions from the simultaneous digestion of excess sludge in the anaerobic reactors.

The total methane emission is calculated by assuming a methane recovery (MR) of 99% from the anaerobic reactors and thus a loss or leakage of 1%:

CH_4 *emission = EF * TOW * (1-MRind) = 0.2 * 32 * P.E. * 0.01 = 0.64 * P.E.*

Definitions
MR_{ind} = Fraction of methane recovered from the treatment process = 0.99 (Oonk, 2004)

To ensure emissions are correctly allocated to target groups in the PRTR, they are calculated for four separate company categories, whereas in the CRF and NIR they are all listed under CRF category 5.D.2.

Activity data
For 1990-2016 the activity data could be derived from the results of a yearly survey among companies with an Industrial Wastewater Treatment Plant, conducted by Statistics Netherlands. Due to budget cuts, this survey is no longer existing.
The activity data and CH4 emissions of 2017 are a copy of the 2016 values. For 2018, 2019 and 2020, the activity data are also based on 2016 data, but corrected, on basis of literature and reports, for IWWTP's that were taken out of service or were newly installed. This

temporal method will be used until the moment that the methods of the 2019 refinement of the IPCC 2006 Guidelines will be used.

Numerical estimate of the recovered CH4 in anaerobic industrial wastewater treatment plants
In response to a review question it is investigated whether data on biogas production from industrial anaerobic wastewater treatment plants can be derived or estimated from information becoming available via the individual Annual Emission (ePRTR) Reports. In the 2022 NIR this is elaborated for 2019 and 2020 only (see also table 7.10 of NIR 2021).

The total amount of IWWTP biogas recovered in 2020 equals 66.2 million m3, but this only includes data from 35 out of total 50 anaerobic IWWTPs, equalling 84% of total TOW treated. For the remaining 15 plants, no data are available, but based on the amount of TOW this missing volume can be estimated at an extra 12.5 million m3. Total recovery can then be estimated at 78.7 m3 biogas.

There is no specific information available on the methane content of biogas from anaerobic industrial wastewater treatment plants. If we use the average value for biogas from domestic wastewater sludge digesting (0.44 kg CH4/ m3 biogas, see 2.3.2.4.3) a total recovery of 34.7 Gg CH4 can be calculated for 2020.

Applying a loss by leakage of 1% of total CH4 recovered, this results in an emission of 0.347 Gg CH4. This figure can be compared with the current CS method resulting in an emission of 0.411 Gg CH4 (+19% higher). Given all uncertain factors in both methods this difference seems quite acceptable.

2.3.2.4.6 Indirect nitrous oxide emissions from nitrogen discharges via effluents (CRF 5.D.3)

IPCC defaults are used for the calculation of indirect N_2O emissions from surface water, as a result of communal and industrial discharges (IPCC, 2006).

Emission factor, EF = 0.005(kg N_2O-N / kg N), i.e. 0.5% of the nitrogen in effluent is converted to N_2O-N (IPCC, 2006)

The emissions are calculated as follows:

$$N_2O_{WWTP,effluent} = N_{effluent} * EF * 44/28$$

$N_2O_{effluentc}$	= indirect nitrous oxide emissions from discharging N to surface water (in kg yr^{-1})
$N_{effluent}$	= the sum of the nitrogen present in effluent from waste water treatment plants, industry and consumers
44/28	= conversion from N_2O-N to N_2O

Rationale for country specific AD and not using the "Note" in the Box 6.1 in 2006 IPCC GL.
For calculating indirect (or better: 'delayed') N_2O emissions from wastewater treatment effluent, The Netherlands uses country specific activity data on $N_{effluent}$ instead of using equation 6.8 of the IPCC

2006GL. The reason is that equation 6.8 of the IPCC 2006GL might result in an overestimation of $N_{Effluent}$, because FAO statistics seem to be based on protein supply data and might also include amounts not being consumed (e.g. food waste) and consequently not being disposed to wastewater. So the Netherlands use activity data derived from several sources, including statistical surveys, environmental reporting and models, often based on actual measurements. These data are inventoried yearly via the National Emission Inventory system (PRTR-system), in which several agencies and institutes work together. The data includes loads of Nitrogen of 1) effluents of all Urban Wastewater Treatment Plants, 2) all direct discharges from companies and households, 3) estimates of incidental waste water discharges like from combined sewer overflows.
As a consequence of using these data, we do not take into account the "Note" in Box 6.1 of the IPCC 2006 GL. The discharges of N already represent 'end of pipe' values, so they don't need to be adjusted for amounts of N related to emissions resulting from nitrification/denitrification processes in advanced centralized waste water treatment.

Compilation of $N_{effluent}$ data
The $N_{effluent}$ data can be constructed from the PRTR database in the following way:

1. Go to www.prtr.nl; In Dutch www.emissieregistratie.nl.
2. Select ‘Emissions’ in the menu.
3. Select ‘Make your graph or map’.
4. You are now in the selection screen ‘1a General’.
   a. In the substances list, select Total-Nitrogen.
   b. select all the available years (‘key years’ and the last two years).
   c. select compartment ‘Loads to surface water’.
5. Go to the screen ‘1b Sector/activity’.
   a. Tick all boxes of the main sectors, except ‘National Total’, ‘Other’ and ‘Agriculture’.
   b. Extent the agricultural sector by clicking the ‘+’ sign. Choose all subsectors except ‘Uit- en afspoeling’ (leaching and run-off from soils).
6. Click on the next tab ‘2. Show’. The screen shows a graph with the emission trend. Below this graph the data are presented in a table.
7. One can export the table by clicking ‘To Excel’ at the bottom of the page.

The discharge data are compiled via a number of methods. All methods are documented in factsheets. Go to the home page of www.prtr.nl, click on ‘Documentation’, choose ‘Water’, choose ‘Factsheets’ and choose `Nederlands’. Here one finds a list of all factsheets in which for all water emission sources an elaborate methodological description is provided.

2.3.2.4.7 Emission not calculated within category 5D
The following emissions are not calculated:

N_2O emissions from industrial wastewater treatment
The IPCC 2006 Guidelines does not provide a method for N2O emissions from industrial sources, except for industrial wastewater that is co-discharged with domestic wastewater into the sewer system. The N_2O emissions from industrial sources are believed to be insignificant compared to emissions from domestic wastewater. In the Netherlands most industries discharge their wastewater into the sewer system/WWTPs (emissions included in 5D1). Indirect emissions from surface water resulting from discharge of wastewater effluents, are already included (IE) under 5D3 (other, wastewater effluents).

Direct N_2O emissions from septic tanks (5D3, septic tanks)
Direct emissions of N_2O from septic tanks are not calculated since they are unlikely to occur, given the anaerobic circumstances in these tanks. Indirect N_2O emissions from septic tank effluents are included (IE) in CRF category 5D3 'Indirect N_2O emission from surface water as a result of discharge of domestic and industrial effluents'.

CH_4 emissions from industrial sludge treatment (5D2)
Data from the survey among IWWTPs conducted by Statistics Netherlands shows that only 2 out of a total of 160 IWWTPs are equipped with anaerobic sludge digestion reactors. This data is not published on www.cbs.statline.nl for reasons of confidentiality. Forthcoming CH_4 emissions are not estimated (NE) because it is not known what sludge treatment capacity these plants have and how much sludge is digested. It is likely that these emissions are a very minor source and can be neglected.

2.3.2.5 Mechanical Biological treatment and sewage sludge incineration
MBT
Mechanical, Biological Treatment (MBT) of waste occurs in the Netherlands by a few installations. In these installations waste is separated. The separated waste streams are treated in different manners:
- Recycling, this occurs in other installations and gives no emissions within the MBT;
- as fuel, this occurs in other installations and gives no emissions within the MBT;
- flammable residues are treated in waste incineration plants. This is taken into account within the work package WIP's;
- dumping of waste. This is taken into account in the work package of landfill sites;
- Digestion of organic wet fraction (ONF), further explained hereafter.

Composting of residues does not occur.

Digestion of ONF
In IPCC 2006, V5, CH_4, by Anaerobic digestion of organic waste is stated that "where technical standards for biogas plants...CH_4 emissions are

likely close to zero. N_2O emissions from the process are assumed to be negligible…". Thus no emissions are given for digestion of ONF.

In IPCC 2006, V5, CH_4.1.1 it is stated that "Emissions during mechanical operations can be assumed negligible." Thus no emissions are stated for the mechanical operations.

Emissions of combustion of the recovered biogas are reported in the energy sector.
There are no emissions to be reported by MBT in the Netherlands. This is noted as NO.

2.3.2.5.1 Sewage sludge incineration
There are installations that incinerate sewage sludge. These installations produce energy. Thus these installations are part of the energy sector.

2.4 Emissions from oil and gas extraction, transport and distribution (CRF 1A1c, 1A3ei gaseous and 1B)

The emissions from oil and gas extraction, oil and gas transport, and gas distribution consists of the ten Emission Sources (ESs) listed in Table . Background information about emission estimation methods can be found in NOGEPA (2009), Gastec (2004) and KIWA/Gastec (2006).

Oil and gas extraction
The Dutch oil and gas extraction companies are all members of NOGEPA (Netherlands Oil and Gas Exploration and Production Association). Since 1995 these companies publish annual environmental reports (AERs/MJVs) that, since 2002, also report on emissions as per the international requirements. This means that, from 2002 onwards, the following emissions sources have been reported separated, for both onshore and offshore applications:

- Captive consumption, for gas production (including energy generation)
- Captive consumption for oil production (including energy generation)
- Venting gas production
- Flaring gas production
- Venting oil production
- Flaring oil production
- Drilling activities

Gas transport
Gasunie Transport Services BV (a subsidiary of NV Nederlandse Gasunie) is responsible for the transport of natural gas in the Netherlands. The Gasunie has an extensive gas transport network that consists of underground pipelines totalling around 11,900 km Eleven mixing stations supply the gas to various groups of customers at the required quality. Fourteen compressor stations provide the necessary pressure for transporting the natural gas to the end-users. Measurement and control stations at 80 locations throughout the national gas transport network ensure the transfer of natural gas from the main network to regional networks, which have a lower transport pressure. The gas is eventually supplied to the (industrial) end-users and to the

distribution network and countries via around 1,150 gas distribution points and 12 export stations.
Compressors driven by gas turbines and reciprocating gas engines enable pressurised gas transport. These turbines and engines produce combustion emissions, including CO_2 and CH_4. Fugitive emissions of CH_4 and a small amount of CO_2 emissions are released from leakages of equipment as flanges, connections and valves and during maintenance activities.

Oil transport
Crude oil is transported through the Netherlands territory via underground pipelines to Belgium and Germany.
Gas distribution
The gas distribution system ensures that natural gas is distributed at low, medium and high pressures. The system consists of main underground pipelines and connections, plus a number of above-ground gas pressure measurement and control installations, which all function as a single system. Within this main system, there are also various local gas distribution systems that distribute the gas to the end-users. These low-pressure networks include gas distribution systems with a working pressure of 30-100 mbar. The medium-pressure networks operate at 1-4 bar, and the high-pressure gas distribution networks operated at a working pressure of 8 bar. The main pipelines are made of the following types of materials: polythene (PE), hard PVC, impact-resistant PVC, steel, grey cast iron, nodular cast iron, asbestos cement, or other unknown materials.
CH_4 (and a small amount of CO_2) emissions evade during leakages and accidents with the distribution network (main pipelines and connections to the home) and/or through activities at the distribution stations. A relative high amount of emissions are caused by the grey-cast-iron network (Gastec, 2004, Hendriks and De Jager, 2001). During the 1970s and 1980s the largest leaks were repaired in the old grey-cast-iron pipelines when was switched from (wet) town gas to (dry) natural gas. Many leaking lead-based connections were replaced or permanently sealed. Urban areas in particular still have many old cast iron pipes. These have gradually been replaced over time, and therefore currently make up a smaller percentage of the total distribution network; 10% in 1990, 5% in 2010 (KIWA, 2011).

The next part of this section describes the calculation method for each emission source.

Table 38 Emission sources in the sector NACE 06-09 Oil/gas extraction & oil and gas transport and distribution

CRF	**ES CODE**	**EMISSION SOURCE**
1.A.1.c	0020400	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore
1.A.1.c	0020502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities
1.A.1.c	8120001	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore
1.A.3.ei gaseous (combustion CO2 and N2O),1.B.2.b.4 (other	6800100	Gas transport

CRF	ES CODE	EMISSION SOURCE
emissions)		
1.B.2.a.3	8120503	NACE 495: Transport of oil via pipelines
1.B.2.b.5	0800200	Gas distribution
1.B.2.c.iii Venting (Combined)	8120002	NACE 06: Extraction of crude oil and natural gas, venting, offshore
1.B.2.c.iii Venting (Combined)	8120502	NACE 06: Extraction of crude oil and natural gas, venting, onshore
1.B.2.c.iii Flaring (Combined)	8120000	NACE 06: Extraction of crude oil and natural gas, flaring, offshore
1.B2.c.iii Flaring (Combined)	8120500	NACE 06: Extraction of crude oil and natural gas, flaring, onshore

2.4.1 Calculation method of preliminary emission figures

2.4.1.1 Oil and Gas extraction (CRF 1.A.1.c,1.B.2.c.1, 1.B.2.c.)

The calculation of preliminary emissions is done the same way as the calculation of the final emissions. See the description in section 2.4.2. If the eAERs have not all been accepted by the competent authorities the preliminary data are equated with the final data of the previous year, for both the emissions and the activity data.

2.4.1.2 Oil and Gas transport (CRF 1.A.3.ei gaseous, 1.B.2.b.4)

The calculation of preliminary emissions is done the same way as the calculation of the final emissions. See the description in section 2.4.2.

2.4.1.3 Gas distribution (CRF 1.B.2.B.5)

The calculation of preliminary emissions is done the same way as the calculation of the final emissions. See the description in section 2.4.2. In the event that the delivery of data is delayed and the report ‘Methaanemissie door Gasdistributie’ is not available for establishing the preliminary data, these data can be established by multiplying the final data of the previous year by the ratio Domestic natural gas consumption reporting year / Domestic natural gas consumption previous year as published by Statistics Netherlands (CBS) on Statline.

2.4.2 Calculation method of final emission figures

2.4.2.1 Oil and Gas extraction (CRF 1.A.1.c, 1.B.2.c.1, 1.B.2.c.)

The various companies calculate emissions for each of their plants, using company-specific emission factors and (measured) volumes. These company-specific emission factors are determined according to the (crude) gas composition. The (measured) volumes are the amounts of crude gas consumed, vented and flared. The method used by the companies complies with the Tier-3 method, as described in the 2006 IPCC Guidelines (Volume 2, Chapter 4, p.4.46). Each company totals its emission figures from all plants and these figures are included in their Annual Environmental Reports (eAER’s).

For the period 1990-2001 the total emissions, excluding drilling activities, were taken from the annual reports by the oil and gas extraction companies as drawn up by Fugro-Ecodata. The differentiation into captive consumption, venting and flaring for the years 1990-2001 (inclusive) was carried out using the CBS (Statistics Netherlands) Natural Gas Balances for the Oil and Gas Production Industry, plus the

Venting (including removed CO_2) and Flaring data (1990-2003) published by operators NAM and GDF.
The calculation methods for each emission source are described below.

ES_CODE 0020502 NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities
Emission estimates of CO_2 and CH_4
Because of their low volumes the emissions of drilling activities are not split up into onshore and offshore but reported in the eAERs as a sum. For all substances this is equal to the sum of the emissions from drilling activities reported in the AERs of the extraction companies. The total CO_2 and CH_4 emissions are included in the database as combustion emissions.
Activity data
Volume of natural gas (TJ) used as fuel; this value is established by dividing CO_2 emissions by 56.8. The CO_2 emissions are established by adding up the total reported CO_2 emissions from drilling activities of the individual extraction companies from the eAERs.

ES_CODE 0020400 SBI 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore
Emission estimates of the CO_2, N_2O, CH_4
- CO_2: Sum of the emissions reported under 'Production' and 'Energy Generation' from the individual eAERs of the extraction companies. The choice to add up these emission was made because the division between Production and Energy Production emissions has not yet been implemented consistently; the competent authority is actively pursuing improvement in this respect.
- CH_4: Volume of natural gas used by the extraction companies * EF CH_4 natural gas
- N_2O: Sum of all N_2O emissions from the individual eAERs.

The total CO_2, N_2O and CH_4 emissions are all included in the database as combustion emission.

Activity data
Volume of natural gas (TJ) used as fuel.
As the monitoring of the total volume of natural gas by the Netherlands Enterprise Agency (RVO) will be discontinued the activity data are taken from Netherlands Statistics for the whole time frame from this submisson on (CBS, 2021) The total volume of natural gas used as fuel is divided to onshore and offshore according to the onshore and offshore CO_2 emissions.

ES_CODE 8120001 SBI 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore.
The emissions and activity data are established in the same way as for "onshore extraction".

ES_CODE 8120000 SBI 06: Extraction of crude oil and natural gas, flaring, offshore
Emission estimates of CO_2 en CH_4
The sum of all flaring emissions from the individual eAERs of the extraction companies. The total CO_2 and CH_4 emissions are both included in the database as process emissions.

Activity data
Total volume of flared natural gas (TJ). This is calculated as the sum of the reported volumes of flared natural gas in the individual eAERs.

ES_CODE 8120500 SBI 06: Extraction of crude oil and natural gas, flaring, onshore.
The emissions of CO_2 and CH_4 as well as the activity data are established in the same way as for “offshore flaring”.

ES _CODE 8120002 SBI 06: Extraction of crude oil and natural gas, venting, offshore
Emission estimates of CO_2 en CH_4
The total CO_2 and CH_4 emission is the sum of the venting emissions from the AERs of the extraction companies. In addition, the fugitive CH_4 emissions from Oil and Gas Extraction are regarded as venting emissions because the split between these sources was not always reported consistently. The total CO_2 and CH_4 emissions are all included in the database as process emissions.

Activity data
Total volume of vented natural gas (TJ), as reported in the eAERs.

ES_CODE 8120502 SBI 06: Extraction of crude oil and natural gas, venting, onshore
The CO_2 and CH_4 emissions, and the activity data are established in the same way as for “offshore venting”.

2.4.2.2 Oil and gas transport (CRF 1A3ei gaseous, 1.b.2.b.4)
ES_CODE 6800100 Gas transport
Emission estimates of CO_2 and CH_4 from gas transport were obtained from Gasunie Nederland (GUN). Up to and including 2008 and from 2013 on these data were taken from the Gasunie Annual Report, section on Safety, Health and Environment (SHE). From 2009-2012 these data were published in the separate Gasunie CSR Annual Report, in which all environment-related data are included (Gasunie SHE, various years) Emissions are listed in the PRTR database as follows:

- Total CO_2 emissions are included in the database counting towards Air IPCC combustion emissions.
- Total CH_4 emissions are included in the database counting towards Air IPCC process emissions.

The method used by Gasunie Nederland is a rigorous bottom-up assessment which complies with the TIER 3 method as described in the 2006 IPCC Guidelines (Volume 2, Chapter 4, p4.46).

Small exceptions are the fugitive CO_2 emissions and the combustion emission of N_2O during the transportation of natural gas which are not included in the total emissions obtained from Gasunie Nederland For completeness, the (very small) amount of fugitive CO_2 emissions from gas transportation is calculated using a TIER 1 method with the default IPCC emission factor of 8,8E-7 Gg per 10^6 m^3 of marketable gas as taken from the IPCC Guidelines 2006 (Volume 2, Chapter 4, table 4.2.4). The small amount combustion emissions of N_2O from natural gas transport is calculated using a TIER 1 method with the default IPCC emission factor of 0.1 kg/TJ of consumed natural gas as taken from the IPCC Guideliness 2006 (see also sector 2.1.3.3 Emission factors).

From the NIR 2016 submission onwards, CO_2 and N_2O combustion emissions for gas transport are allocated to CRF 1A3ei Pipeline transport gaseous fuels. CO_2 process emissions- and CH_4- emissions of gas transport can still be found in CRF category 1B2b4 Gas transmission and storage and CO_2 and CH_4 emissions from pipelines for oil are allocated to CRF category 1B2a3 Oil transport.
For NIR 2016 the emissions of methane from Gas transmission were evaluated and improved. For CRF category 1B2b4 gas transmission, improved emission data of methane (CH_4) for 1990-2014 became available as a result of the ongoing implementation of the LDAR (Leak Detection and Repair) programme of Gasunie (Gasunie SHE 2014; Gasunie/Kema 2011). Leakages at larger facilities such as the compressor stations were all fully measured. Plus emissions of fugitive emissions of methane from each of those facilities were added to the emissions the year after the facilities came into operation. The adjustments of the methane emissions for the smaller facilities were based on the measurements of a sample of those facilities and plus emissions were added for the whole time-series 1990-2014 (Gasunie 2015; Gasunie/DNV-GL 2015). At the moment there are no planned actions to investigate if it is possible to disaggregate the CH_4-combustion emissions from fugitive emissions since this will not change the total emissions but only would reallocate the emissions.

Activity data
Volume of transported natural gas in billion m^3 obtained from Gasunie Nederland (GUN).
Captive consumption of natural gas in million m^3: converted to TJ using a factor 31.65 MJ/m^3.

ES_CODE 8120503 SBI 495: Transport of oil via pipelines
Emission estimates of CO_2 and CH_4
The emissions are calculated using the TIER 1 method of multiplying the volume of transported crude oil (Gg/year) with an emission factor. The emission factors for CO_2 and CH_4 from the transport of crude oil are calculated on the basis of the default TIER 1 IPCC emission factors (IPCC 2006, Table 4.2.4) which are converted from kg/m^3 to kg/Gg for the situation in the Netherlands.
Activity data
The volume of crude oil transported through the Netherlands to Germany and Belgium as reported annually by Statistics Netherlands (CBS, multiple years) in the Statline database.

2.4.2.3 Gas distribution (CRF 1.B.2.b.4)

ES_CODE 0800200 Gas distribution

Emission estimates of CH_4, CO_2

The total CH4 emissions in m3 are taken from the Methaanemissie door Gasdistributie (Methane Emission from Gas Distribution) annual report, commissioned by Netbeheer Nederland (Association of Energy Network Operators in the Netherlands) and compiled by KIWA (KIWA, multiple years). The CH4 emission in m3 is calculated using a bottom up method which complies with a TIER 3 method as described IPCC 2006 Chapter 4. The IPCC Tier 3 method for CH4 emissions from Gas distribution due to leakages (1B2b5) is based on country-specific EFs calculated from leakage measurements.
From 2004 onwards, the gas distribution sector annually recorded the number of leaks found per material and detailed information of pipeline length per material. Also a yearly survey of leakages per length, material and pressure range is carried out where every five years the whole length of the grid is covered.
Because of the availability of new sets of leakage measurements Netbeheer Nederland commissioned an evaluation of the used emission factors. With this evaluation the emissions of methane from Gas distribution were improved for NIR 2016 (KIWA, 2015). In earlier submissions the IPCC Tier 3 method for methane (CH4) emissions from Gas distribution due to leakages was based on two country-specific EFs: 610 m3 methane per km of pipeline for grey cast iron, and 120 m3 per km of pipeline for other materials. The EF's were based on the small base of seven measurements at one pressure level of leakage per hour for grey cast iron and 18 measurements at three pressure levels for other materials (PVC, steel, nodular cast iron and PE) and subsequently aggregated to factors for the pipeline material mix in 2004. As a result of a total of forty additional leakage measurements an improved set of emission factors could be derived. Based on the (total of) 65 leakage measurements, the pipeline material mix in 2013 and the results of the leakage survey three new emission factors were calculated: 323 m3 methane per km of pipeline for grey cast iron, 51 m3 methane per km of pipeline for other materials with a pressure of <= 200 mbar and 75 m3 methane per km of pipeline for other materials with a pressure of >200 mbar. Using these improved EF's led to a reduction of the calculated emissions of methane for the whole time series 1990-2014.

The CH_4 and CO_2 emission in kg using the following formulas:

CH_4 emission in kg = CH_4 emission in m^3 * 0.716
where: 0.716 is the relative density of CH_4

Emission of CO_2 in kg = CH_4 emission in m^3 * 100/80 * 0.89% * 1.98

Where:

- 100/80 is required to convert the volume of CH_4 to the total volume of natural gas.
- 0.89% is the proportion of CO_2 in the volume of natural gas and 1.98 is the relative density of CO_2.

The proportion of CO_2 in natural gas originates from Gasunie (Gasunie, various years).

The total CO_2 and CH_4 emissions are all included in the database as process emissions (substance flow type “P”).

Activity data
The volume of distributed natural gas (in billion m^3) is included in the CRF. Data Source is the annual report ‘Methaanemissie door Gasdistributie ‘(KIWA, several years). This report is commissioned by Netbeheer Nederland (Association of Energy Network Operators in the Netherlands) and compiled by KIWA.

3 Emission calculations according to the Air Actual method

Methods for calculation of industrial emissions comprise five different source categories that have distinct pathways of data collection and calculation methodology.

1. Industrial emissions of individual companies in the PRTR are largely based on data reported by the companies themselves, mainly by way of the eAER (see paragraph 3.1).
2. A supplemental estimate of combustion emissions is made for all remaining emissions released by combustion of a range of different fuels (see paragraph 3.2).
3. A supplemental estimate of process emissions is made for all remaining emissions released by industrial processes (which have not been reported in the eAER) (see paragraph 3.3).
4. A separate calculation is made for emissions released from waste (see paragraph 3.4).
5. Emissions released by extraction, transport and distribution of oil and gas are also included separately (see paragraph 3.5).

Emissions are calculated for both the greenhouse gases and the other substances. See paragraph 1.1 for the differences between the Air IPCC and the Air Actual methodology.

3.1 Emissions of individually registered companies

The following section of the report explains how the preliminary and final emission figures of individual companies are established.

3.1.1 Calculation method of preliminary emission figures

Preliminary emission figures are calculated annually (mid-June) using the following method:

$$\text{Preliminary emission}_{t} = \text{Emission}_{t-1} \times \text{Incremental factor}_{t}$$

Definitions:

Preliminary emission = Preliminary emission of year t (kg/year)
Emission$_{t-1}$ = Final emission of year t-1 (kg/year)
Incremental factor = Representative factor for the change in emission

Calculation of preliminary emissions is company-specific. The incremental factors however are calculated per sector, which are linked to a NACE code. With a NACE code assigned to each company, this automatically links them to the relevant incremental factor, i.e. the incremental factor applicable to its NACE code. This implies that all individual companies within the same NACE code are given the same incremental factor.

Because the incremental factor has not been calculated for every sector due to lack of complete high quality data, there are companies whose emissions are not incremented. In those cases the preliminary emissions are the same as the final emissions of one year earlier.

The method used to establish the incremental factors is explained below, followed by an explanation of the other calculation factors.

Calculating incremental factors:
For the sectors ‘Chemical industry’, ‘Commercial and governmental institutions’, ‘Refineries’ and ‘Energy sector’, the incremental factors are calculated based on the preliminary emission reports of the largest companies in the sector for year t-1 and year t (annual environmental reports (AER) or reports for the emissions trading scheme (ETS)). For the other sectors, the incremental factors are based on the ratio between the production index of year t-1 and year t.
The incremental factors of non-relevant preliminary emissions are set at unit value (1.00).
As an example, Table 39 shows the incremental factors for 2016.

Table 39 Incremental factors for emission year 2016 compared to emission year 2015

Sector	NACE code	CH_4	CO_2	N_2O	NMVOS	NO_x	PM_{10}	SO_2
Waste sector	38.2	1.00	**1.14**	1.00	1.00	**1.03**	1.00	1.00
Chemical industry	20.1	1.00	**1.04**	**0.81**	**0.85**	**1.07**	**1.14**	**0.74**
Commercial and governmental institutions		1.00	**1.04**	1.00	1.00	1.00	**0.94**	1.00
Refineries	19.2	**1.04**	**1.00**	**0.95**	**0.93**	**0.96**	**0.80**	**1.01**
Energy sector, NACE35	35	1.00	**0.98**	1.00	1.00	**0.84**	**0.66**	**0.68**
Energy sector, NACE6	06/09.1	1.00	**0.89**	1.00	1.00	**0.82**	1.00	1.00
Other		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other Industry, Base metal	24	1.00	**1.00**	1.00	**1.00**	**0.98**	**1.02**	**0.95**
Other Industry, Food products, beverages and tobacco	10 -- 12	1.00	**1.03**	1.00	**0.78**	**0.95**	**1.11**	1.00
Other Industry, Paper industries	17	1.00	**0.99**	1.00	1.00	**1.02**	1.00	1.00
Other Industry, Construction material	23	1.00	**1.01**	1.00	1.00	**0.96**	1.00	1.00
Other Industry, Other		1.00	1.00	1.00	1.00	1.00	1.00	1.00

3.1.2 *Calculation method of final emission figures*

The final figures are calculated using the emission data the companies have included in their annual environmental reports. For that reason, this method is more complex than the one used to calculate the preliminary figures. Paragraph 3.1.2.1 describes the emission figures reported in the annual environmental reports and paragraph 3.1.2.2 describes the other emission estimates.

3.1.2.1 Emission figures reported in the eAER

The National Institute for Public Health and the Environment (RIVM) takes the figures from the eAER (electronic Annual Environmental Report) once a year (1 September) for inclusion in the PRTR. Any changes a company makes to the eAER after 1 September will not be included in the PRTR until the following year (unless there is an urgent reason to include these changes in the Emissions Registry, for example

when the changes have a significant effect on the total emissions in the Netherlands).
The data from the eAERs must be processed to create a database of which the structure, the usability and the quality is compatible with the PRTR. The data should also be suitable for estimating the emissions of company's not individually registered (supplemental estimate of industrial emissions). The method for the supplemental estimates is explained in sections 3.2 and 3.3. To ensure the quality of the emission data, several inspections take place. Also, the emissions are linked to the fuel types used (a distinction is made between process and combustion emissions) and to the installations and emission points (e.g. chimneys). The emissions are already correctly linked to fuels, installations and emission points in most of the eAERs, but these links need to be added or corrected for some parts of the eAER data. This paragraph describes the processing of the data and the quality checks.

Processing of eAER data
The processing of the emission data consists of a few steps:
1. Selection of the emissions per plant and per fuel type
2. Adjustment of the distribution of emissions across fuel types
3. Changes to particulate matter and NMVOC
4. Conversion to the PRTR format

1. Selection of all emissions per plant and fuel type
TNO receives a file containing eAER data from RIVM for processing. A selection is made of those companies that need to be included in the PRTR. This means that waste water treatment plants (WWTPs), airports and landfill sites are excluded from further processing (approx. 30 companies), because their emissions are included in the PRTR via a different pathway (see chapter 3.4 for the WWTPs and landfill sites and the transport methodology report for airports).

2. Adjustment of the distribution of emissions across fuel types
The link between fuel use and the emission is not always reported completely or explicitly in the annual environmental reports. The link between fuel use and the emission is necessary for calculating implied emission factors which can be used in the supplemental emission calculation (see paragraph 3.2). The following changes in the data are implemented.

