**Estimation of NMVOC emissions**

**from diffuse sources**

June 2010

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# METHODOLOGY

## Emission estimation

Emissions can be estimated at different levels of complexity. Within the IPCC Guidelines and adopted by EMEP/EEA Guidebook, these are expressed in three tiers of increasing complexity.

The ‘Tier 1’ method is a ‘simple’ method using default emission factors only. To upgrade a Tier 1 to a Tier 2 method, the default emission factors should be replaced by country-specific or technology-specific emission factors. This might also require a further split of the activity data over a range of different technologies, implicitly aggregated in the Tier 1 method. A Tier 3 method could be regarded as a method that uses the latest scientific knowledge in more sophisticated approaches and models; more detailed definitions follow.

**Tier 1:**

A method uses readily available statistical data on the intensity of processes (activity rates) and default emission factors. These emission factors assume a linear relation between the intensity of the process and the resulting emissions. The Tier 1 default emission factors also assume an average or typical process description. This method is the simplest method, has the highest level of uncertainty and should not be used to estimate emissions from key categories.

The Tier 1 approach uses the general equation:

*ENMVOC= ARproduction, process, use, technology x EFNMVOC,*

where,

ARproduction, process, use = activity rate for specific activity

EF = emission factor for this process, technology

**Tier 2: More complex method**

Tier 2 is similar to Tier 1 but uses more specific emission factors developed on the basis of knowledge of the types of processes and specific process conditions that apply in the country for which the inventory is being developed. Tier 2 methods are more complex, will reduce the level of uncertainty, and are considered adequate for estimating emissions for key categories.

*ENMVOC=∑ ARproduction, process, use, technology x EFNMVOC,*

where,

ARproduction, process, use = activity rate for specific activity

EF = emission factor for this process, technology

**Tier 3:**

Tier 3 is defined as any methodology more detailed than Tier 2; hence there is a wide range of Tier 3 methodologies. At one end of the range there are methodologies similar to Tier 2 (i.e. activity data x emission factor) but with a greater disaggregation of activity data and emission factors. At the other end of the range are complex, dynamic models in which the processes leading to emissions are described in great detail. The key criterion to be met before a Tier 3 methodology can replace a Tier 2 methodology is a more accurate estimation of the relevant emissions, reducing the following common sources of error.

## Gridding

An appropriate approach is chosen according to the sector and recommendations provided in relevant EMEP Guidebook chapter.

In several cases population statistics is used as a basis for disaggregation.

In these cases when the emission factor is connected with activity data concerning production, product use or handling or similar, average population (share by county in percentage) is used for disaggregation, because there is no considerable difference in share by counties in different years. See Annex I.

In these cases, emission factor is connected by population, a more exact approach is applied. The emission for each county is estimated by taking into account actual population data.

# ENERGY SECTOR (NFR 1)

## Distribution of oil products (NFR 1.B.2.a.v)

### Source description

Emissions from this source category have historically contributed significantly to the total anthropogenic NMVOC emissions. However, European Directive 94/63/EC (EU, 1994) has mandated vapour collection and recovery during the loading of gasoline transport equipment (i.e. tank trucks, rail tank cars and barges) and during the discharge of tank trucks into storage at service stations. It has also imposed emission controls on all gasoline storage tanks at terminals, dispatch stations and depots. The result of these controls has been a very significant reduction in NMVOC emissions from this sector in the EU.

Emissions of NMVOCs to atmosphere occur in nearly every element of the oil product distribution chain. The vast majority of emissions occur during the storage and handling of gasoline due to their much higher volatility compared to other fuels such as gasoil, kerosene, etc.

**Situation in Estonia**

In Estonia, oil terminals and service stations must have permits when the total loading turnover exceeds 2000 m3 per year[[1]](#footnote-1). That means only the smallest service stations are considered as diffuse sources. Oil terminals and service stations that are permitted are not included in this project.

European Directive 94/63/EC has mandated vapour collection and recovery for discharge of tank trucks into storage at service stations (Stage 1B). In Estonia the regulation on implementation the requirements of the EU Directive 94/63/EC came into force in 1998.

The timetable for the implementation of Stage 1B vapour collection and recovery equipment according the requirements is following:

- from January 1 2001 for existing service stations with turnover over 1000 m3 and all others situated in densely populated or industrial areas,

- from January 2004 for service stations with turnover over 500 m3,

- from January 2005 for service stations with turnover over 100 m3.

Most probably the majority of the not-permitted gasoline stations are having turnover from 100 to 2000 m3. From 2005 these must have vapour collection and recovery equipment.

### Emission factors

As the situation regarding the requirements of vapour recovery equipment has changed over the years, different emission factors are used for different periods.

1. For the years 1990, 1995 and 2000 the emission factor from Corinair 2007 is applied;
2. For the years 2005-2008 the emission factor from EMEP Guidebook 2009 is applied

#### Emission factor for 1990-2000

The emission factor for gasoline distribution was 3930 g NMVOC/Mg of total gasoline handled.

#### Emission factor for 2005-2008

Tier 2 emission factors are used for NMVOC emission calculations in 2005-2008.

Service Stations

In the tables below, the technology specific emission factors for Service Stations are provided. As the majority of the emissions at service stations are from gasoline storage and refuelling (compared to emissions from gasoil), emission factors are only provided for gasoline.

**Table 1 Tier 2 emission factors for source category 1.B.2.a.v Distribution of Oil Products, Service Stations, Storage tank Filling**

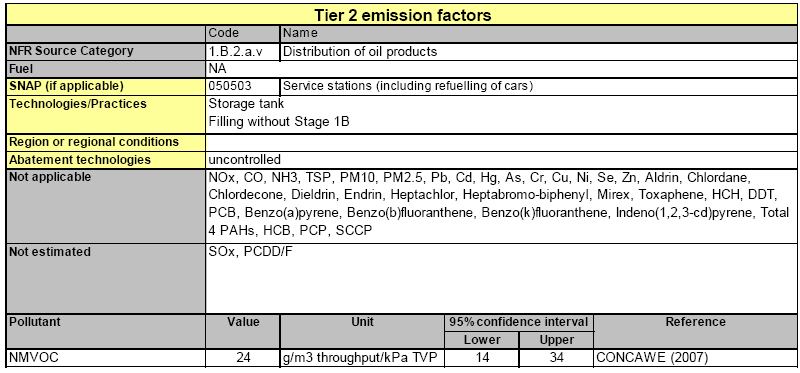


Table 2 Tier 2 emission factors for source category 1.B.2.a.v Distribution of Oil Products, Service Stations, Storage tank breathing

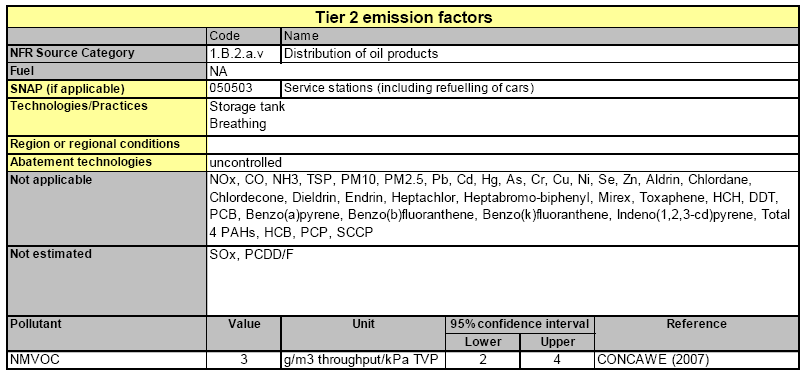


Table 3 Tier 2 emission factors for source category 1.B.2.a.v Distribution of Oil Products, Service Stations, Automobile refuelling

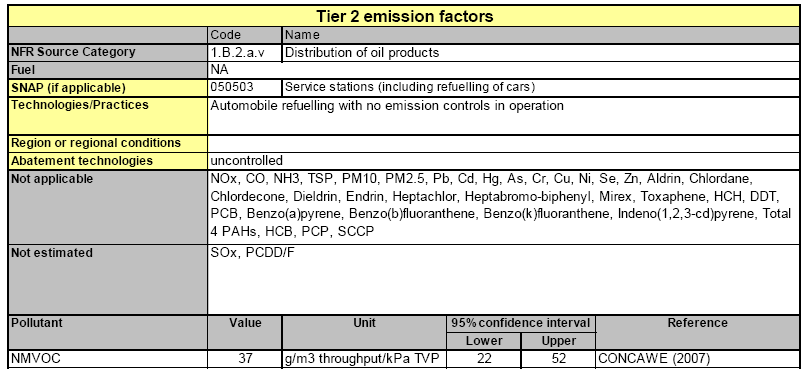
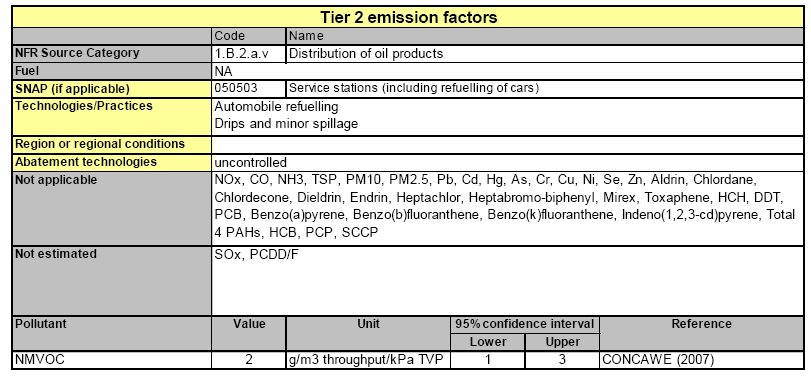


Table 4 Tier 2 emission factors for source category 1.B.2.a.v Distribution of Oil Products, Service Stations, Automobile refuelling: drips and spills

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**Abatement**

In the previous chapter Stage 1B abatement technology requirement is described. The resulting emission can be calculated by replacing the technology specific emission factor with an abated emission factor as given in the formula:

*EF technology, abated =* (1−η*abatement*) × *EF technology, unabated*

**Table 5 Abatement efficiencies (ηabatement) for source category 1.B.2.a.v Distribution of oil products, Service stations, Storage tank filling**



The emission factors in the tables above depend on the True Vapour Pressure (TVP). This pressure is the vapour pressure at loading, and depends on the loading temperature. The definition of the TVP is as follows:

TVP = RVP10AT+B

where A=0.000007047RVP+0.0132 and B=0.0002311RVP-0.5236, T is the temperature (in °C) and RVP is the Reid Vapour Pressure (in kPa).

The annual average loading temperature at terminals can be assumed to equal the average annual ambient temperature.

### Emission factor calculation for Estonia

The annual average temperature in Estonia is equal to 5˚C.[[2]](#footnote-2)

The RVP for gasoline (gasoline 95) in Estonia according to Register of Fuel Monitoring in 2005-2008 is presented in following table.

Table 6 Annual average RVP of gasoline 95 in Estonia in 2005-2008

|  |  |
| --- | --- |
| Year | Annual average RVP, kPa |
| 2008 | 75,3 |
| 2007 | 74,8 |
| 2006 | 75,8 |
| 2005 | 72,3 |
| **Average** | **74,6** |

RVP for gasoline is up to 74,6 kPa.

TVP = 74,6 x 10(0,000007047x74,6+0,0132)\*5+(0,0002311x74,6-0,5236) = 27,2 kPa

Consequently an average true vapour pressure for gasoline is 27,2 kPa (5˚C).

One integrated emission factor representing all activities in the small service station is calculated for emission calculations.

Table 7 Total emission factor for emissions from gasoline handling in service stations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Tier 2 emission factors for source category 1.B.2.a.v Distribution of Oil Products | | | | | |
| Category | Emission source | NMVOC emission factor, g/m3 throughput/kPa TVP | Abatement efficiency (ηabatement), % | True Vapour Pressure (TVP), kPa | NMVOC emission factor for gasoline, g/m3 throughput |
| Gasoline in service stations | Storage tank Filling with no Stage 1B | 24 | 95% | 27,2 | 33 |
| Storage tank Breathing | 3 | - | 27,2 | 82 |
| Automobile refuelling with no emission controls in operation | 37 | - | 27,2 | 1006 |
| Automobile refuelling Drips and minor spillage | 2 | - | 27,2 | 54 |
| **Emission factor for all the activities total** | **66** | **-** | - | **1175** |

### Activity data

Activity data on the subject of gasoline consumption is available from Statistics Estonia.

Table 8 Consumption of motor gasoline by counties in 1990-2008 (thousand tons)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| **Eesti** | **523** | **247** | **282** | **290** | **308** | **323** | **320** |
| *By county:* |  |  |  |  |  |  |  |
| Harju | 174 | 97 | 123 | 145 | 156 | 168 | 164 |
| Hiiu | 11 | 3 | 2 | 1 | 2 | 2 | 1 |
| Ida-Viru | 54 | 24 | 22 | 23 | 26 | 25 | 24 |
| Jõgeva | 18 | 7 | 9 | 7 | 7 | 8 | 7 |
| Järva | 24 | 8 | 8 | 8 | 8 | 7 | 7 |
| Lääne | 17 | 6 | 7 | 5 | 5 | 5 | 5 |
| Lääne-Viru | 28 | 15 | 16 | 11 | 13 | 14 | 15 |
| Põlva | 13 | 6 | 5 | 6 | 5 | 6 | 6 |
| Pärnu | 37 | 17 | 17 | 18 | 18 | 18 | 19 |
| Rapla | 17 | 7 | 6 | 6 | 7 | 7 | 8 |
| Saare | 18 | 6 | 7 | 6 | 6 | 8 | 8 |
| Tartu | 45 | 24 | 35 | 31 | 31 | 33 | 32 |
| Valga | 15 | 8 | 8 | 6 | 6 | 5 | 6 |
| Viljandi | 24 | 11 | 10 | 10 | 11 | 11 | 11 |
| Võru | 28 | 8 | 7 | 7 | 7 | 6 | 6 |

The assumed liquid gasoline density is 730 kg/m3.[[3]](#footnote-3)

For calculations consumption values are converted from thousand tons to thousand m3.

Table 9 Consumption of motor gasoline by counties in 1990-2008 (thousand m3)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| **Eesti** | **716** | **338** | **386** | **397** | **422** | **442** | **438** |
| *By county:* |  |  |  |  |  |  |  |
| Harju | 238 | 133 | 168 | 199 | 214 | 230 | 225 |
| Hiiu | 15 | 4 | 3 | 1 | 3 | 3 | 1 |
| Ida-Viru | 74 | 33 | 30 | 32 | 36 | 34 | 33 |
| Jõgeva | 25 | 10 | 12 | 10 | 10 | 11 | 10 |
| Järva | 33 | 11 | 11 | 11 | 11 | 10 | 10 |
| Lääne | 23 | 8 | 10 | 7 | 7 | 7 | 7 |
| Lääne-Viru | 38 | 21 | 22 | 15 | 18 | 19 | 21 |
| Põlva | 18 | 8 | 7 | 8 | 7 | 8 | 8 |
| Pärnu | 51 | 23 | 23 | 25 | 25 | 25 | 26 |
| Rapla | 23 | 10 | 8 | 8 | 10 | 10 | 11 |
| Saare | 25 | 8 | 10 | 8 | 8 | 11 | 11 |
| Tartu | 62 | 33 | 48 | 42 | 42 | 45 | 44 |
| Valga | 21 | 11 | 11 | 8 | 8 | 7 | 8 |
| Viljandi | 33 | 15 | 14 | 14 | 15 | 15 | 15 |
| Võru | 38 | 11 | 10 | 10 | 10 | 8 | 8 |

### Results

As a part of service stations are permitted, data regarding point sources is subtracted in following ways.

* In 1990 and 1995 no companies were reporting as point sources, all gasoline distribution was handled like diffuse sources,
* In 2000 only one company was reporting as a point source according to CollectER, situated in Lääne county. No activity data is available. Emission from point sources is subtracted from total calculated VOC emission.

In 2005 more than 200 companies were reporting as point sources according to CollectER. In one case (Hiiu county) reported NMVOC emission exceeds calculated NMVOC emission. In this case diffuse emission is estimated to be equal to zero and emissions from other counties have been reduced accordingly in even parts.

* CollectER does not provide emission by counties, emission from point sources is divided evenly by consumption. Divided emission from point sources is subtracted from total calculated VOC emission.
* For 2006-2008 activity data relating to point sources is available and activity data for emission calculations from point sources is calculated as following:

gasoline distribution in diffuse sources = total gasoline consumption – gasoline distribution in point sources.

In some cases gasoline consumption by county is smaller than reported gasoline distribution by county. This is most probably affected by the fact that in OSIS data regarding point sources is connected to actual location and in Statistics Estonia data is connected to the legal address of the company.

In those cases “gasoline distribution in diffuse sources” is estimated to be equal to zero and gasoline distribution in other counties has been reduced accordingly in even parts.

Table 10 NMVOC emission from gasoline distribution in service stations and emission distribution by counties