- The eAER format only requires the NO_x, SO_2 and PM_{10} combustion emissions per plant to be reported. For the other combustion emissions company-level values are allowed. Ideally, combustion emissions in the PRTR should be linked to a fuel type. To create such a link, these other emissions are divided across the fuels used based on a number of default emission factors. These default emission factors are not used to calculate emissions, but only to divide the emissions across fuel types as efficiently as possible. For EPRTR substances there are default emission factors based on the literature (EMEP/EEA, 2019; Veldt, 1993) and the reference values in the eAER. For the other substances the emissions are divided based on the quantity of energy consumed. The total emission per company is not changed.
- Companies sometimes report a number of fuel types for a single plant combined with one emission value. To prevent these

emissions being counted multiple times (i.e. for each fuel type) the emission is divided across the fuel types in the same way as the other combustion emissions (see previous bullet).
- The changes made do not influence the total emission estimate from companies.

3. Changes to particulate matter and NMVOC
Companies report an NMVOC total in their eAER sometimes with a specification of individual substances. If the emissions of both the NMVOC total and the specific substances would be included in the PRTR, this would result in duplication of the total NMVOC emission. For that reason only the specific substances are included in the PRTR and the NMVOC total is not. The sum of the emissions of specific substances has to be equal to the NMVOC emissions in the eAER. In some cases, however, the specified substances do not add up to the reported NMVOC total. In those cases a substance 'NMVOC other' is added in order to warrant that the presented NMVOC total remains equal to the total NMVOC figure in the eAER.

With regard to particulate matter, companies report Total Suspended Particulates (TSP) and have the opportunity to specify the amount of particulates that are PM_{10} and $PM_{2.5}$. The specification however is not always reported by companies. If the emissions of both the TSP and PM_{10} would be included in the PRTR, this would result in duplication of the TSP emission in the emission reporting. For that reason PM_{10} and coarse particulates (here defined as TSP minus PM_{10}) are included in the PRTR and the TSP is not. If the company did not report PM_{10}, then it is assumed that TSP consists of coarse particulates only (but this occurs only for a small fraction of the companies). If the company did not report $PM_{2.5}$, then this is estimated with default $PM_{2.5}/PM_{10}$ ratios (see paragraph 3.1.2.2).

4. Converting eAER data to PRTR data
The conversion of the final eAER data to PRTR data involves a number of steps to implement the data encoding required for the PRTR database. The eAER emission substances and fuels are converted to PRTR emission substances and fuels. In addition, depending on a company's economic core activity, an emission source category will be assigned to its emissions (see annex 1 for the list of emission sources). It is possible that this economic core activity differs each year, and that emissions of a company are allocated to different emission source categories each year.

Checks on eAER data
The eAER data is checked on several parts:
1. Checking CO_2 emissions and fuels consumption
2. Checking the trends and the emission factors
3. Other checks on emission data

The checks may allow for revision of emission figures in the PRTR (compared to the figures reported in the eAER). Any changes will be communicated to the relevant companies and competent authorities. In some cases, the competent authority and/or the company decide to alter the emissions reported in the eAER. The emission data as included in the PRTR have no official status for the company. Only the data in the eAER represent the company's official figures. The unaltered emission figures in the eAER are used for official individual international reporting, such as EPRTR.

1. Checking plant-level CO_2 emissions and fuel consumption
All plant-level CO_2 emissions and fuel consumption figures are selected and checked manually to verify that the reported fuel consumption and CO_2 emission are a realistic match. The first criterion applied is the assumption that company-level emission factors cannot be more than 5% higher or lower than the official Dutch standard emission factors (Zijlema, 2022).
If the company-level emission factor shows a difference of more than 5%, the cause will be investigated. There are several possible causes. The following cases have been reported so far:

- A company has reported CO_2 process emissions. If the plant-level emission matches the fuel consumption, no adjustment is required. If the reported emission has not been split up into combustion and process emissions, this can be done as part of the checking phase. However, these adjustments will never result in a change of the total CO_2 emission reported.
- A company has reported a fuel type other than natural gas. The emission factor of the natural gas used will always be close to the standard emission factor. However, for some other fuels (biomass, waste, residual gases, etc), the emission factor can vary considerably based on its composition. In that case the non-compliant emission factor is often accepted (depending on the fuel type and provided it differs by no more than a factor of 3) and the reported CO_2 emission is not amended.
- The company reported a CO_2 emission but no fuel consumption. In that case the company's reported energy consumption will be taken from the energy section of the AER. If a company has reported a fuel consumption that is clearly erroneous (e.g. differs by a factor of 1000), the energy consumption from the energy section of the AER will be used. However, these adjustments will not result in a change of the total CO_2 volume reported.
- The company reported its fuel consumption but no CO_2 emissions. In that case the CO_2 emission will be calculated using the standard emission factors (Zijlema, 2022). This leads to a change in the CO_2 emission included in the PRTR compared to the value reported by this company.
- The company did not report all CO_2 emissions. In rare cases a company may report the same CO_2 emissions that are used in ETS (Emissions trading scheme). However, this value often does not include the total emission of all plants and fuel types that are required for inclusion in the PRTR (e.g. no CO_2 emissions from biomass). This leads to a change in the CO_2 emission included in the PRTR compared to the value reported by this company.
- The emissions are incorrect, e.g. by a factor of 1000. In that case the emission is corrected by using the standard emission factors (Zijlema, 2022), before inclusion in the PRTR.
- In rare cases it is impossible to account for or correct improbable figures. In such cases the respective companies and corresponding emissions are not included in the PRTR.

To illustrate the order of magnitude of the emissions and the number of companies in Table 40 the summary of the CO_2 check for 2016 is presented.

Table 40 Summary of the CO_2 and fuel type check for 2016.

Category	**Number**	**CO_2 in eAER (ktonnes)**	**CO_2 in PRTR (ktonnes)**	**CO_2 difference (ktonnes)**	**CO_2 difference (%)**
No changes	344	20,790	20,790	0	0.0%
Change, total CO_2 emission unchanged	181	69,914	69,914	0	0.0%
Change, total CO_2 emission changed	28	13,015	13,109	94	0.7%
Not included in PRTR	7	29	0	29	100.0%
Total	560	103,748	103,842	94	0.09%

Remark: Fuel and/or CO_2 emissions were reported by a total of 560 companies, of which 553 were included in the PRTR.

2. Checking the trend and emission factor
A general check of emission data is performed on the trend, emission factor and emission factor trend. Depending on the substance the emission is subject to a specific criterion it must meet. The emission factor check is not performed for NH_3, heavy metals and PAH, because the range in potential emission factors is very large. The emission factor check is also not performed for the greenhouse gases, because CO_2 was already checked at a very detailed level and CH_4 and N_2O are not relevant for LRTAP reporting. The trend check is not performed for heavy metals and PAH, because these emissions are often measured, which can result in larger yearly differences. Table 41 shows the substances that are subject to the checks.

Table 41 List of substances subject to checks

Substance name	**SO_2**	**CO**	**PM_{10}**	**NO_x**	**PCDD/F**	**NH_3**	**CO_2**	**N_2O**	**CH_4**	**Heavy metals**	**PAH**
Emission factor check	X	X	X	X	X						
Trend check	X	X	X	X	X	X	X	X	X		
Unit check										X	X

The criteria used to determine if further examination of an emission is required are defined as follows:

- *Emission factor check*: the emission factor of these substances is calculated. If the calculated value is outside the specified range, the emission will be examined further. Table 42 shows the range of emission factors.
- *Trend check:*
  - If the difference between the emission of this year and the emission of the previous two years is more than a factor of 4, the emissions will be examined further.
  - If the difference between the emission of this year and the average emission of the last five years exceeds the standard difference of emissions during the last five years by more than a factor of 2, the emissions will be examined further.
- *Unit check*: if the difference between the present year's emission and the emission of the previous two years is more than a factor of 200. This criterion can be used for error checking in units (factor-1000 errors).

Table 42 Specified range of emission factors for a selection of substances. If the derived emission factor is outside this range, the emission figures will be examined further.

Substance	Unit	Minimum emission factor	Maximum emission factor
NO_x (nitrogen oxide)	g/GJ	10	1000
SO_2 (sulphur dioxide)	g/GJ	0.2	900
CO (carbon monoxide)	g/GJ	1	2000
PM_{10} (particulate matter)	g/GJ	0.2	150
PCDD and PCDF (dioxins)	µg/GJ	0.0005	3

The final step focuses on emissions with striking patterns: for each substance and each company the time series of emissions is examined, after which the emissions with most striking patterns are selected for further examination.

This check results in a list of emissions requiring further examination in the explanatory sections or the written annex to the eAER. In many cases companies have an explanation for the changes in emissions, such as the implementation of emission abatement installations or temporarily suspension thereof as a consequence of maintenance activities. If the explanation fits in with the reported emission, it will be included in the PRTR (with no further changes). Finally, this process results in only a few emissions that require adjustment (e.g. if a factor-1000 error or a double-reported emission is found).

3. Other checks of emission data
Apart from the standard checks referred to above, other checks are performed that differ from year to year. These can involve a further examination of e.g. a group of companies or a series of emissions of a certain substance. Checks of this type may differ from year to year. If clues are found that point to reporting inconsistencies in a group of companies concerning a certain substance, the entire group of companies will be examined further.

3.1.2.2 Other emission estimates

In addition to the individually registered companies that maintain an emissions report in the eAER format, the PRTR also uses emission estimates. The reasons and methods are explained in the following section.

Additional estimates of company-specific emissions
Companies do not report emissions of all substances that are released, e.g. because the emissions do not exceed the threshold value for reporting in the eAER. Emissions that have not been reported are calculated using an emission estimate. For a number of substances/sectors emissions are estimated at the level of individual companies. These estimates have not been reported by the relevant companies and therefore do not get official status. $PM_{2.5}$ is currently being calculated for all sectors (if companies do not report $PM_{2.5}$ themselves), and for some sectors a more extensive individual estimates are made.

$PM_{2.5}$ emissions
$PM_{2.5}$ emissions are estimated for all companies that do not report $PM_{2.5}$ emissions, but do report PM_{10} emissions. Emission of $PM_{2.5}$ is calculated from the reported PM_{10} emission. For each sector and fuel type the fraction of particulate matter (PM_{10}) consisting of $PM_{2.5}$ has been estimated (see Visschedijk & Dröge, 2019 and Appendix 3 of this report). This fraction can be used to estimate the $PM_{2.5}$ emission, that is included in the PRTR.

Individual estimates
Many annual environmental reports do not contain all emissions that are significant for the PRTR. A typical situation is when a company does not report emissions because they do not exceed the threshold value. For a number of different sectors emissions are therefore estimated individually to enable inclusion of an estimate in the PRTR. The emission calculated in this way provides an estimate of the emission for the sector as a whole. However, individual differences between companies are not known, so the company-specific emission is more uncertain than the emission for the sector as whole. The PRTR-website presents emissions as a company-specific value, with a remark that it is a PRTR estimate.

The individual estimates are made for the following sectors:
- Waste incineration plants (NO_x, CO, SO_x, metal emissions)
- Tile and brickworks sector (fluor, NO_x, CO and mercury)
- Refineries (metal emissions)
- Non-ferro (metal emissions)
- Chemical sector (metal emissions)
- Mineral products sector (metal emissions)
- Iron and steel sector (PCB emissions)

Individual estimates for waste incineration plants
Calculation of individual estimates is based on emissions reported by the few companies who do report emissions for the relevant substances. The reported emission of these companies is divided by the fuel consumption in order to assess company-specific implied emission factors. For waste incineration plants a three-year average of these derived emission factors is calculated, and this is used to estimate the emissions of missing substances.

Individual estimates for tile and brickworks sector
To estimate the emission of omitted substances for the tile and brickworks sector, the ratio between the reported CO_2 emission and the emission of the relevant substances is calculated (for the companies that have reported these emissions now or in earlier years). If companies have reported the relevant emissions in earlier years, then individual implied ratios have been used to estimate emissions. If companies have never reported these emissions before, then the median of the reported ratios of other companies is used. The median-based estimate was chosen because the derived emission factor of some companies is very high, which would result in an unrealistically high emission factor in case an average-based estimate was used.

Individual estimates for refineries, non-ferro sector and the chemical sector (metal emissions)
Metal emissions are released from fuel combustions, but it is rarely reported by individual companies. Individual estimates of these metal emissions have been made for the refineries, the non-ferro sector and the chemical sector. The metal emissions have been calculated top-down, by multiplying the fuel consumption statistics of each sector with tier 1 emissions factors from chapter 1A1 and 1A2 of the EMEP/EEA Guidebook (2019) and an assumed abatement efficiency of 50% for mercury, 90% for selenium and 95% for the other metals (from: EMEP/EEA Guidebook, 2019, chapter 1A1, page 78). In the next step, the metal emissions have been divided over the companies that use other fuels than natural gas. It has been divided over the companies in proportion to the reported CO_2 emissions of these companies (which is used as a proxy for fuel consumption). If the individual emission is higher than the reporting threshold, then it is assumed that the emission is equal to the reporting threshold (assuming that a company would have reported these emissions if they were above the reporting threshold). If a company has already reported a certain metal emission, then the individual estimate of that metal emission is discarded for that company, and only the reported emission is used.

Individual estimates for the mineral products sector (metal emissions)
Metal emissions for the mineral products sector have been calculated for 2 companies only, as these are the only two companies who combust a significant amount of fuels (other than natural gas). Emissions have been calculated by multiplying the fuel consumption with tier 1 emissions factors from chapter 1A2 of the EMEP/EEA Guidebook (2019) and an assumed abatement efficiency of 50% for mercury, 90% for selenium and 95% for the other metals (from: EMEP/EEA Guidebook, 2019, chapter 1A1, page 78). If the individual emission is higher than the reporting threshold, then it is assumed that the emission is equal to the reporting threshold (assuming that a company would have reported these emissions if they were above the reporting threshold). If a company has already reported a certain metal emission, then the individual estimate of that metal emission is discarded for that company, and only the reported emission is used.

Individual estimates for the iron and steel sector (PCB)
The PCB emissions from iron and steel production have been calculated. Up to 2000, the emissions have been estimated based on the dioxin emission and the ratio between dioxin and PCB in the EMEP/EEA Guidebook (2019), 2C1, table 3.1. From 2001 onwards, the company has measured these emissions (but these were not reported in the eAER).

Other information sources
The substance emissions of large dry bulk storage and transhipment companies are not reported in the eAERs. Instead these emissions are assessed annually by the competent authorities and added to the PRTR. For earlier years (1990-2005), an annual assessment is made of the industries for which more data was required (to improve supplemental estimates, etc.). Establishing individual emission data took place in consultation with companies based on data pertaining to fuel

consumption, production or measurements performed. Emissions were calculated by multiplying fuel consumption or production data by process-dependent emission factors. The emission factors used were taken from sources including Mulder (1997), Scheffer & Jonker (1997) and various industry-specific reports. Any measurements were also included in the calculation when available.

3.2 Supplemental estimates of combustion emissions

The purpose of the supplemental estimates is to calculate the supplemental emissions from stationary sources related to fuel consumption of the companies that are not individually registered in order to obtain a correct national total for all emission sources. The Annual Environmental Reports (eAER) of registered companies serve as source material.
Not all companies that use fossil fuels submit an eAER and for that reason the total energy consumption in the Netherlands is taken from the CBS Dutch Energy balance sheet.

The emission calculations are based on eAER data because the emission amounts are largely determined by optimisation of the combustion process and possible flue gas scrubbing.
Apart from the emissions, the energy consumption of eAER companies is also included in the data. The energy balance sheet managed by Statistics Netherlands (CBS) lists the total energy consumption in the Netherlands for each sector, subdivided by fuel type. The difference in consumption between the CBS Dutch Energy balance sheet and consumption reported by eAER companies is referred to as supplemental fuel consumption. Because the emissions are caused by the combustion of fuels, this supplemental fuel consumption underlies the calculation of missing emissions.

The emissions related to this supplemental energy consumption are calculated by multiplying supplemental energy consumption by the source-specific emission factor for each fuel type and “consumer group”.

3.2.1 Emission sources

An emission source is defined as any stationary source in the Netherlands where fuel combustion takes place. Table 43 shows de emission sources described in this section.

Table 43 List of combustion emission sources defined by NACE 2008 classification

ES CODE	EMISSION SOURCE
0012101	Residential combustion, appliances, gas leakage before ignition
0012102	Residential combustion, space heating
0020401	NACE 41-43: construction and building industries
0020405	NACE 84: public administration, governmental institutions and compulsory social insurance
0020500	Commercial and governmental institutions
0020500	Commercial and governmental institutions
0401201	Combustion in agricultural buildings
0401202	Combustion in agricultural greenhouses
0800700	Residential combustion, cooking

ES CODE	EMISSION SOURCE
0800800	Residential combustion, hot water
8900200	NACE 10-12: manufacture of food products, beverages and tobacco
8900300	NACE 13/14: manufacture of textiles and textile apparel
8900400	NACE 15: leather industry and fur preparation
8900600	NACE 17.1/17.2: manufacture of pulp, paper and paperboard
8900700	NACE 18/58: publishing, printing and reproduction of recorded media
8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds
8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds
8901100	NACE 20.1: manufacture of basic chemicals
8901100	NACE 20.1: manufacture of basic chemicals
8901100	NACE 20.1: manufacture of basic chemicals
8901702	NACE 22: manufacture of rubber and plastic products
8902100	NACE 25: manufacture of metal structures and parts of structures
8902200	NACE 28: manufacture of machinery
8902301	NACE 26/28: manufacture of machinery and electronic apparatus
8902303	NACE 27: manufacture of electrical apparatus
8902304	NACE 26: manufacture of computers and electronic and optical apparatus
8902400	NACE 29: motor-industry
8908000	NACE 31/32: manufacture of furniture and other goods
8908100	NACE 30: manufacture of other transport equipment
8912101	NACE 16: manufacture of wooden products
8912500	NACE 19.202: manufacture of refined petroleum products - not oil refineries
8913700	NACE 20.2-20.5: chemical products industry
8914600	NACE 23: construction material and glass industry
8915300	NACE 26/31/32: manufacture of electronic apparatus and furniture
8916000	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap
8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals
8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals
8920400	NACE 35: production and distribution of electricity and gas
8920500	NACE 36: collection, purification and distribution of water
8921800	NACE 38.1/38.2 (partly): waste-incineration plants
8921900	NACE 39: sanitation and other waste management
8922000	NACE 38.1/38.2 (partly): landfill gas companies
8922701	NACE 08: other quarrying and mining
8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products
8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products
8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel
8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel
8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel
8930401	NACE 35: decentral production of electricity, general
8930410	NACE 35: production of electricity, heat

Emissions from oil and gas extraction are calculated by RIVM. Emissions from waste incineration are calculated by the Department of Public Works and Water Management (*Rijkswaterstaat*) and are therefore not included in this section. These emission sources are described in paragraphs 3.4 and 3.5.

3.2.2 *Calculation method of preliminary emission figures*

Calculation of preliminary emissions is based on the energy statistics without the large corporations. Emissions from large corporations can be omitted here because these will be added to the PRTR-I (Pollutant Release and Transfer Register-Individual) on a preliminary basis via eAER(see paragraph 3.1).

The preliminary emissions are calculated as follows:
*Preliminary emission = preliminary energy consumption / energy consumption t-1 * emissions t-1*

where:

Preliminary emissions	= Emissions of last year (kg)
Emissions t-1	= Emissions of the year before last year (kg)
Preliminary energy consumption	= Energy consumption of last year (GJ)
Energy consumption t-1	= Energy consumption of the year before last year (GJ)

Additional adjustment may be required if literature shows an emission source has changed.

3.2.3 *Calculation method of final emission figures*

3.2.3.1 Introduction

The calculation is based on the fuel consumption figures from the CBS Dutch Energy balance sheet and the data reported by companies in their eAER. The eAER data is used to create the PRTR-I. The method to create PRTR-I is described in section 3.1.

The combustion emissions of a proportion of Dutch companies are known through their eAERs. However, the emissions of households, commercial and governmental institutions, agriculture and non-registered companies are not. Combustion emissions of these sources are calculated based on fuel consumption.

Emissions are linked to fuel consumption. The CBS Dutch Energy balance sheet provides a comprehensive overview of energy consumption in the Netherlands. The difference in consumption between the energy statistics and consumption by PRTR-I companies is referred to as supplemental fuel consumption. As a formula:

Supplemental fuel consumption = (Consumption in energy statistics) – (Consumption PRTR-I)

where:

Supplemental fuel consumption	= Fuel consumption of companies that are not individually registered (GJ)
Consumption in energy statistics	= Fuel consumption according to the CBS Energy Balance Sheet (GJ)
Consumption PRTR-I	= Fuel consumption of companies that are individually registered (GJ)

Supplemental emissions are established by multiplying the supplemental consumption by the relevant emission factor. As a formula:
*EMIS_supplemental = supplemental fuel consumption * EF*

where:
EMIS_supplemental = Supplemental emission (kg)
EF = emission factor (kg/GJ)

The supplemental consumption is calculated for each company category and each fuel type.

3.2.3.2 Activity data

Emissions are caused by fuel combustion. The CBS Energy Statistics provides a comprehensive overview of energy consumption in the Netherlands.

Two files are provided by CBS Energy Statistics:
1. The energy consumption of individual companies, obtained by CBS through a survey;
2. Fuel consumption as published by CBS in the energy statistics (file data subdivided by company group and fuel type, including supplemental estimates of consumption, not covered by CBS survey).

These files are combined in one emission calculation database including energy statistics of individual companies and energy statistics of supplemental estimates.

The result is a file containing the total energy consumption in the Netherlands including the data of individual companies covering all reporting years, allowing company-specific calculations to be made.

The emissions of mobile equipment are covered by the calculation of emissions from mobile sources, which is described in the transport methodology report (Geilenkirchen et al., 2021).

Apart from the emissions, the fuel consumption from the eAER companies is included in the Annual Environmental Reports.

Before the supplemental consumption can be calculated, the energy statistics and PRTR-I first need to be cleared. This covers a large number of companies with the same unit listed in both the energy statistics and the PRTR-I. These companies will be removed from the system.

The reasons include:
1. allocation
2. incomplete PRTR-I data (no link between fuel and emission)

Re 1. For instance, in the AERs a number of cogeneration plants are allocated to the corresponding company, while in the energy statistics they are allocated to the energy sector.
Re 2. This is done if the energy consumption data in the PRTR-I are incomplete or unavailable. Cases like this are rare though.

The difference in consumption between the CBS Energy balance and consumption reported by AER companies is referred to as supplemental fuel consumption.

3.2.3.3 Type Emission factors

In order to calculate the emission, the supplemental fuel consumption is multiplied by an emission factor, i.e. out of three possible sets of emission factors:

1. Standard emission factors
2. Specific emission factors
3. Factors from a recent study

The emission factors from the first set (standard emission factors) are most commonly used.

Standard emission factors

Standard emission factors are available in the EMEP/EEA air pollutant emission inventory guidebook 2019. For greenhouse gases, the emissions factors are shown in paragraph 3.2.3.4.

Specific emission factors

The emission factors are determined for each company category, subdivided by fuel type, for:

- Hydrocarbons
- SO_2
- NO_x
- CO
- Particulate matter

These specific emission factors are determined using eAER data from the PRTR-I file from which a selection of companies has been removed (see paragraph 3.2.3.3).
The emission factors are determined by adding up the emission for each homogeneous category following standard industrial classification, subdivided by fuel type, and the corresponding consumption, and dividing the totals:

EF_spec = emission / fuel consumption

Considering individually registered companies it has to be noted that in some cases not all substances are reported (e.g. CO_2 and NO_x are reported, but CO is not).
In the calculation of emission factors, the energy consumption related to a substance is only included in the calculation of the specific emission factors if the emission has been reported. For that reason, the fuel consumption can vary when the emission factors for different substances are calculated.

Application of specific emission factors is subject to the following pragmatic conditions:

- The consumption used to calculate the specific emission factor must be more than half of the consumption in the company category;
- The variation of emission factors over the previous three years must be below 10%.

For waste gases, the emission factor is calculated differently because waste gases as fuel have company specific characteristics (emissions depend on the type of waste gas and the production process). The majority of companies using waste gas are large companies, i.e. obliged to submit AERs and therefore listed in the PRTR-I. When a company misses the deadline for submission or if inclusion in the PRTR-I is rejected because the AER fails to meet quality standards then the emission factors for waste gas is determined by calculating the average of the previous three years.

Emission factors from a recent study
Sometimes the emission factor for a certain emission source differs from the standard emission factor. In those cases additional research is required. Examples of such research are the reports by Visschedijk, 2007 and Kok, 2014. These reports deal with emission factors of metals and PAH in certain sectors and with the effects on NO_x emission factors of the introduction of CHP-plants and the evolution of residential equipment.

3.2.3.4 Used emission factors
Separate sets of emission factors are available for different company categories. These are shown below. Specific emission factors are derived yearly. In these tables, the specific emission factors for the last year are shown.

Table 43 a General combustion emission factors for industry and electricity production (g/GJ), Natural gas

Substance name	**1a1a**	**1a2b**	**1a2c**	**1a2d**	**1a2e**	**1a2f**	**1a2g**
NMVOC *1	2.6	2.6	2.6	2.6	3.8 *4	2.0 *4	5.2 *4
Hydrocarbons *3	6.5	6.5	6.5	6.5	9.5	5.0	13.0
Sulphur dioxide *1	0.281	0.281	0.281	0.281	0.281	0.281	0.281
Nitrogen oxides as NO_2 *4	21.0	55.0	37.0	43.0	30.0	40.0	37.0
Carbon monoxide *4	6.0	23.6 *2	21.0	39.3	40.0	30.0	50.0
Particulate matter (PM10) *2	0.2	0.297	0.297	0.297	0.297	0.297	0.297
Particulate matter (PM2.5) *5	0.15	0.297	0.223	0.297	0.045	0.267	0.297
Elementary Carbon *5	0	0	0	0	0	0	0

References:
*1 EMEP/EEA Guidebook (2019), 1A1, table 4.6, average value
*2 For 1A1a: EMEP/EEA Guidebook (2019), 1A1, table 3.17, average value. For 1A2: EMEP/EEA Guidebook (2019), 1A1, table 4.6, minimum value
*3 Calculated from NMVOC emission factor. It is assumed that 40% of the hydrocarbon consist of NMVOC.
*4 Specific emission factors derived from reported emissions in eAER
*5 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge, 2019.

Table 43 b General combustion emission factors for industry and electricity production (g/GJ), solid, liquid and biomass fuels

Substance name	Coal	Fuel oil	Biogas	Wood 1a1a	Wood 1a2e NACE 31	Wood 1a2e NACE 16
NMVOC	5.0 *9	4.0 *5	8.45 *4	1.33 *3	1.07 *3	5.6 *3
Hydrocarbons *7	10.0	8.0	13.0	3.33	2.67	14.0
Sulphur dioxide	300 *5	450 *5	10 *4	10 *3	10 *3	10 *3
Nitrogen oxides as NO_2	150 *1	64 *5	80 *4	70 *3	120 *3	150 *3
Ammonia				37 *8	37 *8	37 *8
Carbon monoxide	150 *1	10 *5	20 *4	150 *3	160 *3	750 *3
Particulate matter (PM10)	60 *1	25 *5	2 *4	10 *3	12 *3	27 *3
Particulate matter (PM2.5) *6	30	22.5	1.5	10	12	25
Elementary Carbon *6	0	0	0.12	2.7	3.36	7.0

References:
*1 EMEP/EEA Guidebook (2019), 1A2, table 3.2, minimum value
*2 Specific emission factors
*3 From ‘Kennisdocument Houtstook in Nederland’ (Koppejan and de Bree, 2018)
*4 EF from emission source E400109
*5 Methodology report of Guis (2006)
*6 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge, 2019.
*7 Calculated from NMVOC emission factor. NMVOC percentages in hydrocarbon are: 50% for coal, 50% for fuel oil, 65% for biogas, 40% for wood.
*8 EMEP/EEA Guidebook (2019), 1A4, table 3.48, average value
*9 EF should have been 10 g/GJ (EMEP/EEA Guidebook 2019, 1A2, table 3.2 minimum value). Will be corrected in the 2021 data (impact is very small)

Table 44 Combustion emission factors for commercial and institutional sectors (g/GJ)

Substance name	Natural gas	Diesel oil	Coal	Biogas	Wood
NMVOC	2.0 *1	10 *14	0.1 *11	8.45 *7	16 *12
Hydrocarbons *8	5.0	20	0.2	13	40 *12
Sulphur dioxide	0.2 *2	94 *4	450 *3	10 *7	10 *12
Nitrogen oxides as NO_2	21 *10	60 *10	150 *3	80 *7	122 *12
Ammonia					37 *6
Carbon monoxide	15 *2	30 *14	150 *3	20 *7	150 *12
Particulate matter (PM10)	0.28 *13	4.5 *14	60 *3	2 *7	38 *6
Particulate matter (PM2.5) *9	0.28	3.6	60	2	37
Elementary Carbon *9	0.008	1.8	0.266	0.08	5.6

References:
*1 EMEP/EEA Guidebook (2019), 1A4, table 3.27, average value
*2 EMEP/EEA Guidebook (2019), 1A4, table 3.27, minimum value
*3 EMEP/EEA Guidebook (2019), 1A4, table 3.7, minimum value
*4 EMEP/EEA Guidebook (2019), 1A4, table 3.9, average value
*5 EMEP/EEA Guidebook (2019), 1A4, table 3.9, minimum value
*6 EMEP/EEA Guidebook (2019), 1A4, table 3.48, average value
*7 EF from emission source E400109
*8 Calculated from NMVOC emission factor. NMVOC percentages in hydrocarbon are: 40% for natural gas, 50% for coal, 50% for diesel, 65% for biogas, 40% for wood.
*9 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge, 2019.
*10 Visschedijk (2022). From 2005 onwards the NOx-emission factor decreases due to the further implementation of low NOx technologies (EF2005: 42,5 to EF2020: 21).
*11 EF should have been 10 g/GJ (EMEP/EEA Guidebook 2019, 1A4, table 3.7, minimum value). Will be corrected in the 2021 data (impact is very small)

*12 Methodology report of Guis (2006)
*13 EF should have been 0.27 g/GJ (EMEP/EEA Guidebook 2019, 1A4, table 3.27, minimum value). Will be corrected in the 2021 data (impact is very small)
*14 EFs should have been 20 g NMVOC/GJ, 93 g CO/GJ and 21 g PM10/GJ (EMEP/EEA Guidebook 2019, 1A4, table 3.9, average value). Will be corrected in the 2021 data (impact is very small).