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NMVOC emission from gasoline distribution in service stations | | | | | | | | | | | | | | | | | | | | | | | | |
| Year | 1990 | | 1995 | | 2000 | | | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | |
| Emission factor | 3930 | g NMVOC/ Mg | 3930 | g NMVOC/ Mg | 3930 | | g NMVOC/Mg | | 1175 | | g/m3 throughput | | 1175 | | g/m3 throughput | | 1175 | | g/m3 throughput | | 1175 | | g/m3 throughput | |
| County | Gasoline consumption, 103 t | NMVOC emission, t | Gasoline consumption, 103 t | NMVOC emission, t | Gasoline consumption, 103 t | NMVOC emission, t | NMVOC from point sources, t | NMVOC from diffuse sources, t | Gasoline consumption, 103 m3 | NMVOC emission, t | NMVOC from point sources, t | NMVOC from diffuse sources, t | Gasoline consumption, 103 m3 | Gasoline distribution point sources, 103 m3 | Gasoline distribution diffuse sources, 103 m3 | NMVOC from diffuse sources, t | Gasoline consumption, 103 m3 | Gasoline distribution point sources, 103 m3 | Gasoline distribution diffuse sources, 103 m3 | NMVOC from diffuse sources, t | Gasoline consumption, 103 m3 | Gasoline distribution point sources, 103 m3 | Gasoline distribution diffuse sources, 103 m3 | NMVOC from diffuse sources, t |
| Estonia | 523 | **2055** | 247 | **971** | 282 | 1108 | 22 | **1087** | 397 | 467 | 360,68 | **106** | 422 | 340,8 | 81,1 | **95,257** | 442 | 360,6 | 81,8 | **96,164** | 438,4 | 361,2 | 77,1 | **90,627** |
| *By county:* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Harju | 174 | 684 | 97 | 381 | 123 | 483 |  | 483 | 199 | 233 | 221,11 | 12 | 214 | 185,6 | 27,1 | 31,864 | 230 | 192,6 | 36,8 | 43,197 | 224,7 | 185,3 | 38,9 | 45,659 |
| Hiiu | 11 | 43 | 3 | 12 | 2 | 8 |  | 8 | 1 | 2 | 5,37 | 0 | 3 | 4,6 | 0,0 | 0,000 | 3 | 2,9 | 0,0 | 0,000 | 1,4 | 2,7 | 0,0 | 0,000 |
| Ida-Viru | 54 | 212 | 24 | 94 | 22 | 86 |  | 86 | 32 | 37 | 12,09 | 25 | 36 | 14,4 | 20,3 | 23,813 | 34 | 18,7 | 14,8 | 17,438 | 32,9 | 17,9 | 14,5 | 17,048 |
| Jõgeva | 18 | 71 | 7 | 28 | 9 | 35 |  | 35 | 10 | 11 | 4,28 | 7 | 10 | 5,7 | 2,9 | 3,438 | 11 | 6,9 | 3,3 | 3,886 | 9,6 | 8,4 | 0,7 | 0,867 |
| Järva | 24 | 94 | 8 | 31 | 8 | 31 |  | 31 | 11 | 13 | 5,13 | 7 | 11 | 4,8 | 5,1 | 6,040 | 10 | 5,3 | 3,5 | 4,153 | 9,6 | 8,2 | 0,9 | 1,085 |
| Lääne | 17 | 67 | 6 | 24 | 7 | 28 | 21,72 | 6 | 7 | 8 | 6,81 | 1 | 7 | 8,4 | 0,0 | 0,000 | 7 | 8,3 | 0,0 | 0,000 | 6,8 | 8,3 | 0,0 | 0,000 |
| Lääne-Viru | 28 | 110 | 15 | 59 | 16 | 63 |  | 63 | 15 | 18 | 11,08 | 6 | 18 | 9,2 | 7,7 | 8,999 | 19 | 11,6 | 6,9 | 8,085 | 20,5 | 12,3 | 7,8 | 9,166 |
| Põlva | 13 | 51 | 6 | 24 | 5 | 20 |  | 20 | 8 | 10 | 1,53 | 8 | 7 | 3,0 | 2,8 | 3,315 | 8 | 2,2 | 5,3 | 6,253 | 8,2 | 2,7 | 5,0 | 5,893 |
| Pärnu | 37 | 145 | 17 | 67 | 17 | 67 |  | 67 | 25 | 29 | 21,13 | 8 | 25 | 19,4 | 4,3 | 5,008 | 25 | 21,0 | 2,9 | 3,418 | 26,0 | 24,9 | 0,6 | 0,746 |
| Rapla | 17 | 67 | 7 | 28 | 6 | 24 |  | 24 | 8 | 10 | 7,64 | 2 | 10 | 12,9 | 0,0 | 0,000 | 10 | 12,6 | 0,0 | 0,000 | 11,0 | 11,7 | 0,0 | 0,000 |
| Saare | 18 | 71 | 6 | 24 | 7 | 28 |  | 28 | 8 | 10 | 2,79 | 7 | 8 | 5,2 | 2,1 | 2,415 | 11 | 5,1 | 5,1 | 5,970 | 11,0 | 7,1 | 3,3 | 3,914 |
| Tartu | 45 | 177 | 24 | 94 | 35 | 138 |  | 138 | 42 | 50 | 41,70 | 8 | 42 | 46,7 | 0,0 | 0,000 | 45 | 48,2 | 0,0 | 0,000 | 43,8 | 45,6 | 0,0 | 0,000 |
| Valga | 15 | 59 | 8 | 31 | 8 | 31 |  | 31 | 8 | 10 | 3,40 | 6 | 8 | 3,9 | 3,4 | 3,947 | 7 | 5,7 | 0,4 | 0,443 | 8,2 | 5,4 | 2,3 | 2,700 |
| Viljandi | 24 | 94 | 11 | 43 | 10 | 39 |  | 39 | 14 | 16 | 12,65 | 3 | 15 | 10,3 | 3,8 | 4,418 | 15 | 11,5 | 2,8 | 3,326 | 15,1 | 12,9 | 1,6 | 1,932 |
| Võru | 28 | 110 | 8 | 31 | 7 | 28 |  | 28 | 10 | 11 | 3,96 | 7 | 10 | 6,9 | 1,7 | 2,032 | 8 | 8,0 | 0,0 | 0,000 | 8,2 | 7,8 | 0,0 | 0,000 |

## Natural gas (NFR 1B2b)

### Source description

The term “fugitive emissions” is broadly applied here to mean all greenhouse gas emissions from gas systems except contributions from fuel combustion. Natural gas systems comprise all infrastructure required to produce, collect, process or refine and deliver natural gas and petroleum products to market. The system begins at the wellhead, or oil and gas source, and ends at the final sales point to the consumer.

The sources of fugitive emissions on gas systems include, but are not limited to, equipment leaks, evaporation and flashing losses, venting, flaring, incineration and accidental releases (e.g., pipeline dig-ins, well blow-outs and spills). While some of these emission sources are engineered or intentional (e.g., tank, seal and process vents and flare systems), and therefore relatively well characterized, the quantity and composition of the emissions is generally subject to significant uncertainty.

**Situation in Estonia[[4]](#footnote-4)**

Natural gas is imported into Estonia from Russia and from the Inčukalns underground gas storage in Latvia.

AS Eesti Gaas has two gas metering stations on the border of Estonia, where the volumes of imported gas are measured. Gas is distributed to customers through gas pipelines, distribution stations and gas pressure reducing stations.



Figure 1 Map of high-pressure gas distribution pipelines

The gas pipeline goes through ten counties: Ida-Viru, Lääne-Viru, Harju, Rapla, Jõgeva, Tartu, Põlva, Võru, Viljandi and Pärnu. All counties have gas consumers.

The construction of the natural gas pipeline to the towns of Pärnu and Sindi was completed in 2006. The natural gas pipelines also reached the customers in the County town of Rapla and the town of Püssi.[[5]](#footnote-5)

### Emission factors

**EMEP/EEA air pollutant emission inventory guidebook (2009) does not provide calculations methodology for NMVOC calculations from gas distribution. Therefore IPPC Guidelines for National Greenhouse inventories (2006) is used.**

Tier 1 emission factors are used (Equation 1).

The activity rate for this sector is natural gas consumption. Unit: million m3

Emission factor unit: Gg per 106 of marketable gas/Utility sales.

The available default emission factors are presented below in . While some types of fugitive emissions correlate poorly with, or are unrelated to, throughput on an individual source basis (e.g., fugitive equipment leaks), the correlations with throughput become more reasonable when large populations of sources are considered. Furthermore, throughput statistics are the most consistently available activity data for use in Tier 1 calculations.

Table 11 Tier 1 emission factors for fugitive emissions (including venting and flaring) from gas operations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Category | Sub-category | Emission source | IPCC Code | in developed countries | | in developing countries and countries with economies in transition | | Units of measure |
| NMVOC | | NMVOC | |
| Value | Uncertainty value (% of value) | Value | Uncertainty value (% of value) |
| Gas transmission & Storage | Transmission | Fugitives | 1.B.2.b.iii.4 | 7,0E-06 | +-100% | 7,0E-06 to 1,6E-05 | -40 to +250% | Gg per 106 m3 of marketable gas |
| Venting | 1.B.2.b.i | 4,6E-06 | +-75% | 4,6E-06 to 1,1E-05 | -40 to +250% | Gg per 106 m3 of marketable gas |
| Gas Distribution | All | All | 1.B.2.b.iii.5 | 1,6E-05 | -20 to +500% | 1,6E-05 to 3,6E-5 | -20 to +500% | Gg per 106 m3 of utility sales |

Until 2004, the Estonian economy can be classified as an economy in transition. The emission factors are chosen accordingly. For the transition period from 1990 to 2004 the emission factor for countries with economies in transition is used. It is expected that the emissions have decreased equally within this period.

Table 12 Tier 1 emission factors for fugitive emissions (including venting and flaring) from gas operations for different years

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Category | Sub-category | Emission source | IPCC Code | NMVOC | | | | |
| 1990 | 1995 | 2000 | 2005-2008 | Units of measure |
| Gas transmission & Storage | Transmission | Fugitives | 1.B.2.b.iii.4 | 1,6E-05 | 1,3E-05 | 9,6E-06 | 7,0E-06 | Gg per 106 m3 of marketable gas |
| Venting | 1.B.2.b.i | 1,1E-05 | 8,7E-06 | 6,4E-06 | 4,6E-06 | Gg per 106 m3 of marketable gas |
| Gas Distribution | All | All | 1.B.2.b.iii.5 | 3,6E-05 | 2,9E-05 | 2,2E-05 | 1,6E-05 | Gg per 106 m3 of utility sales |
| Total | - | - | - | **6,3E-05** | **5,0E-05** | **3,8E-05** | **2,8E-05** | **Gg per 106 m3 of utility sales** |

### Activity data

Activity data on the subject of annual natural gas consumption is available from Statistics Estonia.

Table 13 Activity data used for NMVOC emission calculation in 1990 – 2008 (million m3)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Year | **1991** | **1995** | **2000** | **2005** | **2006** | **2007** | **2008** |
| Estonia | 1521 | 723 | 826 | 997 | 1009 | 1003 | 961 |
| *By county* |  |  |  |  |  |  |  |
| Harju | 757 | 351 | 506 | 611 | 621 | 591 | 527 |
| Hiiu | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ida-Viru | 468 | 261 | 219 | 275 | 275 | 279 | 279 |
| Jõgeva | 14 | 4 | 4 | 8 | 4 | 5 | 6 |
| Järva | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lääne | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lääne-Viru | 73 | 24 | 28 | 35 | 35 | 40 | 36 |
| Põlva | 34 | 11 | 12 | 8 | 8 | 10 | 11 |
| Pärnu | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| Rapla | 0 | 6 | 17 | 17 | 20 | 22 | 24 |
| Saare | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tartu | 175 | 66 | 39 | 41 | 43 | 49 | 61 |
| Valga | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Viljandi | 0 | 0 | 1 | 2 | 3 | 7 | 8 |
| Võru | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

### Results

Table 14 NMVOC emissions from natural gas distribution, in tons (NFR 1 B 2 b)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 1990 | | 1995 | | 2000 | | 2005 | | 2006 | | 2007 | | 2008 | |
| Emission factor, Gg/106 m3 | **6,3E-05** | | **5,0E-05** | | **3,8E-05** | | **2,8E-05** | | **2,8E-05** | | **2,8E-05** | | **2,8E-05** | |
|  | Gas consumption, 106 m3 | NMVOC emission, t | Gas consumption, 106 m3 | NMVOC emission, t | Gas consumption, 106 m3 | NMVOC emission, t | Gas consumption, 106 m3 | NMVOC emission, t | Gas consumption, 106 m3 | NMVOC emission, t | Gas consumption, 106 m3 | NMVOC emission, t | Gas consumption, 106 m3 | NMVOC emission, t |
| Estonia | 1516 | **95,508** | 723 | **36,408** | 826 | **31,152** | 997 | **27,517** | 1009 | **27,848** | 1003 | **27,683** | 961 | **26,524** |
| *By county* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Harju | 755 | 47,565 | 351 | 17,675 | 506 | 19,083 | 611 | 16,864 | 621 | 17,140 | 591 | 16,312 | 527 | 14,545 |
| Hiiu | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 |
| Ida-Viru | 466 | 29,358 | 261 | 13,143 | 219 | 8,259 | 275 | 7,590 | 275 | 7,590 | 279 | 7,700 | 279 | 7,700 |
| Jõgeva | 14 | 0,882 | 4 | 0,201 | 4 | 0,151 | 8 | 0,221 | 4 | 0,110 | 5 | 0,138 | 6 | 0,166 |
| Järva | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 |
| Lääne | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 |
| Lääne-Viru | 73 | 4,599 | 24 | 1,209 | 28 | 1,056 | 35 | 0,966 | 35 | 0,966 | 40 | 1,104 | 36 | 0,994 |
| Põlva | 34 | 2,142 | 11 | 0,554 | 12 | 0,453 | 8 | 0,221 | 8 | 0,221 | 10 | 0,276 | 11 | 0,304 |
| Pärnu | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 9 | 0,248 |
| Rapla | 0 | 0,000 | 6 | 0,302 | 17 | 0,641 | 17 | 0,469 | 20 | 0,552 | 22 | 0,607 | 24 | 0,662 |
| Saare | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 |
| Tartu | 174 | 10,962 | 66 | 3,324 | 39 | 1,471 | 41 | 1,132 | 43 | 1,187 | 49 | 1,352 | 61 | 1,684 |
| Valga | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 |
| Viljandi | 0 | 0,000 | 0 | 0,000 | 1 | 0,038 | 2 | 0,055 | 3 | 0,083 | 7 | 0,193 | 8 | 0,221 |
| Võru | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 | 0 | 0,000 |

Results are smaller than previously reported in NFR reports due to the change of emission factor.

# INDUSTRIAL PROCESSES (NFR 2)

## Road paving with asphalt (NFR 2.A.6)

### Source description

Asphalt roads are a compacted mixture of aggregate and an asphalt binder. Natural gravel, manufactured stone (from quarries) or by-products from metal ore refining are used as aggregates. Asphalt cement or liquefied asphalt may be used as asphalt binder.

The most significant source of ducted emissions from batch mix plants is the dryer, which emits particulate matter and small amounts of VOCs derived from combustion exhaust gases. Aggregate dust, VOCs and a fine aerosol of liquids are also emitted from the hot-side conveying, classifying and mixing equipment.

For any given amount of asphalt, total emissions are believed to be the same, regardless of stockpiling, mixing and application times. The major source of NMVOCs from the use of liquefied asphalts is the cutback asphalt.

Since most of the emissions occur at the paving locations themselves, emissions can be disaggregated based on the percentage of total paved road surfaces. If this information is not available, the emissions may also be disaggregated based on mobile sources emission estimates or even population.

### Default emission factors

EMEP/EEA Guidebook provides the Tier 1 emission factor table for emissions from road paving with asphalt. The default emission factors are constructed based on an assessment of the available emission factors from a detailed review of the hot mix industry (US EPA, 2004). The emission factor represents an average between batch mix and drum mix hot mix asphalt plants.

Tier 1 emission factors are used for calculations. Equation 1 is applied.

Table 15 Tier 1 emission factors for source category 2.A.6 Road paving with asphalt



### Activity data

Information regarding asphalt production and laying is available from Estonian Asphalt Pavement Association (www.asfaldiliit.ee) for the years 1995-2008. For the year 1990 the asphalt production rate is given in the Estonian Road Administration Annual Report 1990.

According to the Asphalt Pavement Association all production companies but not all asphalt laying companies are members of the association. Values for the asphalt produced are higher than the quantity of laid asphalt. For that reason asphalt production values are used for emission calculations from road paving with asphalt.

Table 16 Activity data for NMVOC emission calculations from asphalt production in 1990 – 2008 (in tons)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Produced Asphalt Mixtures | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Dense Asphalt concrete |  | - | - | - | 881724 | 831935 | 900123 |
| Open-Graded Asphalt Concrete |  | - | - | - | 439958 | 425103 | 442298 |
| Cold Mixtures |  | - | - | - | 24123 | 10863 | 10719 |
| Light Asphalt Concrete |  | - | - | - | 72461 | 67338 | 57455 |
| Stone Mastic Asphalt |  | - | - | - | 31354 | 77711 | 69467 |
| Other types |  | - | - | - | 32288 | 73622 | 26783 |
| **All types total** | **864 000** | **475000** | **667000** | **1164000** | **1481908** | **1486572** | **1506846** |

### Results

Table 17 NMVOC emission from road paving with asphalt (NFR 2.A.6) in tons

|  |  |  |
| --- | --- | --- |
| **NFR** | **2.A.6** |  |
| **SNAP** | **NA** |  |
| **Activity** | **Road Paving with Asphalt** |  |
| Emission factor: | 16 | g/Mg asphalt |
| Year | Produced Asphalt Mixtures, t | NMVOC, t |
| 1990 | 864 000 | 13,824 |
| 1995 | 475000 | 7,600 |
| 2000 | 667000 | 10,672 |
| 2005 | 1164000 | 18,624 |
| 2006 | 1481908 | 23,711 |
| 2007 | 1486572 | 23,785 |
| 2008 | 1506846 | 24,110 |

Emission is disaggregated by the length of roads which are constructed or repaired by the asphalt concrete surface in the county. Data about construction and repair work is collected from the Estonian Road Administration Annual Reports 1990-2008.[[6]](#footnote-6)

The Estonian Asphalt Pavement Association does not publish county-specific information.

The structure of the Estonian Road Administration has changed over the years and for the years 1995-2000 annual reports do not provide information regarding the total length of asphalt roads constructed and repaired by counties. For these years the division is made by the total length of road and streets. Data regarding the length of all roads and streets by county is available from the Statistical office for the year 2004. This is used as a basis for distribution. It is assumed that the share by counties has not been changed over the years.

Table 18 Length of roads and streets by county, in kilometers, and share by county

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | 2004 | | | |
| Road type | National roads | Local roads and streets | All roads | Share by county |
| **Estonia** | **16459** | **18507,2** | **34966,2** | **100%** |
| Harju | 1547 | 2534,2 | 4081,2 | 11,67% |
| Hiiu | 473 | 358,5 | 831,5 | 2,38% |
| Ida-Viru | 917 | 706,6 | 1623,6 | 4,64% |
| Jõgeva | 1110 | 608,6 | 1718,6 | 4,92% |
| Järva | 973 | 1260,9 | 2233,9 | 6,39% |
| Lääne | 749 | 1108,9 | 1857,9 | 5,31% |
| Lääne-Viru | 1160 | 1660,3 | 2820,3 | 8,07% |
| Põlva | 1155 | 1080 | 2235 | 6,39% |
| Pärnu | 1433 | 1297 | 2730 | 7,81% |
| Rapla | 1011 | 1332 | 2343 | 6,70% |
| Saare | 1087 | 1317 | 2404 | 6,88% |
| Tartu | 1254 | 1876,4 | 3130,4 | 8,95% |
| Valga | 1117 | 819,2 | 1936,2 | 5,54% |
| Viljandi | 1223 | 991,8 | 2214,8 | 6,33% |
| Võru | 1250 | 1555,8 | 2805,8 | 8,02% |

Table 19 Length of constructed and repaired by counties and emission distribution shares by counties