Table 45 Combustion emission factors in the residential sector (g/GJ)

Substance name	**Natural gas**	**Natural gas Cooking**	**Diesel Oil**	**LPG**	**Petroleum**	**Coal**
NMVOC	2.0 *2	2.0 *2	8.5 *5	1.3 *7	5 *5	30 *6
Hydro carbons *8	4.0	5.0	17	2.0 *7	10	60
Sulphur dioxide	0.3 *1	0.3 *2	70 *3	0 *7	70 *3	450 *5
Nitrogen oxides as NO_2	14,4 *10	57 *10	51 *3	40 *7	51 *3	150 *5
Carbon monoxide	22 *1	30 *2	57 *3	10 *7	57 *3	2000 *5
Particulate matter (PM10)	0.28 *1	2.2 *2	1.9 *3	2 *7	1.9 *3	240 *5
Particulate matter (PM2.5) *9	0.28	2.2	1.9	2	1.9	220
Elementary Carbon *9	0.015	0.119	0.162	0.17	0.162	44

References:
*1 EMEP/EEA Guidebook (2019), 1A4, table 3.16, average value
*2 EMEP/EEA Guidebook (2019), 1A4, table 3.13, average value
*3 EMEP/EEA Guidebook (2019), 1A4, table 3.5, average value
*4 EMEP/EEA Guidebook (2019), 1A4, table 3.19, average value
*5 EF should have been 0.69 g/GJ (EMEP/EEA Guidebook 2019, 1A4, table 3.5 average value). Will be corrected in the 2021 data (impact is very small)
*6 EF should have been 300 g/GJ (EMEP/EEA Guidebook 2019, 1A4, table 3.19 average value). Will be corrected in the 2021 data (impact is very small)
*7 Methodology report of Guis (2006)
*8 Calculated from NMVOC emission factor. NMVOC percentages in hydrocarbon are: 40% for natural gas, 50% for coal, 50% for diesel, 40% for wood.
*9 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge, 2019.
*10 See Visschedijk,2022.

Table 46 Combustion emission factors in the agricultural sector (g/GJ)

Substance name	**Natural gas**	**LPG**	**Biogas**	**Wood**
NMVOC	25,6 *1	1.3 *5	8.45 *4	16 *3
Hydrocarbons *9	64	2.0	13	40
Sulphur dioxide	0.2 *2	0 *5	10 *4	11 *3
Nitrogen oxides as NO_2	35 / 41.6 *8	40 *5	80 *4	80 *3
Ammonia				37 *7
Carbon monoxide	56 *11	10 *5	20 *4	170 *3
Particulate matter (PM10)	0.28 *6	0.3 *5	2 *4	17 *3
Particulate matter (PM2.5) *10	0.28	0.3	2	16
Elementary Carbon *10	0.008	0.012	0.08	2.4

References:
*1 Calculated from NMVOC emission factor. NMVOC percentages in hydrocarbon are: 40% for natural gas
*2 EMEP/EEA Guidebook (2019), 1A4, table 3.27, minimum value
*3 From ‘Kennisdocument Houtstook in Nederland’ (Koppejan and de Bree, 2018)
*4 EF from emission source E400109
*5 Methodology report Zonneveld (Guis, 2006)

*6 EF should have been 0.27 g/GJ (EMEP/EEA Guidebook 2019, 1A4, table 3.27 minimum value). Will be corrected in the 2021 data (impact is very small)
*7 EMEP/EEA Guidebook (2019), 1A4, table 3.48, average value
*8 The emission factor of 45 g/GJ is used for gas engines (source: Hulskotte, 2017), while the emission factor of 41.6 is used for boilers (source: Guis, xxx).
*9 Calculated from NMVOC emission factor. NMVOC percentages in hydrocarbon are: 50% for diesel, 65% for biogas, 40% for wood. Hydrocarbons see Visschedijk 2022
*10 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge, 2019.
*11 Visschedijk, 2022

All companies in the CRF categories 1A1b, 1A1c, 1A2b report an eAER, so supplemental emissions are not calculated in these categories.

The PCB emissions are not reported in the eEARs of the companies. In order to be able to determine these emissions, the method used for the other emitters is unsuitable. Therefore, the PCB emissions are calculated top down on the basis of the total use of solid fuels and biomass reported in the CBS Energy Statistics, multiplied with the emission factors from Table 47.

Table 47 List of PCB emission factors of solid fuels (Microgram/GJ)

Year	Solid fuels (1A1 and 1A2)	Solid fuels (1A4)	Biomass
1990	52,4	170	0.06
1991	42,1	170	0.06
1992	31,7	170	0.06
1993	21,4	170	0.06
1994	11,0	170	0.06
1995-2020	0,67	170	0.06

The PCB emission factor of solid fuels in 1A4 is from the EMEP/EEA Guidebook (2019), chapter 1A4, table 3.7. The PCB emission factor of biomass is from the EMEP/EEA Guidebook (2019), chapter 1A2, table 3.5.

The PCB emission factor of solid fuels in 1A1 and 1A2 is based on the correlation between the dioxin and PCB emission factors in the guidebook and in the Dutch emission inventory. This is calculated as follows:
The implied dioxin emission factor in electricity production form solid fuels is 62.57 ng/GJ in 1990 and 0.7968 ng/GJ in 2015-2017. Compared to the dioxin emission factor in chapter 1A2, table 3.2 of the EMEP/EEA Guidebook (2019) of 203 ng dioxin/GJ, the Dutch implied emission factor is a factor 3.2 lower in 1990 and a factor 255 lower in 2015-2017. It is assumed that emission reduction technologies for dioxin will also result in a similar emission reduction of PCB. Therefore, the emission factor is calculated by dividing the default PCB emission factor from chapter 1A2, table 3.2 of the EMEP/EEA Guidebook (2019) of 170 microgram PCB/GJ with the factor difference of 3.2 in 1990 and 255 in 2015-2017. This results in an emission factor of 52.4 microgram/GJ in 1990 and 0.67 microgram/GJ in 2015-2017. In the early 90s, dioxin emissions have reduced significantly, and it is therefore assumed that the low emission factor is valid from 1995 onwards. The emission factors in the period 1990-1995 have been interpolated. See Table 45 for the emission factors used.

The mercury emissions caused by combustion of natural gas are based on a study from the Gasunie in which country specific emission factors are determined:

- 1990 – 2009 emissionfactor 0,039 mg/GJ
- 2010 – 2016 emissionfactor 0,023 mg/GJ
- 2017 – 2020 emissionfactor 0,010 mg/GJ

Emission factors (mg/GJ) from natural gas combustion of the metals listen below are taken from the EMEP guidebook 2019

Plumbum	0.0015
Cadmium	0.00025
Arsenic	0.12
Chrome	0.00076
Nickel	0.00051
Selenium	0.0112
Zinc	0.0015

3.2.3.5 Aggregation

The energy statistics and AER data are aggregated to the same fuel names and NACE level. The energy file and PRTR file are now in the same format to ensure the files can be compared and used to make the calculations. This is required for the calculation of the emission factor and to establish the supplemental consumption.

Table 48 List of aggregated fuels

CBS name	**AER aggregation name**
Coal and coal briquettes	Coal
Lignite	Lignite
Coal cokes	Cokes
Coke oven gas	coke oven gas
Blast furnace gas	Blast furnace gas
Coal bitumen	tar, pitch, asphalt
Crude oil	crude oil
Natural gas condensate	Condensate
Other crude oil raw materials	waste oil
Refinery gas	waste gas
Chemical waste gas	waste gas
LPG, propane, butane	Lpg
Naphthas	Naphtha
Crude oil aromatics	Aromatics
Aviation fuel	avgas (aviation fuel)
Jet fuel (kerosene base)	aviation kerosene
Petrol / gasoline	petrol/gasoline
Other light oils	Dfo
Petroleum	Petroleum
Gas oil, diesel oil, heating oil < 15cSt	Dfo
Heavy heating oil >= 15cSt	fuel oil
Lubricating oils and fats	Lubricants
Bitumen	tar, pitch, asphalt
Mineral turpentine	Lubricants
Mineral waxes	Lubricants

CBS name	AER aggregation name
Raw materials for carbon black	other oil products
Petroleum cokes	Pcokes
Total anti-knock preparations	other oil products
Additives for lubricants	other oil products
Other crude oil products H27	other oil products
Other products (not H27)	other oil products
Natural gas	natural gas (Slochteren)
Fermentation gas	Biogas
Sewage gas	Biogas
Landfill gas	Biogas
Industrial fermentation gas	Biogas
Biomass, liquid	Biomass
Biomass, solid	Biomass
Wood	Wood

3.3 Supplemental estimation of process emissions

Within the PRTR the industrial company category data usually consists of a part with the process emissions from the available individual company data and a part with the process emissions from the missing companies grouped by NACE-category, the so-called supplemental estimate.
The eAERs are the source material for the individual company data. The eAER data and additional information from non-AER companies make up the PRTR-I file. The method is described in section 3.1.
The total process emissions of a company category are established by adding up the individual company data and the supplemental estimate.

This chapter describes the methods for calculation of the supplemental estimates of the process emissions of a number of industrial company categories.

3.3.1 Emission sources

Table shows the emission source (following the NACE = general industrial classification of Economic activities in the European communities) for which supplemental estimates are established.

Table 49 List of process emission sources defined by NACE 2008 classification described in this section

ES CODE	EMISSION SOURCE
0833400	NACE 52.10/52.24: Cargo handling and storage
8900200	NACE 10-12: Food, beverages and tobacco industry
8900700	NACE 18/58: Publishing, printing and reproduction of recorded media
8900900	NACE 20.15: Manufacture of fertilisers and nitrogen compounds
8901700	NACE 22.1: Manufacture of rubber products
8901706	NACE 22.1: Manufacture of rubber products, fugitive
8910000	NACE 10.1: Processing and preserving of meat and poultry
8910300	NACE 10.4: Manufacture of oils and fats
8910400	NACE 10.5: Dairy industry
8910406	NACE 10.5: Dairy industry, fugitive
8910500	NACE 10.6: Manufacture of grain mill products, excl. starches and starch products
8910506	NACE 10.6: Manufacture of grain mill products, excl. starches and starch products, fugitive

ES CODE	EMISSION SOURCE
8910600	NACE 10.9: Manufacture of prepared animal feeds
8910606	NACE 10.9: Manufacture of prepared animal feeds, fugitive
8911700	NACE 15.11: Tanning of leather and fur preparation
8911900	NACE 16.1: Sawmilling and planing of wood; impregnation of wood
8912100	NACE 16.23: Manufacture of builders' carpentry and joinery
8912106	NACE 16: Manufacture of wooden products, fugitive
8912406	NACE 17: Manufacture of paper, paperboard and articles of paper and paperboard, fugitive
8913002	NACE 20.16: Manufacture of plastics in primary forms, handling of F-gases
8913005	NACE 20.16: Manufacture of plastics in primary forms, production of HCFK 22
8913900	NACE 22.2: Manufacture of plastics products
8913906	NACE 22.2: Manufacture of plastic products, fugitive
8914602	NACE 24.2: Manufacture of tubes and pipes
8914606	NACE 23: Construction material and glass industry, fugitive
8914800	NACE 30.1: Ship-building, painting
8914900	NACE 24.5: Casting of metals
8915000	NACE 25-33/95: Metal-electronic industry
8915003	NACE 25-33/95: Metal-electronic industry, painting and dyeing
8915006	NACE 25-33/95: Metal-electronic industry, fugitive release of PM_{10}
8918000	NACE 10.8: Other manufacture of food products
8918006	NACE 10.8: Other manufacture of food products, fugitive
8918106	NACE 13: Manufacture of textiles, fugitive
8919700	NACE 13.20: Textile weaving
8920400	NACE 35: Production and distribution of gas and electricity
8924202	NACE 19.2: Manufacture of refined petroleum products, terminals
8924406	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel
8924407	NACE 24.1-24.3/24.51/24.52: Base metal: iron and steel
8924502	Solvent and other product use: other
8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary
8914702	NACE 24.45: Manufacture of non-ferrous metals, aluminium
8914704	NACE 24.45: Manufacture of non-ferrous metals, copper
8914705	NACE 24.45: Manufacture of non-ferrous metals, lead
8914706	NACE 24.45: Manufacture of non-ferrous metals, zinc
8911400	NACE 13.3: Finishing of textiles
8911500	NACE 13.93: Manufacture of carpets and rugs
8912200	NACE 17.1: Manufacture of pulp, paper and paperboard
8912300	NACE 17.2: Manufacture of articles of paper and paperboard
8912600	NACE 20.12: Manufacture of dyes and pigments
8913000	NACE 20.13: Manufacture of inorganic basic chemicals
8912900	NACE 20,149: Manufacture of organic basic chemicals (no petrochemicals)
8913100	NACE 20.2: Manufacture of pesticides
8913200	NACE 20.3: Manufacture of paints, varnishes and similar coatings, printing ink and mastics
8913400	NACE 20.41: Manufacture of detergents
8913600	NACE 20.52: Manufacture of glues and adhesives
8919300	NACE 20.59: Manufacture of other chemical products n.e.c.
8913800	NACE 20.6: Manufacture of synthetic and artificial fibres
8914000	NACE 23.1: Manufacture of glass and glassware
8914200	NACE 23.32: Manufacture of bricks and tiles
8914300	NACE 23.6: Manufacture of articles of concrete, plaster and cement
8914500	NACE 23.9: Manufacture of other non-metallic mineral products

3.3.2 *Calculation method of preliminary emission figures*

3.3.2.1 Emissions of industrial processes in product manufacturing

Calculation of the preliminary emissions is based on the production index figures of Statistics Netherlands (CBS).

The t-1 emissions are calculated as follows:

(Preliminary prod. index figure year(t+1) / Final prod. index figure (Year t)) * Emission(Year t)

Note: Year t = last year for which final emission figures have been calculated.

If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

3.3.3 *Calculation method of final emission figures*

3.3.3.1 General estimation method for supplemental emissions of industrial processes in product manufacturing

For the emission sources summed in
Table 50 a generic method is used to estimate the supplemental emissions for all substances, because no additional data is available for a substance-specific estimation of the supplemental emissions.

Table 50 Emission sources using the general method to estimate the supplemental emissions

ES CODE	EMISSION SOURCE
8910500	NACE 10.6: Manufacture of grain mill products, excl. starches and starch products
8911400	NACE 13.3: Finishing of textiles
8911500	NACE 13.93: Manufacture of carpets and rugs
8912200	NACE 17.1: Manufacture of pulp, paper and paperboard
8912300	NACE 17.2: Manufacture of articles of paper and paperboard
8912600	NACE 20.12: Manufacture of dyes and pigments
8913000	NACE 20.13: Manufacture of inorganic basic chemicals
8912900	NACE 20,149: Manufacture of organic basic chemicals (no petrochemicals)
8913100	NACE 20.2: Manufacture of pesticides
8913200	NACE 20.3: Manufacture of paints, varnishes and similar coatings, printing ink and mastics
8913400	NACE 20.41: Manufacture of detergents
8913600	NACE 20.52: Manufacture of glues and adhesives
8919300	NACE 20.59: Manufacture of other chemical products n.e.c.
8913800	NACE 20.6: Manufacture of synthetic and artificial fibres
8914000	NACE 23.1: Manufacture of glass and glassware
8914300	NACE 23.6: Manufacture of articles of concrete, plaster and cement
8914500	NACE 23.9: Manufacture of other non-metallic mineral products
8914602	NACE 24.2: Manufacture of tubes and pipes
8914900	NACE 24.5: Casting of metals
8919700	NACE 13.20: Textile weaving
8911700	NACE 15.11: Tanning of leather and fur preparation

Up to 2007, the emissions of the non-reporting facilities (Em_non_IF) were calculated as follows:

*Em non_IF = IEF * (TP –P_IF)*

Where
IEF = the implied emission factor
TP = Total production (Production Statistics, Statistics Netherlands)
P_IF = Production of individual facilities (Production Statistics, Statistics Netherlands)

The implied emission factors were calculated as follows:

IEF = Em_IF / P_IF
Where
Em_IF = the sum of the emissions from individual facilities; (since 1999 most of the emissions of the individual facilities were derived from the Annual Environmental Reports (AER))

Since 2007, due to a lack of production figures, emissions from non-reporting facilities are calculated as follows:

$Em\ non\_IF = (PI_{(t)} / PI_{(t-1)}) * Em\ non\text{-}IF_{(t-1)}$

Where
PI = production indices at 2 digit level (Statistics Netherlands)
t = year

If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

3.3.3.2 Substance-specific estimation for supplemental emissions of industrial processes in product manufacture

In addition to emission sources where a generic method is applied to estimate supplemental emissions of all substances, there are also emission sources whereby substance-specific methods are applied. This section describes these substance-specific methods.
For the sake of clarity emission sources are subdivided into groups (referencing emission sources) based on the substances released. Depending on the substances released from each source a number of emission sources may appear in several groups. The subdivision into groups is as follows:

- Group 1: PM_{10} / $PM_{2.5}$
- Group 2: Other NMVOCs, toluene, hexane and ethanol
- Group 3: F-gases
- Group 4: Fugitive PM_{10} / $PM_{2.5}$ emissions in industrial sectors due to industrial building ventilation
- Group 5: NMVOC emissions from industrial coating application
- Group 6: Other

The calculation methods for definitive emissions for each group with emission sources are described below.

Group 1: PM_{10}/$PM_{2.5}$

The group PM_{10} / $PM_{2.5}$ includes emission source categories summed in Table 51.

Table 51 Emission sources using the substance-specific method to estimate supplemental PM_{10} and $PM_{2.5}$ emissions

Code	**ES_CODE**	**PROCESS_DESCRIPTION**
A	0833400	NACE 52.10/52.24: Cargo handling and storage
B	8910000	NACE 10.1: Processing and preserving of meat and poultry
C	8910300	NACE 10.4: Manufacture of oils and fats
D	8910400	NACE 10.5: Dairy industry
F	8910600	NACE 10.9: Manufacture of prepared animal feeds
G	8918000	NACE 10.8: Other manufacture of food products

PM_{10} emission calculation

Code: A

Normally, all storage and transhipment companies are listed in the PRTR-I and the PM_{10}/$PM_{2.5}$ emission from this source is 0. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. When necessary, these emissions can be adjusted using production indices.

Code: D

Until 2015, the total PM_{10} emissions from the dairy industry were be taken from the FOI's yearly report from the dairy industry (FO-Ecodata. The supplemental estimate is established by subtracting the PM_{10} emission from the dairy industry listed in the PRTR-I from the total emission.

Since 2016 the total emissions of the (sub)categories are calculated as follows:

Em Total (sub)category(t) = Em Total (sub)category(t-1) * (PI(t) / PI(t-1))

Where:

t = year

PI = production indices (Statistics Netherlands)

The emissions from this source are calculated as follows:

Em = TOTAL Em –EmComp

Where:

TOTAL Em = total emissions of the (sub)categories

EmComp = emissions from the individually registered companies (PRTR-I)

If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

Codes: B, C, F and G
Until 2000, the emissions of the non-reporting facilities (Em non_IF)were calculated as follows:

*Em non_IF = IEF * (TP –P_IF)*

Where:
IEF = the implied emission factor
TP = Total production (sub)category (Production Statistics, Statistics Netherlands)
P_IF = Production of individual facilities (Production Statistics, Statistics Netherlands)

The implied emission factors were calculated as follows:
IEF = Em IF / P_IF

Where:
Em_IF = the sum of the data from the individual facilities

Due to lack of production figures and emission data from individual facilities, the total emissions of the (sub)categories are calculated as follows, since 2000:
*Em Total (sub)category(t) = Em Total (sub)category(t-1) * (PI(t) / PI(t-1))*

Where:
t = year
PI = production indices (Statistics Netherlands)

Finally, the emissions (Em_sup) from these emission sources are calculated as follows:

Em_sup = Em Total (sub)category(t) −EmComp

Where:
Em Total (sub)category$_{(t)}$ = total emissions of the (sub)categories
EmComp = emissions from individually registered companies (PRTR-I)
If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

$PM_{2.5}$ emission calculation
A source specific TNO conversion table (Visschedijk and Droge, 2019), included in Appendix 3,was used to derive the $PM_{2.5}$ emissions from the PM_{10} emissions.

Group 2: Other NMVOCs, toluene, hexane and ethanol
The group other NMVOCs includes emission sources summed in Table 52.

Table 52 Emission sources using the substance-specific method to estimate supplemental NMVOCs, toluene, hexane and ethanol emissions

Code	ES CODE	EMISSION SOURCE
A	0833400	NACE 52.10/52.24: Cargo handling and storage
B	8900700	NACE 18/58: Publishing, printing and reproduction of recorded media
C	8901700	NACE 22.1: Manufacture of rubber products
D	8910300	NACE 10.4: Manufacture of oils and fats
E	8911900	NACE 16.1: Sawmilling and planing of wood; impregnation of wood
F	8913900	NACE 22.2: Manufacture of plastic products
G	8915000	NACE 25-33/95: Metal-electronic industry
H	8918000	NACE 10.8: Other manufacture of food products
I	8924202	NACE 19.2: Manufacture of refined petroleum products, terminals

Code: A
Based on the revised *Handboek Emissiefactoren* (Emission Factors Manual; RIVM/MNP, 2004) the sector association submitted a new NMVOC emission figure for the entire category for 2006.
After 2006 the total NMVOC emission is estimated by multiplying the emission of the previous year by the production index figure of the present year / production index figure of the previous year. The supplemental emissions are estimated by subtracting the PRTR-I emissions from the total emissions. If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.
Code: B
Up to and including the emission year 2007 the total NMVOC emissions were taken from the annual reports on the Evaluation of the Environmental Policy Agreement for the Printing Industry and Packaging Printers (FO-Industrie, 2008).
After 2007 the total NMVOC emissions are estimated as follows:

*EM Total = (SPI(t)/SPI(t-1) * *EM Total of the previous year.*

Where:
SPI = sales of printing ink (https://www.vvvf.nl/home-en/factsandfigures
t = year
The supplemental NMVOC emissions are estimated by subtracting the PRTR-I emissions from the total emissions. If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

Codes: C and F
These sources account for the NMVOC emissions released in the manufacture of rubber and plastic products. The underlying data for the supplemental estimate were the total NMVOC emission figures of these (sub)categories (up to and including 2000 based on the KWS2000 project; from 2001 up to and including 2003 based on Infomil). The supplemental emissions were estimated by subtracting the PRTR-I emissions from the total emissions of these (sub)categories.

Due to lack of production figures and emission data from individual facilities, the total emissions of the (sub)categories are calculated as follows, since 2003:
$$Em\ Total\ (sub)category_{(t)} = Em\ Total\ (sub)category_{(t-1)} * (PI_{(t)} / PI_{(t-1)})$$

Where:
t = year
PI = production indices (Statistics Netherlands)

The emissions from this source are calculated as follows:

$$Em = TOTAL\ Em - EmComp$$

Where:
TOTAL Em = total emissions of the (sub)categories
EmComp = emissions from the individually registered companies (PRTR-I)

If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

Code: D
This source accounts for hexane and ethanol emissions released from the processing of soybeans and oil- and fat-rich seeds.
The hexane and ethanol emissions of this source are 0, because all companies have been listed in the PRTR-I since 2002. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. If necessary, these emissions can be adjusted using production indices.

Code: E
This emission source accounts for NMVOC emissions released from wood preservation processes. Up to and including 2000 the emission estimations were based on data from the KWS2000 project. After that, no emissions have been made available through other sources. For that reason the emission has not been changed since 2000. For that reason, the emission of NMVOC from wood treatment processes have been kept stable at 1.100 ton per year since 2003.

In 2018 this emission source has been re-examined to find out whether the current emission trend is still applicable or if it needs to be updated. For this purpose, literature was examined and contact was made with the VHN (the Dutch association of companies in the wood treatment business). The VHN represents wood treatment company's, suppliers of treatment fluids & production equipment and dealers/traders of preserved wood and wood products.

On basis of information provided by the VHN it can be concluded that the emissions of NMVOC from wood preservation processes have abated from 2000 onward. The main reasons for the emission reduction are a combination of smaller amounts of NMVOC in the impregnation- and dip fluids, improvements in the production process and a reduction in the produced volume of preserved wood from 2000 onwards.

As a result, the following trend of NMVOC emissions can be deduced:

YEAR	NMVOC (tonnes)
1990-2000	1,100
2001	900
2002	700
2003	500
2004	300
2005 onwards	100

As mentioned earlier, the steep emission reduction from 2000 to 2005 are the result of stricter regulations on the NMVOC emissions.
The latter stabilisation of the NMVOC emission trend is mainly due to the fact that currently only 2 companies within the Netherlands produce creosote preserved wood. Although their exact annual production numbers are not known, the VHN estimates that the annual production of preserved wood and the related amount of impregnation fluid needed is fairly stable.

The VHN predicts that the annual amount of creosote preserved wood produced by these 2 companies will further decrease in the future due to stricter regulations within the Netherlands and the EU. In the end it is expected that the amount of creosote preserved wood produced in the Netherlands will decrease to zero and thereby the NMVOC emissions of this emission source.

Code: G
This emission source concerns NMVOC emissions released from the "cleaning and degreasing" process. The NMVOC emissions from this emission source have not been subject to any structural monitoring since 1995. This has resulted in the following series of emissions:

1981: 8.0 ktonnes
1992: 5.1 ktonnes
1993: 4.5 ktonnes
1994: 4.0 ktonnes
1995 up to and including 1999: 3.5 ktonnes
2000 up to now: 2.9 ktonnes

The up to and including 1999 figures were taken from the KWS2000 Final Report (Infomil, 2002) and the 2000 figure from the 2010 VOC Reduction Plan for the Metal-Electronic Industry (FME-CWM, 2003). After that, no emissions have been made available through other sources. For that reason the emission has not been changed since 2000.

Code: H
This emission source includes ethanol emissions released from bread bakeries. Based on research performed by CREM an emission of 2.1 ktonnes (Infomil, 2002) was determined once. After that, no emissions

have been made available through other sources. For that reason, the emission of ethanol from bread bakeries have been kept stable at 2.100 ton per year since 1998.

In 2018 this emission source has been re-examined to find out whether the current emission trend is still applicable or if it needs to be updated. For this purpose, literature was examined (among others from Statistics Netherlands - CBS), contact was made with the Dutch Bakery Centre (NBC) and multiple industrial bakeries.

Ethanol emissions from bakeries originate from the yeast fermentation of all yeast containing bakery products. These mainly include: all types of bread, rolls (a.o. hamburgers, hot dogs, etc.) and sweet yeast products (a.o. brioche, doughnuts, etc.). NMVOC emissions from bakeries are not being registered, calculated or estimated and therefore emissions from bakeries will have to be deduced from sales data.
On basis of the annual amount of bread sold/consumed in the Netherlands and the average amount of ethanol emitted per unit of bread, the annual amount of ethanol produced by bakeries can be calculated.

The annual amount of bread sold in the Netherlands is calculated by Statistics Netherlands (CBS) and the Dutch Bakery Centre (NBC):

- 1990-2008: Bread consumption per inhabitant from CBS (https://opendata.cbs.nl/statline/#/CBS/nl/dataset/37154/table?dl=1D9AB) combined with number of inhabitants.
- From 2009 onwards: Statistics from NBC (https://www.nbc.nl/nieuws/steeds-meer-brood-wordt-buitenshuis-gegeten)

According to chapter 2H2, table 3.11 in the EMEP/EEA Guidebook (2019), the average amount of ethanol produced per unit of typical European bread is 4.5 kg/ton of bread.

The Total annual NMVOC emissions from the bread production are calculated as follows:

*TOTAL Em = (ConsPP * InhNL) * 4.5*

Where:
ConsPP = annual average bread consumption per person
InhNL = annual number of inhabitants in the Netherlands

These calculated emissions are exclusive of any possible emission-reducing measures. Out of contacts with multiple Dutch industrial bakeries (Industrial bakeries have a market share of between 80–85% in the Netherlands - European Bread Market Reports 2010-2013), it appears that no emission reducing measures are being taken.
The emissions coming from the yeast fermentation are only being diluted in order to reduce the NMVOC concentrations.

Code: I
This concerns four oil terminals whose total emissions are provided by DCMR on an annual basis.

Group 3: F-gases
The group F-gases includes the emission sources summed in Table 53.

Table 53 Emission sources using the substance-specific method to estimate supplemental F-gas emissions

ES CODE	EMISSION SOURCE
8913002	NACE 20.16: Manufacture of plastics in primary forms, handling of F-gases
8913005	NACE 20.16: Manufacture of plastics in primary forms, production of HCFK 22
8924502	Solvent and other product use: other
8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary

The methods to determine the total HFC/PFC/CH_4 emissions from several sources are described in paragraph 2.2. The supplemental estimate is determined by subtracting the HFC/PFC/CH_4 emissions from the industry listed in the PRTR-I from the total emission.

Group 4: Fugitive PM_{10} / $PM_{2.5}$ emissions in industrial sectors due to industrial building ventilation
The group fugitive PM_{10}/$PM_{2.5}$ emissions includes the emission sources summed in Table .

Table 54 Emission sources using the substance-specific method to estimate supplemental PM_{10} and $PM_{2.5}$ emissions due to interior ventilation

ES CODE	EMISSION SOURCE
8901706	NACE 22.1: Manufacture of rubber products, fugitive
8910406	NACE 10.5: Dairy industry, fugitive
8910506	NACE 10.6: Manufacture of grain mill products, excl. starches and starch products, fugitive
8910606	NACE 10.9: Manufacture of prepared animal feeds, fugitive
8912106	NACE 16: Manufacture of wooden products, fugitive
8912406	NACE 17: Manufacture of paper, paperboard and articles of paper and paperboard, fugitive
8913906	NACE 22.2: Manufacture of plastic products, fugitive
8914606	NACE 23: Construction material and glass industry, fugitive
8915006	NACE 25-33/95: Metal-electronic industry, fugitive release of PM_{10}
8918006	NACE 10.8: Other manufacture of food products, fugitive
8918106	NACE 13: Manufacture of textiles, fugitive
8924406	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel

This concerns fugitive PM_{10} and $PM_{2.5}$ emissions due to ventilation of production buildings.
PM_{10}-emissies from these sources (2.7 ktonnes/year) were estimated for the first time in 2000 (Haskoning, 2000). An update of this study was performed in 2012 (RoyalHaskoningDHV, 2012). This has resulted in new emission estimates for 2010. For the period up to and including 2000 the emissions from the 2000 study were used, and for the period 2001-2010 the emissions were determined by linear interpolation. The total emission has not been changed since 2010 because actual emissions could deviate a factor of 2 to 3 from estimated emissions. A source specific TNO conversion table (Visschedijk and Droge, 2019) was used to derive the $PM_{2.5}$ emissions from the PM_{10} emissions.

Group 5: NMVOC emissions from industrial coating application
The group NMVOC from industrial coating application includes the emission sources summed in Table 55.

Table 55 mission sources using the substance-specific method to estimate supplemental NMVOCs, emissions from industrial coating application

Code	**ES CODE**	**EMISSION SOURCE**
A	8912100	NACE 16.23: Manufacture of builders' carpentry and joinery
B	8914800	NACE 30.1: Ship-building, painting
C	8915003	NACE 25-33/95: Metal-electronic industry, painting and dyeing

These emission sources are responsible for a part of the NMVOC emissions from industrial coating applications.

Codes: A and B:
The annual national paint sales in ton are provided by the annual paint sales statistics of the Netherlands Association of Paint Producers (VVVF). Up to and including
2016 these Statistics also included information on the NMVOC contents. For that reason the 2015 NMVOC contents are used since 2017.
The VVVF represents 100% of the total market of these industrial sectors.
It is assumed that all paint sold will be used the same year and the NMVOC emitted is 100% of the NMVOC content. So, the total NMVOC emissions (TOTAL Em) from these industrial sectors are equal to the NMVOC content (in ton)

The NMVOC emissions from these emission sources are calculated as follows:

$$Em = TOTAL\ Em - EmComp$$

Where:
EmComp = NMVOC emissions from the individually registered companies (PRTR-I)

Code: C
The annual national paint sales are provided by the annual paint sales statistics of the Netherlands Association of Paint Producers (VVVF). Until 2016 these Statistics also included information on the NMVOC content. For that reason the 2015 NMVOC contents in % are used since 2017. Until 2000 the VVVF represents about 95% of the total market and from 2000 onwards this share is 90%. The remaining part (5/10%) consists of directly imported paint.
The Total NMVOC emissions from the metal-electronic industry are calculated as follows:

$$TOTAL\ Em = (EmN + EmI + EmCA) * (1 - 0.34)$$

Where:
EmN = NMVOC content of national paint sales
EmI = NMVOC content of directly imported paint.