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 1990 | | 1995 | | 2000 | | 2005 | | | | 2006 | | | | 2007 | | | | 2008 | | | |
| County | Construction and repair of asphalt concrete paved roads, km | Share by county, % | Total length of asphalt concrete laid (construction + repair), km | Share by county, % (by total length of roads) | Total length of asphalt concrete laid (construction + repair), km | Share by county, % (by total length of roads) | Construction of asphalt concrete paved roads, km | Repairs of asphalt concrete roads (overlays), km | Total length of asphalt concrete laid, km | Share by county, % | Construction of asphalt concrete paved roads, km | Repairs of asphalt concrete roads (overlays), km | Total length of asphalt concrete laid, km | Share by county, % | Construction of asphalt concrete paved roads, km | Repairs of asphalt concrete roads (overlays), km | Total length of asphalt concrete laid, km | Share by county, % | Construction of asphalt concrete paved roads, km | Repairs of asphalt concrete roads (overlays), km | Total length of asphalt concrete laid, km | Share by county, % |
| **Estonia** | **200,7** | **100,0%** | **65,2** | **100%** | **104,4** | **100%** | 28,4 | 146,1 | **174,5** | **100%** | 20,5 | 235 | **255,5** | **100%** | 34,6 | 130,3 | **164,9** | **100%** | 43,5 | 250,5 | **294** | **100%** |
| *By county* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Harju | 20,4 | 10,2% | *-* | *11,67%* |  | *11,67%* | 8,1 | 72,1 | 80,2 | 45,96% |  | 49,5 | 47,9 | 18,75% | 4,7 | 48 | 52,7 | 31,96% | 33,409 | 70,354 | 103,763 | 35,30% |
| Hiiu |  | 0,0% | *-* | *2,38%* |  | *2,38%* |  |  | 0 | 0,00% | 0,9 | 6,9 | 7,8 | 3,05% | 0,1 |  | 0,1 | 0,06% |  | 2,500 | 2,500 | 0,85% |
| Ida-Viru | 14,8 | 7,4% | *-* | *4,64%* |  | *4,64%* | 9,1 |  | 9,1 | 5,21% | 8,1 | 13,7 | 21,8 | 8,53% | 5,6 |  | 5,6 | 3,40% | 5,228 | 4,179 | 9,407 | 3,20% |
| Jõgeva | 1,2 | 0,6% | *-* | *4,92%* |  | *4,92%* |  | 14,8 | 14,8 | 8,48% |  | 16,7 | 16,7 | 6,54% | 4,6 | 5,4 | 10 | 6,06% |  |  | 0,000 | 0,00% |
| Järva | 17,4 | 8,7% | *-* | *6,39%* |  | *6,39%* |  | 11,9 | 11,9 | 6,82% |  | 19,8 | 19,8 | 7,75% |  | 27,3 | 27,3 | 16,56% | 3,577 | 35,311 | 38,888 | 13,23% |
| Lääne | 15,2 | 7,6% | *-* | *5,31%* |  | *5,31%* |  |  | 0 | 0,00% |  | 9,8 | 9,8 | 3,84% |  | 2,5 | 2,5 | 1,52% |  | 2,488 | 2,488 | 0,85% |
| Lääne-Viru | 21,7 | 10,8% | *-* | *8,07%* |  | *8,07%* |  |  | 0 | 0,00% |  |  | 0 | 0,00% |  | 12,9 | 12,9 | 7,82% | 1,250 | 65,582 | 66,832 | 22,74% |
| Põlva |  | 0,0% | *-* | *6,39%* |  | *6,39%* | 2,5 | 5,9 | 8,4 | 4,81% |  | 9,8 | 9,8 | 3,84% | 3,5 | 5,5 | 9 | 5,46% |  |  | 0,000 | 0,00% |
| Pärnu | 23,2 | 11,6% | *-* | *7,81%* |  | *7,81%* |  | 22,4 | 22,4 | 12,84% | 1,6 | 5,5 | 7,1 | 2,78% | 16,1 | 7,4 | 23,5 | 14,25% |  | 11,952 | 11,952 | 4,07% |
| Rapla | 32,1 | 16,0% | *-* | *6,70%* |  | *6,70%* | 1,3 |  | 1,3 | 0,74% |  | 10,9 | 10,9 | 4,27% |  |  | 0 | 0,00% |  | 9,400 | 9,400 | 3,20% |
| Saare |  | 0,0% | *-* | *6,88%* |  | *6,88%* |  | 8,7 | 8,7 | 4,99% | 9,7 | 20,8 | 30,5 | 11,94% |  |  | 0 | 0,00% |  | 5,950 | 5,950 | 2,02% |
| Tartu | 29,5 | 14,7% | *-* | *8,95%* |  | *8,95%* | 3,7 |  | 3,7 | 2,12% |  | 13,9 | 13,9 | 5,44% |  | 12,8 | 12,8 | 7,76% |  | 13,360 | 13,360 | 4,54% |
| Valga |  | 0,0% | *-* | *5,54%* |  | *5,54%* |  |  | 0 | 0,00% | 0,2 | 42,2 | 42,4 | 16,59% |  |  | 0 | 0,00% |  | 16,655 | 16,655 | 5,67% |
| Viljandi |  | 0,0% | *-* | *6,33%* |  | *6,33%* | 2 | 10,3 | 12,3 | 7,05% |  | 17,1 | 17,1 | 6,69% |  | 8,5 | 8,5 | 5,15% |  | 11,106 | 11,106 | 3,78% |
| Võru | 25,2 | 12,6% | *-* | *8,02%* |  | *8,02%* | 1,7 |  | 1,7 | 0,97% |  |  | 0 | 0,00% |  |  | 0 | 0,00% |  | 1,650 | 1,650 | 0,56% |

Table 20 NMVOC emission from road paving with asphalt

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NMVOC emission from road paving with asphalt, t | | | | | | | | | | | | | | |
| Year | 1990 | | 1995 | | 2000 | | 2005 | | 2006 | | 2007 | | 2008 | |
| County | Share by county, % | NMVOC, t | Share by county, % | NMVOC, t | Share by county, % | NMVOC, t | Share by county, % | NMVOC, t | Share by county, % | NMVOC, t | Share by county, % | NMVOC, t | Share by county, % | NMVOC, t |
| Estonia | 100% | 13,824 | 100% | 7,600 | 100% | 10,672 | 100% | 18,624 | 100% | 23,711 | 100% | 23,785 | 100% | 24,110 |
| *By county* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Harju | 10,2% | 1,405 | *11,67%* | 0,887 | *11,67%* | 1,246 | 45,96% | 8,560 | 18,75% | 4,445 | 31,96% | 7,601 | 35,30% | 8,511 |
| Hiiu | 0,0% | 0,000 | *2,38%* | 0,181 | *2,38%* | 0,254 | 0,00% | 0,000 | 3,05% | 0,724 | 0,06% | 0,014 | 0,85% | 0,205 |
| Ida-Viru | 7,4% | 1,019 | *4,64%* | 0,353 | *4,64%* | 0,496 | 5,21% | 0,971 | 8,53% | 2,023 | 3,40% | 0,808 | 3,20% | 0,772 |
| Jõgeva | 0,6% | 0,083 | *4,92%* | 0,374 | *4,92%* | 0,525 | 8,48% | 1,580 | 6,54% | 1,550 | 6,06% | 1,442 | 0,00% | 0,000 |
| Järva | 8,7% | 1,198 | *6,39%* | 0,486 | *6,39%* | 0,682 | 6,82% | 1,270 | 7,75% | 1,837 | 16,56% | 3,938 | 13,23% | 3,190 |
| Lääne | 7,6% | 1,047 | *5,31%* | 0,404 | *5,31%* | 0,567 | 0,00% | 0,000 | 3,84% | 0,909 | 1,52% | 0,361 | 0,85% | 0,204 |
| Lääne-Viru | 10,8% | 1,495 | *8,07%* | 0,613 | *8,07%* | 0,861 | 0,00% | 0,000 | 0,00% | 0,000 | 7,82% | 1,861 | 22,74% | 5,482 |
| Põlva | 0,0% | 0,000 | *6,39%* | 0,486 | *6,39%* | 0,682 | 4,81% | 0,897 | 3,84% | 0,909 | 5,46% | 1,298 | 0,00% | 0,000 |
| Pärnu | 11,6% | 1,598 | *7,81%* | 0,593 | *7,81%* | 0,833 | 12,84% | 2,391 | 2,78% | 0,659 | 14,25% | 3,390 | 4,07% | 0,980 |
| Rapla | 16,0% | 2,211 | *6,70%* | 0,509 | *6,70%* | 0,715 | 0,74% | 0,139 | 4,27% | 1,012 | 0,00% | 0,000 | 3,20% | 0,771 |
| Saare | 0,0% | 0,000 | *6,88%* | 0,523 | *6,88%* | 0,734 | 4,99% | 0,929 | 11,94% | 2,830 | 0,00% | 0,000 | 2,02% | 0,488 |
| Tartu | 14,7% | 2,032 | *8,95%* | 0,680 | *8,95%* | 0,955 | 2,12% | 0,395 | 5,44% | 1,290 | 7,76% | 1,846 | 4,54% | 1,096 |
| Valga | 0,0% | 0,000 | *5,54%* | 0,421 | *5,54%* | 0,591 | 0,00% | 0,000 | 16,59% | 3,935 | 0,00% | 0,000 | 5,67% | 1,366 |
| Viljandi | 0,0% | 0,000 | *6,33%* | 0,481 | *6,33%* | 0,676 | 7,05% | 1,313 | 6,69% | 1,587 | 5,15% | 1,226 | 3,78% | 0,911 |
| Võru | 12,6% | 1,736 | *8,02%* | 0,610 | *8,02%* | 0,856 | 0,97% | 0,181 | 0,00% | 0,000 | 0,00% | 0,000 | 0,56% | 0,135 |

## Food and drink (2.D.2)

### Source description

Emissions from food manufacturing include all processes in the food production chain, which occur after the slaughtering of animals and the harvesting of crops. Emissions from drink manufacturing include the production of alcoholic beverages, especially wine, beer and spirits. Emissions from the production of other alcoholic drinks are not covered.

For food processing, major facilities may be identified and national emissions could be disaggregated based on plant capacity or employment. For the remaining emissions, it is good practice to disaggregate data by population.

The manufacture of most beverages is associated with particular regions of a country. The lowest level of accuracy is obtained by disaggregating the net emission according to population density. Greater accuracy is achieved by identifying regions where particular beverages are produced and confining the distribution of emissions to those regions.

### Emission factors

It is recommended to use the product-based default emission factors (not background emission factors) since relevant activity statistics for these factors are more likely to be available.

Emission factors presented in this section are based on the following assumptions:

* 0.15 tonne of grain is required to produce 1 tonne of beer (Passant, 1993).
* Malt whiskies are typically matured for ten years. Grain whiskies are typically matured for six years. It is assumed that brandy is matured for three years and that other spirits are not matured.
* Beer is considered to be typically 4% alcohol by volume and to weigh 1 tonne per m3.
* If no better data is available, spirits are assumed to be 40% alcohol by volume.
* Alcohol (ethanol) has a density of 789 kg/m3.

Tier 2 emission factors are used for emission calculations. The relevant emission factors are given in the tables below.

Emission factors are believed to be constant over the years 1990-2008.

**Default emission factors based on products: food**

Table 21 Tier 2 emission factors for source category 2.D.2 Food and drink, Bread (typical)

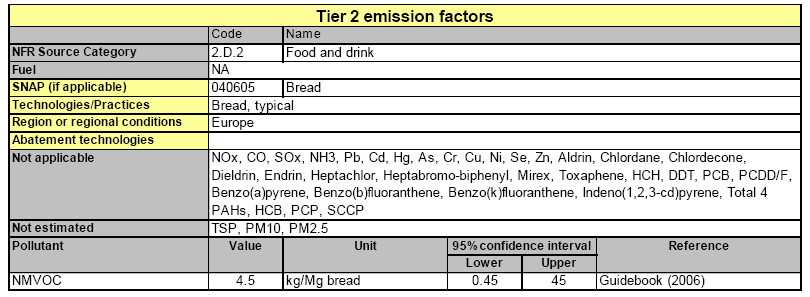
****

Table 22 Tier 2 emission factors for source category 2.D.2 Food and drink, Cakes, biscuits and breakfast cereals

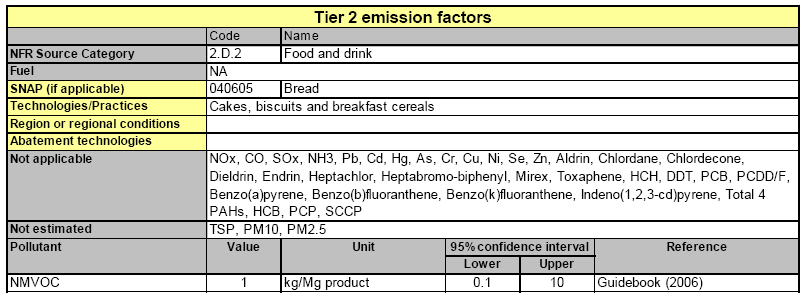
****

Table 23 Tier 2 emission factors for source category 2.D.2 Food and drink, Meat, fish and poultry

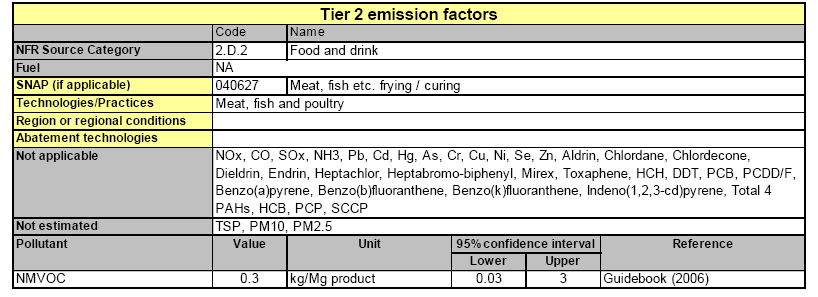
****

Table 24 Tier 2 emission factors for source category 2.D.2 Food and drink, Margarine and solid cooking fats

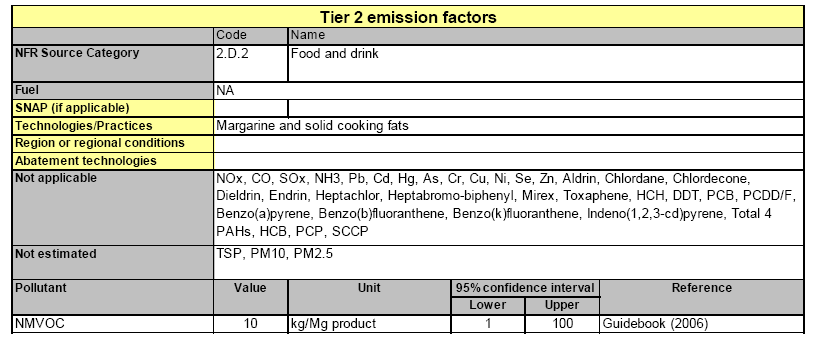
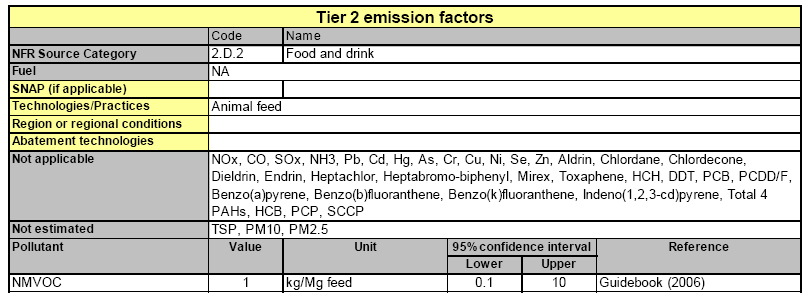
****

Table 25 Tier 2 emission factors for source category 2.D.2 Food and drink, Animal feed 

**Default emission factors based on products: drinks**

Table 26 Tier 2 emission factors for source category 2.D.2 Food and drink, Wine

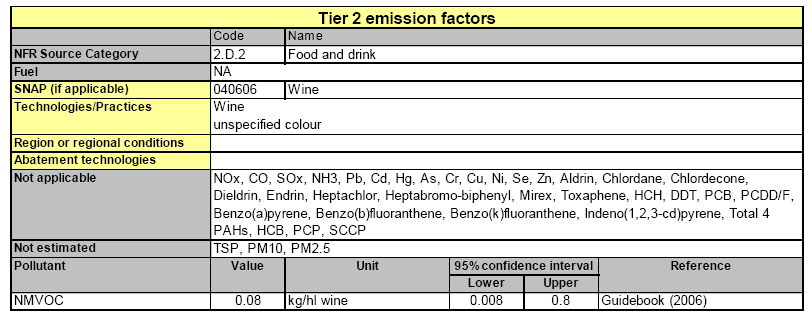
****

Table 27 Tier 2 emission factors for source category 2.D.2 Food and drink, Beer

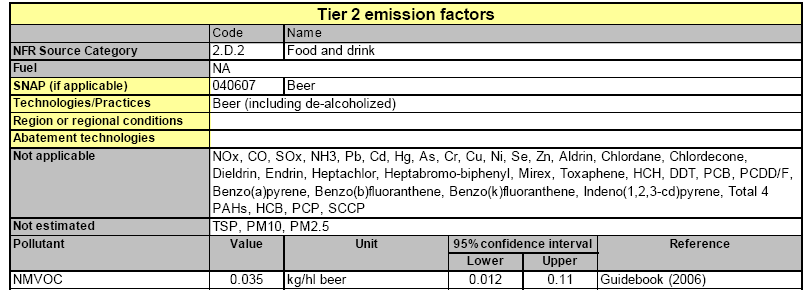
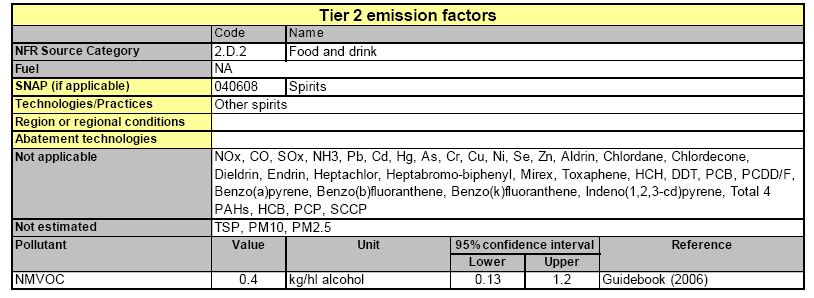
****

Table 28 Tier 2 emission factors for source category 2.D.2 Food and drink, Other spirits



### Activity data

Activity data on the subject of food and drink production is available from Statistics Estonia.

Meat and fish

Data regarding meat also includes home-killed meat.

Data regarding the nominal catch of fish from Statistics Estonia is only available since 1995.

Table 31 Total fish landed

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Area | Nominal catch, tons | | | | | |
| Year | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Atlantic ocean | 70107 | 24695 | 16538 | 13723 | 14930 | 14559 |
| Baltic Sea | 59169,8 | 85176 | 79760,7 | 73039,4 | 80244,1 | 83575,053 |
| Inland waters | 2365,1 | 3189,2 | 2400,5 | 2856,1 | 2567,844 | 2748,897 |
| Aquaculture production | 316,8 | 360 | 554,1 | 702,6 | 781 | 814,2 |
| TOTAL | 133636,9 | 115060,2 | 100704,2 | 91624,5 | 99748,944 | 102890,95 |

Table 32 Activity data for NMVOC emission calculation in 1990 – 2008

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NFR | SNAP | Product group (food and drink) | Unit of activity data | Emission factor | | 1990 | | 1995 | | 2000 | | 2005 | | 2006 | | 2007 | | 2008 | |
| value | unit | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t |
| **2.D.2** | **040605** | **Bread** | **thousand t** | **4,5** | **kg/Mg bread** | **151** | **679,500** | **99,7** | **448,650** | **76,5** | **344,250** | **72,4** | **325,800** | **74,4** | **334,800** | **78,8** | **354,600** | **77,6** | **349,200** |
| **2.D.2** | **040606** | **Cakes, biscuits and breakfast cereals** | **thousand t** | **1** | **kg/Mg product** | **14,9** | **14,900** | **5** | **5,000** | **4,4** | **4,400** | **.** |  | **9,4** | **9,400** | **9,7** | **9,700** | **8,9** | **8,900** |
| **2.D.2** | **040627** | **Meat, fish and poultry etc. frying/curing** | **thousand t** | **0,3** | **kg/Mg product** | **182,5** | **54,750** | **201,34** | **60,401** | **168,4** | **50,508** | **167,804** | **50,341** | **161,02** | **48,306** | **170,25** | **51,075** | **177,49** | **53,247** |
|  |  | *Meat products (Statistics and home-killed)* | thousand t | 0,3 | kg/Mg product | 182,5 | 54,750 | 67,7 | 20,310 | 53,3 | 15,990 | 67,1 | 20,130 | 69,4 | 20,820 | 70,5 | 21,150 | 74,6 | 22,380 |
|  |  | *Fish products* | thousand t | 0,3 | kg/Mg product |  | 0,000 | 133,64 | 40,091 | 115,1 | 34,518 | 100,704 | 30,211 | 91,62 | 27,486 | 99,75 | 29,925 | 102,89 | 30,867 |
| **2.D.2** | **NA** | **Margarine and solid cooking fats** | **thousand t** | **10** | **kg/Mg product** | **6,6** | **66,000** | **3,7** | **37,000** | **0,8** | **8,000** | **1,2** | **12,000** | **0** | **0,000** | **0** | **0,000** | **0** | **0,000** |
|  |  | *Solid cooking fats* | *thousand t* | 10 | kg/Mg product | *0* | 0,000 | *3,6* | 36,000 | *0,8* | 8,000 | *1,2* | 12,000 | *.* |  | *.* |  | *.* |  |
|  |  | *Margarine* | *thousand t* | 10 | kg/Mg feed | *6,6* | 66,000 | *0,1* | 1,000 | *0* | 0,000 | *0* | 0,000 | *..* |  | *..* |  | *..* |  |
| **2.D.2** | **NA** | **Animal feed** | **thousand t** | **1** | **kg/Mg product** | **851,8** | **851,800** | **162,8** | **162,800** | **133,3** | **133,300** | **177** | **177,000** | **208,9** | **208,900** | **214,2** | **214,200** | **215,3** | **215,300** |
| **2.D.2** | **040606** | **Wine** | **thousand hl** | **0,08** | **kg/hl wine** | **37** | **2,960** | **14** | **1,120** | **32,6** | **2,608** | **88,8** | **7,104** | **77,5** | **6,200** | **53,5** | **4,280** | **38,8** | **3,104** |
| **2.D.2** | **040607** | **Beer** | **thousand hl** | **0,035** | **kg/hl beer** | **769** | **26,915** | **499,6** | **17,486** | **950,1** | **33,254** | **1342,5** | **46,988** | **1431,1** | **50,089** | **1411,6** | **49,406** | **1281,8** | **44,863** |
| **2.D.2** | **040608** | **Other sprits** | **thousand hl** | **0,4** | **kg/hl alcohol** | **229** | **91,600** | **267** | **106,800** | **106,8** | **42,720** | **205** | **82,000** | **244,7** | **97,880** | **255,3** | **102,120** | **191,5** | **76,600** |
|  |  | *Crude spirits* | *thousand hl* | 0,4 | kg/hl alcohol | *82* | 32,800 | *91* | 36,400 | *20,4* | 8,160 | *37,1* | 14,840 | *61,6* | 24,640 | *39,3* | 15,720 | *15,5* | 6,200 |
|  |  | *Distilled spirits* | *thousand hl* | 0,4 | kg/hl alcohol | *147* | 58,800 | *176* | 70,400 | *86,4* | 34,560 | *167,9* | 67,160 | *183,1* | 73,240 | *216* | 86,400 | *176* | 70,400 |
|  |  |  |  |  |  |  | **1788,425** |  | **839,257** |  | **619,040** |  | **701,233** |  | **755,575** |  | **785,381** |  | **751,214** |

### Emission calculations and results

The emission factor for bread and white bread production is the same (4,5 kg/MgNMVOC bread). Statistical data for white bread production (shortened process, emission factor 2 kg/MgNMVOC bread), wholemeal bread production (EF 3 kg/MgNMVOC bread) and light rye bread production (EF 3 kg/MgNMVOC bread) is not available.

For spirits the emission factor 0,4 kg/hl alcohol is chosen since Estonia produces mainly vodka whose production does not involve maturation processes.

Table 33 NMVOC emissions from food and drink production, in tons (NFR 2.D.2)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NFR | SNAP | Product group (food and drink) | Unit of activity data | Emission factor | | 1990 | | 1995 | | 2000 | | 2005 | | 2006 | | 2007 | | 2008 | |
| value | unit | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t | Production | NMVOC, t |
| **2.D.2** | **040605** | **Bread** | **thousand t** | **4,5** | **kg/Mg bread** | **151** | **679,500** | **99,7** | **448,650** | **76,5** | **344,250** | **72,4** | **325,800** | **74,4** | **334,800** | **78,8** | **354,600** | **77,6** | **349,200** |
| **2.D.2** | **040606** | **Cakes, biscuits and breakfast cereals** | **thousand t** | **1** | **kg/Mg product** | **14,9** | **14,900** | **5** | **5,000** | **4,4** | **4,400** | **.** |  | **9,4** | **9,400** | **9,7** | **9,700** | **8,9** | **8,900** |
| **2.D.2** | **040627** | **Meat, fish and poultry etc. frying/curing** | **thousand t** | **0,3** | **kg/Mg product** | **182,5** | **54,750** | **201,34** | **60,401** | **168,4** | **50,508** | **167,804** | **50,341** | **161,02** | **48,306** | **170,25** | **51,075** | **177,49** | **53,247** |
|  |  | *Meat processed* | thousand t | 0,3 | kg/Mg product | 182,5 | 54,750 | 67,7 | 20,310 | 53,3 | 15,990 | 67,1 | 20,130 | 69,4 | 20,820 | 70,5 | 21,150 | 74,6 | 22,380 |
|  |  | *Fish processed* | thousand t | 0,3 | kg/Mg product |  | 0,000 | 133,64 | 40,091 | 115,1 | 34,518 | 100,704 | 30,211 | 91,62 | 27,486 | 99,75 | 29,925 | 102,89 | 30,867 |
| **2.D.2** | **NA** | **Margarine and solid cooking fats** | **thousand t** | **10** | **kg/Mg product** | **6,6** | **66,000** | **3,7** | **37,000** | **0,8** | **8,000** | **1,2** | **12,000** | **0** | **0,000** | **0** | **0,000** | **0** | **0,000** |
|  |  | *Solid cooking fats* | *thousand t* | 10 | kg/Mg product | *0* | 0,000 | *3,6* | 36,000 | *0,8* | 8,000 | *1,2* | 12,000 | *.* |  | *.* |  | *.* |  |
|  |  | *Margarine* | *thousand t* | 10 | kg/Mg feed | *6,6* | 66,000 | *0,1* | 1,000 | *0* | 0,000 | *0* | 0,000 | *..* |  | *..* |  | *..* |  |
| **2.D.2** | **NA** | **Animal feed** | **thousand t** | **1** | **kg/Mg product** | **851,8** | **851,800** | **162,8** | **162,800** | **133,3** | **133,300** | **177** | **177,000** | **208,9** | **208,900** | **214,2** | **214,200** | **215,3** | **215,300** |
| **2.D.2** | **040606** | **Wine** | **thousand hl** | **0,08** | **kg/hl wine** | **37** | **2,960** | **14** | **1,120** | **32,6** | **2,608** | **88,8** | **7,104** | **77,5** | **6,200** | **53,5** | **4,280** | **38,8** | **3,104** |
| **2.D.2** | **040607** | **Beer** | **thousand hl** | **0,035** | **kg/hl beer** | **769** | **26,915** | **499,6** | **17,486** | **950,1** | **33,254** | **1342,5** | **46,988** | **1431,1** | **50,089** | **1411,6** | **49,406** | **1281,8** | **44,863** |
| **2.D.2** | **040608** | **Other sprits** | **thousand hl** | **0,4** | **kg/hl alcohol** | **229** | **91,600** | **267** | **106,800** | **106,8** | **42,720** | **205** | **82,000** | **244,7** | **97,880** | **255,3** | **102,120** | **191,5** | **76,600** |
|  |  | *Crude spirits* | *thousand hl* | 0,4 | kg/hl alcohol | *82* | 32,800 | *91* | 36,400 | *20,4* | 8,160 | *37,1* | 14,840 | *61,6* | 24,640 | *39,3* | 15,720 | *15,5* | 6,200 |
|  |  | *Distilled spirits* | *thousand hl* | 0,4 | kg/hl alcohol | *147* | 58,800 | *176* | 70,400 | *86,4* | 34,560 | *167,9* | 67,160 | *183,1* | 73,240 | *216* | 86,400 | *176* | 70,400 |
|  |  |  |  |  |  |  | **1788,425** |  | **839,257** |  | **619,040** |  | **701,233** |  | **755,575** |  | **785,381** |  | **751,214** |

In some cases the emissions are underestimated due to confidentiality issues. If there are less than three producers in the group the data is confidential. This is relevant to margarine and solid cooking fats.

There are also some permitted fish processing companies (mainly smoking) that report NMVOC emissions. Some permit applications were studied (MasekoNord and Spratfil in Harju county) and it was found that NMVOC emission originates from smoke generators as a result of incomplete combustion and not from fish processing itself. Therefore these emissions are different from the calculated NMVOC emission which occur primarily from the cooking of meat, fish and poultry, releasing mainly fats and oils and their degradation products.

### NMVOC from food and drink production by county

**Bread production**

Major bread and pastry producers[[7]](#footnote-7) are presented in the following table.

Table 34 Bread companies in Estonia in 2002

|  |  |  |
| --- | --- | --- |
| Company | County | Approximate market share, % |
| Leibur | Harju | 31% |
| ETK Leib / AS Eesti Pagar | Järva | 18% |
| Pere Leib | Tartu | 16% |
| Fazer | Harju | 7% |
| Järle | Ida-Viru | 6% |
| Hallik | Lääne-Viru | 5% |
| Vilma | Viljandi | 3% |

The remaining 14% of emission is disaggregated by population.

Most probably the bread production division by counties has changed only slightly over the years. The Estonian Association of Bakeries gives market shares by production for 2006. This is not used for calculations, because for example AS Eesti Pagar which holds a large market share is not a member of the association. Therefore distribution by the year 2002 is used for all years.

Table 35 Bread companies and production shares in 2006[[8]](#footnote-8)

|  |  |
| --- | --- |
| Company | Production share |
| Leibur | 42,8% |
| Fazer | 19,1% |
| Pere L | 18,0% |
| Hallik | 7,6% |
| Lõuna P | 2,6% |
| Saare L | 2,3% |
| Pagarip. | 2,1% |
| Euroleib | 1,9% |
| Balti Sep. | 1,9% |
| Hiiu P | 1,2% |
| Lihula L | 0,5% |
| Eng.Serv. | 0,0% |

Table 36 NMVOC emission from bread production by counties

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from bread production, t | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **679,500** | **448,650** | **344,250** | **325,800** | **334,800** | **354,600** | **349,200** |
| *By county* | *Share by county* |  |  |  |  |  |  |  |
| Harju | 43,41% | 294,979 | 194,765 | 149,443 | 141,434 | 145,341 | 153,936 | 151,592 |
| Hiiu | 0,11% | 0,719 | 0,474 | 0,364 | 0,345 | 0,354 | 0,375 | 0,369 |
| Ida-Viru | 7,84% | 53,298 | 35,191 | 27,002 | 25,555 | 26,261 | 27,814 | 27,390 |
| Jõgeva | 0,39% | 2,635 | 1,739 | 1,335 | 1,263 | 1,298 | 1,375 | 1,354 |
| Järva | 18,39% | 124,947 | 82,498 | 63,301 | 59,909 | 61,563 | 65,204 | 64,211 |
| Lääne | 0,29% | 1,987 | 1,312 | 1,006 | 0,952 | 0,979 | 1,037 | 1,021 |
| Lääne-Viru | 5,70% | 38,722 | 25,567 | 19,618 | 18,566 | 19,079 | 20,207 | 19,900 |
| Põlva | 0,33% | 2,236 | 1,477 | 1,133 | 1,072 | 1,102 | 1,167 | 1,149 |
| Pärnu | 0,92% | 6,252 | 4,128 | 3,167 | 2,997 | 3,080 | 3,262 | 3,213 |
| Rapla | 0,38% | 2,569 | 1,696 | 1,301 | 1,232 | 1,266 | 1,340 | 1,320 |
| Saare | 0,36% | 2,477 | 1,636 | 1,255 | 1,188 | 1,221 | 1,293 | 1,273 |
| Tartu | 17,52% | 119,080 | 78,624 | 60,329 | 57,095 | 58,673 | 62,142 | 61,196 |
| Valga | 0,36% | 2,473 | 1,633 | 1,253 | 1,186 | 1,218 | 1,290 | 1,271 |
| Viljandi | 3,59% | 24,381 | 16,098 | 12,352 | 11,690 | 12,013 | 12,723 | 12,530 |
| Võru | 0,40% | 2,745 | 1,812 | 1,391 | 1,316 | 1,352 | 1,432 | 1,411 |

**Cakes, biscuits and other flour confectionery** are also produced in the same factories as bread and pastry and the shares by county are expected to be the same.

Table 37 NMVOC emission from cakes and biscuits production by counties

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from flour confectionery, t | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **14,900** | **5,000** | **4,400** |  | **9,400** | **9,700** | **8,900** |
| *By county* | *Share by county* |  |  |  |  |  |  |  |
| Harju | 43,41% | 6,468 | 2,171 | 1,910 | 0,000 | 4,081 | 4,211 | 3,864 |
| Hiiu | 0,11% | 0,016 | 0,005 | 0,005 | 0,000 | 0,010 | 0,010 | 0,009 |
| Ida-Viru | 7,84% | 1,169 | 0,392 | 0,345 | 0,000 | 0,737 | 0,761 | 0,698 |
| Jõgeva | 0,39% | 0,058 | 0,019 | 0,017 | 0,000 | 0,036 | 0,038 | 0,035 |
| Järva | 18,39% | 2,740 | 0,919 | 0,809 | 0,000 | 1,728 | 1,784 | 1,637 |
| Lääne | 0,29% | 0,044 | 0,015 | 0,013 | 0,000 | 0,027 | 0,028 | 0,026 |
| Lääne-Viru | 5,70% | 0,849 | 0,285 | 0,251 | 0,000 | 0,536 | 0,553 | 0,507 |
| Põlva | 0,33% | 0,049 | 0,016 | 0,014 | 0,000 | 0,031 | 0,032 | 0,029 |
| Pärnu | 0,92% | 0,137 | 0,046 | 0,040 | 0,000 | 0,086 | 0,089 | 0,082 |
| Rapla | 0,38% | 0,056 | 0,019 | 0,017 | 0,000 | 0,036 | 0,037 | 0,034 |
| Saare | 0,36% | 0,054 | 0,018 | 0,016 | 0,000 | 0,034 | 0,035 | 0,032 |
| Tartu | 17,52% | 2,611 | 0,876 | 0,771 | 0,000 | 1,647 | 1,700 | 1,560 |
| Valga | 0,36% | 0,054 | 0,018 | 0,016 | 0,000 | 0,034 | 0,035 | 0,032 |
| Viljandi | 3,59% | 0,535 | 0,179 | 0,158 | 0,000 | 0,337 | 0,348 | 0,319 |
| Võru | 0,40% | 0,060 | 0,020 | 0,018 | 0,000 | 0,038 | 0,039 | 0,036 |

**Meat processing**

Major meat processing companies[[9]](#footnote-9) are presented in following table.

Table 38 Meat processing companies

|  |  |  |
| --- | --- | --- |
| Company | County | Approximate market share |
| Rakvere LK | Lääne-Viru | 30% |
| Atria Grupp | Valga, Võru, Põlva | 14 (4,6+4,6+4,6) |
| Maag | Lääne, Lääne-Viru | 10% (5+5) |

As some of the meat is processed locally in small facilities and at home the remaining 46% of emission is disaggregated by population.

Table 39 NMVOC emission from meat processing by counties

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from meat processing, t | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **54,750** | **20,310** | **15,990** | **20,130** | **20,820** | **21,150** | **22,380** |
| *By county* | *Share by county* |  |  |  |  |  |  |  |
| Harju | 17,78% | 9,734 | 3,611 | 2,843 | 3,579 | 3,702 | 3,760 | 3,979 |
| Hiiu | 0,35% | 0,190 | 0,071 | 0,056 | 0,070 | 0,072 | 0,073 | 0,078 |
| Ida-Viru | 6,06% | 3,317 | 1,230 | 0,969 | 1,219 | 1,261 | 1,281 | 1,356 |
| Jõgeva | 1,27% | 0,697 | 0,259 | 0,204 | 0,256 | 0,265 | 0,269 | 0,285 |
| Järva | 1,28% | 0,698 | 0,259 | 0,204 | 0,257 | 0,266 | 0,270 | 0,285 |
| Lääne | 5,96% | 3,263 | 1,211 | 0,953 | 1,200 | 1,241 | 1,261 | 1,334 |
| Lääne-Viru | 37,30% | 20,419 | 7,575 | 5,964 | 7,508 | 7,765 | 7,888 | 8,347 |
| Põlva | 5,75% | 3,147 | 1,167 | 0,919 | 1,157 | 1,197 | 1,216 | 1,286 |
| Pärnu | 3,02% | 1,655 | 0,614 | 0,483 | 0,609 | 0,629 | 0,639 | 0,677 |
| Rapla | 1,24% | 0,680 | 0,252 | 0,199 | 0,250 | 0,259 | 0,263 | 0,278 |
| Saare | 1,20% | 0,656 | 0,243 | 0,192 | 0,241 | 0,249 | 0,253 | 0,268 |
| Tartu | 5,01% | 2,743 | 1,017 | 0,801 | 1,008 | 1,043 | 1,060 | 1,121 |
| Valga | 5,86% | 3,210 | 1,191 | 0,937 | 1,180 | 1,221 | 1,240 | 1,312 |
| Viljandi | 1,93% | 1,058 | 0,392 | 0,309 | 0,389 | 0,402 | 0,409 | 0,432 |
| Võru | 5,99% | 3,282 | 1,217 | 0,958 | 1,207 | 1,248 | 1,268 | 1,341 |

**Fish processing**

Fish production is divided by the number of companies within the county[[10]](#footnote-10).

Table 40 Number of fish processing companies by counties

|  |  |  |
| --- | --- | --- |
| County | Nr of companies | % of total number of companies in Estonia |
| Harju | 27 | 30 |
| Hiiu | 2 | 2 |
| Ida-Viru | 8 | 9 |
| Jõgeva | 5 | 6 |
| Järva | 1 | 1 |
| Lääne | 6 | 7 |
| Lääne-Viru | 1 | 1 |
| Põlva | 1 | 1 |
| Pärnu | 17 | 19 |
| Saare | 10 | 11 |
| Tartu | 12 | 13 |
| Total | 90 | 100 |

Table 41 NMVOC emission from fish processing by counties

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from fish processing, t | | | | | |
| County | Year | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **40,091** | **34,518** | **30,211** | **27,486** | **29,925** | **30,867** |
| *By county* | *Share by county* |  |  |  |  |  |  |
| Harju | 30% | 12,027 | 10,355 | 9,063 | 8,246 | 8,978 | 9,260 |
| Hiiu | 2% | 0,802 | 0,690 | 0,604 | 0,550 | 0,599 | 0,617 |
| Ida-Viru | 9% | 3,608 | 3,107 | 2,719 | 2,474 | 2,693 | 2,778 |
| Jõgeva | 6% | 2,405 | 2,071 | 1,813 | 1,649 | 1,796 | 1,852 |
| Järva | 1% | 0,401 | 0,345 | 0,302 | 0,275 | 0,299 | 0,309 |
| Lääne | 7% | 2,806 | 2,416 | 2,115 | 1,924 | 2,095 | 2,161 |
| Lääne-Viru | 1% | 0,401 | 0,345 | 0,302 | 0,275 | 0,299 | 0,309 |
| Põlva | 1% | 0,401 | 0,345 | 0,302 | 0,275 | 0,299 | 0,309 |
| Pärnu | 19% | 7,617 | 6,558 | 5,740 | 5,222 | 5,686 | 5,865 |
| Rapla | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Saare | 11% | 4,410 | 3,797 | 3,323 | 3,023 | 3,292 | 3,395 |
| Tartu | 13% | 5,212 | 4,487 | 3,927 | 3,573 | 3,890 | 4,013 |
| Valga | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Viljandi | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Võru | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |

**Margarine and solid cooking fats production**

Solid cooking fats are produced in Põlva Piim Tootmine OÜ, situated in Põlva county.

Table 42 NMVOC emission from solid cooking fats production by counties

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from solid cooking fats production, t | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **0,000** | **36,000** | **8,000** | **12,000** | **0,000** | **0,000** | **0,000** |
| *By county* | *Share by county* |  |  |  |  |  |  |  |
| Harju | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Hiiu | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Ida-Viru | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Jõgeva | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Järva | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne-Viru | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Põlva | 100% | 0,000 | 36,000 | 8,000 | 12,000 | 0,000 | 0,000 | 0,000 |
| Pärnu | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Rapla | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Saare | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Tartu | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Valga | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Viljandi | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Võru | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |

Margarine was produced in Tallinna Parfümeeria ja Toidurasvade Kombinaat in the beginning of the 90s, situated in Harju county.

Table 43 NMVOC emission from margarine production by counties

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from margarine production, t | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **66,000** | **1,000** | **0,000** | **0,000** | **0,000** | **0,000** | **0,000** |
| *By county* | *Share by county* |  |  |  |  |  |  |  |
| Harju | 100% | 66,000 | 1,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Hiiu | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Ida-Viru | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Jõgeva | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Järva | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne-Viru | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Põlva | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Pärnu | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Rapla | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Saare | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Tartu | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Valga | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Viljandi | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Võru | 0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |

Animal feed production

Emission from animal feed production is disaggregated by agricultural land use.