It is assumed that:
- all paint sold will be used the same year and that the NMVOC emitted is 100% and the imported paint contains the same amount of NMVOCs as the paint sold by VVVF.
- 50% of the directly imported paint is used by this source

EmCA (Emission by using cleaning agent) = 0.3 * Used amount of cleaning agent.
Used amount of cleaning agent = 0.15 * Paint consumption

0.34 = Destruction factor for abatement technology (afterburner)

The factors 0.3, 0.15 and 0.34 have been derived from the NMVOC reduction plan 2010 (FME/CWM, 2003)
The NMVOC emissions from this emission source are calculated as follows:

Em =TOTAL Em – EmComp

Where:
EmComp =NMVOC emissions form the individually registered companies (PRTR-I)

Group 6: Other
The group other includes various emission sources summed in Table 56.

Table 56 Emission sources using the substance-specific method to estimate supplemental emissions of other substances

Code	**ES CODE**	**EMISSION SOURCE**
A	8915000	NACE 25-33/95: Metal-electronic industry
B	8920400	NACE 35: Production and distribution of gas and electricity
C	8924407	NACE 24.1-24.3/24.51/24.52: Base metal: iron and steel
D	8914702	NACE 24.45: Manufacture of non-ferrous metals, aluminium
E	8900200	NACE 10-12: Food, beverages and tobacco industry
F	8900900	NACE 20.15: Manufacture of fertilisers and nitrogen compounds
G	8914704	NACE 24.45: Manufacture of non-ferrous metals, copper
H	8914705	NACE 24.45: Manufacture of non-ferrous metals, lead
I	8914706	NACE 24.45: Manufacture of non-ferrous metals, zinc
J	8914200	NACE 23.32: Manufacture of bricks and tiles

Code: A
This concerns the emissions of chrome, copper, nickel and zinc, as well as $PM_{10}/PM_{2.5}$. Up to and including 2000 (emissions of 1998) the total emissions of this sector were calculated using production/consumption figures provided by VOM (Materials Surface Treatment Association) and VELATEC (Welding Technology Association), and emission factors were taken from SPIN (Cooperative Project for Process Descriptions in Dutch Industry) process descriptions. The supplemental estimate is determined by subtracting the PRTR-I emissions of these substances from the total.

Due to lack of production figures and emission data from individual facilities, the total emissions of this sector are calculated as follows, since 2000:

$$Em\ Total_{(t)} = Em\ Total_{(t-1)} * (PI_{(t)} / PI_{(t-1)})$$

Where
T = year
PI = production indices (Statistics Netherlands)

The emissions from this source are calculated as follows:

$$Em = Em\ Total_{(t)} - EmComp$$

Where:
Em Total $_{(t)}$ = total emissions of the sector
EmComp = emissions form the individually registered companies (PRTR-I)

A source specific TNO conversion table (Visschedijk and Droge, 2019) was used to derive the $PM_{2.5}$ emissions from the PM_{10} emissions.
If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

Code: B
Normally, all fluoride emissions from coal-fired power stations are listed in the PRTR-I and the fluoride emission from this source is 0. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. If necessary, these emissions can be adjusted using production indices.

Codes: C and D
For the supplemental estimate of the emissions from these sources a separate supplemental estimation method is used for the PAH emissions. For all other substances the generic supplemental estimation method (described in section 3.3.3.1) is used.
If there is no complete registration for the 4 individual PAHs a set of specific factors can be used for the calculation of the emissions of the missing individual PAHs. These factors were obtained from a specific study (Visschedijk, 2007).

Code: E
This concerns leakage of ammonia from cooling installations. A constant emission is maintained for this emission source.

Code: F
Normally, all fertilizer manufacturers are listed in the PRTR-I and the CO_2 emission from this source is 0. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. If necessary, these emissions can be adjusted using production indices.

Codes: G, H and I
Normally, all companies in these company categories are listed in the PRTR-I and the emissions from this source are 0. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. If necessary, these emissions can be adjusted using production indices.

Code: J
For the supplemental estimate of the emissions from the manufacture of bricks and tiles a separate supplemental estimation method is used for inorganic fluorides. For all other substances the generic supplemental estimation method (described in section 3.3.3.1) is used.
Based on the total sum of inorganic fluorides reported by the companies for 2000 and the annually reported production volume of bricks (KNB, multiple years) the volume of inorganic fluorides is estimated annually:

$$\text{Company group emission present year} = \frac{\text{Production entire company category present year}}{\text{Production entire company category in 2000}} \times \text{Emission entire company category in 2000}$$

The sum of the emissions of inorganic fluorides of individual companies (company-specific emission source T104300 NACE23.32: manufacture of bricks and tiles) is subtracted from this annually calculated total inorganic fluoride emission, and the remainder is reported as the supplemental estimate from this emission source.

3.4 Emissions from waste treatment

3.4.1 Emission sources
This section covers the emissions that arise from waste disposal and treatment. The following source categories are identified:
- Waste incineration,
- Landfills,
- Composting,
- Wastewater treatment.

3.4.2 Calculation method of preliminary emission figures
3.4.2.1 Waste incineration
The emission of Waste incineration plants (WIP's) are for Air actual calculated as part of the individual emissions (see chapter 3.1), except for threepriority substances, hexachlorobenzene (HCB), pentachlorobenzene (PeCB) and Polychlorinated Biphenyls (PCB's). the preliminary values are the final values of the previous year.

3.4.2.2 Landfill sites
The emissions for the Air Actual method are calculated in the same way as for the Air IPCC method See the description in section 2.3.2.2.

3.4.2.3 Composting
The emissions for the Air Actual method are calculated in the same way as for the Air IPCC method See the description in section 2.3.2.3

3.4.2.4 Sewer systems and wastewater treatment

The calculations of preliminary combustion emissions according to Air Actual are done in the same way as final emissions. The activity data are established in late May. This means the preliminary emissions are identical to the final emissions. See the description in section 3.4.2.4
For process emissions of Toluene and Benzene from domestic wastewater treatment and total NMVOC emissions of industrial biological waste water treatment, the preliminary figures are a copy of the previous year. For calculation of the final emission figures, see section 3.4.3.4.

3.4.3 Calculation method of final emission figures

3.4.3.1 Waste incineration

The emission of Waste incineration plants (WIP's) are for Air actual calculated as part of the individual emissions (see chapter 3.1), except for threepriority substances, hexachlorobenzene (HCB), pentachlorobenzene (PeCB) and Polychlorinated Biphenyls (PCB's).
The emission of two of these priority substances, hexachlorobenzene (HCB) and pentachlorobenzene (PeCB) are calculated based on the weight of the incinerated waste. In this work package the emissions of these two substances have been calculated for the period from 1990 up to and including 2004. From 2005 the emissions are included in the supplements of the individual plants.

Hexachlorobenzene (HCB)
TNO 2011 contains an estimation of the HCB emission factor, which is 0.2 mg/ton. The total emission for HCB was calculated based on the total amount of incinerated waste by weight. The emissions are linked to the activity data for the amount of incinerated waste in ktonnes based on the ratio of biomass to non-biomass by weight. These values are calculated for the period from 1990 up to and including 2004. From 2005 the emissions of this substance are factored into the supplemental estimates of the emissions.
In 2013, TNO (TNO 2013) conducted additional research (included in Annex 3) into the emission factor of HCB, which concluded that in the early 1990s flue gas scrubbing systems were less effective than in later years. Based on this conclusion, the emission factor for the period from 1990 up to and including 1994 was amended. The emission factor trend was brought in line with the trend of the PCDD/P emission decrease. The emission factors for each year are shown in Table 57.

Table 57 Emission factors HCB, (mg/ton waste)

Year	**1990**	**1991**	**1992**	**1993**	**1994**	**1995->**
HCB	16.08	12.91	10.36	6.72	3.31	0.20

Pentachlorobenzene (PeCB)
TNO 2011 contains an estimation of the PeCB emission factor, which is 0.29 mg/ton. The total emission for HCB was calculated based on the total amount of incinerated waste by weight. The emissions are linked to the activity data for the amount of incinerated waste in ktonnes based on the ratio of biomass to non-biomass by weight. These values are calculated for the period from 1990 up to and including 2004. From 2005 the emissions of this substance are factored into the supplemental estimates of the emissions.

In 2013, TNO (TNO 2013) conducted additional research into the emission factor of PeCB, which concluded that in the early 1990s flue gas scrubbing systems were less effective than in later years. Based on this conclusion, the emission factor for the period from 1990 up to and including 1994 was amended. The emission factor trend was brought in line with the trend of the PCDD/P emission decrease. The emission factors for each year are shown in Table 58.

Table 58 Emission factors PeCB, (mg/ton waste)

Year	1990	1991	1992	1993	1994	1995->
PeCB	23.32	18.71	15.01	9.74	4.80	0.29

Polychlorinated Biphenyls (PCB's)
The EMEP/EEA air pollutant emission inventory guidebook - 2016 gives in gives in the sectoral guidance chapter 5.C.1.a Municipal waste incineration 2016 emission factors for PCB's. A tier 1 approach is used. In table 3-1 of the guidance chapter the given emission factor is 3.4 ng/Mg. As stated in the Guidebook is this emission factor *"…can be assumed to be representative for modern waste incineration plants and are based on measurements carried out in Denmark (Nielsen et al., 2010) following the implementation of the EU waste incineration directive*". As waste incinerators in the Netherlands must comply with the same regulation a similar emission factor is to be expected.
The emissions are linked to the activity data for the amount of incinerated waste in ktonnes based on the ratio of biomass to non-biomass by weight which are calculated for the Air IPCC method in section 2.3.2.1.1.

With the new guidebook 2019 (EMEP/EEA air pollutant emission inventory guidebook – 2019) the emission factor remains the same.

3.4.3.2 Landfill sites
The emissions for the Air Actual method are calculated in the same way as for the Air IPCC method See the description in section 2.3.2.2.

3.4.3.3 Composting
The emissions for the Air actual method are calculated in the same way as for the Air IPCC method. See the description in section 2.3.2.3.

3.4.3.4 Sewer systems and water treatment
Like many other industrial plants, waste water treatment plants produce combustion emissions. Natural gas is used for space heating and sludge drying installations, and domestic fuel oil is also used in small volumes. Small fractions of biogas are released by sludge fermentation. The bulk of the biogas is used as fuel in CHP plants to generate electricity, while another portion is flared. Occasionally biogas may be vented directly into the atmosphere. The latter emissions (methane) are factored into the IPCC process emissions for waste water treatment plants (see section 2.3.1.4). Biotransformation processes occurring in treatment tanks and during sludge processing also cause the release of N_2O and CH_4. The calculation of these emissions is described in section 2.3.1.4. Domestic waste water treatment plants also emit small amounts of Benzene en Toluene from the biological treatment basins (see 3.4.3.4.3 for calculation method and emission factors). Total NMVOC emissions

from industrial biological waste water treatment are also estimated; for the method and emission factor see section 3.4.3.4.2 and 3.4.3.4.3.

3.4.3.4.1 Emission sources

This concerns the emission source E400109: NACE 37: Collection and treatment of sewage;
0910001: NACE 10-11: Food and beverage industry (waste water treatment;
0910002: NACE 17: Manufacturing of paper and cardboard (waste water treatment);
0910003: NACE 20-21: Manufacturing of chemical and pharmaceutical products (waste water treatment);
0910004: NACE 38: Waste collection, processing and treatment (waste water treatment);
0910005: NACE unknown: Industry not specified, Other industrial processes (waste water treatment).

3.4.3.4.2 Inventory of fuel consumption data and wastewater data

Fuel consumption data for calculating combustion emissions based on the Air Actual method is collected by means of a separate inventory performed by Statistics Netherlands (CBS) in partnership with Netherlands Enterprise Agency (RVO) the Dutch Water Authorities and consultancy firm Arcadis. This so-called collective retrieval of energy consumption data from waste water treatment plants is initiated in January using spreadsheets in Excel format, which are sent out to plant operators by Arcadis. All consumption figures of each plant are entered into the spreadsheet, and – in the case of biogas – the flared and vented volumes as well.
In the period up to and including May the data is validated by CBS and Arcadis. Plant operators may be contacted if any corrections are required. When the final consumption figures are established, CBS will calculate the current combustion emissions for each plant, and submit these data as such to the PRTR. Energy statistics are included in the consumption figures in the file for calculating the IPCC greenhouse gas emissions (Energy statistics). See section 2.1 for a detailed description of the calculation and processing of the IPCC combustion emissions.
Information on the population of industrial biological waste water treatment plants and related volumes of waste water treatment is compiled from a database of Statistics Netherlands for the years 1993-2016 as well as from data from the AER's on volumes of waste water. For a short description of the method to determine the volumes of industrial waste water treated in industrial biological waste water treatment plants see Geertjes & Baas, 2022 (in Dutch, in preparation). Data on 2017-2020 are a copy of the 2016 values. Next year, an update of the AER reporting will facilitate compilation of yearly actual data on 2022 and future years.

3.4.3.4.3 Emission factors

The emission factors for combustion used are the standard emission factors of in section 3.2.
The emissions are calculated by multiplying fuel consumption (in GJ) by the emission factors. No supplemental estimate is made because observational data are complete here.

The process emissions of Toluene and Benzene from domestic wastewater handling are determined on the basis of specific emission factors and country-specific activity data for the number of capita connected including the extra fraction of industrial and commercial wastewater. For description of the full methodology, see STOWA (2014).

Emission = PE * EFPLANT

Definitions
PE = actual load in inventory year, expressed in Pollution Equivalents (persons)
EFPLANT = emission factor
For Benzene EFPLANT = 7 mg per PE (STOWA, 2014)
For Toluene EFPLANT = 250 mg per PE (STOWA, 2014)

The number of Pollution Equivalents in fact is a proxy for the total number of persons connected to the public WWTP's, including the industrial, commercial and urban run-off fraction of the incoming waste water. One P.E. equals the average amount of waste water - and degradable pollutants contained in it - from one person per day. The P.E. is implemented as national standard in Dutch waste water management and is determined at all public WWTP's on basis of measurements of (average) daily COD and Nitrogen-Kjeldahl loads in the influent. The PE is calculated as

PE = (COD + 4,57*Nkjeldahl)/150

Definitions:
COD = daily load of COD in influent of WWTP, gram COD/day
Nkjeldahl = daily load of Nkjeldahl-N in influent of WWTP, gram Nkjeldahl-N/day
150 = gram of oxygen needed to convert degradable pollutants of one person per day
The activity data needed to calculate the PE are taken from yearly statistics on Urban Waste Water Treatment, compiled by Statistics Netherlands.

The process emission of NMVOC emissions from biological industrial waste water treatment are calculated using the TIER 2 method from the EMEP/EEA air pollutant emission inventory guidebook – 2019:

Emission = Volume treated * EF

Definitions:
Volume treated = total volume of industrial wastewater biologically treated (m3)
EF = emission factor NMVOC = 15 mg NMVOC/m3 wastewater biologically treated (default)
For method of compiling the activity data on volumes of waste water: see 3.4.3.4.2.

3.5 Emissions from oil and gas extraction, transport and distribution

The emissions from oil and gas extraction, oil and gas transport, and gas distribution are established for the ten Emission Sources (ESs) listed in Table 59.

Table 59 Emission sources in the sector NACE 06-09 Oil/gas extraction & oil and gas transport and distribution

ES CODE	EMISSION SOURCE
0020400	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore
0020502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities
0800200	Gas distribution
6800100	Gas transport
8120000	NACE 06: Extraction of crude oil and natural gas, flaring, offshore
8120001	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore
8120002	NACE 06: Extraction of crude oil and natural gas, venting, offshore
8120500	NACE 06: Extraction of crude oil and natural gas, flaring, onshore
8120502	NACE 06: Extraction of crude oil and natural gas, venting, onshore
8120503	NACE 495: Transport of oil via pipelines

3.5.1 Calculation method of preliminary emission figures

3.5.1.1 Oil and gas extraction

Generally the calculation of preliminary emissions is performed in the same way as the calculation of the final emissions. See the description in section 3.5.2. Only emissions for gas transport are calculated in a different way.

ES_CODE 6800100 Gas transport

The preliminary emissions from gas transport are calculated by increasing the emissions of the previous year by the factor *Emission reporting year / Emission previous year* from Gasunie's Annual Corporate Social Responsibility Report (Gasunie SHE, various years).

3.5.2 Calculation method of final emission figures

The calculation methods for each emission source of the emission to air are described below. The calculation method for the greenhouse gases is similar to the Air IPCC method and is described in paragraph 2.4.

3.5.2.1 Extraction of crude oil and natural gas

ES_CODE 0020502 NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities

Emission estimates of SO_2 and NO_x.

Because of their low volumes the emissions are not split up into onshore and offshore but reported in the eAERs as a sum. For all substances this is equal to the sum of the emissions from drilling activities reported in the AERs of the extraction companies. The total SO_2 and NO_x emissions are included in the database as combustion emissions

Activity data

Volume of natural gas (TJ) used as fuel. This value is established by dividing CO_2 (IPCC) emissions (in ton) by the emission factor of 56.8

(ton/TJ). The CO_2 emissions are established by adding up the total reported CO_2 emissions from drilling activities of the individual extraction companies from the eAERs.
If the eAERs have not all been accepted by the competent authorities the preliminary data are equated with the final data of the previous year. The preliminary activity rates are established using the same method as the emissions.

ES_CODE 0020400 SBI 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore
Emission estimates of the NMVOS, benzene, NO_x and SO_2

Method:
- NMVOC, NO_x and SO_2: Sum of all emissions from the individual eAERs.
- Benzene is not reported in the eAERs, but the emission is derived from the eAERs by using a VOC profile based on a benzene/methane ratio of *20.6/1000*. The benzene emission from onshore activities is allocated to this ES_CODE in its entirety, but is derived from the sum of all CH_4 emissions reported in the individual eAERs under onshore venting, fugitive, flaring and production.

The total NO_x and SO_2 emissions are all included in the database as combustion emissions. The total NMVOC and benzene emissions as process emissions.

Activity data
Volume of natural gas (TJ) used as fuel.
Source up to and including 2010: The total volume of natural gas (TJ) used as fuel, both onshore and offshore, is taken from the Netherlands Enterprise Agency's Annual Results of MJA. From 2011 on the volume of natural gas used as fuel is no longer published, but may be obtained from the Netherlands Enterprise Agency (RVO.nl, personal information). The underlying emissions are taken from the MJA-module in the eAERs of the oil and gas operators. The total volume of natural gas used as fuel is divided according to the onshore and offshore CO_2 emissions.

If the eAERs have not all been accepted by the competent authorities the preliminary data are equated with the final data of the previous year. The preliminary activity rates are established using the same method as the emissions.

ES_CODE 8120001 SBI 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore.
The emissions and activity data are established in the same way as described above for "onshore extraction".

3.5.2.2 Oil and gas transport
ES_CODE 6800100 Gas transport
Emission estimates of NMVOC and NO_x

The total NO_x, CO_2 and CH_4 emissions of gas transport were obtained from Gasunie Nederland (GUN). Up to and including 2008 and from 2013 on these data were taken from the Gasunie Annual Report, section on Safety, Health and Environment (SHE). From 2009-2012 these data were published in the separate Gasunie Annual Corporate Social Responsibility Report, in which all environment-related data are included (Gasunie SHE, various years).

The total NMVOC emission is calculated as follows:
- Total VOC = 1.09 * volume of CH_4
- NMVOC = Total VOC –CH_4 volume

The factor of 1.09 is based on a profile used by Gasunie (Gasunie, various years).
Some of these emissions are already listed in the PRTR under individual companies (PRTR-I). The emission of the supplemental estimate is calculated as follows:

Supplemental estimate emission = Total emission – PRTR-I emission

Activity data
Volume of transported natural gas in billion m^3 obtained from Gasunie Nederland (GUN). Captive consumption of natural gas in million m^3 is converted to TJ using a factor 31.65 MJ/m^3.

3.5.2.3 Gas distribution

ES_CODE 0800200 Gas distribution
Emission estimate NMVOS
The NMVOC emission is established as follows:
- Total VOC = 1.09 * volume of CH_4
- NMVOC = Total VOC – volume of CH_4

where:
The factor of 1.09 is based on a substance profile used by Gasunie (Gasunie, various years).

The total NMVOC emissions are all included in the database as process emissions. As described in paragraph 2.4, the total CH_4 emissions in m^3 are taken from the “Methaanemissie door Gasdistributie” Netbeheer Nederland (Association of Energy Network Operators in the Netherlands) and compiled by KIWA.

Activity data:
The volume of distributed natural gas (in billion m^3) is included in the CRF. Data Source is the annual report “*Methaanemissie door Gasdistributie”* (KIWA, several years). In case the delivery of this report is delayed and the report is not available for establishing the preliminary data, these data is established by multiplying the final data of the previous year by the ratio *Domestic natural gas consumption reporting year / Domestic natural gas consumption previous year* as published by Statistics Netherlands (CBS) on Statline.

4 Quality

The annual project plan the of Dutch Pollutant Release and Transfer Register RIVM (RIVM, 2019) describes the tasks and responsibilities of the parties involved in the PRTR process, such as deliverables, time schedules (planning) and emissions estimation methods as well as those of the members of several Task Forces. The annual work plan also describes the general QC activities to be performed by the Task Forces before the annual database is consolidated. As part of its National System regarding greenhouse gases the Netherlands has developed and implemented a QA/QC programme. This programme is re-assessed and updated annually (RVO, 2015).
In the annual National Inventory Report (NIR) and Informative Inventory Report (IIR) the quality verification actions are described in a special paragraph.

4.1 General quality control

The ER work package leaders check that:

1. the basic data are well documented and adopted (check for typing errors, use of the correct units and correct conversion factors);
2. the calculations have been implemented correctly;
3. assumptions are consistent, also whether specific parameters (e.g. activity data) are used consistently;
4. complete and consistent data sets have been supplied.

Any actions that result from these checks are noted on an ‘action list’ by the ER secretary. The work package leaders carry out these actions and they communicate by e-mail regarding these QC checks, actions and results with the ER secretary.

While adding a new emission year the work package leader performs a trend analysis, in which data from the new emission year are compared with data from the previous emission year. The work package leader provides an explanation if the increase or decrease of emissions exceeds the minimum level of 5% at target group level or 0.5% at national level. These explanations are also sent by e-mail to the ER secretary by the work package leaders. The ER secretary keeps a logbook of all these QC checks and trend explanations and archives all concerned e-mails on the ER network. This shows explicitly that the required checks and corrections have been carried out. Based on the results of the trend analysis and the feedback on the control and correction process (‘action list’) the Working Group on Emissions Monitoring (WEM) gives advice to the institute representatives (Deltares on behalf of Rijkswaterstaat, Statistics Netherlands (CBS) and Netherlands Environmental Assessment Agency (PBL)) to approve the dataset. The ER project leader at RIVM defines the dataset, on receipt of an e-mail by the institute representatives, in which they give their approval.
Furthermore, all changes of emissions in the whole time series as a result of recalculations are documented in CRF table 8(b).

In order to check the quality of the emission figures for the sources, general QA/QC procedures have been followed that are in line with the IPCC guidelines. These are described further in the QAQC programme used by the National System, and the annual working plans published by the ER.

4.2 Quality of the several emission sources

The quality of emission figures depends on the method. For that reason, the quality of the figures is described for each section.

Quality of individual company emissions
The emission figures of individually registered companies are yearly collected, revised, supplemented and reported in a consistent manner. The reports are validated by several relevant competent authorities after publication. Therefore, the basis for these figures is to be considered as relatively robust.

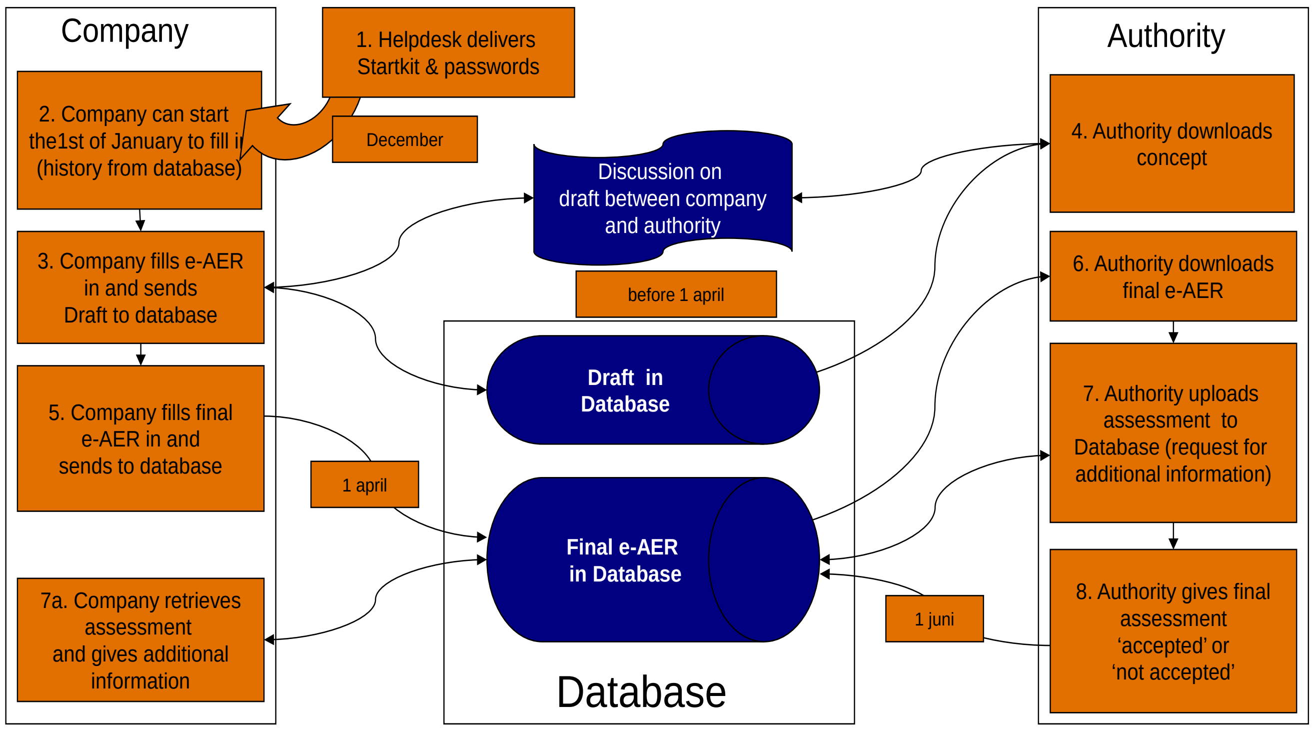
There are three mechanisms in place to maximise the data quality before publication.
In the first place, within the software used (producing the eAER) several checks and balances are integrated, helping the companies and the competent authorities as well. As a basis there is a check on consistency with earlier reported years: depending on the pollutant, new emission data is marked red when the emission entered differs more than a certain percentage from the emission assessed the year before. The percentages depend on the pollutant. When a pollutant is introduced that was not reported in earlier years the new emission is shown by a different colour.
Furthermore, within the software there is a consistency check on the total amount of fuels used and the total amount of CO_2 emission reported. CO_2 emissions are calculated by multiplying the reported fuel consumption with the heat content (specified by the company) and default emission factors. These reported and calculated CO2 emissions are compared and a warning is shown if there is a difference of more than a certain percentage. Also the fuel usage is compared for all fuels that has been entered in the air emissions module and for all fuelsthat has been entered in the independent energy module (which is part of the eAER).
When the company users specify energy contents of fuels outside the expected ranges they are prompted for explanation. The total mass consistency of the various fractions of PM (TSP, PM_{10}, $PM_{2.5}$) is checked within eAER. Analogous checks have been built in the eAER software for NMVOCs, where the companies either can specify NMVOC components adding up to the total VOC-emission or can choose a default profile. Generally speaking, the eAER software allows the companies to overrule all checks and balances, but in such cases an explanation is prompted.

The eAER tooling has a second mechanism to ensure the quality of the data: before a dataset of a facility can be published to the competent authority the data is electronically checked to avoid inconsistencies. For example, when companies enter an emission of a certain pollutant they are requested to make reference to the methodology used.

And as a third general mechanism members of the ENINA taskforce assist the local competent authorities every year by checking the most relevant emissions. The eAER system is used to advice the company users and competent authorities by placing specific remarks and questions for additional explanations at specific points when the yearly eAERs are still in preliminary stage.

Also after publication and acceptance of the data by the competent authority the emission reports are systematically screened for errors by the ENINA taskforce. Most striking example probably is the CO_2 screening, which involves a comparison of the reported fuel consumption with the reported CO_2 emissions using standard emission factors (Zijlema, 2022). Deviant emissions are deleted from the emission file if no adequate explanation is provided (see also 3.1.2.1).

Supplemental estimates for individually registered companies whose emissions are below reporting threshold are compared to previous years and to the emissions from the entire sector. These emissions are less accurate, since they do not take into account the differences between the individual companies.



Quality of the combustion emissions
Quality checks for GHG emissions:
The fuel consumption according to the Energy statistics corresponds to the fuel consumption which is used in the calculation of greenhouse gas emissions. Since the energy use by mobile sources is calculated by the Task Force Traffic and Transport, it is checked that the consumption by mobile sources is not included in the calculation of emissions from stationary sources.
Furthermore, the energy consumption of the final year is compared with the energy consumption of the previous year. It is also verified that the changes in the activity data can be explained by known developments, such as the shift to coal (due to the lower prices) or the reduced natural gas use (due to a warmer winter).

The emissions of the final year are compared to emissions from the previous year. It is verified that the changes can be explained by known developments.
Also additional checks are performed:
- Is the emission factor applicable for that year used for natural gas?
- Are the company-specific emission factors for coal and residual gases used in the calculation?
- Are the additional CH_4 emissions from gas engines added?

Quality checks for non GHG emissions:
The following checks are performed:
- The energy consumption of year t is compared with the energy consumption of year t-1. It is verified that the changes in the activity data can be explained by known developments.
- The emissions of year t are compared with emissions from year t-1. It is verified that the changes can be explaned by trends in the energy consumption or changes in emission abatement .

Quality of the process emissions
Quality checks for process emissions are part of the overall QA/QC. In addition the consistency of the fractions of PM_{10} and $PM_{2.5}$ is checked.

Quality of the emissions from waste disposal
Quality checks for incineration, landfilling and composting are part of the overall QA/QC (Wever, 2020).

Quality of the emissions in the oil and gas sector.
Quality checks for emissions in the oil and gas sector are part of the overall QA/QC procedures of the Dutch Pollutant Release and Transfer Register.
Until 2013 the eAER emissions of the oil- and gas operators were not included in the checking mechanism of members of the ENINA taskforce to assist the local competent authorities. This situation was historically caused by a different competent authority of the oil and gas industries compared to other industrial companies. Competent authority for the oil and gas operators is State Supervision of Mines (Ministry of Economic Affairs). From 2014 on arrangements were made with State Supervision of Mines to include the oil and gas operators in the advising process of ENINA.

4.3 Uncertainty

Uncertainty of the emissions is estimated based on expert judgements. The uncertainty of greenhouse gases has been estimated in 2013 by the several emission experts with individual expert elicitation discussions (for each expert separately).
The uncertainty of emissions from waste incineration and landfilling has been estimated with an approach 1 uncertainty calculation (error propagation).

The uncertainty of NEC-pollutants (NO_x, SO_x, NH_3, NMVOC, PM) has been estimated in 2016 by the several emission experts in an expert elicitation workshop (with all the experts together).

Both the individual expert elicitation and the expert elicitation workshop were set up following the expert elicitation guidelines in the IPCC 2006 Guidelines. The expert elicitation contained the following steps:

1. Motivating: The expert elicitation method was explained to the experts, including a description of possible biases.
2. Structuring: The emission sources for which the uncertainty needed to be estimated were provided to the experts prior to the elicitation. Uncertainty needed to be estimated for activity data and emission factor separately, unless the expert indicated that it was not possible to define these separately from each other.
3. Conditioning: The expert explained the method, and all relevant data have been discussed.
4. Encoding: The expert quantifies the uncertainty for each emission source
5. Verification: The uncertainty is analysed and checked with the expert. Afterwards, an overview of the uncertainty estimates is provided to the experts and the experts could provide feedback on the uncertainty estimates.

The uncertainty estimates are used in a Monte Carlo analysis to evaluate the total uncertainty of the emissions. For most emission sources, the uncertainty is estimated for the activity data and emission factor of a specific emission source and this uncertainty is included in the Monte Carlo analysis. For some emission sources, other expert judgements were made that deviated from the standard uncertainty estimate:

- For some emissions sources, only an estimate of the emission was made (without an uncertainty estimate for the activity data and emission factor separately). In this case, the uncertainty is included in the Monte Carlo analysis as an emission factor uncertainty. The uncertainty of the activity data is set to 0.
- In some cases, there was only an uncertainty estimation for a group of emission sources together. For example, there was an uncertainty estimate of the natural gas use in industry and not for all of the industrial sectors separately. If uncertainty is only estimated for a group of emission sources, then this is included in the Monte Carlo analysis as one grouped (correlated) uncertainty for all the relevant emission sources. When samples of the activity data are drawn in the Monte Carlo analysis, it is ensured that the total of the individual samples of activity data (for example the samples for natural gas use in each sector

separately) is equal to the sample of the total activity data (for example the sample for the total natural gas use in industry).

In some cases, the emission factor in one emission source is correlated to a similar emission factor in another emission source. For example, the CO_2 emission factor of natural gas in different industrial sectors are correlated to each other. This means that it is expected that the emission factors will show similar deviations. If the CO_2 emission factor of natural gas in the food industry would be 2% too low, then it is expected that the CO_2 emission factor of natural gas in the clothing industry is also 2% too low. In this case, the emission factor uncertainty is included in the Monte Carlo analysis as one (correlated) uncertainty estimate for all the emission factors of natural gas in the several sectors. When a sample is drawn in the Monte Carlo analysis for the CO_2 emission factor of natural gas, this sample is used for all the relevant emission sources where this emission factor is used. Results of the Monte Carlo analyses are shown in the National Inventory Report for greenhouse gases (NIR) and the Informative Inventory Report of air pollutants (IIR).

Information about uncertainties of greenhouse gases and NEC-pollutants are included in a confidential report.
The ENINA Task Force can provide this information to official review teams (after they have signed a confidentiality agreement).

5 Recalculations

The task forces responsible for the emission calculations may decide to amend the method between two subsequent years if it becomes apparent that improvements are possible. The recalculations for the IPCC methodology (chapter 2) are approved by the Advisory Board NIE before they are implemented. The method amendments are explained in this chapter.

Air IPCC

- A new estimation method is introduced to recalculate the series 2F6 (HFC's from other use) from 2015 tot 2020, instead of keeping constant.

Air Actual

- New NOx emission factors were determined for small combustion installations (services and agriculture sectors)

6 Emission characteristics

Emission characteristics are supplemental data needed by atmospheric dispersion and transformation models in order to enable the operation of these models. The emission characteristics are very specific for the emission sources and are therefore most efficiently collected simultaneously with the emission data.
Characteristics of emissions concern all specifications of emissions, including height, outflow area and coordinates of the sources and the thermal content of the emission flow. These are important parameters for modelling the dispersal of air pollutants. The emission characteristics of the different sectors have been established and elaborated by Dröge et al. (2010). These emission characteristics are used to model the air quality for the GCN maps showing large-scale concentrations.

Emission characteristics of individual companies have been established. All emission points (fluxes, ventilation registers, storage yards, etc.) are included in this. For the other sectors, sector-specific emission characteristics have been established by derivation. The table below shows these emission characteristics (from Dröge et al., 2010).

Table 60 Sector-specific emission characteristics. H = Height above ground level (metre) and T = Thermal content of the emission plume (MW)

GCN	**Sector**	**SO_2**		**NO_x**		**PM_{10}**		**$PM_{2.5}$**	
		H	**T**	**H**	**T**	**H**	**T**	**H**	**T**
1100	Food, beverages and tobacco	15	0.34	15	0.34	22	0.92	22	0.92
1300	Chemical	12	0.13	12	0.175	11	0.10	11	0.10
1400	Construction materials	24	0.59	17	0.44	10	0	10	0
1500	Base metal	12	0.04	13	0.05	15	0	15	0
1700	Machining	10	0	10	0	10	0	10	0
1800	Other industry	22	0.28	22	0.28	10	0	10	0
2100	Energy production	40	0.22	40	0.22	40	0.22	40	0.22
2200	Onshore oil and gas extraction	5	0.15	5	0.15	5	0.15	5	0.15
2200	Offshore oil and gas extraction	50	0.15	50	0.15	50	0.15	50	0.15
4300	Greenhouse heating	8	0.4	8	0.4	8	0.4	8	0.4
5100	Waste processing	3.5	0.5	3.5	0.5	3.5	0.5	3.5	0.5
6100	WWTPs	10	0.375	10	0.375	10	0.375	10	0.375
6200	Collection/purification/distribution of drinking water	8	0.014	8	0.014	8	0.014	8	0.014
6400	Other Commercial & Governmental Institutions	4	0	11	0.014	4	0	4	0
7100	Construction	4.5	0	4.5	0	4.5	0	4.5	0
8100	Residential combustion	10	0	11	0	9	0	9	0

Table 61 Sector-specific emission characteristics. H = Height above ground level (metre) and T = Thermal content of the emission plume (MW), continued

GCN	**Sector**	**NH_3**		**CO**		**C_6H_6**	
		H	**T**	**H**	**T**	**H**	**T**
1100	Food, beverages and tobacco	50	1.22	15	0.34	15	0.34
1300	Chemical	12	0.13	12	0.13	12	0.13
1400	Construction materials	24	0.59	24	0.59	24	0.59
1500	Base metal	13	0.05	13	0.05	13	0.05
1700	Machining	10	0	10	0	10	0
1800	Other industry	22	0.28	22	0.28	22	0.28
2100	Energy production	40	0.22	40	0.22	40	0.22
2200	Onshore oil and gas extraction	5	0.15	5	0.15	5	0.15
2200	Offshore oil and gas extraction	50	0.15	50	0.15	50	0.15
4300	Greenhouse heating	8	0.4	8	0.4	8	0.4
5100	Waste processing	20	0	3.5	0.5	3.5	0.5
6100	WWTPs	10	0.375	10	0.375	10	0.375
6200	Collection/purification/ distribution of drinking water	8	0.014	8	0.014	8	0.014
6400	Other Commercial & Governmental Institutions	6	0	11	0.014	11	0.014
7100	Construction	4.5	0	4.5	0	4.5	0
8100	Residential combustion	9	0	9	0	9	0

7 Spatial allocation

Emissions are calculated on the national level. Because the emission figures are also used for air quality modelling, spatial allocation of emissions is important. For emissions sources that are not registered individually, national emission totals are allocated according suitable proxy data. In this way for instance, road traffic emissions are allocated on the basis of the number of vehicles per road type and agricultural emissions based on the number of livestock per shed type. Emissions of individual companies are directly linked to a coordinate. Many of the supplemental estimations mentioned in this report are spatially allocated by the number of employed persons of companies with NACE codes that are connected to the emission sources (ES). Each emission source has a specific allocation proxy. See www.emissieregistratie.nl for more information about the proxies applied for spatial allocation.

8 Terminology

AD	Activity Data
AER	Annual Environmental Report (Dutch acronym: MJV)
CBS	Statistics Netherlands
CFC	Chlorofluorocarbons
CH_4	Methane
CHP	Combined Heat and Power
CLRTAP	Convention on Long-Range Transboundary Air Pollution (UN-ECE)
CO	Carbon monoxide
CO_2	Carbon dioxide
CRF	Common Reporting Format (of emission data files, annexed to an NIR)
DOC	Degradable Organic Carbon
eAER	electronic Annual Environmental Report (Dutch acronym: eMJV)
EEA	European Environment Agency
EF	Emission Factor
EMEP	European programme for Monitoring and Evaluation of long-range transmission of air Pollutants
ENINA	Task Group Energy, Industry and Waste Handling
EPRTR	European Pollutant Register and Transfer Register
ER-I	Emission Registration, Individual facilities
ES	Emission source
ETS	Emission Trading System
ESD	Effort Sharing Decision
EU	European Union
EURAL	European unified list of waste categories
EVOA	EVOA: Waste shipment permit (Regulation (EC) No 1013/2006)
F-gases	Group of fluorinated compounds comprising HFCs, PFCs, CH_4, NF_3
FGD	Flue Gas Desulphurisation
FO-I	Dutch Facilitating Organisation for Industry
GCN	Maps of background concentrations with legal status on behalf of environmental permitting
GHG	Greenhouse Gas
GPG	Good Practice Guidance
GWP	Global Warming Potential
GUN	Gasunie Nederland
HCB	Hexachlorobenzenes
HCFC	Hydrochlorofluorocarbons
HFC	Hydrofluorocarbons
HHW	Household Hazardous Waste
IEA	International Energy Agency
IEF	Implied Emission Factor
IPCC	Intergovernmental Panel on Climate Change
ISTS	Individual Sewage Treatment System
IWWTP	Industrial Wastewater Treatment Plant
KNB	Royal Dutch Construction Ceramics Association
LEI	agricultural economics institute

LMA	National registration centre for waste
MCF	Methane Conversion Factor
MJA	Multiple year agreement about energy efficiency
MJV	annual environmental report
MSW	Municipal Solid Waste
MMR	Monitoring Mechanism Regulation
MW	Mega Watt
N_2O	Nitrous oxide
NACE	statistical classification of economic activities in the European Union of 2008: Nomenclature générale des Activités économiques dans les Communautés Européennes (Dutch acronym: SBI)
NAM	Nederlandse Aardolie Maatschappij
NAV	Dutch association of aerosol producers
NCV	Net Calorific Value
NEa	Dutch emissions authority
NEC	National Emission Ceilings
NH_3	Ammonia
NF_3	Nitrogentrifluoride
NIE	National Inventory Entity
NIR	National Inventory Report (annual greenhouse gas inventory report to UNFCCC)
NMVOC	Non Methane Volatile Organic Compounds
NOGEPA	Netherlands Oil and Gas Exploration and Production Association
NO_x	Nitrogen oxides
NVPU	Netherlands Association of polyurethane hard foam manufacturers
ODS	Ozone Depleting Substances
PAH	Polycyclic Aromatic Hydrocarbons
PBL	Netherlands environmental assessment agency
PFC	Perfluorocarbons
PM	Particulate matter
PM_{10}	Particulate matter (< 10 micrometer)
$PM_{2.5}$	Particulate matter (< 2.5 micrometer)
PRTR	Pollutant Release and Transfer Register
PRTR-I	Pollutant Release and Transfer Register – of Individual companies
PeCB	Pentachlorobenzenes
QA	Quality Assurance
QC	Quality Control
RHW	Residual Household Waste
RIVM	National institute for public health and the environment
RVO	Netherlands Enterprise Agency
SBI	Standaard bedrijven indeling (see NACE)
SCR	Selective Catalytic Reduction
CH_4	Sulphur hexafluoride
SNCR	Selective Non-Catalytic Reduction
SO_2	Sulphur dioxide
t-1	Last year
t-2	Year before last year
TOC	Total Organic Carbon
TNO	Netherlands organisation for applied scientific research
TSP	Total Suspended Particulates

UNFCCC	United Nations Framework Convention on Climate Change
UR	Undefinable Residues
VOC	Volatile Organic Compound
VELATEC	Welding technology association
VOM	Materials Surface Treatment Association
VVVF	Association of Paint and Printing Ink Manufacturers
WAR	Working group on waste registration
WIP	Waste Incineration Plant
WWTP	Wastewater Treatment Plant

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Appendix 1 Emission Sources

ES code	Process description (English)	Process description (Dutch)	CRF	Section
0012100	Residential combustion	SBI: Huishoudens, verbrandingsemissies	1.A.4.b.i	2.1
0012101	Residential combustion, appliances, gas leakage before ignition	SBI: Huishoudens, verbrandingsemissies (gasslip)	1.A.4.b.i	2.1 and 3.2
0012102	Residential combustion, space heating	Vuurhaarden consumenten, hoofdverwarming woningen		3.2
0020400	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore	SBI 06/09.1: Aardolie- en gaswinning en dienstverlening voor de aardolie- en aardgaswinning, onshore (PBL)	1.A.1.c	2.4 and 3.5
0020401	NACE 41-43: construction and building industries	SBI 41-43: Bouwnijverheid	1.A.2.g.v	2.1 and 3.2
0020405	NACE 84: public administration, governmental institutions and compulsory social insurance	SBI 84: Openbaar bestuur, overheidsdiensten en verplichte sociale verzekeringen		3.2
0020500	Commercial and governmental institutions	Handel, diensten, overheid	1.A.4.a.i and 2.D.1	2.1, 2.2 and 3.2
0020502	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities	SBI 06/09.1: Aardolie- en gaswinning en dienstverlening voor de aardolie- en aardgaswinning, booractiviteiten	1.A.1.c	2.4 and 3.5
0120000	Solvent and other product use: air conditioning equipment, mobile	Wegverkeer airco mobiel	2.F.1	2.2
0401200	NACE 0: other agriculture, hunting and services to agriculture and hunting	SBI 0: Overig landbouw, jacht en dienstverlening voor de landbouw en jacht	1.A.4.c.i	2.1
0401201	Combustion in agricultural buildings	Vuurhaarden landbouw	1.A.4.c.i	2.1 and 3.2
0401202	Combustion in agricultural greenhouses	Vuurhaarden landbouw, glastuinbouw		3.2
0444900	Indirect related to waste water	Emissies indirect t.g.v. N-emissies afvalwater N_2O	5.D.1	2.3 and 3.4
0800200	Gas distribution network	Gasdistributie	1.B.2.b.5	2.4 and 3.5
0800700	Residential combustion, cooking	Vuurhaarden consumenten, koken		3.2
0800800	Residential combustion, hot water	Vuurhaarden consumenten, warm water voorziening		3.2
0811301	Propellants and solvents in aerosol cans consumers	Drijfgassen en oplosmiddellen spuitbussen consumenten	2.F.4	2.1 and 3.3
0811302	Propellants and solvents in aerosol cans commercial and governmental institutions	Drijfgassen en oplosmiddel spuitbussen HDO	2.F.4	3.3
0833400	NACE 52.10/52.24: cargo handling and storage	SBI 52.10/52.24: Laad-, los- en overslagactiviteiten en opslag		3.3
0834000	NACE 35.11: production of electricity, flue gas desulphurization	SBI 35.11: Productie van elektriciteit, rookgasontzwaveling	2.A.4.d	2.2

ES code	Process description (English)	Process description (Dutch)	CRF	Section
1810100	Cleaning solvents commercial and governmental institutions	Oplosmiddelen/reiningen HDO	2.F.5	3.3
1810400	Fire extinguishers commercial and governmental institutions	Brandblussers HDO	2.F.3	3.3
6800100	Gas transport network	Gastransport	1.A.3ei gaseous and 1.B.2.b.4	2.4 and 3.5
6800201	Natural gas use CHP agriculture	Aargasverbruik WKK landbouw	1.A.4.c.i	3.2
6800202	Natural gas use non-CHP agriculture	Aargasverbruik niet-WKK landbouw	1.A.4.c.i	3.2
8120000	NACE 06: extraction of crude oil and natural gas, flaring, offshore	SBI 06: Aardolie- en gaswinning, flaring, offshore (PBL)	1.B.2.c.2.iii	2.4 and 3.5
8120001	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore	SBI 06/09.1: Aardolie- en gaswinning en dienstverlening voor de aardolie- en aardgaswinning, offshore (PBL)	1.A.1.c	2.4 and 3.5
8120002	NACE 06: extraction of crude oil and natural gas, venting, offshore	SBI 06: Aardolie- en gaswinning, venting, offshore (PBL)	1.B.2.c.1.iii	2.4 and 3.5
8120500	NACE 06: extraction of crude oil and natural gas, flaring, onshore	SBI 06: Aardolie- en gaswinning, flaring, onshore (PBL)	1.B.2.c.2.iii	2.4 and 3.5
8120502	NACE 06: extraction of crude oil and natural gas, venting, onshore	SBI 06: Aardolie- en gaswinning, venting, onshore (PBL)	1.B.2.c.1.iii	2.4 and 3.5
8120503	NACE 495: Transport of oil via pipelines	SBI 495: Olietransport via pijpleidingen	1.B.2.a.3	2.4 and 3.5
8900200	NACE 10-12: manufacture of food products, beverages and tobacco	SBI 10-12: Voedings- & genotmiddelenindustrie	1.A.2.e	2.1, 3.2 and 3.3
8900205	NACE 10.810 sugar production, lime production	SBI 10.810: Vervaardiging van suiker: productie van kalk	2.A.2.	2.2
8900300	NACE 13/14: manufacture of textiles and textile apparel	SBI 13/14: Vervaardiging van textiel en kleding	1.A.2.g.vi	2.1 and 3.2
8900400	NACE 15: leather industry and fur preparation	SBI 15: Lederindustrie en bontbereiding	1.A.2.g.vi	2.1 and 3.2
8900600	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	SBI 17.1/17.2: Vervaardiging van pulp, papier, karton, papier- en kartonwaren	1.A.2.d	2.1 and 3.2
8900601	NACE: unknown industry	SBI onbekend: Industrie, n.n.b. Overige industrie	1.A.2.g.viii	2.1
8900700	NACE 18/58: publishing, printing and reproduction of recorded media	SBI 18/58: Uitgeverijen, drukkerijen, reproductie van opgenomen media	1.A.2.d	2.1, 3.2 and 3.3
8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds	SBI 20.15: Vervaardiging van kunstmeststoffen en stikstofverbindingen	1.A.2.c and 2.B.1	2.1, 3.2 and 3.3
8901100	NACE 20.1: manufacture of basic chemicals	SBI 20.1: Vervaardiging van chemische basisproducten	1.A.2.c, 2.B.8.g and 2.D.1	2.1, 2.2 and 3.2
8901700	NACE 22.1: manufacture of rubber products	SBI 22.1: Vervaardiging van producten van rubber		3.3
8901702	NACE 22: manufacture of rubber and plastic products	SBI 22: Vervaardiging van producten van rubber en	1.A.2.c	2.1 and 3.2

ES code	Process description (English)	Process description (Dutch)	CRF	Section
		kunststof		
8901706	NACE 22.1: manufacture of rubber products, diffuse	SBI 22.1: Vervaardiging van producten van rubber, diffuus		3.3
8902100	NACE 25: manufacture of metal structures and parts of structures	SBI 25: Metaalproductenindustrie (exclusief machinebouw)	1.A.2.g.vi ii	2.1 and 3.2
8902200	NACE 28: manufacture of machinery	SBI 28: Machinebouw	1.A.2.g.i	2.1 and 3.2
8902301	NACE 26/28: manufacture of machinery and electronic apparatus	SBI 26/28: Machinebouw en electronische aparaten	1.A.2.g.vi ii	2.1 and 3.2
8902302	NACE 26/27: electro technical industry	SBI 26/27: Elektrotechnische industrie	2.C.7	2.2
8902303	NACE 27: manufacture of electrical apparatus	SBI 27: Vervaardiging van elektrische apparatuur	1.A.2.g.vi ii	2.1 and 3.2
8902304	NACE 26: manufacture of computers and electronic and optical apparatus	SBI 26: Vervaardiging computers en elektronische en optische apparatuur	1.A.2.g.vi ii	2.1 and 3.2
8902400	NACE 29: motor-industry	SBI 29: Auto-industrie	1.A.2.g.ii	2.1 and 3.2
8908000	NACE 31/32: manufacture of furniture and other goods	SBI 31/32: Vervaardiging van meubels en overige goederen	1.A.2.g.vi ii	2.1 and 3.2
8908100	NACE 30: manufacture of other transport equipment	SBI 30: Overige transportmiddelen	1.A.2.g.ii	2.1 and 3.2
8910000	NACE 10.1: processing and preserving of meat and poultry	SBI 10.1: Slachterijen en vleesverwerking		3.3
8910300	NACE 10.4: manufacture of oils and fats	SBI 10.4: produktie oliën en vetten		3.3
8910400	NACE 10.5: dairy industry	SBI 10.5: Zuivelindustrie		3.3
8910406	NACE 10.5: dairy industry, diffuus	SBI 10.5: Zuivelindustrie, diffuus		3.3
8910500	NACE 10.6: manufacture of grain mill products, excl. starches and starch products	SBI 10.6: Meelproduktie (excl. zetmeel)		3.3
8910506	NACE 10.6: manufacture of grain mill products, excl. starches and starch products, diffuse	SBI 10.6: Meelproduktie (excl. zetmeel), diffuus		3.3
8910600	NACE 10.9: manufacture of prepared animal feeds	SBI 10.9: Diervoederindustrie	2.H.2	2.2 and 3.3
8910606	NACE 10.9: manufacture of prepared animal feeds, diffuse	SBI 10.9: Diervoederindustrie, diffuus		3.3
8911400	NACE 13.3: finishing of textiles	SBI 13.3: Textielveredeling		3.3
8911500	NACE 13.93: manufacture of carpets and rugs	SBI 13.93: Vervaardiging van vloerkleden en tapijt		3.3
8911700	NACE 15.11: tanning of leather and fur preparation	SBI 15.11: Leerlooierijen en bontbereiding		3.3
8911900	NACE 16.1: sawmilling and planing of wood; impregnation of wood	SBI 16.1: Primaire houtbewerking en verduurzamen van hout		3.3
8912100	NACE 16.23: manufacture of builders' carpentry and joinery	SBI 16.23: Vervaardiging van overig timmerwerk voor de bouw		3.3
8912101	NACE 16: manufacture of wooden products	SBI 16: Houtindustrie en vervaardiging van artikelen van hout, kurk, riet en vlechtwerk	1.A.2.g.iv	2.1 and 3.2

ES code	Process description (English)	Process description (Dutch)	CRF	Section
		(geen meubels)		
8912106	NACE 16: manufacture of wooden products, diffuse	SBI 16: Houtindustrie en vervaardiging van artikelen van hout, kurk, riet en vlechtwerk (geen meubels), diffuus		3.3
8912200	NACE 17.1: manufacture of pulp, paper and paperboard	SBI 17.1: Vervaardiging van papierpulp, papier en karton		3.3
8912300	NACE 17.2: manufacture of articles of paper and paperboard	SBI 17.2: Vervaardiging van papier- en kartonwaren		3.3
8912406	NACE 17: manufacture of paper, paperboard and articles of paper and paperboard, diffuse	SBI 17: Vervaardiging van papier, karton en papier- en kartonwaren, diffuus		3.3
8912500	NACE 19.202: manufacture of refined petroleum products - not oil refineries	SBI 19.202: Aardolieverwerking, excl. raffinage	1.A.1.c	2.1 and 3.2
8912600	NACE 20.12: manufacture of dyes and pigments	SBI 20.12: Vervaardiging van kleur- en verfstoffen		3.3
8912700	NACE 20.13: manufacture of inorganic basic chemicals, production of active carbon	SBI 20.13: Basischemie anorganisch, productie actieve kool	2.B.8.g	2.2
8912702	NACE 20.13: manufacture of inorganic basic chemicals, soda consumption (PBL)	SBI 20.13: Basischemie anorganisch, soda verbruik (PBL)	2.A.4.b	2.2
8912704	NACE 20.13: manufacture of inorganic basic chemicals, production of soda ash (CBS)	SBI 20.13: Basischemie anorganisch, productie soda ash (CBS)	2.B.7	2.2
8912800	NACE 20.14: manufacture of inorganic basic chemicals, charcoal production	SBI 20.14: Basischemie anorganisch, productie van houtskool	1.B.1.b	2.2
8912900	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	SBI 20.149: Basischemie organisch (geen petrochemische producten)	2.B.8.g	2.2 and 3.3
8913000	NACE 20.13: manufacture of inorganic basic chemicals	SBI 20.13: Basischemie anorganisch	2.B.8.g	2.2 and 3.3
8913002	NACE 20.16: manufacture of plastics in primary forms, handling of F-gasses	SBI 20.16: Vervaardiging van kunststof in primaire vorm, handling F-gassen	2.B.9	2.2 and 3.3
8913005	NACE 20.16: manufacture of plastics in primary forms, production of HCFK 22	SBI 20.16: Vervaardiging van kunststof in primaire vorm, productie HCFK 22	2.B.9	2.2 and 3.3
8913100	NACE 20.2: manufacture of pesticides	SBI 20.2: Chemische bestrijdingsmiddelenindustrie		3.3
8913200	NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	SBI 20.3: Vervaardiging van verf, lak, vernis, inkt en mastiek		3.3
8913400	NACE 20.41: manufacture detergents	SBI 20.41: Vervaardiging van was- en schoonmaakmiddelen		3.3
8913600	NACE 20.52: manufacture of glues and adhesives	SBI 20.52: Vervaardiging van lijm en bereide kleefmiddelen		3.3
8913700	NACE 20.2-20.5: chemical products industry	SBI 20.2-20.5: Chemische producten industrie	1.A.2.c	2.1 and 3.2
8913800	NACE 20.6: manufacture of synthetic	SBI 20.6: Vervaardiging van		3.3

ES code	Process description (English)	Process description (Dutch)	CRF	Section
	and artificial fibres	synthetische en kunstmatige vezels		
8913900	NACE 22.2: manufacture of plastic products	SBI 22.2: Vervaardiging van producten van kunststof		3.3
8913906	NACE 22.2: manufacture of plastic products, diffuse	SBI 22.2: Vervaardiging van producten van kunststof, diffuus		3.3
8914000	NACE 23.1: manufacture of glass and glassware	SBI 23.1: Vervaardiging van glas en glaswerk	2.A.3	2.2 and 3.3
8914100	NACE 23.2-23.4: Manufacture of ceramic products	SBI 23.2-23.4: Vervaardiging van keramische producten	2.A.4	3.3
8914101	NACE 23.32: manufacture of ceramic products for the building industries (no (floor) tiles)	SBI 23.32: Vervaardiging van keramische producten voor de bouw (geen tegels en plavuizen)	2.A.4.a	2.2
8914200	NACE 23.32: manufacture of bricks and tiles	SBI 23.32: Vervaardiging van bakstenen en dakpannen		3.3
8914300	NACE 23.6: manufacture of articles of concrete, plaster and cement	SBI 23.6: Vervaardiging van producten van beton, gips en cement	2.A.1	2.2 and 3.3
8914500	NACE 23.9: manufacture of other non-metallic mineral products	SBI 23.9: Vervaardiging van overige niet-metaalhoudende minerale producten		3.3
8914600	NACE 23: construction material and glass industry	SBI 23: Bouwmaterialen- en glasindustrie	1.A.2.f	2.1 and 3.2
8914602	NACE 24.2: manufacture of tubes and pipes	SBI 24.2: Vervaardiging van stalen buizen en pijpen		3.3
8914606	NACE 23: construction material and glass industry, diffuse	SBI 23: Bouwmaterialen- en glasindustrie, diffuus		3.3
8914700	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	SBI 24.4/24.53/24.54: Vervaardiging en gieten van lichte en overige non-ferrometalen	2.C.3	2.2
8914702	NACE 24.45: manufacture of non-ferrous metals, aluminium	SBI 24.45: Vervaardiging van overige non-ferrometalen, aluminium		3.3
8914704	NACE 24.45: Manufacture of non-ferrous metals, copper	SBI 24.45: Vervaardiging van overige non-ferrometalen, koper		3.3
8914705	NACE 24.45: Manufacture of non-ferrous metals, lead	SBI 24.45: Vervaardiging van overige non-ferrometalen, lood		3.3
8914706	NACE 24.45: Manufacture of non-ferrous metals, zinc	SBI 24.45: Vervaardiging van overige non-ferrometalen, zink		3.3
8914800	NACE 30.1: ship-building, painting	SBI 30.1: Scheepsbouw, verven		3.3
8914900	NACE 24.5: casting of metals	SBI 24.5: Gieten van metalen		3.3
8915000	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry	SBI 25-33/95: Metalelektro (exclusief SBI 30.1/33.15)		3.3
8915003	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, painting and dyeing	SBI 25-33/95: Metalelektro (exclusief SBI 30.1/33.15), verven en lakken		3.3
8915005	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, metallic products, (electrical) appliances, instruments,	SBI 25-33/95: Metalelektro (exclusief SBI 30.1/33.15), metalen producten, (electrische) apparaten, instrumenten,	2.D.1	2.2

ES code	Process description (English)	Process description (Dutch)	CRF	Section
	parts	onderdelen		
8915006	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, diffuse release of PM_{10}	SBI 25-33/95: Metalelektro (exclusief SBI 30.1/33.15), diffuus vrijkomend PM_{10}		3.3
8915300	NACE 26/31/32: manufacture of electronic apparatus and furniture	SBI 26/31/32: Vervaardiging van electronische aparaten en meubels	1.A.2.g.viii	2.1 and 3.2
8916000	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	SBI 38.3: Voorbereiding tot recycling	1.A.4.a.i	2.1 and 3.2
8918000	NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products	SBI 10.8: Overige voedingsmiddelenindustrie (exclusief SBI 10.81 en 10.82)		3.3
8918006	NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products, diffuse	SBI 10.8: Overige voedingsmiddelenindustrie (exclusief SBI 10.81 en 10.82), diffuus		3.3
8918106	NACE 13: manufacture of textiles, diffuse	SBI 13: Vervaardiging van textiel, diffuus		3.3
8919200	NACE 24.3: Manufacture of other products of first processing of steel	SBI 24.3: Overige eerste verwerking van ijzer en staal	1.A.2.a	3.2
8919300	NACE 20.59: manufacture of other chemical products n.e.c.	SBI 20.59: Vervaardiging van overige chemische producten n.e.g.		3.3
8919504	NACE 20.11: Manufacture of industrial gases, production of methanol	SBI 20.11: Vervaardiging van industriële gassen, productie methanol	1.A.2.c	3.2
8919512	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals), production of caprolactam (PBL)	SBI 20.149: Basischemie organisch (geen petrochemische producten), productie caprolactam (PBL)	2.B.4	2.2
8919514	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals), production of nitric acid (PBL)	SBI 20.149: Basischemie organisch (geen petrochemische producten), productie salpeterzuur (PBL)	2.B.2	2.2
8919700	NACE 13.20: textile weaving	SBI 13.20: Weven van textiel		3.3
8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	SBI 24.4/24.53/24.54: Vervaardiging en gieten van lichte en overige non-ferrometalen	1.A.2.b and 2.C.3	2.1 and 3.2
8920400	NACE 35: production and distribution of electricity and gas	SBI 35: Productie en distributie van elektriciteit en gas	1.A.1.a	2.1, 3.2 and 3.3
8920500	NACE 36: collection, purification and distribution of water	SBI 36: Winning en distributie van water	1.A.4.a.i	2.1and 3.2
8921800	NACE 38.1/38.2 (partly): waste-incineration plants	SBI 38.1/38.2 (ged.): Afvalverbrandingsinstallaties (AVI's)	1.A.1.a	2.1 and 3.2
8921804	NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	SBI 38.2/84.1: Behandeling van afval inclusief gemeentelijke AVI's	1.A.1.a	2.3 and 3.4
8921900	NACE 39: sanitation and other waste management	SBI 39: Sanering en overig afvalbeheer		3.2