Table 44 Agricultural land use in counties

|  |  |
| --- | --- |
| County | Agricultural land distribution by counties |
| Harju | 6,3% |
| Hiiu | 1,8% |
| Ida-Viru | 2,9% |
| Jõgeva | 8,2% |
| Järva | 9,5% |
| Lääne | 4,7% |
| Lääne-Viru | 12,1% |
| Põlva | 5,4% |
| Pärnu | 8,8% |
| Rapla | 6,3% |
| Saare | 5,8% |
| Tartu | 8,8% |
| Valga | 4,7% |
| Viljandi | 9,8% |
| Võru | 4,8% |

Table 45 NMVOC emission from animal feed production by counties

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from animal feed production, t | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **851,800** | **162,800** | **133,300** | **177,000** | **208,900** | **214,200** | **215,300** |
| *By county* | *Share by county* |  |  |  |  |  |  |  |
| Harju | 6,3% | 53,936 | 10,309 | 8,441 | 11,208 | 13,228 | 13,563 | 13,633 |
| Hiiu | 1,8% | 15,462 | 2,955 | 2,420 | 3,213 | 3,792 | 3,888 | 3,908 |
| Ida-Viru | 2,9% | 24,818 | 4,743 | 3,884 | 5,157 | 6,087 | 6,241 | 6,273 |
| Jõgeva | 8,2% | 69,847 | 13,349 | 10,931 | 14,514 | 17,130 | 17,564 | 17,654 |
| Järva | 9,5% | 80,798 | 15,443 | 12,644 | 16,789 | 19,815 | 20,318 | 20,422 |
| Lääne | 4,7% | 39,714 | 7,590 | 6,215 | 8,252 | 9,740 | 9,987 | 10,038 |
| Lääne-Viru | 12,1% | 103,043 | 19,694 | 16,125 | 21,412 | 25,271 | 25,912 | 26,045 |
| Põlva | 5,4% | 46,314 | 8,852 | 7,248 | 9,624 | 11,358 | 11,646 | 11,706 |
| Pärnu | 8,8% | 74,747 | 14,286 | 11,697 | 15,532 | 18,331 | 18,796 | 18,893 |
| Rapla | 6,3% | 53,299 | 10,187 | 8,341 | 11,075 | 13,071 | 13,403 | 13,472 |
| Saare | 5,8% | 49,238 | 9,411 | 7,705 | 10,231 | 12,075 | 12,382 | 12,445 |
| Tartu | 8,8% | 75,165 | 14,366 | 11,763 | 15,619 | 18,434 | 18,901 | 18,999 |
| Valga | 4,7% | 40,298 | 7,702 | 6,306 | 8,374 | 9,883 | 10,134 | 10,186 |
| Viljandi | 9,8% | 83,897 | 16,035 | 13,129 | 17,433 | 20,575 | 21,097 | 21,206 |
| Võru | 4,8% | 41,224 | 7,879 | 6,451 | 8,566 | 10,110 | 10,366 | 10,420 |

**Wine production**

Between 1990 and 2005 emission from wine production is disaggregated by the market situation in 1999. The situation has slightly changed over the years but this is estimated as an average distribution.

Table 46 Wine producers in Estonia 1999[[11]](#footnote-11)

|  |  |  |  |
| --- | --- | --- | --- |
| Company | County | Turnover 1999, million kroons | Approximate market share, % |
| AS Karme | Viljandi | 11,957 | 6,8% |
| AS Valtu Vein | Rapla | 20,225 | 11,6% |
| AS Tarco Vein | Harju | 5,806 | 3,3% |
| AS Linda Nektar | Võru | 8,198 | 4,7% |
| AS Nurga | Jõgeva | 2,717 | 1,6% |
| AS Võhu Vein | Lääne-Viru | 29,002 | 16,6% |
| Põltsamaa Felix | Jõgeva | 76,624 | 43,9% |
| Viru Joogid AS | Ida-Viru | 20,175 | 11,5% |
| **Total** |  | **174,704** | **100,00%** |

In 2003 the biggest wine producers were AS Võhu Vein, AS Linda Nektar, AS Põltramaa Felix, AS Valtu Vein, AS Karme, AS Tarco vein, AS Nurga and AS Tallinna Karastusjoogid.[[12]](#footnote-12) Production numbers or shares are not given, but the main list is close to 1999.

In the year 2006, AS Linda Nektar produced 61% of the total amount of natural wine produced. Natural wine accounts for 98% of the total wine production.[[13]](#footnote-13) Põltsamaa Felix holds a production share of 17%. The remaining 22% are disaggregated by population. Linda Nektar assumes a leading position in the wine production market in 2007 and 2008. Therefore the division by counties is estimated similarly for the period from 2006 to 2008.

Table 47 NMVOC emission from wine production by counties

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from wine production, t | | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 |  | 2006 | 2007 | 2008 |
| Estonia | 100% | **2,960** | **1,120** | **2,608** | **7,104** | 100% | **6,200** | **4,280** | **3,104** |
| *By county* | *Share by county 1990-2005* |  |  |  |  | *Share by county 2006-2008* |  |  |  |
| Harju | 3,3% | 0,098 | 0,037 | 0,086 | 0,234 | 8,50% | 0,527 | 0,364 | 0,264 |
| Hiiu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,17% | 0,010 | 0,007 | 0,005 |
| Ida-Viru | 11,5% | 0,340 | 0,129 | 0,300 | 0,817 | 2,90% | 0,180 | 0,124 | 0,090 |
| Jõgeva | 45,5% | 1,347 | 0,510 | 1,187 | 3,232 | 17,61% | 1,092 | 0,754 | 0,547 |
| Järva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,61% | 0,038 | 0,026 | 0,019 |
| Lääne | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,46% | 0,028 | 0,020 | 0,014 |
| Lääne-Viru | 16,6% | 0,491 | 0,186 | 0,433 | 1,179 | 1,10% | 0,068 | 0,047 | 0,034 |
| Põlva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,52% | 0,032 | 0,022 | 0,016 |
| Pärnu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 1,45% | 0,090 | 0,062 | 0,045 |
| Rapla | 11,6% | 0,343 | 0,130 | 0,303 | 0,824 | 0,59% | 0,037 | 0,025 | 0,018 |
| Saare | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,57% | 0,036 | 0,025 | 0,018 |
| Tartu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 2,40% | 0,149 | 0,103 | 0,074 |
| Valga | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,57% | 0,035 | 0,024 | 0,018 |
| Viljandi | 6,8% | 0,201 | 0,076 | 0,177 | 0,483 | 0,92% | 0,057 | 0,040 | 0,029 |
| Võru | 4,7% | 0,139 | 0,053 | 0,123 | 0,334 | 61,63% | 3,821 | 2,638 | 1,913 |

**Beer production**

NMVOC emission from beer production is divided by the beer sales statistics for 2007.[[14]](#footnote-14)

Table 48 Beer production companies in 2007

|  |  |  |  |
| --- | --- | --- | --- |
| Producer | County | Beer sold in Estonia 2007, hl | Approximate market share % |
| Saku Õlletehase AS | Harju | 590899 | 47,7% |
| AS A.Le Coq | Tartu | 519950 | 42,0% |
| AS Viru Õlu | Lääne-Viru | 115400 | 9,3% |
| AS Puls Brewery | Lääne-Viru | 11478 | 0,9% |
| AS Sillamäe Õlletehas | Ida-Viru | 1346 | 0,1% |
| **Total** |  | **1239073** | **100,0%** |

In 2000 Tartu Õlletehas (nowadays AS A Le Coq) put 42,9 million litres of beer on the market, Saku Õlletehas sold 45,9 million litres of beer. The share of Viru Õlu was 9%.[[15]](#footnote-15) Therefore, it is estimated, that the beer market has been stable at least for the last ten years.

Table 49 NMVOC emission from beer production by counties

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from beer production, t | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **26,915** | **17,486** | **33,254** | **46,988** | **50,089** | **49,406** | **44,863** |
| *By county* | *Share by county* |  |  |  |  |  |  |  |
| Harju | 47,7% | 12,838 | 8,341 | 15,862 | 22,413 | 23,892 | 23,567 | 21,400 |
| Hiiu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Ida-Viru | 0,1% | 0,027 | 0,017 | 0,033 | 0,047 | 0,050 | 0,049 | 0,045 |
| Jõgeva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Järva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne-Viru | 10,2% | 2,745 | 1,784 | 3,392 | 4,793 | 5,109 | 5,039 | 4,576 |
| Põlva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Pärnu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Rapla | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Saare | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Tartu | 42,0% | 11,304 | 7,344 | 13,966 | 19,735 | 21,037 | 20,751 | 18,842 |
| Valga | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Viljandi | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Võru | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |

**Spirits production**

Crude spirits were produced in Lääne-Viru County (Rakvere Piiritusetehas ja Moe Piiritusetehas) untill 2008.

Table 50 NMVOC emission from crude spirits production by counties

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from crude spirits production, t | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **32,800** | **36,400** | **8,160** | **14,840** | **24,640** | **15,720** | **6,200** |
| *By county* | *Share by county* |  |  |  |  |  |  |  |
| Harju | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Hiiu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Ida-Viru | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Jõgeva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Järva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne-Viru | 100,0% | 32,800 | 36,400 | 8,160 | 14,840 | 24,640 | 15,720 | 6,200 |
| Põlva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Pärnu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Rapla | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Saare | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Tartu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Valga | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Viljandi | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Võru | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |

Emissions from other spirits production are disaggregated by production volumes in 2007. In 2003, Liviko was the market leader (production share 53%). Ofelia held 1/5, Onistar 17% and Liiwi Heliis 9% of the remaining market shares. The market situation is similar to the situation in 2007, therefore the 2007 distribution is used for disaggregation for the year 1990 to 2007.

In the first half of 2008 Onistar stopped production, significantly changing the market situation. Therefore, emissions are disaggregated based on the 2008 division. The production share of the Offex Group is not given but it is estimated based on the remaining percentage, i.e 4%.

Major spirit producers and production shares are presented in the following table.

Table 51 Spirit production companies[[16]](#footnote-16)[[17]](#footnote-17)

|  |  |  |  |
| --- | --- | --- | --- |
| Company | County | Approximate production share 2007, % | Approximate production share 2008, % |
| AS Liviko | Harju | 60% | 64% |
| AS Altia Eesti (formerly: Ofelia) | Harju | 18% | 19% |
| AS Onistar | Harju | 12% |  |
| OÜ Offex Grupp | Harju | 4% | *4%* |
| AS Liiwi Heliis | Viljandi | 3% | 8% |
| AS Remedia | Harju | 3% | 5% |
| Total |  | 100% | 100% |

Table 52 NMVOC emission from distilled spirits production by counties

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from distilled spirits production, t | | | | | | | |
| County | Year | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 |  | 2008 |
| Estonia | 100% | **58,800** | **70,400** | **34,560** | **67,160** | **73,240** | **86,400** | 100% | **70,400** |
| *By county* | *Share by county 1990-2007* |  |  |  |  |  |  | *Share by county 2008* |  |
| Harju | 97,0% | 57,036 | 68,288 | 33,523 | 65,145 | 71,043 | 83,808 | 92,0% | 64,768 |
| Hiiu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Ida-Viru | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Jõgeva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Järva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Lääne | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Lääne-Viru | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Põlva | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Pärnu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Rapla | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Saare | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Tartu | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Valga | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |
| Viljandi | 3,0% | 1,764 | 2,112 | 1,037 | 2,015 | 2,197 | 2,592 | 8,0% | 5,632 |
| Võru | 0,0% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,0% | 0,000 |

# PRODUCT USE (NFR 3)

## Paint application (3.A)

### Source description

The use of paint is a major source of NMVOC emissions; they make up about 9% of the total NMVOC emissions in the CORINAIR90 inventory. This number may have changed over time, but it is certain that paint use is still one of the main sources of NMVOC. The use of paints is generally not considered relevant for emissions of particulate matter or heavy metals and POPs.

Most paints contain organic solvent, which must be removed by evaporation after the paint has been applied to a surface in order for the paint to dry or ‘cure’. Unless captured and either recovered or destroyed, these solvents can be considered to be emitted to the atmosphere. Some organic solvent may be added to coatings before application and will also be emitted. Further solvent that is used for cleaning coating equipment is also emitted.

The proportion of organic solvent in paints can vary considerably. Traditional solvent borne paints contain approximately 50% organic solvents and 50% solids. In addition, more solvent may be added to further dilute the paint before application. High solids and waterborne paints both contain less organic solvent - typically less than 30% while powder coatings and solvent free liquid coatings contain no solvent at all.

The most important pollutant released from painting activities is NMVOC. Particulate matter can also be emitted where spraying is used as an application technique, however many spraying operations are carried out in spray booths fitted with some type of particulate arrestment device. As mentioned earlier, heavy metal compounds, used as pigments, could be emitted to air; however, no emission factors are available.

Due to the wide range of paint applications and the even larger number of paint formulations which are available, there must be considerable scope for uncertainty in emission factors. Due to developments in paint formulation the emission factors may be valid for only a short period. Improved emission factors are therefore required especially for controlled processes.

Another aspect is the variation of paint types. This requires good activity data, which may not be present, particularly with the increasing use of alternatives to high solvent paints.

#### Decorative coating application (3.A.1)

This section refers to two sub-categories of paint application:

**Paint application: construction and buildings (SNAP activity 060103)**

This category refers to the use of paints for architectural application by construction enterprises and professional painters.

**Paint application: domestic use (SNAP activity 060104)**

This category refers to the use of paints for architectural or furniture applications by private consumers. It is good practice not to include other domestic solvent use. However, it is sometimes difficult to distinguish between solvents used for thinning paints and solvents used for cleaning.

#### Industrial coating application (3.A.2)

This section describes the following sub-categories of paint application:

1. manufacture of automobiles;
2. car repairing;
3. coil coating;
4. boat building;
5. wood
6. and other industrial paint application.

Most of the sub-categories are expected to be covered by air pollution permits. The only sector that is expected to not be covered by air pollution permits, is **car repairing**.

**Paint application: car repairing (SNAP activity 060102)**

This category refers to the coating of road vehicles carried out as part of vehicle repair, conservation or decoration outside of manufacturing sites, or any use of refinishing-type coatings which is carried out as part of an original manufacturing process. In some countries, specialist paints which are used for coating small volume vehicles such as heavy goods vehicles and buses are classified as vehicle refinishing paints.

#### Other coating application (3.A.3)

This category refers to the use of high performance protective and/or anti corrosive paints applied to structural steel, concrete and other substrates and any other non industrial coatings which are not covered by any of the other SNAP codes described in “Paint application” section. The sector includes coatings for offshore drilling rigs, production platforms and similar structures as well as road marking paints and non decorative floor paints. Most paint is applied in-situ by brushing, rolling or spraying, although a significant proportion of new-construction steelwork may be coated in shop.

It is estimated that this sector is not very important and emission is estimated together with 3.A.1 (decorative coating application). It is also very complicated to distribute paint use between 3.A.1 and 3.A.3.

### Default emission factors

The Tier 1 default emission factors have been taken from the online version of the GAINS model (IIASA, 2008). A (rounded) weighted average emission factor over all countries in the model has been derived from dividing total NMVOC emissions by total paint use. Data for 2000 has been used in order to estimate an average emission factor describing the situation; however care should be taken when applying this emission factor. Because of the EU directive 2004/42/EC, which came into force on January 1st 2007, it is no longer allowed to bring decorative or vehicle refinishing paint products to the market with a VOC content that exceeds the maximum for those product categories in EU Member States For non-EU countries however, emissions may be significantly higher than the estimate provided here. This has been taken into account in the 95% confidence intervals. These are expert judgements based on old literature values and the more specific implied emission factors from GAINS.

Emissions from the industrial coating application sector have been significantly reduced by the introduction of the European Solvents Directive (1999/13/EC).

In Estonia directive 2004/42/EC was implemented in 2005 and came into force in 2007 (I stage) and 2010 (II stage). The Solvents directive (1999/13/EC) was implemented in 2004 and came into force in 2004 (2007 for existing installations).

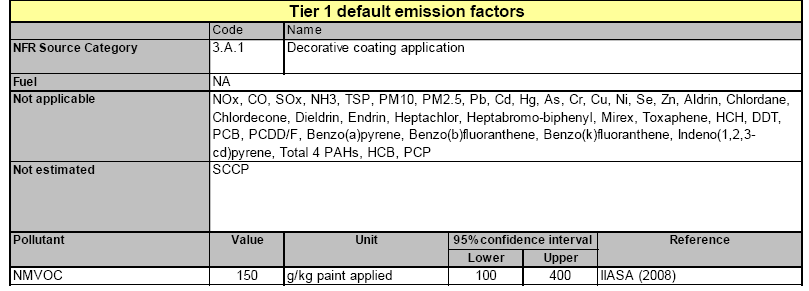
Emission factors presented in the EMEP Guidebook 2009 version were developed for 2000.

Emission factors from previous Corinair version (2000, 2nd edition) are used for the years 1990 and 1995.

#### Decorative coating application (3.A.1)

For years 2000-2008 EMEP Guidebook 2009 Tier 1 emission factors are used for calculations. Equation 1 is applied.

Table 53 Tier 1 emission factors for source category 3.A.1 Decorative coating application



For the years 1990-1995 Corinair (2000) emission factors are used for calculations. As this guidebook provides different emission factors for solventborne and waterborne paints, averaged emission factor is calculated taking into account the proportion of solventborne and waterborne paints used.

NMVOC emission factor for decorative solventborne paints (all) is 300-400 g/kg of paint (average 350 g/kg is used) and for waterborne paints 33 g/kg of paints.

Precise division by solventborne and waterborne paint production is not known. The ratio is estimated by the year 2000 production when approximately 55% of paint produced was solventborne and 45% waterborne. Taking also into account import and export data it was estimated that 56% of decorative paint used in 1995 was solventborne and 46% of paint waterborne.

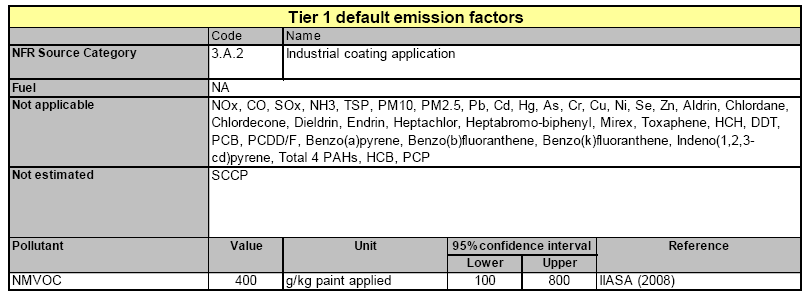
Weighted average emission factor can be calculated as follows:

(56% x 350 g/kg + 46% x 33 g/kg)/100% = 211 g/kg of paint.

#### Industrial coating application (3.A.2)

For the years 2000-2008 EMEP Guidebook 2009 Tier 1 emission factors are used for calculations. Equation 1 is applied.

Table Tier 1 emission factors for source category 3.A.2 Industrial coating application

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For years 1990-1995 Corinair (2000) emission factor is used for calculations.

Different emission factors are proposed for vehicle refinishing (in range 280-700 g/kg of paint, no abatement included). Emission factor 600 g/kg of paint is chosen as 3 different factors are similar to this value.

### Activity data

The quantity of paints and lacquers used in total in Estonia is estimated by the import and export data (CN codes 3208, 3209 and 3210) and production data (total amount of paints and lacquers) from Statistics Estonia.

Data regarding import and export is not available for 1990, therefore the total amount of paint used in this year in Estonia is not known.

Some paint is used by point sources (permitted companies) and most of the remaining paint is used for decorative coating application (3.A.1)

Also some of the paint is used for car repairing (3.A.2).