ES code	Process description (English)	Process description (Dutch)	CRF	Section
8922000	NACE 38.1/38.2 (partly): landfill gas companies	SBI 38.1/38.2 (ged.): Stortgasbedrijven	1.A.4.a.i	2.1 and 3.2
8922701	NACE 08: other quarrying and mining	SBI 08: Winning van delfstoffen (geen olie en gas)	1.A.2.g.iii	2.1 and 3.2
8924100	NACE 19.1: manufacture of coke oven products	SBI 19.1: Vervaardiging van cokesovenproducten	1.B.1.b	2.2 and 3.3
8924102	NACE 19.1: manufacture of coke oven products (ACZ)	SBI 19.1: Vervaardiging van cokesovenproducten (ACZ)	1.A.1.c and 1.B.1.b	2.1 and 2.2
8924103	NACE 19.1: production of coke, coke factory Corus	SBI 19.1: Vervaardiging van cokesovenproducten, cokesfabriek Corus	1.A.1.c and 1.B.1.b	2.1 and 2.22.2
8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products	SBI 19.2: Aardolieverwerking (exclusief SBI 19.202)	1.A.1.b and 1.B.2.a.4	2.12.1, 2.2 and 3.2
8924202	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products, terminals	SBI 19.2: Aardolieverwerking (exclusief SBI 19.202), terminals		3.3
8924204	NACE 19.201: manufacture of refined petroleum products	SBI 19.201: Aardolieraffinage	1.B.2.a.4	2.2
8924400	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, consumption of lime (PBL)	SBI 24.1-24.3: Basismetaalindustrie, verwerking en vervaardiging ijzer en staal, kalkgebruik (PBL)	2.A.4.d	2.2
8924401	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, anode use with production of electrosteel	SBI 24.1-24.3: Basismetaalindustrie, verwerking en vervaardiging ijzer en staal, anode-gebruik bij electrostaal productie	2.C.1.c	2.2
8924402	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	SBI 24.1-24.3: Basismetaalindustrie, verwerking en vervaardiging ijzer en staal	2.C.1.a	2.2
8924406	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, diffuse	SBI 24.1-24.3: Basismetaalindustrie, verwerking en vervaardiging ijzer en staal, diffuus		3.3
8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	SBI 24.1-24.3/24.51/24.52: Basismetaal ijzer en staal	1.A.2.a, 2.C.1.f and 2.D.1	2.1, 2.2, 3.2 and 3.3
8924500	Solvent and other product use: aerosol propellant	Oplosmiddel- en ander productgebruik: aerosolen drijfgas	2.F.4	3.3
8924501	Solvent and other product use: foam blowing agents	Oplosmiddel- en ander productgebruik: harde schuimen als isolatiemedium	2.F.2	3.3
8924502	Solvent and other product use: other	Oplosmiddel- en ander productgebruik: overig	2.F.6 and 2.G.2	2.2 and 3.3
8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary	Oplosmiddel- en ander productgebruik: Stationair koelen, vriezen en airco	2.F.1	2.2 and 3.3
8924509	NACE 25-33/95 (excluding NACE	SBI 25-33/95: Metalelektro	2.E.1	2.2

ES code	Process description (English)	Process description (Dutch)	CRF	Section
	30.1/33.15): metal-electronic industry, production of semi-conductors	(exclusief SBI 30.1/33.15), productie van halfgeleiders (PBL)		
8930401	NACE 35: decentral production of electricity, general	SBI 35: Decentrale productie elektriciteit, algemeen	1.A.1.a	2.1 and 3.2
8930410	NACE 35: production of electricity, heat	SBI 35: Productie elektriciteit, warmte	1.A.1.a	2.1 and 3.2
E400102	Anaerobic waste water treatment plants, other industries	Emissies methaan door lekverliezen uit anaërobe aWZI's	5.D.2	2.3 and 3.4
E400103	Anaerobic waste water treatment plants, waste treatment plants	Emissies methaan door lekverliezen uit anaërobe aWZI's, afvalverwijderingsbedrijven	5.D.2	2.3 and 3.4
E400104	Anaerobic waste water treatment plants, paper industries	Emissies methaan door lekverliezen uit anaërobe aWZI's, papierindustrie	5.D.2	2.3 and 3.4
E400105	Anaerobic waste water treatment plants, food industries	Emissies methaan door lekverliezen uit anaërobe aWZI's, voeding/genotmidd. ind.	5.D.2	2.3 and 3.4
E400106	Discharges of domestic waste water: septic tanks, anaerobic processes	Emissies septic tanks	5.D.1	2.3 and 3.4
E400107	NACE 90.01: collection and treatment of sewage	RWZI emissies water- en sliblijn, individueel	5.D.1	2.3 and 3.4
E400108	NACE 90.01: collection and treatment of sewage	RWZI spui van slibgistingsgas, individueel	5.D.1	2.3 and 3.4
E400109	NACE 37: collection and treatment of sewage	SBI 37: Afvalwaterinzameling en -behandeling	1.A.4.a.i	2.3 and 3.4
E400313	Digesting of organic waste from households	Gft-afval vergisting	5.B.2.a	2.3 and 3.4
E400314	Composting of organic waste from households	Gft-afval compostering	5.B.1.a	2.3 and 3.4
E400315	Digesting of organic horticultural waste	Groenafval vergisting	5.B.2.b	2.3 and 3.4
E400316	Composting of organic horticultural waste	Groenafval compostering	5.B.1.b	2.3 and 3.4
E401200	Solid waste disposal on land: managed disposal	Emissies vanuit stortplaatsen verbranding stortgas	1.A.1.a	2.3 and 3.4
E402200	Solid waste disposal on land: managed disposal	Emissies vanuit stortplaatsen	5.A.1	2.3 and 3.4
N000400	Indirect CO_2 from NMVOC: energy	Indirect CO_2 van NMVOC, Energie	1.	2.2
N000401	Indirect CO_2 from NMVOC: traffic & transport	Indirect CO_2 van NMVOC, Verkeer en Vervoer	2.	2.2
N000402	Indirect CO_2 from NMVOC: refineries	Indirect CO_2 van NMVOC, Raffinaderijen	1.	2.2
N000403	Indirect CO_2 from NMVOC: consumers	Indirect CO_2 van NMVOC, Consumenten	2.	2.2
N000404	Indirect CO_2 from NMVOC: combustion in commercial and governmental buildings	Indirect CO_2 van NMVOC, HDO	2.	2.2
N000405	Indirect CO_2 from NMVOC: industry	Indirect CO_2 van NMVOC, Industrie	2.	2.2
N000406	Indirect CO_2 from NMVOC: construction and building industies	Indirect CO_2 van NMVOC, Bouw	2.	2.2

ES code	Process description (English)	Process description (Dutch)	CRF	Section
N000407	Indirect CO_2 from NMVOC: agriculture	Indirect CO_2 van NMVOC, Landbouw	2.	2.2
N000408	Indirect CO_2 from NMVOC: waste	Indirect CO_2 van NMVOC, Afvalsector	5.	2.2
N091100	Use of lubricants, railways	Railverkeer smeermiddelen gebruik	2.D.1	2.2 and 3.3
N091200	Use of lubricants, road traffic	Wegverkeer smeermiddelen gebruik	2.D.1	2.2 and 3.3
N091300	Use of lubricants, inland navigation	Binnenvaart smeermiddelen gebruik	2.D.1	2.2 and 3.3
N091400	Use of lubricants, air traffic	Luchtvaart smeermiddelen gebruik	2.D.1	2.2 and 3.3
N339000	NACE 06-33: Industry not specified	SBI 06-33: Industrie, niet gespecificeerd	1.A.2.g.viii	2.1
N340000	Limestone application in NACE 45: road construction	Overig kalksteen gebruik (wegenbouw) (CBS)	2.A.4.d	2.2
T100100	Facilities NACE 13.20: textile weaving	SBI 13.20 (per bedrijf): Weven van textiel		3.1
T100201	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	SBI 10-12 (per bedrijf): Voedings- & genotmiddelenindustrie		3.1
T100202	Facilities NACE 16.21/16.22: manufacture of veneer sheets; manufacture of plywood, laminboard, particle board, fibre board and other panels and boards	SBI 16.21/16.22 (per bedrijf): Vervaardiging van fineer en plaatmateriaal en parketvloeren		3.1
T100300	Facilities NACE 13/14: manufacture of textiles and textile apparel	SBI 13/14 (per bedrijf): Vervaardiging van textiel en kleding		3.1
T100400	Facilities NACE 15: leather industry and fur preparation	SBI 15 (per bedrijf): Lederindustrie en bontbereiding		3.1
T100600	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	SBI 17 (per bedrijf): Vervaardiging van papier, karton en papier- en kartonwaren		3.1
T100601	Facilities NACE 20/21: manufacture of chemical products	SBI 20/21 (per bedrijf): Vervaardiging van chemische producten		3.1
T100700	Facilities NACE 20.1:manufacture of basic chemicals, corp. 101103	SBI 20.1 (per bedrijf): Vervaardiging van chemische basisproducten, bedr. 101103		3.1
T100701	Facilities NACE 20.1:manufacture of basic chemicals, corp. 62	SBI 20.1 (per bedrijf): Vervaardiging van chemische basisproducten, bedr. 62		3.1
T100800	Facilities NACE 19: manufacture of coke oven and refined petroleum products	SBI 19 (per bedrijf): Vervaardiging van cokesovenproducten en aardolieverwerking		3.1
T100801	Facilities NACE 23.51: manufacture of cement	SBI 23.51 (per bedrijf): Vervaardiging van cement		3.1
T100901	Facilities NACE 24: manufacture of metals in primary forms	SBI 24 (per bedrijf): Vervaardiging van metalen in primaire vorm		3.1
T101001	Facilities NACE 35.111:production of electricity	SBI 35.111 (per bedrijf): Elektriciteitsproduktie		3.1

ES code	Process description (English)	Process description (Dutch)	CRF	Section
T101100	Facilities NACE 20.1: manufacture of basic chemicals	SBI 20.1 (per bedrijf): Vervaardiging van chemische basisproducten		3.1
T101300	Facilities NACE 52.10/52.24: cargo handling and storage	SBI 52.10/52.24 (per bedrijf): Laad-, los- en overslagactiviteiten en opslag		3.1
T101500	Facilities NACE 13.3: finishing of textiles	SBI 13.3 (per bedrijf): Textielveredeling		3.1
T101600	Facilities NACE 13.93: manufacture of carpets and rugs	SBI 13.93 (per bedrijf): Vervaardiging van vloerkleden en tapijt		3.1
T101702	Facilities NACE 20.5: manufacture of other chemical products	SBI 20.5 (per bedrijf): Overige chemische producten		3.1
T101800	Facilities NACE 15.11: tanning of leather and fur preparation	SBI 15.11 (per bedrijf): Leerlooierijen en bontbereiding		3.1
T101900	Facilities NACE 16.1: sawmilling and planing of wood; impregnation of wood	SBI 16.1 (per bedrijf): Primaire houtbewerking en verduurzamen van hout		3.1
T102000	Facilities NACE 16.23: manufacture of builders' carpentry and joinery	SBI 16.23 (per bedrijf): Vervaardiging van overig timmerwerk voor de bouw		3.1
T102100	Facilities NACE 17.1: manufacture of pulp, paper and paperboard	SBI 17.1 (per bedrijf): Vervaardiging van papierpulp, papier en karton		3.1
T102101	Facilities NACE 19.1: manufacture of coke oven products	SBI 19.1 (per bedrijf): Vervaardiging van cokesovenproducten		3.1
T102102	Facilities NACE 23: construction material and glass industry	SBI 23 (per bedrijf): Bouwmaterialen- en glasindustrie		3.1
T102200	Facilities NACE 17.2: manufacture of articles of paper and paperboard	SBI 17.2 (per bedrijf): Vervaardiging van papier- en kartonwaren		3.1
T102201	Facilities NACE 19.201: manufacture of refined petroleum products	SBI 19.201 (per bedrijf): Aardolieraffinage		3.1
T102202	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	SBI 24.1-24.3 (per bedrijf): Basismetaalindustrie, verwerking en vervaardiging ijzer en staal		3.1
T102300	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	SBI 24.4/24.5 (per bedrijf): Basismetaalindustrie, vervaardiging van non-ferro metalen en gieten van metalen		3.1
T102400	Facilities NACE 20.12: manufacture of dyes and pigments	SBI 20.12 (per bedrijf): Vervaardiging van kleur- en verfstoffen		3.1
T102401	Facilities NACE 20.13: manufacture of inorganic basic chemicals, corp. 104710	SBI 20.13 (per bedrijf): Basischemie anorganisch, bedr. 104710		3.1
T102402	Facilities NACE 20.13: manufacture of inorganic basic chemicals, corp. 105014	SBI 20.13 (per bedrijf): Basischemie anorganisch, bedr. 105014		3.1
T102403	Facilities NACE 20.13: manufacture of inorganic basic chemicals	SBI 20.13 (per bedrijf): Basischemie anorganisch		3.1

ES code	Process description (English)	Process description (Dutch)	CRF	Section
T102500	Facilities NACE 20.13: manufacture of inorganic basic chemicals	SBI 20.13 (per bedrijf): Basischemie anorganisch		3.1
T102501	Facilities NACE 20.141: manufacture of petrochemicals	SBI 20.141 (per bedrijf): Vervaardiging van petrochemische producten		3.1
T102601	Facilities NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	SBI 20.149 (per bedrijf): Basischemie organisch (geen petrochemische producten)		3.1
T102700	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	SBI 20.15 (per bedrijf): Vervaardiging van kunstmeststoffen en stikstofverbindingen		3.1
T102701	Facilities NACE 26: manufacture of computers and electronic and optical apparatus	SBI 26 (per bedrijf): Vervaardiging computers en elektronische en optische apparatuur		3.1
T102800	Facilities NACE 20.16: manufacture of plastics in primary forms	SBI 20.16 (per bedrijf): Vervaardiging van kunststof in primaire vorm		3.1
T102900	Facilities NACE 20.2: manufacture of pesticides	SBI 20.2 (per bedrijf): Chemische bestrijdingsmiddelenindustrie		3.1
T103000	Facilities NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	SBI 20.3 (per bedrijf): Vervaardiging van verf, lak, vernis, inkt en mastiek		3.1
T103001	Facilities NACE 21.20: manufacture of pharmaceutical preparations (no raw materials)	SBI 21.20 (per bedrijf): Vervaardiging van farmaceutische producten (geen grondstoffen)		3.1
T103002	Facilities NACE 30: manufacture of other transportation	SBI 30 (per bedrijf): Overige transportmiddelen		3.1
T103100	Facilities NACE 21.1: manufacture of pharmaceutical preparations	SBI 21.1 (per bedrijf): Vervaardiging van farmaceutische producten		3.1
T103101	Facilities NACE 20.41: manufacture detergents	SBI 20.41 (per bedrijf): Vervaardiging van was- en schoonmaakmiddelen		3.1
T103200	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	SBI 20.4 (per bedrijf): Vervaardiging was- en schoonmaakmiddelen, parfums en cosmetica		3.1
T103201	Facilities NACE 20.51: manufacture of explosives	SBI 20.51 (per bedrijf): Vervaardiging van kruit en springstoffen		3.1
T103300	Facilities NACE 20.52: manufacture of glues and adhesives	SBI 20.52 (per bedrijf): Vervaardiging van lijm en bereide kleefmiddelen		3.1
T103600	Facilities NACE 20.59: manufacture of other chemical products n.e.c.	SBI 20.59 (per bedrijf): Vervaardiging van overige chemische producten n.e.g.		3.1
T103601	Facilities NACE 23.1: manufacture of glass and glassware	SBI 23.1 (per bedrijf): Vervaardiging van glas en		3.1

ES code	Process description (English)	Process description (Dutch)	CRF	Section
		glaswerk		
T103700	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	SBI 20.6 (per bedrijf): Vervaardiging van synthetische en kunstmatige vezels		3.1
T103900	Facilities NACE 49-53: transport; communications	SBI 49-53 (per bedrijf): Transport, communicatie		3.1
T104101	Facilities NACE 24.2: manufacture of tubes and pipes	SBI 24.2 (per bedrijf): Vervaardiging van stalen buizen en pijpen		3.1
T104200	Facilities NACE 23.2-23.4: manufacture of ceramic products	SBI 23.2-23.4 (per bedrijf): Vervaardiging van keramische producten		3.1
T104201	Facilities NACE 38.2 collection and treatment of waste	SBI 38.2 (per bedrijf): Afvalinzameling/beh, AVI's		3.1
T104300	Facilities NACE 23.32: manufacture of bricks and tiles	SBI 23.32 (per bedrijf): Vervaardiging van bakstenen en dakpannen		3.1
T104301	Facilities NACE 96: wellness and other services, funeral sector	SBI 96 (per bedrijf): Wellness en overige dienstverlening; uitvaartbranche		3.1
T104400	Facilities NACE 24.3: other first processing of iron and steel	SBI 24.3 (per bedrijf): Overige eerste verwerking van ijzer en staal		3.1
T104500	Facilities NACE 20.59: manufacture of other chemical products n.e.c.	SBI 20.59 (per bedrijf): Vervaardiging van overige chemische producten n.e.g.		3.1
T104501	Facilities NACE 23.9: manufacture of other non-metallic mineral products	SBI 23.9 (per bedrijf): Vervaardiging van overige niet-metaalhoudende minerale producten		3.1
T104600	Facilities NACE 13.99 manufacture of other textiles n.e.c.	SBI 13.99 (per bedrijf): Vervaardiging van overige textielproducten n.e.g.		3.1
T104700	Facilities NACE 20.11: manufacture of industrial gasses	SBI 20.11 (per bedrijf): Vervaardiging van industriële gassen		3.1
T104701	Facilities NACE 24.45: manufacture of other non-ferrous metals	SBI 24.45: (per bedrijf) Vervaardiging van overige non-ferrometalen		3.1
T104702	Facilities NACE 24.45: manufacture of non-ferrous metals, aluminium	SBI 24.45 (per bedrijf) Vervaardiging van overige non-ferrometalen, aluminium		3.1
T104704	Facilities NACE 24.45: manufacture of non-ferrous metals, copper	SBI 24.45 (per bedrijf) Vervaardiging van overige non-ferrometalen, koper		3.1
T104705	Facilities NACE 24.45: manufacture of non-ferrous metals, lead	SBI 24.45 (per bedrijf) Vervaardiging van overige non-ferrometalen, lood		3.1
T104706	Facilities NACE 24.45: manufacture of non-ferrous metals, zinc	SBI 24.45 (per bedrijf) Vervaardiging van overige non-ferrometalen, zink		3.1
T104801	Facilities NACE 20.17: manufacture	SBI 20.17 (per bedrijf):		3.1

ES code	Process description (English)	Process description (Dutch)	CRF	Section
	of synthetic rubber products in primary forms	Vervaardiging van synthetische rubber in primaire vorm		
T104900	Facilities NACE 13.20: textile weaving	SBI 13.20 (per bedrijf): Weven van textiel		3.1
T104901	Facilities NACE 24.5: casting of metals	SBI 24.5 (per bedrijf): Gieten van metalen		3.1
T105000	Facilities NACE 10.1: processing and preserving of meat and poultry	SBI 10.1 (per bedrijf): Slachterijen en vleesverwerking		3.1
T105100	Facilities NACE 10.3: processing and preserving of fruit and vegetables	SBI 10.3 (per bedrijf): Groente- en fruitverwerking		3.1
T105200	Facilities NACE 10.4: manufacture of oils and fats	SBI 10.4 (per bedrijf): produktie oliën en vetten		3.1
T105300	Facilities NACE 10.5: dairy industry	SBI 10.5 (per bedrijf): Zuivelindustrie		3.1
T105400	Facilities NACE 10.6: manufacture of grain mill products, excl. starches and starch products	SBI 10.6 (per bedrijf): Meelproduktie (excl. zetmeel)		3.1
T105500	Facilities NACE 10.9: manufacture of prepared animal feeds	SBI 10.9 (per bedrijf): Diervoederindustrie		3.1
T105600	Facilities NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products	SBI 10.8 (per bedrijf): Overige voedingsmiddelenindustrie (exclusief SBI 10.81 en 10.82)		3.1
T105700	Facilities NACE 11.07: manufacture of soft drinks and other beverages	SBI 11.07 (per bedrijf): Vervaardiging van dranken		3.1
T105800	Facilities NACE 12: manufacture of tobacco products	SBI 12 (per bedrijf): Verwerking van tabak		3.1
T105900	Facilities NACE 18/58: publishing, printing and reproduction of recorded media	SBI 18/58 (per bedrijf): Uitgeverijen, drukkerijen, reproductie van opgenomen media		3.1
T106000	Facilities NACE 22.1: manufacture of rubber products	SBI 22.1 (per bedrijf): Vervaardiging van producten van rubber		3.1
T106100	Facilities NACE 22.2: manufacture of plastic products	SBI 22.2 (per bedrijf): Vervaardiging van producten van kunststof		3.1
T106200	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	SBI 25 (per bedrijf): Metaalproductenindustrie (exclusief machinebouw)		3.1
T106300	Facilities NACE 28: manufacture of machinery	SBI 28 (per bedrijf): Machinebouw		3.1
T106600	Facilities NACE 29: motor-industry	SBI 29 (per bedrijf): Auto-industrie		3.1
T106700	Facilities NACE 30 (excl 30.1): manufacture of other transportation	SBI 30 (per bedrijf): Overige transportmiddelen (exclusief SBI 30.1)		3.1
T106900	Facilities NACE 31/32: manufacture of furniture and other goods	SBI 31/32 (per bedrijf): Vervaardiging van meubels en overige goederen		3.1
T107000	Facilities NACE 38.3: preparation to recycling of metal and non-metal	SBI 38.3 (per bedrijf): Voorbereiding tot recycling		3.1

ES code	Process description (English)	Process description (Dutch)	CRF	Section
	waste and scrap			
T107001	Facilities NACE 84.1: public administration services	SBI 84.1 (per bedrijf): Openbaar bestuur		3.1
T107100	Facilities NACE 08: other quarrying and mining	SBI 08 (per bedrijf): Winning van delfstoffen (geen olie en gas)		3.1
T107200	Facilities NACE 41-43: construction and building industries	SBI 41-43 (per bedrijf): Bouwnijverheid		3.1
T107201	Facilities NACE 85-88: education and healthcare	SBI 85-88 (per bedrijf): Onderwijs en gezondheids- en welzijnszorg		3.1
T107300	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	SBI 06/09.1 (per bedrijf): Aardolie- en gaswinning en dienstverlening voor de aardolie- en aardgaswinning		3.1
T107400	Facilities NACE 68-82: renting and consultancy activities	SBI 68-82 (per bedrijf): Verhuur en zakelijke dienstverlening (niet financieel)		3.1
T107500	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	SBI 45 (per bedrijf): Handel en reparatie van auto's en motorfietsen		3.1
T107600	Facilities NACE 01: agriculture, hunting and services to agriculture and hunting	SBI 01 (per bedrijf): Landbouw, jacht en dienstverlening voor de landbouw en jacht		3.1
T107601	Facilities NACE 59/60/90/91/93/96: culture, sports, leisure and other community services	SBI 59/60/90/91/93/96 (per bedrijf): Cultuur, sport, recreatie en overige dienstverlening		3.1
T108300	Facilities NACE 23.6: manufacture of articles of concrete, plaster and cement	SBI 23.6 (per bedrijf): Vervaardiging van producten van beton, gips en cement		3.1
T108400	Facilities NACE 30.1: ship-building	SBI 30.1 (per bedrijf): Scheepsbouw		3.1
T108500	Facilities NACE 35: production and distribution of electricity and gas	SBI 35 (per bedrijf): Productie en distributie van elektriciteit en gas		3.1
T109000	Facilities NACE 16: manufacture of wooden products	SBI 16 (per bedrijf): Houtindustrie en vervaardiging van artikelen van hout, kurk, riet en vlechtwerk (geen meubels)		3.1
T109300	Facilities NACE 23.5: manufacture of cement, lime and plaster	SBI 23.5 (per bedrijf): Vervaardiging van cement, kalk en gips		3.1
T111200	Facilities NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	SBI 38.2/84.1 (per bedrijf): Behandeling van afval inclusief gemeentelijke AVI's		3.1
T111201	Facilities NACE 38.2: waste treatment	SBI 38.2 (per bedrijf): Behandeling van afval		3.1
T111300	Facilities NACE 37: collection and treatment of sewage	SBI 37 (per bedrijf): Afvalwaterinzameling en -behandeling		3.1
T112200	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	SBI 19.202 (per bedrijf): Aardolieverwerking, excl. raffinage		3.1
T137300	Facilities NACE 26/27: electro	SBI 26/27 (per bedrijf):		3.1

ES code	Process description (English)	Process description (Dutch)	CRF	Section
	technical industry	Elektrotechnische industrie		
T137400	Facilities NACE 26/31/32: manufacture of electronic apparatus, furniture and other goods	SBI 26/31/32 (per bedrijf): Vervaardiging van electronische apparaten, meubels en overige goederen		3.1
T151100	Facilities NACE 46/47: retail and wholesale trade	SBI 46/47 (per bedrijf): Detail- en groothandel		3.1
T151301	Facilities NACE 39: sanitation and other waste management	SBI 39 (per bedrijf): Sanering en overig afvalbeheer		3.1
T165202	Facilities NACE 64: Financial services (excl. insurances and pension funds)	SBI 64 (per bedrijf): Financiele dienstverlening (excl. verzekeringen en pensioenfondsen)		3.1
T400100	NACE 90.01: collection and treatment of sewage	RWZI spui van slibgistingsgas, CO_2, individueel		3.4

Appendix 2 List of company data

Introduction

The database of the Dutch Pollutants Release and Transfer Registry (PRTR) includes data on individual sources concerning emissions of and data on the companies, as well as WWTPs, airports and other possible localised sources. The method descriptions of individual emissions of companies and WWTPs into the air are described in this Method Report (see sections 3.1 and 3.4.2.4). The method descriptions of individual emissions of companies and airports into water are available on www.emissieregistratie.nl.

The list of company data includes background information on all individual localised sources. The most important purpose of the list of company data is to ensure that all data related to company sites whose individual emission data are collected by the PRTR can be linked to a single unique company number. This Annex describes the data management method these individual localised sources (hereafter referred to as 'companies') are subject to.

Data in the list of company data

The most important purpose of the list of company data is to ensure that all data related to company sites whose individual emission data are collected by the PRTR can be linked to a single unique company number. The list of company data also includes the following data:

- Company code
- Name
- Address, registered office
- Start date
- End date
- Reason of end
- X coordinate (*Rijksdriehoeksmeting*, Dutch national triangulation system)
- Y coordinate (*Rijksdriehoeksmeting*, Dutch national triangulation system)
- Chamber of Commerce registration number
- ETS trade number
- NACE code (varies per year)

The list of company data is part of the Reference Set (Access database). The data model and the content of the reference file is managed by RIVM. The latest version of the Reference Set is available, for PRTR staff only, on the restricted-access web site (*Documenten -> exports*). Historical information of companies can be found in previous versions of the TNO Reference Set (available to PRTR staff on request).

Contributing institutions:

The Pollutant Release and Transfer Register project is directed by RIVM. The contributors to the production process of individual company data are in the first place individual companies and facilities and responsible

people working there and secondly:
- RIVM
- TNO
- CBS
- Deltares

The list of company data is managed by the PRTR moderator, currently RIVM. RIVM manages the data in the eAER and CBS manages the data of WWTPs in the Netherlands. TNO, CBS and Deltares are also responsible for the inclusion of emission data of individual companies in the PRTR.

This Annex does not describe the processing of company emission data. Agreements about the processing of emission data and their annual submission are laid down in the PRTR's annual working plan and the method description of the various task forces. This Annex only describes the processing of general company data included in the list of company data.

Input for the list of company data
Companies are included in the list of company data based on the following information sources:
- Company data, IPPC permits and annual environmental reports (RIVM)
- WWTP data (CBS)

These files will be described below.

RIVMmanages a file for its management tasks related to the processing of IPPC environmental permits and annual environmental reports of companies. This mainly pertains to the individual companies obligated to submit environmental and energy data via the eAER, and includes all contact with the competent authority (air, water) and/or executive services (Environmental Services, Regional Executive Services). This concerns companies reporting in the context of the Comprehensive PRTR Report, the long-range agreement (MJA) covenant, the Oil & Gas covenant, as well as companies "volunteering" reports in connection with their permit obligations.
This file contains all data needed for communication with the companies, as well as the most recent data sets about the companies.

CBS manages a file containing the data on all WWTPs in the Netherlands, and keeps various sets of company data linked to statistical information.

Each file has its own structure and data content. The company number serves as the link between files. Emission registration uses a unique code for each company site. This is typically a physical location for which a permit pursuant to the Environmental Permitting (General Provisions) Act (Wabo) or Water Act has been issued (Installations Decree). This company site is represented by a unique number, the company number (also referred to as NIC code). In the event of a company's relocation, division or merger, or of parts of a company, the link to the company number (NIC) will be reconsidered in accordance with applicable (international) regulations. Of each company to which a number has been

assigned a number of data will be kept up to date using a prearranged format. The numbering is unique and will not be reused.
Company name, address, registered office, coordinates, Chamber of Commerce registration number and ETS trade number are taken from the RIVM- file. Address and registered office must match those in the Basic Register of Addresses and Buildings (BAG). The BAG is also used for the (initial) linking of coordinates; for the company name, the wording/spelling used in the Trade Register (NHR) is leading.
The annual SBI/NACE code will be submitted by CBS for those companies whose emissions have been included in the PRTR.

Annual process
The reference file of the previous round is the starting point. Data submitters submit their data (amended or new data) to the moderator. This will take place on an ad-hoc basis over the course of the year by means of a notification (change request) to the moderator. This concerns a few dozen changes a year at most. The data submitter is the source owner for all data to be submitted in accordance with the data model.

Around 95% of data (emissions and company data) is submitted annually via the eAER (electronic annual environmental report). The database infrastructure is managed by RIVM. Data is entered into the database by the companies (or competent authority) themselves. Missing or incomplete data, such as zip code, Chamber of Commerce registration number and coordinates, are completed by RIVM. The database content is managed by RIVM and the moderator must be notified of changes on 1 October each year. The moderator will implement the changes in the Reference Set before 1 December.