Table Total amount of paint used in Estonia (Statistics Estonia)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | Solventborne paints (CN 3208), t | | Waterborne paints (CN 3209), t | | Other paints and varnishes (CN 3210), t | | Paints and varnishes, t | Total consumption of paints and varnishes, t |
| Import | Export | Import | Export | Import | Export | Production |
| 1995 | 4435,2 | 3890,9 | 1002,8 | 872,6 | 671,3 | 405,1 | 11700 | 12640,7 |
| 2000 | 6375,7 | 7367,5 | 4220,3 | 2871,4 | 681,8 | 92,2 | 13100 | 14046,7 |
| 2005 | 9958,1 | 10913,1 | 8671,5 | 9038,8 | 1139,9 | 306,3 | 21600 | 21111,3 |
| 2006 | 11771 | 13571,2 | 10339,7 | 12626,4 | 1230,7 | 332,4 | 24100 | 20911,4 |
| 2007 | 9627,6 | 13972,3 | 12257,4 | 16275,9 | 1496 | 500,7 | 28700 | 21332,1 |
| 2008 | 7733,6 | 11965,6 | 9516 | 17186,7 | 1979,1 | 762,2 | 24600 | 13914,2 |

There is no statistical information regarding the amount of paint used for car repairing. Therefore, expert opinion was asked from a representative of the Association of Estonian Automobile Sales and Maintenance Companies “repair unit”.

The expert opinion was received from Benefit AS which is the leading car body and car paint shops technology and materials supplier. The total amount of paint used for car repairing in Estonia is estimated to have risen from 100 tons in 1990 up to 180 tons in 2008.

As this is a rough estimate, the growth is estimated to be equal.

Table Use of paints for car repairing in Estonia (3.A.2)

|  |  |
| --- | --- |
| Year | Use of paints for car repairing, t |
| 1990 | 100 |
| 1995 | 122 |
| 2000 | 144 |
| 2005 | 166 |
| 2006 | 171 |
| 2007 | 175 |
| 2008 | 180 |

The paint use for decorative coating application is estimated in the following way:

**Paint used for decorative coating application** = total paint use – paint used by all point sources – paint used by car repairing (diffuse part)

Data regarding import and export is not available for 1990, therefore the total amount of paint used in this year is not known and emission from decorative coating applications cannot be estimated.

It is unknown how much paint has been used by permitted companies between 1995 and 2005. Hence, a reverse calculation is carried out taking into account the emission factor for industrial coating application (400 g/kg NMVOC paint applied).

Sub-sectors have moved under NFR codes 3A1 and 3A2. Therefore all reported emission from point sources is estimated to be from industrial coating applications (3A2).

Table Use of paint in 1995-2005 (calculated)

|  |  |  |
| --- | --- | --- |
| Year | NMVOC emission from point sources, t | Calculated paint use in point sources, t |
| 1995 | 937,26 | *2343,15* |
| 2000 | 460,87 | *1152,18* |
| 2005 | 539,57 | *1348,93* |

Data regarding paint use in point sources is available in the OSIS database for the years 2006-2008.

**Decorative paint** is used by construction enterprises, professional painters (SNAP 060103) and private consumers (SNAP 060104).

For dividing paint between these groups, paint production companies and construction stores were contacted.

Main paint production companies (AS Sadolin, AS Eskaro, AS Tikkurila and AS Caparol) were not able to give answer to this question. Some of them do not have direct sales department.

Also big construction stores (AS ESPAK, Ehitus Service OÜ, Rautakesko AS) were contacted and in interviews it was found that:

1. Sales division by companies and private customers depends on the marketing policy of the store,
2. A change in the division between 1995 and 2008 also depends on the marketing policy,
3. In the years 2004 till 2007 an increase of paint use is mainly caused by the rapid increase of the developments and construction; the elevated use of paint was mainly caused by professional painters and construction companies.

As a result of the discussions it is estimated that up to 60% of paint can be assigned to professional painters and the remaining 40% to private customers.

In the period from 2005 to 2007 there was a lot of development and construction in Estonia and it is estimated that the private use of paints was similar to the amount used in 2000.

Therefore the following assumptions are made

* In 1995, 2000 and 2008 it is estimated that up to 60% of paint went to professional painters and the remaining 40% to private customers
* Consumption of private consumers in 2005-2007 is assumed to be equal to consumption in 2000 and the remaining part is estimated to be used by professional painters and construction companies.

Table Use of paint for decorative coating application (3.A.1) – construction and buildings and domestic use

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | Total consumption of paints and varnishes, t | Paint used in point sources, t | Car paint used in diffuse sources, t\* | Paint used for decorative coating application, t | Paint used for construction and buildings, t | Paint used for domestic purposes, t |
| 1995 | 12640,7 | *2343,15* | 122,0 | 10175,6 | 6105 | 4070 |
| 2000 | 14046,7 | *1152,18* | 144,0 | 12750,5 | 7650 | 5100 |
| 2005 | 21111,3 | *1348,93* | 166,0 | 19596,4 | 14496 | 5100 |
| 2006 | 20911,4 | 1180,968 | 166,6 | 19563,9 | 14464 | 5100 |
| 2007 | 21332,1 | 2614,001 | 172,3 | 18545,8 | 13446 | 5100 |
| 2008 | 13914,2 | 3252,258 | 176,5 | 10485,5 | 6291 | 4194 |

\*-car paint used in point sources is subtracted from total car paint use for repairing (see ).

### Results

#### Industrial coating application

A part of the car paint shops is permitted.

Between 2006 and 2008, activity data regarding paint use in point sources is collected in the OSIS database.

For the years 2006-2008 activity data for calculations is obtained using the following equation:

car paint use in diffuse sources = total car paint use – car paint use in point sources

In 2000 and 2005, according to CollectER some companies were reporting as point sources. No activity data is available. Emission from point sources is subtracted from the total calculated VOC emission.

Table 59 NMVOC emission from car repairing activities (NFR 3.A.2) in tons

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NFR | 3.A.2 |  |  | | |
| SNAP: | 060102 | Activity: | Industrial coating application (car repairing) | | |
| Emission factor (1990-1995) | | 600 | g/kg paint applied | | |
| Emission factor (2000-2008) | | 400 | g/kg paint applied | | |
|  | Total paint use | Paint used in, point sources, t | Paint used in diffuse sources, t | NMVOC from paint use, point sources, t | NMVOC emission from diffuse sources, t |
| 1990 | 100 | NA | 100,0 | 0,0 | 60,0 |
| 1995 | 122 | NA | 122,0 | 0,0 | 73,2 |
| 2000 | 144 | NA | 144,0 | 13,44 | 44,2 |
| 2005 | 166 | NA | 166,0 | 1,36 | 65,0 |
| 2006 | 171 | 3,923 | 166,6 | NA | 66,6 |
| 2007 | 175 | 2,69 | 172,3 | NA | 68,9 |
| 2008 | 180 | 3,533 | 176,5 | NA | 70,6 |

Emission is disaggregated by population. See Annex I.

Table 60 NMVOC emission from car repairing activities by counties

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| County | Year | NMVOC emission from car repairing, t | | | | | | |
| 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | 60,0 | 73,2 | 44,2 | 65,0 | 66,6 | 68,9 | 70,6 |
| *By county* | *Share by county* |  |  |  |  |  |  |  |
| Harju | 38,7% | 23,2 | 28,3 | 17,1 | 25,1 | 25,8 | 26,6 | 27,3 |
| Hiiu | 0,8% | 0,5 | 0,6 | 0,3 | 0,5 | 0,5 | 0,5 | 0,5 |
| Ida-Viru | 13,2% | 7,9 | 9,6 | 5,8 | 8,6 | 8,8 | 9,1 | 9,3 |
| Jõgeva | 2,8% | 1,7 | 2,0 | 1,2 | 1,8 | 1,8 | 1,9 | 2,0 |
| Järva | 2,8% | 1,7 | 2,0 | 1,2 | 1,8 | 1,8 | 1,9 | 2,0 |
| Lääne | 2,1% | 1,3 | 1,5 | 0,9 | 1,4 | 1,4 | 1,4 | 1,5 |
| Lääne-Viru | 5,0% | 3,0 | 3,7 | 2,2 | 3,2 | 3,3 | 3,4 | 3,5 |
| Põlva | 2,4% | 1,4 | 1,7 | 1,0 | 1,5 | 1,6 | 1,6 | 1,7 |
| Pärnu | 6,6% | 3,9 | 4,8 | 2,9 | 4,3 | 4,4 | 4,5 | 4,6 |
| Rapla | 2,7% | 1,6 | 2,0 | 1,2 | 1,8 | 1,8 | 1,9 | 1,9 |
| Saare | 2,6% | 1,6 | 1,9 | 1,2 | 1,7 | 1,7 | 1,8 | 1,8 |
| Tartu | 10,9% | 6,5 | 8,0 | 4,8 | 7,1 | 7,3 | 7,5 | 7,7 |
| Valga | 2,6% | 1,6 | 1,9 | 1,1 | 1,7 | 1,7 | 1,8 | 1,8 |
| Viljandi | 4,2% | 2,5 | 3,1 | 1,9 | 2,7 | 2,8 | 2,9 | 3,0 |
| Võru | 2,9% | 1,7 | 2,1 | 1,3 | 1,9 | 1,9 | 2,0 | 2,0 |

#### Decorative coating application

Emission from decorative coating application is presented in the following table.

Table NMVOC emission from decorative coating application (NFR 3.A.1) in tons

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NFR | 3.A.1 | | | |
| SNAP: | 060103-060104 | | | |
| Activity: | Decorative coating application | | | |
| Emission factor (1995) | | 211 | g/kg paint |  |
| Emission factor (2000-2008) | | 150 | g/kg of paint applied | |
| Year | Construction and buildings (060103) | | Domestic use (060104) | |
| Paint use, t | NMVOC emission, t | Paint use, t | NMVOC emission, t |
| 1995 | 6105 | 1288,2 | 4070,2 | 858,8 |
| 2000 | 7650 | 1147,5 | 5100,2 | 765,0 |
| 2005 | 14496 | 2174,5 | 5100,0 | 765,0 |
| 2006 | 14464 | 2169,6 | 5100,0 | 765,0 |
| 2007 | 13446 | 2016,9 | 5100,0 | 765,0 |
| 2008 | 6291 | 943,7 | 4194,2 | 629,1 |

Both emission from construction and domestic use are disaggregated by population. See Annex I.

Table 62 NMVOC emission from decorative coating application (construction and buildings) by counties

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| County | Year | NMVOC emission from decorative coating application (construction and buildings), t | | | | | |
| 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | 1288,2 | 1147,5 | 2174,5 | 2169,6 | 2016,9 | 943,7 |
| *By county* | *Share by county* |  |  |  |  |  |  |
| Harju | 38,7% | 497,9 | 443,5 | 840,5 | 838,6 | 779,6 | 364,8 |
| Hiiu | 0,8% | 9,7 | 8,7 | 16,4 | 16,4 | 15,2 | 7,1 |
| Ida-Viru | 13,2% | 169,7 | 151,1 | 286,4 | 285,7 | 265,6 | 124,3 |
| Jõgeva | 2,8% | 35,7 | 31,8 | 60,2 | 60,1 | 55,9 | 26,1 |
| Järva | 2,8% | 35,7 | 31,8 | 60,3 | 60,1 | 55,9 | 26,2 |
| Lääne | 2,1% | 26,9 | 24,0 | 45,4 | 45,3 | 42,1 | 19,7 |
| Lääne-Viru | 5,0% | 64,3 | 57,3 | 108,5 | 108,3 | 100,7 | 47,1 |
| Põlva | 2,4% | 30,3 | 27,0 | 51,1 | 51,0 | 47,4 | 22,2 |
| Pärnu | 6,6% | 84,7 | 75,4 | 142,9 | 142,6 | 132,5 | 62,0 |
| Rapla | 2,7% | 34,8 | 31,0 | 58,7 | 58,6 | 54,5 | 25,5 |
| Saare | 2,6% | 33,5 | 29,9 | 56,6 | 56,5 | 52,5 | 24,6 |
| Tartu | 10,9% | 140,3 | 125,0 | 236,8 | 236,3 | 219,6 | 102,8 |
| Valga | 2,6% | 33,5 | 29,8 | 56,5 | 56,4 | 52,4 | 24,5 |
| Viljandi | 4,2% | 54,1 | 48,2 | 91,3 | 91,1 | 84,7 | 39,6 |
| Võru | 2,9% | 37,2 | 33,1 | 62,7 | 62,6 | 58,2 | 27,2 |

Table 63 NMVOC emission from decorative coating application (domestic use) by counties

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| County | Year | NMVOC emission from decorative coating application (domestic use), t | | | | | |
| 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | 858,8 | 765,0 | 765,0 | 765,0 | 765,0 | 629,1 |
| *By county* | *Share by county* |  |  |  |  |  |  |
| Harju | 38,7% | 331,9 | 295,7 | 295,7 | 295,7 | 295,7 | 243,2 |
| Hiiu | 0,8% | 6,5 | 5,8 | 5,8 | 5,8 | 5,8 | 4,8 |
| Ida-Viru | 13,2% | 113,1 | 100,8 | 100,7 | 100,7 | 100,7 | 82,9 |
| Jõgeva | 2,8% | 23,8 | 21,2 | 21,2 | 21,2 | 21,2 | 17,4 |
| Järva | 2,8% | 23,8 | 21,2 | 21,2 | 21,2 | 21,2 | 17,4 |
| Lääne | 2,1% | 17,9 | 16,0 | 16,0 | 16,0 | 16,0 | 13,1 |
| Lääne-Viru | 5,0% | 42,9 | 38,2 | 38,2 | 38,2 | 38,2 | 31,4 |
| Põlva | 2,4% | 20,2 | 18,0 | 18,0 | 18,0 | 18,0 | 14,8 |
| Pärnu | 6,6% | 56,4 | 50,3 | 50,3 | 50,3 | 50,3 | 41,3 |
| Rapla | 2,7% | 23,2 | 20,7 | 20,7 | 20,7 | 20,7 | 17,0 |
| Saare | 2,6% | 22,4 | 19,9 | 19,9 | 19,9 | 19,9 | 16,4 |
| Tartu | 10,9% | 93,5 | 83,3 | 83,3 | 83,3 | 83,3 | 68,5 |
| Valga | 2,6% | 22,3 | 19,9 | 19,9 | 19,9 | 19,9 | 16,4 |
| Viljandi | 4,2% | 36,1 | 32,1 | 32,1 | 32,1 | 32,1 | 26,4 |
| Võru | 2,9% | 24,8 | 22,1 | 22,1 | 22,1 | 22,1 | 18,2 |

## Degreasing (NFR 3.B.1)

### Source description

The metal-working industries are the major users of solvent degreasing. Solvent degreasing is also used in industries as printing and production of chemicals, plastics, rubber, textiles, glass, paper, and electric power. Also repair stations for transportation vehicles use solvent cleaning part of the time.

The contribution of metal degreasing to the total NMVOC emissions (including natural sources) is about 1.8% in CORINAIR countries (CORINAIR 1990 inventory). In addition, metal degreasing could be a significant source of hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) (ETC/AEM-CITEPA-RISOE, 1997).

Metal degreasing by using organic solvents takes place in either open top or closed tanks. The open top tanks however have been phased out in the European Union due to the Solvents Emissions Directive 1999/13/EC. Only small facilities, using not more than 1 or 2 tons of solvent per year (depending on the risk profile of the solvent) are still allowed to use open top tanks. Closed tanks offer much better opportunities for the recycling of solvents.

**Vapour cleaning[[18]](#footnote-18)**

The most common organic solvents for vapour cleaning are:

* methylene chloride (MC)
* tetrachloroethylene (PER)
* trichloroethylene (TRI)
* xylenes (XYL)

The use of CFC in the past is now displaced by HFCs or PFCs. The use of 1,1,1,-trichloroethane (TCA) has been banned since the Montreal Protocol and replaced by trichloroethylene (TRI). Further details about the calculation of the emissions can be found in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006). The application of methylene chloride, tetrachloroethylene and trichloroethylene normally requires a closed cleaning machine.

**Cold cleaning[[19]](#footnote-19)**

The two basic types of cold cleaners are maintenance and manufacturing. Cold cleaners are batch loaded, nonboiling solvent degreasers, usually providing the simplest and least expensive method of metal cleaning. Maintenance cold cleaners are smaller, more numerous, and generally use petroleum solvents as mineral spirits (petroleum distillates and Stoddard solvents).

Cold cleaner operations include spraying, brushing, flushing, and immersion. In a typical maintenance cleaner, dirty parts are cleaned manually by first spraying and then soaking in the tank. After cleaning, the parts are either suspended over the tank to drain or are placed on an external rack that routes the drained solvent back into the cleaner. The cover is intended to be closed whenever parts are not being handled in the cleaner. Typical manufacturing cold cleaners vary widely in design, but there are two basic tank designs: the simple spray sink and the dip tank. Of these, the dip tank provides more thorough cleaning through immersion, and often cleaning efficiency is improved by agitation. Small cold cleaning operations may be numerous in urban areas.

### Methodology and default emission factors

The Tier 1 methodology for emissions from degreasing is based on solvent sales statistics, in combination with assumptions about the distribution over the different environmental compartments (emissions to air, water, soil and conversion to waste).

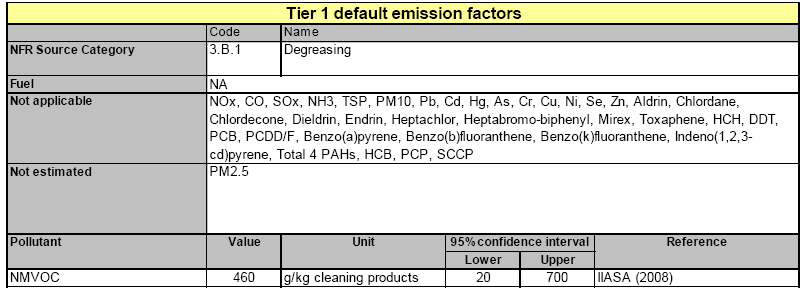
If total solvent sales are not known the following two approaches are applied.

1. vapour cleaning – consumption of most common organic solvents for vapour cleaning (according to EMEP Guidebook 2009) are considered for emission calculations,
2. cold cleaning – emission from the rest of vapour cleaning is estimated by different emission factor by inhabitant

**Emission factor for vapour cleaning**

Tier 1 emission factors are used for calculations. Equation 1 is applied.

Table 64 Tier 1 emission factors for source category 3.B.1 Degreasing

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**Emission factor for cold cleaning**

Emission factor for cold cleaning is taken from the US EPA AP-42[[20]](#footnote-20) emission factor database.

Table 65 Non-methane VOC emissions from small cold cleaning degreasing operations



### Activity data

**Vapour cleaning operations**

Consumption of the most common organic solvents for vapour cleaning (methylene chloride (MC), tetrachloroethylene (PER), trichloroethylene (TRI) and xylenes (XYL) is used as a basis for emission calculations from vapour cleaning.

As PER is used also for dry cleaning, this is not included as degreaser (see explanations in Dry Cleaning chapter).

The consumption of organic solvents can be estimated by the import and export data from Statistics Estonia (by relevant CN codes). Data regarding import and export is not available for 1990. There is no information available regarding production for the years 1990-2005. The OSIS database provides some information regarding xylenes production between 2006 and 2008.

The data is summarized in the following table.

Data regarding import and export is in some cases inconsistent, for example data regarding the export of p-xylene in 2006 and xylene (for other purposes) in 2008. An explanation could be that the solvents have been imported in a previous period and the material is stored till 2006 or 2008 and then exported. To take this assumption into account 50% of the product is considered to be stored in previous years for further export (included under column Export).