In October CBS will be notified of the companies whose emissions from the previous year will be included in the PRTR. CBS will provide information about the economic core activity of these companies in that year, which determines the SBI/NACE code entered into the Reference Set.

History of the list of company data and archiving of company data
The old list of company data in the PRTR (TNO PRTR-I database) contained the company-specific data of thousands of companies whose emission data have been collected over a number of years. The data set of several hundreds of companies was updated each year. Data of currently registered companies, including registered name, contacts and other data, were changed where necessary. Any changes in connection with closures, divisions/mergers or new start-ups were also implemented. For start-ups new company sets were created. The company file was dynamic and could therefore be changed at any given time. Once a year, a subset was extracted from the dynamic file, which would be ‘frozen’ and served as a representation of the registration of that year. The database was managed by TNO.
From 2008 the PRTR reference database is used as the source file instead of the old list of company data. As the moderator, RIVM is also responsible for this data in the PRTR database. This implies that all changes to the reference database are handled by RIVM.

Appendix 3 Ratio between PM2.5 and PM10 for emissions from the energy and industry sector

Table 1 New PM2.5 fractions (to be used in 2019 reporting), compared to the old PM2.5 fractions (which were used in 2018 reporting). This table shows the PM2.5 fractions for the supplementary emission estimates. PRTR codes are internal codes used within the Dutch PRTR.

PRTR codes			**Source category**			**PM2.5 fractions**		**Explanation**
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T107600	V	405	Facilities NACE 01: agriculture, hunting and services to agriculture and hunting	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107600	P	352	Facilities NACE 01: agriculture, hunting and services to agriculture and hunting	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T107300	V	1	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	Combustion	natural gas	1.00	1.00	Assumption for emissions from compressor station
T107300	P	36	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	Process	other fuel	1.00	1.00	Assumption for emissions from compressor station
T107300	P	49	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	Process	waste gas	1.00	1.00	Assumption for emissions from compressor station
T107300	P	352	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	Process		0.00	1.00	Assumption for emissions from compressor station
T107100	V	384	Facilities NACE 08: other quarrying and mining	Combustion	lignite	0.80	0.63	Average of last AERs, Nedmag
T107100	V	361	Facilities NACE 08: other quarrying and	Combustion	natural gas	0.80	0.13	Average of last AERs, Nedmag

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			mining					
T107100	P	361	Facilities NACE 08: other quarrying and mining	Process	natural gas	0.80	1.00	Average of last AERs, Nedmag
T107100	P	352	Facilities NACE 08: other quarrying and mining	Process		0.80	0.77	Average of last AERs, Nedmag
T105000	P	352	Facilities NACE 10.1: processing and preserving of meat and poultry	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T105100	P	352	Facilities NACE 10.3: processing and preserving of fruit and vegetables	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T105200	P	352	Facilities NACE 10.4: manufacture of oils and fats	Process		0.15	0.13	Average of last AERs, crushing/grinding installation
T105300	P	352	Facilities NACE 10.5: dairy industry	Process		0.20	0.98	Average of last AERs, drying of milk powder
T105400	P	352	Facilities NACE 10.6: manufacture of grain mill products, excl. starches and starch products	Process		0.35	0.16	Average of last AERs, crushing/grinding installation
T105600	P	352	Facilities NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products	Process		0.35	0.16	Average of last AERs, sugar production and drying installations
T105500	P	352	Facilities NACE 10.9: manufacture of prepared animal feeds	Process		0.15	0.16	CEPMEIP, average for storage
T100201	H	8	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	biomass gaseous	0.15	1.00	Average of last AERs, crushing/grinding installation
T100201	H	466	Facilities NACE 10-12: manufacture of	Combustion	biomass	0.35	1.00	CEPMEIP default for

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			food products, beverages and tobacco		gaseous			mechanically formed fugitive emissions
T100201	H	382	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	biomass liquid	0.75	0.67	CEPMEIP default for combustion of industrial black liquor
T100201	V	351	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	coal	0.50	0.57	Average of last AERs, drying installation
T100201	V	51	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	coal	0.50	0.57	CEPMEIP default for combustion of coal in a medium sized combustor
T100201	V	392	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	coking coal	0.50	0.43	CEPMEIP default for combustion of coal in a medium sized combustor
T100201	V	482	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	crude oil	0.85	1.00	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T100201	V	52	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T100201	V	480	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	fuel oil	0.85	0.67	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T100201	V	405	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T100201	V	410	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T100201	V	18	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T100201	V	1	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	natural gas	0.15	1.00	Average of last AERs, crushing/grinding installation

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T100201	V	4	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	natural gas	0.15	1.00	Average of last AERs, crushing/grinding installation
T100201	V	361	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	natural gas	0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T100201	V	440	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	other solid fuel	0.50	0.67	Average of last AERs, drying installation
T100201	H	25	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T100201	V	352	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion		0.15	0.16	Average of last AERs, crushing/grinding installation
T105700	P	352	Facilities NACE 11.07: manufacture of soft drinks and other beverages	Process		0.35	0.00	CEPMEIP default for mechanically formed fugitive emissions
T105800	P	352	Facilities NACE 12: manufacture of tobacco products	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T100100	P	352	Facilities NACE 13.20: textile weaving	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T104900	P	352	Facilities NACE 13.20: textile weaving	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T101500	P	352	Facilities NACE 13.3: finishing of textiles	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T101600	P	352	Facilities NACE 13.93: manufacture of carpets and rugs	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T104600	P	352	Facilities NACE 13.99 manufacture of other textiles n.e.c.	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T100300	V	351	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	coal	0.50	1.00	CEPMEIP default for combustion of coal in a medium sized combustor
T100300	V	52	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T100300	V	405	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T100300	V	1	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T100300	V	360	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T101800	P	352	Facilities NACE 15.11: tanning of leather and fur preparation	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T100400	V	52	Facilities NACE 15: leather industry and fur preparation	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T100400	V	17	Facilities NACE 15: leather industry and fur preparation	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T100202	P	352	Facilities NACE 16.21/16.22: manufacture of veneer sheets, manufacture of plywood, laminboard, particle board, fibre board and other panels and boards	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T102000	P	352	Facilities NACE 16.23: manufacture of builders' carpentry and joinery	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T109000	H	25	Facilities NACE 16: manufacture of wooden products	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T109000	H	26	Facilities NACE 16: manufacture of wooden products	Combustion	wood, wood waste	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T102100	P	352	Facilities NACE 17.1: manufacture of pulp, paper and paperboard	Process		0.75	1.00	Average of last AERs, Parenco
T102200	P	352	Facilities NACE 17.2: manufacture of articles of paper and paperboard	Process		0.75	0.33	Average of last AERs, Parenco
T100600	H	381	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	biomass solid	0.75	1.00	CEPMEIP/Ehrlich medium sized wood-fired boiler
T100600	V	51	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	coal	0.50	0.43	CEPMEIP default for combustion of coal in a medium sized combustor
T100600	V	52	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T100600	V	1	Facilities NACE 17: manufacture of	Combustion	natural gas	0.75	1.00	Average of last AERs, Parenco

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			paper, paperboard and articles of paper and paperboard					
T100600	V	361	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	natural gas	0.75	1.00	Average of last AERs, Parenco
T100600	H	37	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	other solid fuel	0.67	0.79	CEPMEIP default for industrial waste fuels
T100600	H	444	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	other solid fuel	0.67	0.75	CEPMEIP default for industrial waste fuels
T100600	V	68	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	waste	0.67	1.00	CEPMEIP default for industrial waste fuels
T100600	V	358	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	waste	0.67	0.79	CEPMEIP default for industrial waste fuels
T105900	P	352	Facilities NACE 18/58: publishing, printing and reproduction of recorded media	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T102101	V	387	Facilities NACE 19.1: manufacture of coke oven products	Combustion	coke oven gas	0.50	0.75	CEPMEIP default for coke oven
T102101	V	352	Facilities NACE 19.1: manufacture of coke oven products	Combustion		0.50	0.40	CEPMEIP default for coke oven
T102101	P	352	Facilities NACE 19.1: manufacture of coke oven products	Process		0.50	0.40	CEPMEIP default for coke oven

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102201	H	471	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	biomass gaseous	0.70	1.00	Ehrlich, cat cracker regenerator
T102201	V	471	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	biomass gaseous	0.70	1.00	Ehrlich, cat cracker regenerator
T102201	H	382	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	biomass liquid	0.70	0.83	Ehrlich, cat cracker regenerator
T102201	V	388	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	chemical waste gas	0.70	0.75	Ehrlich, cat cracker regenerator
T102201	V	52	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	fuel oil	0.85	0.89	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	480	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	fuel oil	0.85	0.89	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	57	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	fuel oil	0.85	1.00	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	405	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	gas/diesel oil	0.70	0.81	Ehrlich, cat cracker regenerator
T102201	V	17	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	gas/diesel oil	0.70	0.83	Ehrlich, cat cracker regenerator
T102201	V	1	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	natural gas	0.70	1.00	Ehrlich, cat cracker regenerator
T102201	V	361	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	natural gas	0.70	0.74	Ehrlich, cat cracker regenerator
T102201	V	39	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	other fuel	0.85	0.74	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	443	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	other gaseous	0.70	0.75	Ehrlich, cat cracker regenerator

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
					fuel			
T102201	V	445	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	other liquid fuel	0.70	0.89	Ehrlich, cat cracker regenerator
T102201	V	448	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	other oil	0.85	0.89	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	454	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	petroleum coke	0.70	0.79	Ehrlich, cat cracker regenerator
T102201	V	44	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	refinery gas	0.70	0.75	Ehrlich, cat cracker regenerator
T102201	V	458	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	refinery gas	0.70	0.81	Ehrlich, cat cracker regenerator
T102201	V	45	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	refinery gas	0.70	0.75	Ehrlich, cat cracker regenerator
T102201	V	472	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	tar and asphalt	0.85	0.89	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	436	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	unknown	0.70	0.74	Ehrlich, cat cracker regenerator
T102201	V	46	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	waste gas	0.70	0.75	Ehrlich, cat cracker regenerator
T102201	V	352	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion		0.70	0.72	Ehrlich, cat cracker regenerator
T102201	P	352	Facilities NACE 19.201: manufacture of refined petroleum products	Process		0.70	1.00	Ehrlich, cat cracker regenerator
T112200	V	52	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	fuel oil	0.95	0.79	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T112200	V	405	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	gas/diesel oil	0.95	0.95	CEPMEIP default for combustion of gas/diesel oil
T112200	V	411	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	gas/diesel oil	0.95	0.80	CEPMEIP default for combustion of gas/diesel oil
T112200	V	19	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	gas/diesel oil	0.95	0.80	CEPMEIP default for combustion of gas/diesel oil
T112200	V	458	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	refinery gas	1.00	0.96	CEPMEIP default for combustion of gaseous fuels
T112200	P	352	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Process		0.70	0.80	Ehrlich, cat cracker regenerator
T100800	V	52	Facilities NACE 19: manufacture of coke oven and refined petroleum products	Combustion	fuel oil	0.50	0.89	CEPMEIP default for cokesoven
T101100	H	377	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T101100	H	422	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T101100	H	466	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T101100	V	383	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	bitumen	0.85	0.66	CEPMEIP/Ehrlich default for combustion of heavy fuel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T101100	V	427	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	carbon monoxide	0.75	0.75	Average of last AERs, production of chemical products
T101100	V	388	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	chemical waste gas	0.75	0.81	Average of last AERs, production of chemical products
T101100	V	351	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	coal	0.50	0.62	CEPMEIP default for combustion of coal in a medium sized combustor
T101100	V	51	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	coal	0.50	0.43	CEPMEIP default for combustion of coal in a medium sized combustor
T101100	V	393	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	coke oven / gas coke	0.50	0.62	CEPMEIP default for combustion of coal in a medium sized combustor
T101100	V	363	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	crude oil	0.85	0.83	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	52	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	fuel oil	0.85	0.83	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	57	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	fuel oil	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	405	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T101100	V	17	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T101100	V	410	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T101100	V	56	Facilities NACE 20.1: manufacture of	Combustion	hydrogen	1.00	1.00	CEPMEIP default for combustion

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			basic chemicals					of gaseous fuels
T101100	V	509	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	naphtha	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T101100	V	1	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	natural gas	0.75	1.00	Average of last AERs, production of chemical products
T101100	V	361	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	natural gas	0.75	0.73	Average of last AERs, production of chemical products
T101100	V	445	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	other liquid fuel	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	448	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	other oil	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	454	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	petroleum coke	0.90	0.58	Assumed low ashlow ash incineration with a high PM2.5 fraction
T101100	V	31	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	refinery gas	0.95	0.75	CEPMEIP default for combustion of gas/diesel oil
T101100	V	44	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	refinery gas	0.75	0.75	Average of last AERs, production of chemical products
T101100	V	458	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	refinery gas	0.75	0.95	Average of last AERs, production of chemical products
T101100	V	472	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	tar and asphalt	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	54	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	tar and asphalt	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	16	Facilities NACE 20.1: manufacture of basic chemicals	Combustion	unknown	0.75	0.75	Average fraction for process emissions in AER, because this

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
								sector contains a large diversity of different processes
T101100	V	358	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	waste	0.67	0.80	CEPMEIP default for industrial waste fuels
T101100	V	46	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	waste gas	0.75	0.75	Average of last AERs, production of chemical products
T101100	V	48	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	waste liquids	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T101100	H	25	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T101100	V	352	Facilities NACE 20.1:manufacture of basic chemicals	Combustion		0.75	0.73	Average of last AERs, production of chemical products
T101100	P	352	Facilities NACE 20.1:manufacture of basic chemicals	Process		0.75	0.61	Average of last AERs, production of chemical products
T100700	P	352	Facilities NACE 20.1:manufacture of basic chemicals, corp. 101103	Process		0.75	0.73	Average of last AERs, production of chemical products
T100701	P	352	Facilities NACE 20.1:manufacture of basic chemicals, corp. 62	Process		0.63	0.73	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T104700	P	352	Facilities NACE 20.11: manufacture of industrial gasses	Process		0.55	0.73	Ehrlich, average for chemical industry
T102400	P	352	Facilities NACE 20.12: manufacture of dyes and pigments	Process		0.35	0.73	CEPMEIP default for mechanically formed fugitive emissions
T102500	P	361	Facilities NACE 20.13: manufacture of inorganic basic chemicals	Process	natural gas	0.95	0.75	Average of last AERs, average combustion in inorganic

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
								chemical sector
T102500	P	352	Facilities NACE 20.13: manufacture of inorganic basic chemicals	Process		0.45	0.37	Average of last AERs, process emissions in the inorganic chemical sector
T102403	P	352	Facilities NACE 20.13: manufacture of inorganic basic chemicals	Process		0.55	0.90	Ehrlich, average for chemical industry
T102401	P	352	Facilities NACE 20.13: manufacture of inorganic basic chemicals, corp. 104710	Process		0.35	0.70	Average of AER 2014, silicium carbide production
T102402	P	352	Facilities NACE 20.13: manufacture of inorganic basic chemicals, corp. 105014	Process		0.65	0.70	Average of AER 2009, Brunner Mond
T102501	P	352	Facilities NACE 20.141: manufacture of petrochemicals	Process		0.85	0.82	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102601	P	361	Facilities NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	Process	natural gas	0.63	1.00	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T102601	P	352	Facilities NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	Process		0.63	0.73	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T102700	V	52	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	fuel oil	0.95	0.34	CEPMEIP default for combustion of gas/diesel oil
T102700	V	57	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	fuel oil	0.85	0.34	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102700	V	405	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	gas/diesel oil	0.95	0.34	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102700	V	33	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	lpg	0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	V	361	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	natural gas	0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	V	352	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion		0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	P	410	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process	gas/diesel oil	0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	P	33	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process	lpg	0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	P	352	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process		0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102800	P	361	Facilities NACE 20.16: manufacture of plastics in primary forms	Process	natural gas	0.63	1.00	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T102800	P	352	Facilities NACE 20.16: manufacture of plastics in primary forms	Process		0.63	0.10	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T102900	V	52	Facilities NACE 20.2: manufacture of pesticides	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102900	V	405	Facilities NACE 20.2: manufacture of pesticides	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T102900	V	410	Facilities NACE 20.2: manufacture of pesticides	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T102900	V	1	Facilities NACE 20.2: manufacture of pesticides	Combustion	natural gas	0.55	1.00	Ehrlich, average for chemical industry
T102900	V	361	Facilities NACE 20.2: manufacture of pesticides	Combustion	natural gas	0.55	1.00	Ehrlich, average for chemical industry
T102900	P	352	Facilities NACE 20.2: manufacture of pesticides	Process		0.55	0.73	Ehrlich, average for chemical industry
T103000	V	361	Facilities NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	Combustion	natural gas	0.50	0.73	Assumption for fugitive emissions from ovens
T103000	P	352	Facilities NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	Process		0.50	0.73	Assumption for fugitive emissions from ovens
T103200	V	405	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103200	V	17	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T103200	V	410	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103200	V	18	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103101	P	352	Facilities NACE 20.41: manufacture detergents	Process		0.55	0.73	Ehrlich, average for chemical industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T101702	H	382	Facilities NACE 20.5: manufacture of other chemical products	Combustion	biomass liquid	0.75	0.16	CEPMEIP default for combustion of industrial black liquor
T101702	H	381	Facilities NACE 20.5: manufacture of other chemical products	Combustion	biomass solid	0.75	0.16	CEPMEIP/Ehrlich medium sized wood-fired boiler
T101702	V	383	Facilities NACE 20.5: manufacture of other chemical products	Combustion	bitumen	0.85	0.99	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101702	V	52	Facilities NACE 20.5: manufacture of other chemical products	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T101702	V	405	Facilities NACE 20.5: manufacture of other chemical products	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T101702	V	33	Facilities NACE 20.5: manufacture of other chemical products	Combustion	lpg	1.00	0.86	CEPMEIP default for combustion of gaseous fuels
T101702	V	1	Facilities NACE 20.5: manufacture of other chemical products	Combustion	natural gas	0.55	1.00	Ehrlich, average for chemical industry
T101702	V	361	Facilities NACE 20.5: manufacture of other chemical products	Combustion	natural gas	0.55	0.73	Ehrlich, average for chemical industry
T101702	V	46	Facilities NACE 20.5: manufacture of other chemical products	Combustion	waste gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T103300	P	352	Facilities NACE 20.52: manufacture of glues and adhesives	Process		0.55	0.73	Ehrlich, average for chemical industry
T103600	P	352	Facilities NACE 20.59: manufacture of other chemical products n.e.c.	Process		0.55	0.66	Ehrlich, average for chemical industry
T104500	P	352	Facilities NACE 20.59: manufacture of other chemical products n.e.c.	Process		0.55	0.73	Ehrlich, average for chemical industry
T103700	V	1	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	Combustion	natural gas	0.55	0.64	Ehrlich, average for chemical industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T103700	V	358	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	Combustion	waste	0.67	0.64	CEPMEIP default for industrial waste fuels
T103700	V	352	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	Combustion		0.55	0.64	Ehrlich, average for chemical industry
T103700	P	352	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	Process		0.55	0.64	Ehrlich, average for chemical industry
T103100	V	52	Facilities NACE 21.1: manufacture of pharmaceutical preparations	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T103100	V	405	Facilities NACE 21.1: manufacture of pharmaceutical preparations	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103100	V	1	Facilities NACE 21.1: manufacture of pharmaceutical preparations	Combustion	natural gas	0.55	1.00	Ehrlich, average for chemical industry
T103001	P	352	Facilities NACE 21.20: manufacture of pharmaceutical preparations (no raw materials)	Process		0.55	0.73	Ehrlich, average for chemical industry
T106000	V	52	Facilities NACE 22.1: manufacture of rubber products	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T106000	P	352	Facilities NACE 22.1: manufacture of rubber products	Process		0.35	0.25	CEPMEIP default for mechanically formed fugitive emissions
T106100	V	52	Facilities NACE 22.2: manufacture of plastic products	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T106100	V	405	Facilities NACE 22.2: manufacture of plastic products	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T106100	V	33	Facilities NACE 22.2: manufacture of plastic products	Combustion	lpg	1.00	1.00	CEPMEIP default for combustion of gaseous fuels

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T106100	V	361	Facilities NACE 22.2: manufacture of plastic products	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T106100	V	358	Facilities NACE 22.2: manufacture of plastic products	Combustion	waste	0.67	0.83	CEPMEIP default for industrial waste fuels
T106100	H	25	Facilities NACE 22.2: manufacture of plastic products	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T106100	V	352	Facilities NACE 22.2: manufacture of plastic products	Combustion		0.35	0.25	CEPMEIP default for mechanically formed fugitive emissions
T106100	P	352	Facilities NACE 22.2: manufacture of plastic products	Process		0.35	0.27	CEPMEIP default for mechanically formed fugitive emissions
T103601	P	352	Facilities NACE 23.1: manufacture of glass and glassware	Process		0.95	0.97	Average of last AERs, glass production
T104200	P	352	Facilities NACE 23.2-23.4: manufacture of ceramic products	Process		0.25	0.92	Ehrlich, fugitive emissions from ceramic industry
T104300	P	352	Facilities NACE 23.32: manufacture of bricks and tiles	Process		0.25	0.92	Ehrlich, fugitive emissions from ceramic industry
T109300	P	352	Facilities NACE 23.5: manufacture of cement, lime and plaster	Process		0.10	0.12	Ehrlich, cement production fugitive emissions
T100801	V	1	Facilities NACE 23.51: manufacture of cement	Combustion	natural gas	0.85	0.74	Average of last AERs, cement production
T100801	V	361	Facilities NACE 23.51: manufacture of cement	Combustion	natural gas	0.85	0.74	Average of last AERs, cement production
T100801	P	393	Facilities NACE 23.51: manufacture of	Process	coke oven /	0.50	0.74	CEPMEIP default for combustion

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			cement		gas coke			of coal in a medium sized combustor
T100801	P	11	Facilities NACE 23.51: manufacture of cement	Process	lignite	0.50	0.74	CEPMEIP default for combustion of coal in a medium sized combustor
T100801	P	1	Facilities NACE 23.51: manufacture of cement	Process	natural gas	0.85	0.74	Average of last AERs, cement production
T100801	P	361	Facilities NACE 23.51: manufacture of cement	Process	natural gas	0.85	0.74	Average of last AERs, cement production
T100801	P	444	Facilities NACE 23.51: manufacture of cement	Process	other solid fuel	0.67	0.74	CEPMEIP default for industrial waste fuels
T100801	P	454	Facilities NACE 23.51: manufacture of cement	Process	petroleum coke	0.90	0.74	Assumed low ash incineration with a high PM2.5 fraction
T100801	P	352	Facilities NACE 23.51: manufacture of cement	Process		0.10	0.87	Ehrlich, cement production fugitive emissions
T108300	P	352	Facilities NACE 23.6: manufacture of articles of concrete, plaster and cement	Process		0.10	0.12	Ehrlich, cement production fugitive emissions
T104501	P	352	Facilities NACE 23.9: manufacture of other non-metallic mineral products	Process		0.80	0.32	PRTR for Denmark, non-metallic mineral products
T102102	H	381	Facilities NACE 23: construction material and glass industry	Combustion	biomass solid	0.75	0.79	CEPMEIP/Ehrlich medium sized wood-fired boiler
T102102	V	51	Facilities NACE 23: construction material and glass industry	Combustion	coal	0.50	0.79	CEPMEIP default for combustion of coal in a medium sized combustor
T102102	V	393	Facilities NACE 23: construction material and glass industry	Combustion	coke oven / gas coke	0.50	0.78	CEPMEIP default for combustion of coal in a medium sized

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
								combustor
T102102	V	52	Facilities NACE 23: construction material and glass industry	Combustion	fuel oil	0.95	0.79	CEPMEIP default for combustion of gas/diesel oil
T102102	V	57	Facilities NACE 23: construction material and glass industry	Combustion	fuel oil	0.90	0.79	Average of last AERs, cement and glass production
T102102	V	405	Facilities NACE 23: construction material and glass industry	Combustion	gas/diesel oil	0.95	0.79	CEPMEIP default for combustion of gas/diesel oil
T102102	V	17	Facilities NACE 23: construction material and glass industry	Combustion	gas/diesel oil	0.95	0.79	CEPMEIP default for combustion of gas/diesel oil
T102102	V	1	Facilities NACE 23: construction material and glass industry	Combustion	natural gas	0.90	0.79	Average of last AERs, cement and glass production
T102102	V	361	Facilities NACE 23: construction material and glass industry	Combustion	natural gas	0.90	0.79	Average of last AERs, cement and glass production
T102102	V	352	Facilities NACE 23: construction material and glass industry	Combustion		0.90	0.79	Average of last AERs, cement and glass production
T102202	V	113	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	blast furnace gas	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2
T102202	V	23	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	blast furnace gas	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2
T102202	V	351	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	coal	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2
T102202	V	387	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture	Combustion	coke oven gas	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			of iron and steel					
T102202	V	394	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	coke oven gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T102202	V	52	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T102202	V	405	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	gas/diesel oil	0.65	1.00	CEPMEIP average integrated iron and steel plant class 2
T102202	V	17	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T102202	V	1	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	natural gas	0.65	1.00	CEPMEIP average integrated iron and steel plant class 2
T102202	V	2	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	natural gas	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T102202	V	361	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	natural gas	0.65	0.64	CEPMEIP average integrated iron and steel plant class 2
T102202	V	440	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	other solid fuel	0.65	0.43	CEPMEIP average integrated iron and steel plant class 2
T102202	V	452	Facilities NACE 24.1-24.3 base metal	Combustion	oxy gas	1.00	0.75	CEPMEIP default for combustion

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			industry, processing and manufacture of iron and steel					of gaseous fuels
T102202	V	352	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion		0.65	0.64	CEPMEIP average integrated iron and steel plant class 2
T104101	P	410	Facilities NACE 24.2: manufacture of tubes and pipes	Process	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T104101	P	352	Facilities NACE 24.2: manufacture of tubes and pipes	Process		0.70	0.38	Ehrlich, metallurgical sector
T104400	P	352	Facilities NACE 24.3: other first processing of iron and steel	Process		0.70	0.50	Ehrlich, metallurgical sector
T102300	V	387	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	coke oven gas	1.00	0.67	CEPMEIP default for combustion of gaseous fuels
T102300	V	391	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	coking coal	0.50	0.67	CEPMEIP default for combustion of coal in a medium sized combustor
T102300	V	405	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	gas/diesel oil	0.70	0.21	Ehrlich, metallurgical sector
T102300	V	17	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T102300	V	18	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102300	V	33	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	lpg	1.00	0.21	CEPMEIP default for combustion of gaseous fuels
T102300	V	1	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	natural gas	0.70	0.67	Ehrlich, metallurgical sector
T102300	V	361	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	natural gas	0.70	0.67	Ehrlich, metallurgical sector
T102300	V	454	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	petroleum coke	0.90	0.58	Assumed low ash incineration with a high PM2.5 fraction
T102300	V	352	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion		0.70	0.67	Ehrlich, metallurgical sector
T104702	V	405	Facilities NACE 24.45: manufacture of non-ferrous metals, aluminium	Combustion	gas/diesel oil	0.95	0.73	CEPMEIP default for combustion of gas/diesel oil
T104702	P	361	Facilities NACE 24.45: manufacture of non-ferrous metals, aluminium	Process	natural gas	0.85	0.73	Average for all AERs, Pechiney and Aldel
T104702	P	352	Facilities NACE 24.45: manufacture of non-ferrous metals, aluminium	Process		0.85	0.73	Average for all AERs, Pechiney and Aldel
T104704	P	352	Facilities NACE 24.45: manufacture of non-ferrous metals, copper	Process		0.75	0.67	CEPMEIP default for secondary copper
T104705	P	352	Facilities NACE 24.45: manufacture of non-ferrous metals, lead	Process		0.70	0.83	Ehrlich, metallurgical sector
T104706	V	405	Facilities NACE 24.45: manufacture of	Combustion	gas/diesel	0.75	1.00	Average of last AERs, Budel Zink

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation new PM2.5 fraction
			non-ferrous metals, zinc		oil			
T104706	P	352	Facilities NACE 24.45: manufacture of non-ferrous metals, zinc	Process		0.75	0.67	Average of last AERs, Budel Zink
T104901	P	352	Facilities NACE 24.5: casting of metals	Process		0.55	0.74	Average of last AERs, Alucast
T100901	P	361	Facilities NACE 24: manufacture of metals in primary forms	Process	natural gas	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2
T100901	P	352	Facilities NACE 24: manufacture of metals in primary forms	Process		0.65	0.65	CEPMEIP average integrated iron and steel plant class 2
T106200	V	52	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	Combustion	fuel oil	0.30	0.67	Average of last AERs, selection of companies in metal industry
T106200	V	1	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	Combustion	natural gas	0.30	1.00	Average of last AERs, selection of companies in metal industry
T106200	V	361	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	Combustion	natural gas	0.30	1.00	Average of last AERs, selection of companies in metal industry
T106200	V	458	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	Combustion	refinery gas	0.30	0.75	Average of last AERs, selection of companies in metal industry
T106200	P	352	Facilities NACE 25: manufacture of metal structures and parts of	Process		0.30	0.36	Average of last AERs, selection of companies in metal industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			structures (excluding manufacture of machinery)					
T137300	V	352	Facilities NACE 26/27: electro technical industry	Combustion		0.20	0.25	Average of last AERs, Aluchemie
T137300	P	352	Facilities NACE 26/27: electro technical industry	Process		0.20	0.28	Average of last AERs, Aluchemie
T137400	P	352	Facilities NACE 26/31/32: manufacture of electronic apparatus, furniture and other goods	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T106300	V	52	Facilities NACE 28: manufacture of machinery	Combustion	fuel oil	0.95	0.67	Average last AERs, Komeco
T106300	V	405	Facilities NACE 28: manufacture of machinery	Combustion	gas/diesel oil	0.95	1.00	Average last AERs, Komeco
T106300	V	33	Facilities NACE 28: manufacture of machinery	Combustion	lpg	0.95	1.00	Average last AERs, Komeco
T106300	V	1	Facilities NACE 28: manufacture of machinery	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T106300	V	352	Facilities NACE 28: manufacture of machinery	Combustion		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T106300	P	352	Facilities NACE 28: manufacture of machinery	Process		0.95	0.33	Average last AERs, Komeco
T106600	V	52	Facilities NACE 29: motor-industry	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T106600	V	405	Facilities NACE 29: motor-industry	Combustion	gas/diesel	0.95	1.00	CEPMEIP default for combustion

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation new PM2.5 fraction
					oil			of gas/diesel oil
T106600	V	17	Facilities NACE 29: motor-industry	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T106600	P	352	Facilities NACE 29: motor-industry	Process		0.85	0.85	Ehrlich, spray coating
T106700	P	352	Facilities NACE 30 (excl 30.1): manufacture of other transportation	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T108400	V	405	Facilities NACE 30.1: ship-building	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T108400	V	17	Facilities NACE 30.1: ship-building	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T108400	V	33	Facilities NACE 30.1: ship-building	Combustion	lpg	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T108400	P	352	Facilities NACE 30.1: ship-building	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T106900	V	46	Facilities NACE 31/32: manufacture of furniture and other goods	Combustion	waste gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T106900	H	25	Facilities NACE 31/32: manufacture of furniture and other goods	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T106900	H	26	Facilities NACE 31/32: manufacture of furniture and other goods	Combustion	wood, wood waste	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T106900	P	352	Facilities NACE 31/32: manufacture of furniture and other goods	Process		0.75	0.33	Average of last AERs, Forbo linoleum
T101001	P	27	Facilities NACE 35.111:production of	Process	coal	0.75	0.78	Average of last AERs, large coal

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation new PM2.5 fraction
			electricity					fired power plants
T101001	P	352	Facilities NACE 35.111:production of electricity	Process		0.10	0.08	CEPMEIP default Storage and handling of coal
T108500	H	8	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass gaseous	1.00	0.87	CEPMEIP default for combustion of gaseous fuels
T108500	H	377	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T108500	H	471	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass gaseous	1.00	0.83	CEPMEIP default for combustion of gaseous fuels
T108500	H	382	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass liquid	0.75	0.78	Average of AER 2013, biomass combustion in power plants
T108500	H	385	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass other	0.75	0.78	Average of last AERs, co-firing in coal fired power plants
T108500	H	381	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass solid	0.75	0.75	Average of last AERs, biomass in large coal fired power plants
T108500	V	113	Facilities NACE 35: production and distribution of electricity and gas	Combustion	blast furnace gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T108500	V	23	Facilities NACE 35: production and distribution of electricity and gas	Combustion	blast furnace gas	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T108500	V	388	Facilities NACE 35: production and distribution of electricity and gas	Combustion	chemical waste gas	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T108500	V	351	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coal	0.75	0.78	Average of last AERs, large coal fired power plants
T108500	V	27	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coal	0.75	0.78	Average of last AERs, large coal fired power plants

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T108500	V	467	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coal	0.75	0.78	Average of last AERs, large coal fired power plants
T108500	V	51	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coal	0.75	0.78	Average of last AERs, large coal fired power plants
T108500	V	387	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coke oven gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T108500	V	394	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coke oven gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T108500	V	482	Facilities NACE 35: production and distribution of electricity and gas	Combustion	crude oil	0.75	0.89	Average of last AERs, co-firing in coal fired power plants
T108500	V	52	Facilities NACE 35: production and distribution of electricity and gas	Combustion	fuel oil	1.00	0.89	Average of last AERs, combustion of light fuel oil
T108500	V	480	Facilities NACE 35: production and distribution of electricity and gas	Combustion	fuel oil	0.75	0.89	Average of last AERs, co-firing in coal fired power plants
T108500	V	57	Facilities NACE 35: production and distribution of electricity and gas	Combustion	fuel oil	0.75	0.89	Average of last AERs, co-firing in coal fired power plants
T108500	V	405	Facilities NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0.95	0.97	CEPMEIP default for combustion of gas/diesel oil
T108500	V	17	Facilities NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T108500	V	410	Facilities NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T108500	V	18	Facilities NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T108500	H	26	Facilities NACE 35: production and distribution of electricity and gas	Combustion	hout, houtmot	0.75	0.71	Average of last AERs, co-firing in coal fired power plants

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation new PM2.5 fraction
T108500	V	1	Facilities NACE 35: production and distribution of electricity and gas	Combustion	natural gas	0.75	1.00	Average of last AERs, co-firing in coal fired power plants
T108500	V	361	Facilities NACE 35: production and distribution of electricity and gas	Combustion	natural gas	0.75	0.83	Average of last AERs, co-firing in coal fired power plants
T108500	V	443	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other gaseous fuel	0.67	0.75	CEPMEIP default for industrial waste fuels
T108500	V	445	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other liquid fuel	0.75	0.89	Average of last AERs, co-firing in coal fired power plants
T108500	V	448	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other oil	0.75	1.00	Average of last AERs, co-firing in coal fired power plants
T108500	V	440	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other solid fuel	0.75	0.78	Average of last AERs, co-firing in coal fired power plants
T108500	V	444	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other solid fuel	0.75	0.78	Average of last AERs, large coal fired power plants
T108500	V	452	Facilities NACE 35: production and distribution of electricity and gas	Combustion	oxy gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T108500	V	402	Facilities NACE 35: production and distribution of electricity and gas	Combustion	phosphor oven gas	1.00	0.87	CEPMEIP default for combustion of gaseous fuels
T108500	V	68	Facilities NACE 35: production and distribution of electricity and gas	Combustion	waste	0.75	0.87	Average of last AERs, co-firing in coal fired power plants
T108500	V	358	Facilities NACE 35: production and distribution of electricity and gas	Combustion	waste	0.75	0.78	Average of last AERs, co-firing in coal fired power plants
T108500	H	378	Facilities NACE 35: production and distribution of electricity and gas	Combustion	wood	0.75	0.71	Average of last AERs, co-firing in coal fired power plants
T108500	H	25	Facilities NACE 35: production and	Combustion	wood	0.75	0.71	Average of last AERs, co-firing in

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			distribution of electricity and gas					coal fired power plants
T111300	P	352	Facilities NACE 37: collection and treatment of sewage	Process		0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T104201	H	8	Facilities NACE 38.2 collection and treatment of waste	Combustion	biomass gaseous	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	H	471	Facilities NACE 38.2 collection and treatment of waste	Combustion	biomass gaseous	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	H	382	Facilities NACE 38.2 collection and treatment of waste	Combustion	biomass liquid	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	H	381	Facilities NACE 38.2 collection and treatment of waste	Combustion	biomass solid	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	52	Facilities NACE 38.2 collection and treatment of waste	Combustion	fuel oil	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	405	Facilities NACE 38.2 collection and treatment of waste	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T104201	V	17	Facilities NACE 38.2 collection and treatment of waste	Combustion	gas/diesel oil	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	1	Facilities NACE 38.2 collection and treatment of waste	Combustion	natural gas	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	361	Facilities NACE 38.2 collection and treatment of waste	Combustion	natural gas	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	448	Facilities NACE 38.2 collection and treatment of waste	Combustion	other oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T104201	V	440	Facilities NACE 38.2 collection and treatment of waste	Combustion	other solid fuel	0.95	1.00	Average of last AERs, modern waste incineration.

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T104201	V	68	Facilities NACE 38.2 collection and treatment of waste	Combustion	waste	0.95	0.99	Average of last AERs, modern waste incineration.
T104201	V	358	Facilities NACE 38.2 collection and treatment of waste	Combustion	waste	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	6	Facilities NACE 38.2 collection and treatment of waste	Combustion	waste oil	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	352	Facilities NACE 38.2 collection and treatment of waste	Combustion		0.95	1.00	Average of last AERs, modern waste incineration.
T111200	P	352	Facilities NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	Process		0.95	1.00	Average of last AERs, modern waste incineration.
T111201	P	361	Facilities NACE 38.2: waste treatment	Process	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T111201	P	352	Facilities NACE 38.2: waste treatment	Process		0.95	1.00	Average of last AERs, modern waste incineration.
T107000	H	382	Facilities NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	biomass liquid	0.80	0.71	Average of last AERs, waste sector
T107000	V	405	Facilities NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107000	P	352	Facilities NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Process		0.80	0.33	Average of last AERs, waste sector
T151301	V	52	Facilities NACE 39: sanitation and other	Combustion	fuel oil	0.95	0.79	CEPMEIP default for combustion

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
			waste management					of gas/diesel oil
T151301	P	352	Facilities NACE 39: sanitation and other waste management	Process		0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T107200	P	352	Facilities NACE 41-43: construction and building industies	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T107500	V	52	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T107500	V	17	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T107500	H	25	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T107500	P	352	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	Process		0.15	0.89	CEPMEIP, average for storage
T151100	V	51	Facilities NACE 46/47: retail and wholesale trade	Combustion	coal	0.50	0.57	CEPMEIP default for combustion of coal in a medium sized combustor
T151100	V	405	Facilities NACE 46/47: retail and wholesale trade	Combustion	gas/diesel oil	0.95	0.80	CEPMEIP default for combustion of gas/diesel oil
T151100	P	352	Facilities NACE 46/47: retail and wholesale trade	Process		0.55	0.81	Ehrlich, average for chemical industry
T103900	H	377	Facilities NACE 49-53: transport, communications	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T103900	V	388	Facilities NACE 49-53: transport, communications	Combustion	chemical waste gas	1.00	0.80	CEPMEIP default for combustion of gaseous fuels

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T103900	V	52	Facilities NACE 49-53: transport, communications	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T103900	V	405	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103900	V	17	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T103900	V	410	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103900	V	411	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T103900	V	19	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T103900	V	476	Facilities NACE 49-53: transport, communications	Combustion	kerosene	0.95	0.00	CEPMEIP default for combustion of gas/diesel oil
T103900	V	33	Facilities NACE 49-53: transport, communications	Combustion	lpg	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T103900	V	1	Facilities NACE 49-53: transport, communications	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T103900	V	361	Facilities NACE 49-53: transport, communications	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T103900	V	44	Facilities NACE 49-53: transport, communications	Combustion	refinery gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T101300	P	352	Facilities NACE 52.10/52.24: cargo handling and storage	Process		0.15	0.12	CEPMEIP, average for storage

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T107400	V	30	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107400	V	34	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107400	V	52	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T107400	V	480	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.85	0.67	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T107400	V	57	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T107400	V	405	Facilities NACE 68-82: renting and consultancy activities	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107400	V	17	Facilities NACE 68-82: renting and consultancy activities	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T107400	V	352	Facilities NACE 68-82: renting and consultancy activities	Combustion		0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T107400	P	352	Facilities NACE 68-82: renting and consultancy activities	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T107001	P	352	Facilities NACE 84.1: public administration services	Process		0.95	1.00	Average of last AERs, modern waste incineration.
T107201	H	26	Facilities NACE 85-88: education and healthcare	Combustion	wood, wood waste	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler

PRTR codes	Source category	PM2.5 fractions	Explanation

EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation for the new PM2.5 fraction
8922701	1	51	NACE 08: other quarrying and mining	Combustion	coal	0,80	0,57	Similar to fraction of individual facilities in table A.1: Average of last AERs, Nedmag
8922701	1	33	NACE 08: other quarrying and mining	Combustion	lpg	0,80	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, Nedmag
8922701	1	1	NACE 08: other quarrying and mining	Combustion	Natural gas	0,80	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, Nedmag
8910000	P		NACE 10.1: processing and preserving of meat and poultry	Process		0,35	0,16	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8910300	P		NACE 10.4: manufacture of oils and fats	Process		0,15	0,16	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation
8910400	P		NACE 10.5: dairy industry	Process		0,20	0,16	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying of milk powder
8910406	P		NACE 10.5: dairy industry, diffuus	Process		0,20	0,33	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying of milk powder
8910500	P		NACE 10.6: manufacture of grain mill products, excl. starches and starch products	Process		0,35	0,16	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8910506	P		NACE 10.6: manufacture of grain mill products, excl. starches and starch products, diffuse	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation
8918000	P		NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products	Process		0,35		Similar to fraction of individual facilities in table A.1: Average of last AERs, sugar production and drying installations
8918006	P		NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8910600	P		NACE 10.9: manufacture of prepared animal feeds	Process		0,15	0,16	Similar to fraction of individual facilities in table A.1: CEPMEIP, average for storage
8910606	P		NACE 10.9: manufacture of prepared animal feeds, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8900200	7	8	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	Biomass gaseous	0,15	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation
8900200	1	51	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	coal	0,50		Similar to fraction of individual facilities in table A.1:
8900200	1	52	NACE 10-12: manufacture of	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
			food products, beverages and tobacco					of gas/diesel oil
8900200	1	33	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	lpg	0,15	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation
8900200	1	1	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	Natural gas	0,15	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation
8900200	1	135	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8919700	4	193	NACE 13.20: textile weaving	Process	processed cotton	0,35	0,34	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8919700	4		NACE 13.20: textile weaving	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8911400	4	155	NACE 13.3: finishing of textiles	Process	finished textiles	0,35	0,35	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8911500	4	186	NACE 13.93: manufacture of	Process	manufactur	0,35	0,33	Similar to fraction of individual

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation for the new PM2.5 fraction
			carpets and rugs		ed carpets			facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8911500	4		NACE 13.93: manufacture of carpets and rugs	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8900300	1	51	NACE 13/14: manufacture of textiles and textile apparel	Combustion	coal	0,50	0,57	CEPMEIP default for combustion of coal in a medium sized combustor
8900300	1	52	NACE 13/14: manufacture of textiles and textile apparel	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8900300	1	33	NACE 13/14: manufacture of textiles and textile apparel	Combustion	lpg	0,35	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8900300	1	1	NACE 13/14: manufacture of textiles and textile apparel	Combustion	Natural gas	0,35	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8900300	1	135	NACE 13/14: manufacture of textiles and textile apparel	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8900300	4	177	NACE 13/14: manufacture of textiles and textile apparel	Process	manufactured other textiles	0,35	0,36	CEPMEIP default for mechanically formed fugitive emissions
8900300	4		NACE 13/14: manufacture of	Process		0,35	0,33	CEPMEIP default for

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
			textiles and textile apparel					mechanically formed fugitive emissions
8918106	P		NACE 13: manufacture of textiles, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8911700	P		NACE 15.11: tanning of leather and fur preparation	Process		0,35	0,10	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8900400	1	1	NACE 15: leather industry and fur preparation	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8911900	4		NACE 16.1: sawmilling and planing of wood, impregnation of wood	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8912100	4		NACE 16.23: manufacture of builders' carpentry and joinery	Process		0,35	0,34	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8912101	1	52	NACE 16: manufacture of wooden products	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8912101	1	33	NACE 16: manufacture of wooden products	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8912101	1	1	NACE 16: manufacture of wooden products	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8912101	1	135	NACE 16: manufacture of wooden products	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8912101	7	25	NACE 16: manufacture of wooden products	Combustion	wood	0,75	0,77	CEPMEIP/Ehrlich medium sized wood-fired boiler
8912106	P		NACE 16: manufacture of wooden products, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8900600	1	51	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	Combustion	coal	0,50	0,57	CEPMEIP default for combustion of coal in a medium sized combustor
8900600	1	52	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	Combustion	fuel oil	0,95	0,83	CEPMEIP default for combustion of gas/diesel oil
8900600	1	33	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8900600	1	1	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8912200	4	158	NACE 17.1: manufacture of pulp, paper and paperboard	Process	manufactured paper and paperboard	0,75	0,33	Similar to fraction of individual facilities in table A.1: Average of last AERs, Parenco
8912200	4		NACE 17.1: manufacture of pulp, paper and paperboard	Process		0,75	0,33	Similar to fraction of individual facilities in table A.1: Average of last AERs, Parenco
8912406	P		NACE 17: manufacture of paper, paperboard and articles of paper and paperboard, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8900700	1	1	NACE 18/58: publishing, printing and reproduction of recorded	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
			media					
8900700	P		NACE 18/58: publishing, printing and reproduction of recorded media	Process		0,35	0,05	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8924200	1	1	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8912500	1	52	NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	fuel oil	0,95	0,67	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8912500	1	1	NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8901100	1	51	NACE 20.1: manufacture of basic chemicals	Combustion	coal	0,50	0,43	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of coal in a medium sized combustor
8901100	1	52	NACE 20.1: manufacture of basic chemicals	Combustion	fuel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8901100	1	33	NACE 20.1: manufacture of basic chemicals	Combustion	lpg	0,75	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, production of

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
								chemical products
8901100	1	1	NACE 20.1: manufacture of basic chemicals	Combustion	natural gas	0,75		Similar to fraction of individual facilities in table A.1: Average of last AERs, production of chemical products
8901100	1	518	NACE 20.1: manufacture of basic chemicals	Combustion	other oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8901100	1	135	NACE 20.1: manufacture of basic chemicals	Combustion	petroleum	0,95	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8901100	1	54	NACE 20.1: manufacture of basic chemicals	Combustion	tar and asphalt	0,85	0,00	Similar to fraction of individual facilities in table A.1: CEPMEIP/Ehrlich default for combustion of heavy fuel oil
8901100	4	183	NACE 20.1: manufacture of basic chemicals	Process	manuafctured primary synthetic rubber	0,63	0,73	Similar to fraction of individual facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry
8901100	4	143	NACE 20.1: manufacture of basic chemicals	Process	Production value industrial gases	0,63	0,09	Similar to fraction of individual facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry
8901100	4		NACE 20.1: manufacture of	Process		0,63		Similar to fraction of individual

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
			basic chemicals					facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry
8912600	4	170	NACE 20.12: manufacture of dyes and pigments	Process	manufactured dyes and pigments	0,35	0,73	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8912600	4		NACE 20.12: manufacture of dyes and pigments	Process		0,35	0,73	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8913000	4	172	NACE 20.13: manufacture of inorganic basic chemicals	Process	manuafctured primary plastics	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913000	4	161	NACE 20.13: manufacture of inorganic basic chemicals	Process	manufactured norganic basic chemicals	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913000	4		NACE 20.13: manufacture of inorganic basic chemicals	Process		0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8912900	4	175	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	Process	manufactured organic basic chemicals	0,63	0,73	Similar to fraction of individual facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry
8912900	4		NACE 20.149: manufacture of	Process		0,63	0,73	Similar to fraction of individual

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
			organic basic chemicals (no petrochemicals)					facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry
8900900	1	52	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	fuel oil	0,95	0,34	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8900900	1	33	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	lpg	0,70	0,34	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying installations in fertilizer production sector
8900900	1	1	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	natural gas	0,70	0,34	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying installations in fertilizer production sector
8900900	4	171	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process	manufactured fertilizers and nitrogen compounds	0,70	0,34	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying installations in fertilizer production sector
8900900	4	2	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process	natural gas	0,70	0,34	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying installations in fertilizer production sector
8913100	4	163	NACE 20.2: manufacture of pesticides	Process	manufactured	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich,

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation for the new PM2.5 fraction
					pesticides			average for chemical industry
8913100	4		NACE 20.2: manufacture of pesticides	Process		0,55	0,72	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913700	1	52	NACE 20.2-20.5: chemical products industry	Combustion	fuel oil	0,95	0,83	CEPMEIP default for combustion of gas/diesel oil
8913700	1	17	NACE 20.2-20.5: chemical products industry	Combustion	gas/diesel oil	0,95	0,83	CEPMEIP default for combustion of gas/diesel oil
8913700	1	33	NACE 20.2-20.5: chemical products industry	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8913700	1	1	NACE 20.2-20.5: chemical products industry	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8913700	1	135	NACE 20.2-20.5: chemical products industry	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8913700	4	176	NACE 20.2-20.5: chemical products industry	Process	manufactured other chemicals	0,55	0,73	Ehrlich, average for chemical industry
8913700	4	178	NACE 20.2-20.5: chemical products industry	Process	manufactured perfumes and cosmetics	0,55	1,00	Ehrlich, average for chemical industry
8913700	4		NACE 20.2-20.5: chemical products industry	Process		0,55	0,73	Ehrlich, average for chemical industry
8913200	4	184	NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and	Process	manufactured paints, lacquers	0,50	0,73	Similar to fraction of individual facilities in table A.1: Assumption for fugitive

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation for the new PM2.5 fraction
			mastics		and ink			emissions from ovens
8913200	4		NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	Process		0,50	0,72	Similar to fraction of individual facilities in table A.1: Assumption for fugitive emissions from ovens
8913400	4	187	NACE 20.41: manufacture detergents	Process	manufactur ed detergents	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913400	4		NACE 20.41: manufacture detergents	Process		0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913600	4	173	NACE 20.52: manufacture of glues and adhesives	Process	manuafctur ed glues	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913600	4		NACE 20.52: manufacture of glues and adhesives	Process		0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8919300	4	166	NACE 20.59: manufacture of other chemical products n.e.c.	Process	manufactur ed photochemi cal products	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8919300	4		NACE 20.59: manufacture of other chemical products n.e.c.	Process		0,55	0,72	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913800	4		NACE 20.6: manufacture of synthetic and artificial fibres	Process		0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich,

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
								average for chemical industry
8901706	P		NACE 22.1: manufacture of rubber products, diffuse	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8913900	P		NACE 22.2: manufacture of plastic products	Process		0,35	0,10	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8913906	P		NACE 22.2: manufacture of plastic products, diffuse	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8901702	1	52	NACE 22: manufacture of rubber and plastic products	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8901702	1	33	NACE 22: manufacture of rubber and plastic products	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8901702	V	33	NACE 22: manufacture of rubber and plastic products	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8901702	1	1	NACE 22: manufacture of rubber and plastic products	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8901702	V	1	NACE 22: manufacture of rubber and plastic products	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8914000	4	157	NACE 23.1: manufacture of glass and glassware	Process	manufactur ed glass	0,95	0,54	Similar to fraction of individual facilities in table A.1: Average of last AERs, glass production

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation for the new PM2.5 fraction
8914000	4		NACE 23.1: manufacture of glass and glassware	Process		0,95	0,89	Similar to fraction of individual facilities in table A.1: Average of last AERs, glass production
8914100	4	169	NACE 23.2-23.4: manufacture of ceramic products	Process	manufactured ceramic products	0,25	0,92	Similar to fraction of individual facilities in table A.1: Ehrlich, fugitive emissions from ceramic industry
8914100	4		NACE 23.2-23.4: manufacture of ceramic products	Process		0,25	0,75	Similar to fraction of individual facilities in table A.1: Ehrlich, fugitive emissions from ceramic industry
8914200	4	83	NACE 23.32: manufacture of bricks and tiles	Process	Bricks	0,25	0,92	Similar to fraction of individual facilities in table A.1: Ehrlich, fugitive emissions from ceramic industry
8914200	4		NACE 23.32: manufacture of bricks and tiles	Process		0,25	0,75	Similar to fraction of individual facilities in table A.1: Ehrlich, fugitive emissions from ceramic industry
8914300	4	180	NACE 23.6: manufacture of articles of concrete, plaster and cement	Process	manufactured cement, chalk and gipsum	0,10	0,45	Similar to fraction of individual facilities in table A.1: Ehrlich, cement production fugitive emissions
8914500	4	204	NACE 23.9: manufacture of other non-metallic mineral products	Process	value of manufactured other	0,80	0,70	Similar to fraction of individual facilities in table A.1: PRTR for Denmark, non-metallic mineral

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
					non-metallic products			products
8914500	4		NACE 23.9: manufacture of other non-metallic mineral products	Process		0,80	0,70	Similar to fraction of individual facilities in table A.1: PRTR for Denmark, non-metallic mineral products
8914600	1	51	NACE 23: construction material and glass industry	Combustion	coal	0,50	0,45	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of coal in a medium sized combustor
8914600	1	13	NACE 23: construction material and glass industry	Combustion	cokes	0,50	0,54	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of coal in a medium sized combustor
8914600	1	52	NACE 23: construction material and glass industry	Combustion	fuel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8914600	1	33	NACE 23: construction material and glass industry	Combustion	lpg	0,90	0,54	Similar to fraction of individual facilities in table A.1: Average of last AERs, cement and glass production
8914600	1	1	NACE 23: construction material and glass industry	Combustion	natural gas	0,90	0,54	Similar to fraction of individual facilities in table A.1: Average of last AERs, cement and glass production

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8914600	1	135	NACE 23: construction material and glass industry	Combustion	petroleum	0,95	0,54	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8914606	P		NACE 23: construction material and glass industry, diffuse	Process		0,90	0,33	Similar to fraction of individual facilities in table A.1: Average of last AERs, cement and glass production
8924406	P		NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, diffuse	Process		0,65		Similar to fraction of individual facilities in table A.1: CEPMEIP average integrated iron and steel plant class 2
8924407	1	33	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8924407	4		NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Process		0,70	0,64	Ehrlich, metallurgical sector
8914602	4	168	NACE 24.2: manufacture of tubes and pipes	Process	manufactured tubes and pipes	0,70	0,37	Similar to fraction of individual facilities in table A.1: Ehrlich, metallurgical sector
8914602	4		NACE 24.2: manufacture of tubes and pipes	Process		0,70	0,37	Similar to fraction of individual facilities in table A.1: Ehrlich, metallurgical sector
8919200	4		NACE 24.3: other first processing of iron and steel	Process		0,70	0,50	Similar to fraction of individual facilities in table A.1: Ehrlich, metallurgical sector
8920100	1	13	NACE 24.4/24.53/24.54:	Combustion	cokes	0,50	0,43	CEPMEIP default for combustion

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
			manufacture and casting of light and other non-ferrous metals					of coal in a medium sized combustor
8920100	1	33	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	Combustion	lpg	1,00	0,73	CEPMEIP default for combustion of gaseous fuels
8920100	1	1	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	Combustion	natural gas	1,00	0,73	CEPMEIP default for combustion of gaseous fuels
8914702	4		NACE 24.45: manufacture of non-ferrous metals, aluminium	Process		0,75	0,67	Similar to fraction of individual facilities in table A.1: CEPMEIP default for sec0ndary copper
8914900	4	111	NACE 24.5: casting of metals	Process	casting of metals	0,55	0,15	Similar to fraction of individual facilities in table A.1: Average of last AERs, Alucast
8914900	4		NACE 24.5: casting of metals	Process		0,55	0,15	Similar to fraction of individual facilities in table A.1: Average of last AERs, Alucast
8902100	1	33	NACE 25: manufacture of metal structures and parts of structures	Combustion	lpg	0,30	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, selection of companies in metal industry
8902100	1	1	NACE 25: manufacture of metal structures and parts of structures	Combustion	natural gas	0,30	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, selection of companies in metal industry
8902100	1	135	NACE 25: manufacture of metal	Combustion	petroleum	0,30	1,00	Similar to fraction of individual

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
			structures and parts of structures					facilities in table A.1: Average of last AERs, selection of companies in metal industry
8915000	P		NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8915006	P		NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, diffuse release of PM10	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8902301	1	52	NACE 26/28: manufacture of machinery and electronic apparatus	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8902301	1	33	NACE 26/28: manufacture of machinery and electronic apparatus	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902301	1	1	NACE 26/28: manufacture of machinery and electronic apparatus	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902301	1	135	NACE 26/28: manufacture of machinery and electronic apparatus	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8915300	1	51	NACE 26/31/32: manufacture of electronic apparatus and furniture	Combustion	coal	0,50	0,57	CEPMEIP default for combustion of coal in a medium sized combustor
8915300	1	52	NACE 26/31/32: manufacture of electronic apparatus and	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
			furniture					
8915300	1	33	NACE 26/31/32: manufacture of electronic apparatus and furniture	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8915300	1	1	NACE 26/31/32: manufacture of electronic apparatus and furniture	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8915300	1	135	NACE 26/31/32: manufacture of electronic apparatus and furniture	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8902304	1	1	NACE 26: manufacture of computers and electronic and optical apparatus	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902303	1	1	NACE 27: manufacture of electrical apparatus	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902200	1	52	NACE 28: manufacture of machinery	Combustion	fuel oil	0,95	0,67	Similar to fraction of individual facilities in table A.1: Average last AERs, Komeco
8902200	1	33	NACE 28: manufacture of machinery	Combustion	lpg	0,35	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8902200	1	1	NACE 28: manufacture of machinery	Combustion	natural gas	0,35	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8902400	1	52	NACE 29: motor-industry	Combustion	fuel oil	0,95	0,67	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8902400	1	33	NACE 29: motor-industry	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902400	1	1	NACE 29: motor-industry	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902400	1	135	NACE 29: motor-industry	Combustion	petroleum	0,95	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8914800	P		NACE 30.1: ship-building, painting	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8908100	1	52	NACE 30: manufacture of other transport equipment	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8908100	1	33	NACE 30: manufacture of other transport equipment	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8908100	1	1	NACE 30: manufacture of other transport equipment	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8908100	1	135	NACE 30: manufacture of other transport equipment	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8908000	1	52	NACE 31/32: manufacture of furniture and other goods	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8908000	1	33	NACE 31/32: manufacture of furniture and other goods	Combustion	lpg	1,00	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gaseous fuels
8908000	1	1	NACE 31/32: manufacture of furniture and other goods	Combustion	natural gas	1,00	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gaseous fuels
8908000	7	25	NACE 31/32: manufacture of furniture and other goods	Combustion	wood	0,75		Similar to fraction of individual facilities in table A.1: CEPMEIP/Ehrlich medium sized wood-fired boiler
8908000	7	26	NACE 31/32: manufacture of furniture and other goods	Combustion	wood, wood waste	0,75	0,77	Similar to fraction of individual facilities in table A.1: CEPMEIP/Ehrlich medium sized wood-fired boiler
8920400	7	8	NACE 35: production and distribution of electricity and gas	Combustion	Biomass gaseous	0,75		Similar to fraction of individual facilities in table A.1: Average of last AERs, co-firing in coal fired power plants
8920400	1	51	NACE 35: production and distribution of electricity and gas	Combustion	coal	0,75	0,83	Similar to fraction of individual facilities in table A.1: Average of last AERs, large coal fired power plants
8920400	1	52	NACE 35: production and distribution of electricity and gas	Combustion	fuel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
								default for combustion of gas/diesel oil
8920400	1	17	NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8920400	1	1	NACE 35: production and distribution of electricity and gas	Combustion	natural gas	0,75		Similar to fraction of individual facilities in table A.1: Average of last AERs, co-firing in coal fired power plants
8920500	1	52	NACE 36: collection, purification and distribution of water	Combustion	fuel oil	0,95	0,80	CEPMEIP default for combustion of gas/diesel oil
8920500	1	17	NACE 36: collection, purification and distribution of water	Combustion	gas/diesel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8920500	1	33	NACE 36: collection, purification and distribution of water	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8920500	1	1	NACE 36: collection, purification and distribution of water	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8920500	1	135	NACE 36: collection, purification and distribution of water	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
E400109	7	8	NACE 37: collection and treatment of sewage	Combustion	Biomass gaseous	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
E400109	H	8	NACE 37: collection and treatment of sewage	Combustion	Biomass gaseous	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
E400109	1	17	NACE 37: collection and treatment of sewage	Combustion	gas/diesel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
E400109	V	17	NACE 37: collection and treatment of sewage	Combustion	gas/diesel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
E400109	1	1	NACE 37: collection and treatment of sewage	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
E400109	V	1	NACE 37: collection and treatment of sewage	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8921804	P		NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	Process		0,95	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, modern waste incineration.
8916000	1	52	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	fuel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8916000	1	33	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8916000	1	1	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8921900	1	52	NACE 39: sanitation and other waste management	Combustion	fuel oil	0,95	0,67	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8921900	1	33	NACE 39: sanitation and other waste management	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	SSE	EVE	Emission source	Emission type	Activity	New (2019)	Old (2018)	Explanation for the new PM2.5 fraction
0020401	1	51	NACE 41-43: construction and building industies	Combustion	coal	0,50	0,50	CEPMEIP default for combustion of coal in a medium sized combustor
0020401	1	33	NACE 41-43: construction and building industies	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
0020401	1	1	NACE 41-43: construction and building industies	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
0020401	7	25	NACE 41-43: construction and building industies	Combustion	wood	0,75	0,77	CEPMEIP/Ehrlich medium sized wood-fired boiler
0833400	P		NACE 52.10/52.24: cargo handling and storage	Process		0,15	0,27	Similar to fraction of individual facilities in table A.1: CEPMEIP, average for storage

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