Table 66 Activity data for NMVOC emission calculations from vapour degreasing activities in 1995 – 2008 (in tons)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CN code | Name of the chemical | 1995 | | | 2000 | | | 2005 | | | 2006 | | | | 2007 | | | | 2008 | | | |
| Import | Export | Use | Import | Export | Use | Import | Export | Use | Import | Export | Prod. | Use | Import | Export | Prod. | Use | Import | Export | Prod. | Use |
| 2903 12 00 | Dichloromethane (methylene chloride) | 138,0 | 93,0 | 45,0 | 38,9 | 0,2 | 38,7 | 31,9 | 0,3 | 31,6 | 33,2 | 0,0 | 0 | 33,2 | 31,4 | 0,0 | 0 | 31,4 | 42,6 | 1,1 | 0 | 41,5 |
| 2903 22 00 | trichloroethylene | 35,8 | 0 | 35,8 | 46,3 | 3,2 | 43,1 | 30,8 | 2,4 | 28,4 | 25,8 | 0,1 | 0 | 25,7 | 25,2 | 0,4 | 0 | 24,8 | 11,1 | 0,8 | 0 | 10,3 |
| 2707 30 90 | Xylole (xylenes): For other purposes | 25,0 | 0 | 25,0 | 8,7 | 0,1\* | 8,6 | 0 | 0 | 0,0 | 1,4 | 0,7\* | 0 | 0,7 | 0,2 | 0,1\* | 0 | 0,1 | 0,0 | 0,9 | 0 | 0,0 |
| 2902 41 00 | o-xylene | 100,5 | 0,1 | 100,4 | 958,8 | 0,0 | 958,8 | 1,8 | 0,0 | 1,8 | 1,4 | 0,0 | 0 | 1,4 | 1,3 | 0,0 | 0 | 1,3 | 0,4 | 0,0 | 0 | 0,4 |
| 2902 42 00 | m-xylene | 0 | 0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,5 | 0,0 | 0,5 | 0,0 | 0,0 | 0 | 0,0 | 0,0 | 0,0 | 0 | 0,0 | 0,0 | 0,0 | 0 | 0,0 |
| 2902 43 00 | p-xylene | 0 | 0 | 0,0 | 437,5 | 218,8\* | 218,8 | 0 | 0 | 0,0 | 14,6 | 9 643,1 | 0 | 0,0 | 3,9 | 0,0 | 8,035 | 11,9 | 0,0 | 0,0 | 6,936 | 6,9 |
| 2902 44 00 | Mixed xylene isomers | 0 | 0 | 0,0 | 300,2 | 2,7 | 297,5 | 263,8 | 0,0 | 263,8 | 306,2 | 0,0 | 6,1 | 312,3 | 233,0 | 0,0 | 0 | 233,0 | 170,2 | 0,3 | 0 | 169,9 |
|  | **Solvents used for vapour degreasing** | 299,3 | 93,1 | **206,2** | 1 790,4 | 225,0 | **1 565,5** | 328,8 | 2,7 | **326,1** | 382,6 | 9 643,9 | 6,1 | **373,3** | 295,0 | 0,5 | 8,0 | **302,5** | 224,3 | 3,1 | 6,9 | **229,0** |

\* stored

**Cold cleaning operations**

The basic activity statistics for using the AP-42 emission factor are national population figures.

Data regarding population by counties is available from Statistics Estonia and is presented in Annex I.

### Results

**Vapour cleaning operations**

Part of the facilities report NMVOC emissions from degreasing operations as point sources. These are taken into account in the calculations of vapour cleaning operations.

Between 2006 and 2008, activity data regarding solvent use for degreasing in point sources is collected into OSIS database.

For the years 2006-2008 activity data for calculations is calculated as following:

solvent use in diffuse sources = total solvent use – solvent use in point sources

There were some companies reporting emissions between 1995 and 2005. No activity data is available. Emission from point sources is subtracted from the total calculated VOC emission.

Table 67 NMVOC emission from vapour degreasing activities (NFR 3.B.1) in tons

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NFR | 3.B.1 |  |  |  |  |
| SNAP: | 0602 | Activity: | Degreasing (vapour cleaning) | | |
| Emission factor: | | 460 | g/kg cleaning products | | |
|  | Total solvent use | Solvent used in point sources, t | Solvent used in diffuse sources, t | NMVOC from degreasing use, point sources, t | NMVOC emission from diffuse sources, t |
| 1995 | 206,2 | NA | 206,2 | 14,7 | 80,1 |
| 2000 | 1 565,5 | NA | 1565,5 | 0,62 | 719,5 |
| 2005 | 326,1 | NA | 326,1 | 3,7 | 146,3 |
| 2006 | 373,3 | 32,243 | 341,057 | NA | 156,9 |
| 2007 | 302,5 | 21,471 | 281,064 | NA | 129,3 |
| 2008 | 229,0 | 52,464 | 176,572 | NA | 81,2 |

NMVOC emission from vapour cleaning operations is disaggregated by population.

Table 68 NMVOC emission from degreasing activities (vapour cleaning) by counties

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| County | Year | NMVOC emission from degreasing (vapour cleaning), t | | | | | |
| 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **80,1** | **719,5** | **146,3** | **156,9** | **129,3** | **81,2** |
| *By county* | *Share by county* |  |  |  |  |  |  |
| Harju | 38,7% | 31,0 | 278,1 | 56,5 | 60,6 | 50,0 | 31,4 |
| Hiiu | 0,8% | 0,6 | 5,4 | 1,1 | 1,2 | 1,0 | 0,6 |
| Ida-Viru | 13,2% | 10,6 | 94,8 | 19,3 | 20,7 | 17,0 | 10,7 |
| Jõgeva | 2,8% | 2,2 | 19,9 | 4,1 | 4,3 | 3,6 | 2,2 |
| Järva | 2,8% | 2,2 | 19,9 | 4,1 | 4,3 | 3,6 | 2,3 |
| Lääne | 2,1% | 1,7 | 15,0 | 3,1 | 3,3 | 2,7 | 1,7 |
| Lääne-Viru | 5,0% | 4,0 | 35,9 | 7,3 | 7,8 | 6,5 | 4,1 |
| Põlva | 2,4% | 1,9 | 16,9 | 3,4 | 3,7 | 3,0 | 1,9 |
| Pärnu | 6,6% | 5,3 | 47,3 | 9,6 | 10,3 | 8,5 | 5,3 |
| Rapla | 2,7% | 2,2 | 19,4 | 4,0 | 4,2 | 3,5 | 2,2 |
| Saare | 2,6% | 2,1 | 18,7 | 3,8 | 4,1 | 3,4 | 2,1 |
| Tartu | 10,9% | 8,7 | 78,4 | 15,9 | 17,1 | 14,1 | 8,8 |
| Valga | 2,6% | 2,1 | 18,7 | 3,8 | 4,1 | 3,4 | 2,1 |
| Viljandi | 4,2% | 3,4 | 30,2 | 6,1 | 6,6 | 5,4 | 3,4 |
| Võru | 2,9% | 2,3 | 20,8 | 4,2 | 4,5 | 3,7 | 2,3 |

**Cold cleaning operations**

Table 69 NMVOC emission from degreasing activities (cold cleaning) (by counties)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NFR | 3.B.1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SNAP: | 0602 | Activity: | Degreasing (cold cleaning) | | | |  |  |  |  |  |  |  |  |
| Emission factor, | 1,8 | kg per capita | | | | |  |  |  |  |  |  |  |  |
| Year | 1990 | | 1995 | | 2000 | | 2005 | | 2006 | | 2007 | | 2008 | |
|  | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t |
| Estonia | 1570599 | **2827,078** | 1448075 | **2606,535** | 1372071 | **2469,728** | 1347510 | **2425,518** | 1344684 | **2420,431** | 1342409 | **2416,336** | 1340935 | **2413,683** |
| *By county* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Harju | 607158 | 1092,884 | 553193 | 995,747 | 526155 | 947,079 | 521038 | 937,868 | 521313 | 938,363 | 522147 | 939,865 | 523277 | 941,899 |
| Hiiu | 11332 | 20,398 | 11170 | 20,106 | 10458 | 18,824 | 10246 | 18,443 | 10222 | 18,400 | 10168 | 18,302 | 10118 | 18,212 |
| Ida-Viru | 221807 | 399,253 | 197899 | 356,218 | 180143 | 324,257 | 173777 | 312,799 | 172775 | 310,995 | 171748 | 309,146 | 170719 | 307,294 |
| Jõgeva | 42607 | 76,693 | 40598 | 73,076 | 38372 | 69,070 | 37473 | 67,451 | 37305 | 67,149 | 37108 | 66,794 | 36922 | 66,460 |
| Järva | 43715 | 78,687 | 41152 | 74,074 | 38871 | 69,968 | 38141 | 68,654 | 36457 | 65,623 | 36328 | 65,390 | 36208 | 65,174 |
| Lääne | 33694 | 60,649 | 30606 | 55,091 | 28695 | 51,651 | 27990 | 50,382 | 27853 | 50,135 | 27713 | 49,883 | 27552 | 49,594 |
| Lääne-Viru | 79767 | 143,581 | 70604 | 127,087 | 67910 | 122,238 | 66464 | 119,635 | 67770 | 121,986 | 67560 | 121,608 | 67375 | 121,275 |
| Põlva | 36186 | 65,135 | 34760 | 62,568 | 32743 | 58,937 | 31752 | 57,154 | 31547 | 56,785 | 31387 | 56,497 | 31175 | 56,115 |
| Pärnu | 99863 | 179,753 | 94424 | 169,963 | 91363 | 164,453 | 89343 | 160,817 | 89017 | 160,231 | 88727 | 159,709 | 88563 | 159,413 |
| Rapla | 39717 | 71,491 | 38560 | 69,408 | 37671 | 67,808 | 37032 | 66,658 | 36869 | 66,364 | 36743 | 66,137 | 36684 | 66,031 |
| Saare | 39890 | 71,802 | 38233 | 68,819 | 36010 | 64,818 | 35208 | 63,374 | 35076 | 63,137 | 34978 | 62,960 | 34845 | 62,721 |
| Tartu | 162924 | 293,263 | 153307 | 275,953 | 149744 | 269,539 | 148886 | 267,995 | 148969 | 268,144 | 149001 | 268,202 | 149283 | 268,709 |
| Valga | 41515 | 74,727 | 38407 | 69,133 | 35861 | 64,550 | 34867 | 62,761 | 34661 | 62,390 | 34455 | 62,019 | 34265 | 61,677 |
| Viljandi | 65135 | 117,243 | 62043 | 111,677 | 58087 | 104,557 | 56616 | 101,909 | 56370 | 101,466 | 56075 | 100,935 | 55877 | 100,579 |
| Võru | 45289 | 81,520 | 43119 | 77,614 | 39988 | 71,978 | 38677 | 69,619 | 38480 | 69,264 | 38271 | 68,888 | 38072 | 68,530 |

## Dry cleaning (NFR 3.B.2)

### Source description

Dry Cleaning refers to any process to remove contamination from furs, leather, down leathers, textiles or other objects made of fibres, using organic solvents.

Emissions arise from evaporative losses of solvent, primarily from the final drying of the clothes, known as deodorisation. Emissions may also arise from the disposal of wastes from the process.

The most widespread solvent used in dry cleaning, accounting for about 90% of the total consumption, is tetrachloroethene (also called tetrachloroethylene or perchloroethylene (PER)). The most significant pollutants from dry cleaning are NMVOCs, including chlorinated solvents. Heavy metal and POP emissions are unlikely to be significant.

### Methodology and default emission factors

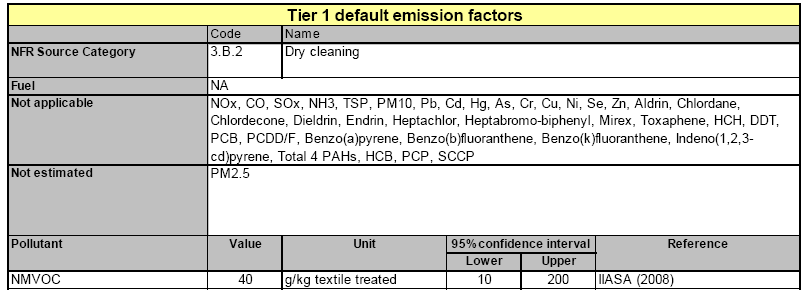
In the Tier 1 approach, the emissions are estimated from solvent consumption data. Most of the solvent is recycled, but some is lost to the environment. This needs to be replaced and it can be assumed that the quantity of solvent, which is used for replacement, is equivalent to the quantity emitted plus the quantity taken away with the sludge.

Solvent emissions directly from the cleaning machine into the air represent about 80% of the solvent consumption (i.e. 80% of solvent used for the replacement of lost solvent) for an open-circuit equipment and a little more than 40% for a closed-circuit machine. Open-circuit equipment however is no longer used within the EU following the European Solvents Directive coming into force. The remainder of the lost solvent is released to the environment in still residues or retained on cleaned clothes, but for the simpler methodology it can be assumed that this eventually finds its way to the atmosphere (Passant, 1993; UBA, 1989. Also, a significant amount of the solvent goes back to the producers and to the recyclers together with the sludge.

Solvent consumption data may be available from the industry and can be compared with a per capita emission factor. In addition, the proportion of solvent lost directly from the machine can also be estimated.

The Tier 1 default emission factors for NMVOC emissions from dry cleaning are a weighted average, calculated from the sum of all activity and emission data from the GAINS model (IIASA, 2008).

Table 70 Tier 1 emission factors for source category 3.B.2 Dry Cleaning

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### Situation in Estonia

For the market situation a description interview with the representative of the main dry cleaning service provider was carried out - SOL Eesti. SOL Eesti operates eight dry cleaning facilities in Tallinn, Pärnu, Kunda and Tartu.

Main findings:

* in Estonia mainly closed-circuit equipment are used for dry cleaning,
* closed-circuit equipment were the main practice already in the 90s,
* main cleaning agent is PER (tetrachloroethylene/perchloroethylene),
* solvent waste (used solvent) is collected and given to hazardous waste companies,
* the quantity of cleaned textile is registered by cleaned items (for example number of cleaned coats or curtains) not by mass units.

In addition four dry cleaning facilities were questioned by phone and by e-mail.

Questions and answers are given in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Answers | | | |
| Question | *Virumaa Puhastus* | *Euroclean* | *Pernau Pesumaja* | *Rea Pesumaja* |
| Technology used? | Closed-circuit machines | Closed-circuit machines (automatic programs) | Closed-circuit machines with activated carbon | Closed-circuit machines |
| Cleaning agent used? | PER | PER | PER | PER |
| Quantity of cleaning agent? | 30 kg per year | 400 kg per year | 165 kg per year | 1070 kg per year |
| Quantity of cleaned textiles? | Ca 2000 kg | do not have statistics | Register by pieces (app. equal to 6,2 tons) | Register by pieces |
| Waste management? | collected | Collected and given to hazardous waste company | Collected and given to hazardous waste company | Collected and given to hazardous waste company |

### Activity data

As the quantity of textile treated is very difficult to estimate because even dry cleaning shops do not have statistics for it, the solvent consumption is taken as a basis for NMVOC calculations.

Solvent emissions directly from the cleaning machine into the air represent about 80% of the solvent consumption (i.e. 80% of solvent used for the replacement of lost solvent) for an open-circuit equipment and a little more than 40% for a closed-circuit machine.

All dry cleaning facilities questioned have closed-circuit equipment and use PER as a cleaning agent.

Used solvent goes to hazardous waste companies.

The quantity of PER used in Estonia can be estimated by the import and export data. Data regarding import and export is not available for 1990.

According to OSIS, no production of tetrachloroethylene/perchloroethylene is reported for 2006-2008.

According to OSIS part of PER emissions are reported as emissions from point sources. This is also subtracted to get the amount of PER emissions from diffuse sources.

Table 71 Activity data for NMVOC emission calculations from dry cleaning activities in 1995 – 2008 (in tons)

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Import, t | Export, t | Total solvent use, t |
| 1995 | 62,1 | - | 62,1 |
| 2000 | 132,8 | 6,6 | 126,2 |
| 2005 | 148,5 | - | 148,5 |
| 2006 | 157,8 | - | 157,8 |
| 2007 | 131,4 | - | 131,4 |
| 2008 | 124,1 | - | 124,1 |

**Methodological issues**

Perchloroethylene might be also used in degreasing process. It is difficult to divide the consumption of PER between dry cleaning and degreasing. That is the reason why all PER used in Estonia is estimated to be used for dry cleaning purpose.

The emission factor for degreasing is 460 g/kg cleaning products which equals about 40%, too.

### Results

Table 72 NMVOC emission from dry cleaning activities (NFR 3.B.2) in tons

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NFR | 3.B.2 |  |  |  |
| SNAP: | 060202 | Activity: | Dry cleaning | |
| Emission factor: | | 400 | g/kg solvent used | |
| Year | Total solvent use | Solvent used in point sources, t | Solvent used in diffuse sources, t | NMVOC emission from diffuse sources, t |
| 1995 | 62,1 | NA | 62,1 | 24,8 |
| 2000 | 126,2 | NA | 126,2 | 50,5 |
| 2005 | 148,5 | 9,4 | 139,120 | 55,6 |
| 2006 | 157,8 | 5,430 | 152,370 | 60,9 |
| 2007 | 131,4 | 6,5 | 124,930 | 50,0 |
| 2008 | 124,1 | 8,379 | 115,721 | 46,3 |

Emission is disaggregated down to counties by population (see Annex I), although some companies are permitted. The part of solvent used in facilities having permits is less than 10% of the total consumption and does not give much influence to the results of distribution by counties.

Table 73 NMVOC emission from dry cleaning activities by counties

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from dry cleaning, t | | | | | |
| County | Year | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **24,8** | **50,5** | **55,6** | **60,9** | **50,0** | **46,3** |
| *By county* | *Share by county* |  |  |  |  |  |  |
| Harju | 38,7% | 9,6 | 19,5 | 21,5 | 23,6 | 19,3 | 17,9 |
| Hiiu | 0,8% | 0,2 | 0,4 | 0,4 | 0,5 | 0,4 | 0,3 |
| Ida-Viru | 13,2% | 3,3 | 6,6 | 7,3 | 8,0 | 6,6 | 6,1 |
| Jõgeva | 2,8% | 0,7 | 1,4 | 1,5 | 1,7 | 1,4 | 1,3 |
| Järva | 2,8% | 0,7 | 1,4 | 1,5 | 1,7 | 1,4 | 1,3 |
| Lääne | 2,1% | 0,5 | 1,1 | 1,2 | 1,3 | 1,0 | 1,0 |
| Lääne-Viru | 5,0% | 1,2 | 2,5 | 2,8 | 3,0 | 2,5 | 2,3 |
| Põlva | 2,4% | 0,6 | 1,2 | 1,3 | 1,4 | 1,2 | 1,1 |
| Pärnu | 6,6% | 1,6 | 3,3 | 3,7 | 4,0 | 3,3 | 3,0 |
| Rapla | 2,7% | 0,7 | 1,4 | 1,5 | 1,6 | 1,3 | 1,2 |
| Saare | 2,6% | 0,6 | 1,3 | 1,4 | 1,6 | 1,3 | 1,2 |
| Tartu | 10,9% | 2,7 | 5,5 | 6,1 | 6,6 | 5,4 | 5,0 |
| Valga | 2,6% | 0,6 | 1,3 | 1,4 | 1,6 | 1,3 | 1,2 |
| Viljandi | 4,2% | 1,0 | 2,1 | 2,3 | 2,6 | 2,1 | 1,9 |
| Võru | 2,9% | 0,7 | 1,5 | 1,6 | 1,8 | 1,4 | 1,3 |

## Printing (NFR 3.D.1)

### Source description

Printing involves the use of inks, which may contain a proportion of organic solvents. These inks may then be subsequently diluted before use. Different inks have different proportions of organic solvents and require dilution to different extents. Printing can also require the use of cleaning solvents and organic dampeners. Ink solvents, diluents, cleaners and dampeners may all make a significant contribution to emissions from industrial printing involves the application of inks using presses.

In the EMEP/EEA guidebook, the following printing categories are identified:

* Heat set offset printing

According to the RAINS model, at EU-25 level for 2000, NMVOC emissions from heat set accounted for 40 kt representing 0.38 % of the total NMVOC emissions. The total activity was 123.59 kt with an average emission factor of 3239 g NMVOC/kg which shows that this industry has already reduced some emissions (EGTEI, 2005).

* Publication packaging

At EU-25 level for 2000 (according to the RAINS model) NMVOC emissions accounted for 61 kt representing 0.58 % of the total NMVOC emissions. The total activity was 191.48 kt of ink, with an average emission of 0.32 kg NMVOC/kg non-diluted ink which means that this industry has already reduced emissions significantly (EGTEI, 2005)

* Rotogravure & Flexography

At EU-25 level for 2000 (according to the RAINS model) NMVOC emissions accounted for 127.56 kt representing 1.2 % of total NMVOC emissions. The total activity was 91.69 kt of non-diluted ink and an average emission of 1.4 kg NMVOC/kg non-diluted ink (EGTEI, 2005).

The emissions of NMVOCs from printing have been significantly reduced following the introduction of the Solvents Emissions Directive 1999/13/EC in March 1999. Larger facilities are now required to control their emissions in such a way that the emission limit value in the residual gas does not exceed a maximum concentration. The threshold is 15 ton/year for heat set offset and flexography/rotogravure in packaging, and 25 ton/year for publication gravure (for the latter installations below the threshold are not likely to exist).

**Situation in Estonia[[21]](#footnote-21)**

The Association of Estonian Printing Industry collects information from 100 printing facilities in Estonia. Based on their main field of activity these are divided into four groups: printing houses for periodicals, books, etiquettes and labels, and advertisements.

The total number of printing houses is decreasing, especially smaller facilities will close down. The total capacity exceeds local market needs and any increase is connected with export.

It is expected that the near future will bring an end to growth. In 2008 and 2009 some printing facilities have stopped their activity and decreasing demands will continue to reduce production outputs and the number of employees.

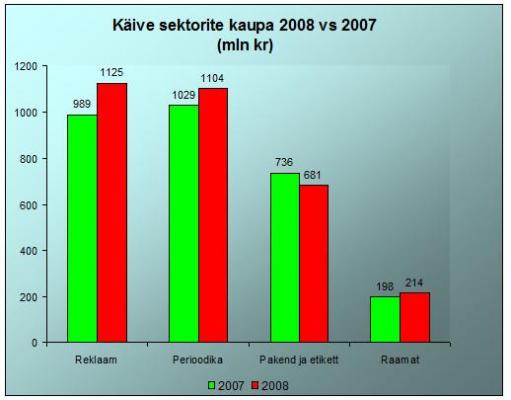


Figure Revenue of different sectors, in million kroons in 2007 and 2008

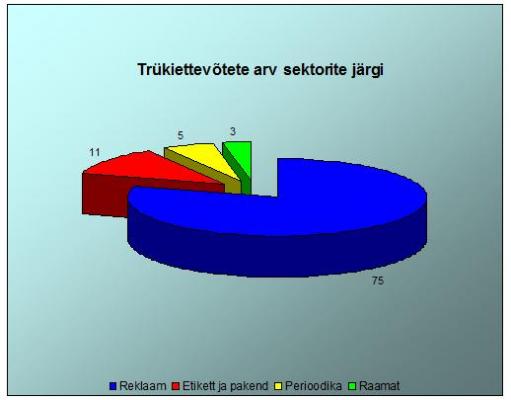


Figure Number of printing houses by sector

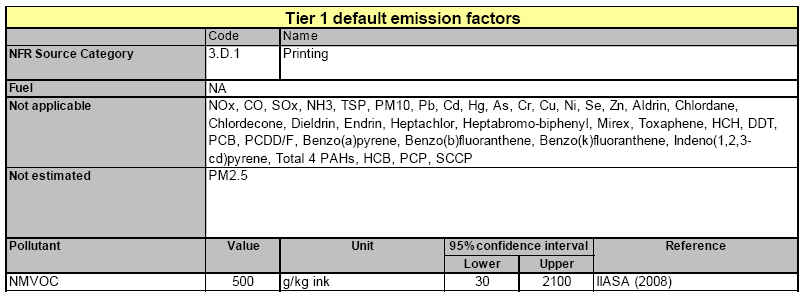
### Default emission factors

Tier 1 emission factors are used for calculations. Equation 1 is applied.

It involves either the use of solvent consumption data or combining ink consumption with emission factors for the industry. Unless the solvent consumption data is used, the use of water based or low solvent inks as well as the extent of controls such as incineration are not considered.

An approach combining ink consumption with emission factor is applied.

Table 74 Tier 1 emission factors for source category 3.D.1 Printing

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The emission factor has been estimated to be constant over the period. According to the revenues of the printing sector the major part of printing is done for advertisements and the press. From Corinair[[22]](#footnote-22) is can be concluded that for press and edition/publication the following techniques are applied (with relevant emission factors):

* cold set web offset – 54 kg/t (g/kg) ink consumed
* heat set web offset – 82 kg/t (g/kg) ink consumed
* rotogravure – 425 kg/t (g/kg) ink consumed

As these stay below the current emission factor, it is not changed over the period.

### Activity data

The quantity of ink (CN code 3215) used in Estonia can be estimated by the import and export data from Statistics Estonia. Data regarding import and export is not available for the year 1990.

Information regarding ink production is not available. According to OSIS, no production of ink is reported between 2006 and 2008.

Table 75 Activity data for NMVOC emission calculations from printing activities in 1995 – 2008 (in tons)

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Import | Export | Use |
| 1995 | 301,6 | 30,5 | **271,1** |
| 2000 | 538,3 | 13,3 | **525,0** |
| 2005 | 2966,1 | 105,4 | **2860,7** |
| 2006 | 1860,6 | 445,0 | **1415,6** |
| 2007 | 2095,4 | 580,2 | **1515,2** |
| 2008 | 2267,9 | 295,4 | **1972,5** |

### Results

A number of printing facilities is permitted.

Between 2006 and 2008, activity data regarding ink use in point sources is collected in the OSIS database.

For the years 2006 to 2008 activity data for calculations is calculated as following:

ink use in diffuse sources = total ink use – ink use in point sources

In 2005, according to CollectER five companies were reporting as point sources. No activity data is available. Emission from point sources is subtracted from total calculated VOC emission.

Table 76 NMVOC emission from printing activities (NFR 3.D.1) in tons

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NFR | 3.D.1 |  |  |  |  |
| SNAP: | 060403 | Activity: | Printing |  |  |
| Emission factor: | | 500 | g/kg ink |  |  |
|  | Total ink use | Inks used in, point sources, t | Ink used in diffuse sources, t | NMVOC from inks use, point sources, t | NMVOC emission from diffuse sources, t |
| 1995 | 271,1 | NA | 271,1 | 0,0 | 135,6 |
| 2000 | 525,0 | NA | 525,0 | 0,0 | 262,5 |
| 2005 | 2860,7 | NA | 2860,7 | 168,25 | 1262,1 |
| 2006 | 1415,6 | 398,110 | 1017,490 | NA | 508,7 |
| 2007 | 1515,2 | 866,668 | 648,532 | NA | 324,3 |
| 2008 | 1972,5 | 818,506 | 1153,994 | NA | 577,0 |

As the biggest printing facilities are permitted, emission from diffuse sources is disaggregated by population as it is also suggested by the guidebook.

Table 77 NMVOC emission from printing activities by counties

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| County | Year | NMVOC emission from printing, t | | | | | |
| 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **135,6** | **262,5** | **1262,1** | **508,7** | **324,3** | **577,0** |
| *By county* | *Share by county* |  |  |  |  |  |  |
| Harju | 38,7% | 52,4 | 101,5 | 487,8 | 196,6 | 125,3 | 223,0 |
| Hiiu | 0,8% | 1,0 | 2,0 | 9,5 | 3,8 | 2,4 | 4,4 |
| Ida-Viru | 13,2% | 17,9 | 34,6 | 166,2 | 67,0 | 42,7 | 76,0 |
| Jõgeva | 2,8% | 3,8 | 7,3 | 35,0 | 14,1 | 9,0 | 16,0 |
| Järva | 2,8% | 3,8 | 7,3 | 35,0 | 14,1 | 9,0 | 16,0 |
| Lääne | 2,1% | 2,8 | 5,5 | 26,4 | 10,6 | 6,8 | 12,0 |
| Lääne-Viru | 5,0% | 6,8 | 13,1 | 63,0 | 25,4 | 16,2 | 28,8 |
| Põlva | 2,4% | 3,2 | 6,2 | 29,7 | 12,0 | 7,6 | 13,6 |
| Pärnu | 6,6% | 8,9 | 17,3 | 82,9 | 33,4 | 21,3 | 37,9 |
| Rapla | 2,7% | 3,7 | 7,1 | 34,1 | 13,7 | 8,8 | 15,6 |
| Saare | 2,6% | 3,5 | 6,8 | 32,9 | 13,2 | 8,4 | 15,0 |
| Tartu | 10,9% | 14,8 | 28,6 | 137,4 | 55,4 | 35,3 | 62,8 |
| Valga | 2,6% | 3,5 | 6,8 | 32,8 | 13,2 | 8,4 | 15,0 |
| Viljandi | 4,2% | 5,7 | 11,0 | 53,0 | 21,4 | 13,6 | 24,2 |
| Võru | 2,9% | 3,9 | 7,6 | 36,4 | 14,7 | 9,4 | 16,6 |

## Domestic solvent use (NFR 3.D.2)

### Source description

Emissions occur due to the evaporation of NMVOCs contained in the products during their use. For most products all of the NMVOC will be emitted to the atmosphere. However, in some products the NMVOC will be lost mainly to waste water.

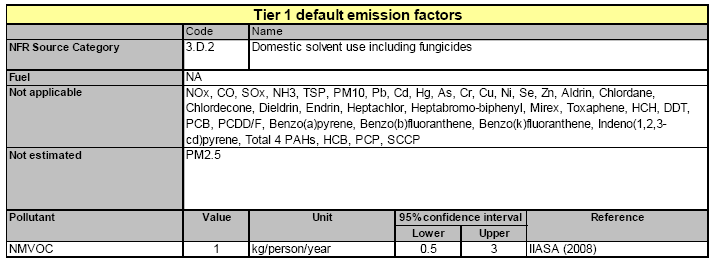
### Default emission factors

The Tier 1 method uses a single emission factor expressed on a per-person basis to derive an emission estimate for the activity by multiplying the emission factor by population.

Tier 1 emission factors are used for calculations. Equation 1 is applied.

The default emission factor for this source category is presented in the following table. It has been derived from an assessment of the emission factors presented in the GAINS model (IIASA, 2008). It represents a weighted average of the emission factor from this model for all the countries considered in 2000.

Table 78 Tier 1 emission factors for source category 3.D.2 Domestic solvent use including fungicides

****

As the Solvents Emissions Directive 1999/13/EC came into force in 2004 in Estonia, a different emission factor is used for the years 1990, 1995 and 2000.

The emission factor according to Corinair (2007)[[23]](#footnote-23) is 2590g (VOC) person-1year-1. This equals to 2,59 kg/person/year.

### Activity data

The basic activity statistics for using the Tier 1 emission factor are national population figures.

Data regarding population by counties is available from Statistics Estonia and is presented in Annex I.

### Results

Table 79 NMVOC emission from domestic solvent use (NFR 3.D.2) in tons

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 1990 | | 1995 | | 2000 | | 2005 | | 2006 | | 2007 | | 2008 | |
| Emission factor, kg/person/year | **2,59** | | **2,59** | | **2,59** | | **1** | | **1** | | **1** | | **1** | |
|  | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t |
| Estonia | 1570599 | **4067,851** | 1448075 | **3750,514** | 1372071 | **3553,664** | 1347510 | **1347,510** | 1344684 | **1344,684** | 1342409 | **1342,409** | 1340935 | **1340,935** |
| *By county* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Harju | 607158 | 1572,539 | 553193 | 1432,770 | 526155 | 1362,741 | 521038 | 521,038 | 521313 | 521,313 | 522147 | 522,147 | 523277 | 523,277 |
| Hiiu | 11332 | 29,350 | 11170 | 28,930 | 10458 | 27,086 | 10246 | 10,246 | 10222 | 10,222 | 10168 | 10,168 | 10118 | 10,118 |
| Ida-Viru | 221807 | 574,480 | 197899 | 512,558 | 180143 | 466,570 | 173777 | 173,777 | 172775 | 172,775 | 171748 | 171,748 | 170719 | 170,719 |
| Jõgeva | 42607 | 110,352 | 40598 | 105,149 | 38372 | 99,383 | 37473 | 37,473 | 37305 | 37,305 | 37108 | 37,108 | 36922 | 36,922 |
| Järva | 43715 | 113,222 | 41152 | 106,584 | 38871 | 100,676 | 38141 | 38,141 | 36457 | 36,457 | 36328 | 36,328 | 36208 | 36,208 |
| Lääne | 33694 | 87,267 | 30606 | 79,270 | 28695 | 74,320 | 27990 | 27,990 | 27853 | 27,853 | 27713 | 27,713 | 27552 | 27,552 |
| Lääne-Viru | 79767 | 206,597 | 70604 | 182,864 | 67910 | 175,887 | 66464 | 66,464 | 67770 | 67,770 | 67560 | 67,560 | 67375 | 67,375 |
| Põlva | 36186 | 93,722 | 34760 | 90,028 | 32743 | 84,804 | 31752 | 31,752 | 31547 | 31,547 | 31387 | 31,387 | 31175 | 31,175 |
| Pärnu | 99863 | 258,645 | 94424 | 244,558 | 91363 | 236,630 | 89343 | 89,343 | 89017 | 89,017 | 88727 | 88,727 | 88563 | 88,563 |
| Rapla | 39717 | 102,867 | 38560 | 99,870 | 37671 | 97,568 | 37032 | 37,032 | 36869 | 36,869 | 36743 | 36,743 | 36684 | 36,684 |
| Saare | 39890 | 103,315 | 38233 | 99,023 | 36010 | 93,266 | 35208 | 35,208 | 35076 | 35,076 | 34978 | 34,978 | 34845 | 34,845 |
| Tartu | 162924 | 421,973 | 153307 | 397,065 | 149744 | 387,837 | 148886 | 148,886 | 148969 | 148,969 | 149001 | 149,001 | 149283 | 149,283 |
| Valga | 41515 | 107,524 | 38407 | 99,474 | 35861 | 92,880 | 34867 | 34,867 | 34661 | 34,661 | 34455 | 34,455 | 34265 | 34,265 |
| Viljandi | 65135 | 168,700 | 62043 | 160,691 | 58087 | 150,445 | 56616 | 56,616 | 56370 | 56,370 | 56075 | 56,075 | 55877 | 55,877 |
| Võru | 45289 | 117,299 | 43119 | 111,678 | 39988 | 103,569 | 38677 | 38,677 | 38480 | 38,480 | 38271 | 38,271 | 38072 | 38,072 |

## Other product use (NFR 3.D.3)

### Fat, edible and non edible oil extraction

This activity includes solvent extraction of edible oils from oilseeds and drying of leftover seeds before resale as animal feed.

If the oil content of the seed is high, for example in olives, the majority of the oil is pressed out mechanically. Where the oil content is lower or the remaining oil is to be taken from material which has already been pressed, solvent extraction is used.

Hexane has become a preferred solvent for extraction. In extracting oil from seeds, the cleaned and prepared seeds are washed several times in warm solvent. The remaining seed residue is treated with steam to capture the solvent and oil which remain in it.

The oil is separated from the oil-enriched wash solvent and from the steamed-out solvent. The solvent is recovered and re-used. The oil is further refined.

**Situation in Estonia**

The major type of seeds used for oil production in Estonia is rape. Some smaller units also press out oil from other seeds, for example flax.

The main oil extracting company in Estonia is Werol Tehased AS.

An interview was carried out with a representative of the company, finding that the company does not use solvents for oil extraction.

At Werol Tehased AS they use mechanical hot pressing for the oil extraction. That leaves 8-10% of oil in rape cake. The technology has been in use since the factory was opened in 1999.

The second biggest oil producer is Oru Taimeõlitööstuse OÜ. The oil is pressed out only mechanically. The production was started in 1985 but no solvents have ever been employed.

It was found out that some small farms also produce small amounts of oil: Kaarli talu in Väike-Maarja, Raismiku talu in Vändra and in Mooste). The oil is mechanical cold pressed.

As solvents are not used for oil extraction in Estonia, this sector is not considered part of the project.

### Preservation of wood

This activity encompasses industrial processes for the impregnation with, or immersion of timber in organic solvent-based preservatives, creosote or water-based preservatives. Wood preservatives may be supplied for both industrial and domestic use. This activity covers only industrial use and does not include domestic use of wood preservatives, which is covered under NFR source category 3.D.2, Domestic solvent use. Most of the information currently available on emissions relates to the industrial use of wood preservatives. This section is not intended to cover the surface coating of timber with paints, varnishes or lacquer.

**Situation in Estonia**

The Estonian Forest Industries Association was questioned regarding wood preservation.

Most of the preservation operations are carried out by using waterborne preservatives. Before it was banned in 2004 CCA was used. CCA is a waterborne preservative. Some creosote and shale oil was used historically. Nowadays creosote is believed not to be in use and therefore wood treated with creosote is imported.

In 2005, all impregnation companies in Estonia were listed by the Estonian Forest Industries Association.

The amount of wood impregnated accounted for ca 135000 tm (theoretical cubic meter of wood). The biggest wood impregnation companies were following: (only waterborne preservatives were used)

* OÜ Hansacom – 33 000 m3
* AS Kestvuspuit 30 000 m3
* AS Imprest 15 000 m3
* OÜ Kehra Puutööstus – 8000 m3
* AS Natural – 5000 m3.

Solventborne preservatives are used by some companies producing windows, doors and loghouses.

The major solventborne supplier VBH was contacted and it was found out that companies, that use solvent-borne preservatives, use more than five tons in year. This is the threshold for air pollution permit. Therefore it is estimated that these installations are covered with permits and are not subject to diffuse emissions.

### Vehicles dewaxing

Some new cars have a protective covering applied to their bodies after painting to provide protection during transport. In the UK, this is usually done only on cars destined for export. Removal of the coating is usually done only at import centres. In continental Europe, cars are transported long distances on land as well as being imported from overseas, so the driving forces affecting the use of such coatings may be different.

Transport protection coverings are not applied to the whole car body, but only to regions of the body considered vulnerable to damage during transport. The pattern of application varies from one manufacturer to another. Some manufacturers do only the bumper, some do only the driver’s door, some do the horizontal surfaces and some do the sides as well.

There are a number of methods for applying coverings for protection during transport. Traditionally, a hydrocarbon wax was used which had to be removed using a mixture of hot water, kerosene and detergent. Recently, two alternative methods have been introduced. The first of these is a water-soluble wax which can be removed with hot water alone without the need for the kerosene. The second is a self-adhesive polyethylene film called ‘Wrap Guard’. This can be peeled off by hand and disposed of as ordinary commercial waste. Most European car manufacturers are currently either already using self-adhesive polyethylene film or are evaluating it. It is expected that within a few years all European manufacturers will be using self-adhesive polyethylene film as their only method of applying transportation protective coverings, as has been the case in the US for a number of years already.

**Situation in Estonia**

Autode Müügi- ja Teenindusettevõtete Eesti Liit (Association of Estonian Automobile Sales and Maintenance Companies) and Toyota Baltic AS were interviewed regarding this activity.

It was found that at least during the last five years no dewaxing operations have been carried out. If needed paint protection is provided by using (polyethylene) film. Waxing is only used in very rare cases, for example special deliveries by sea transport from long distances.

In the period from 1995 to 2005 dewaxing was carried out in rare cases, i.e. special delivery directly from Japan. For these cases it is not known if dewaxing was carried out in Finland or in Estonia. Relevant data is very difficult to get. Most of the dewaxing operations of imported cars are conducted in a treatment centre that is located port Hanko in Finland.

According to the gathered information NMVOC emissions from this source is considered approximately zero and historical emissions are considered negligible.

### Treatment of vehicles

This section addresses the application of protective coatings to the undersides of cars. It is only a very small source of emissions and can be considered negligible nowadays.

Before the early 1980s, car manufacturers did not apply any coating to the underside of their cars. If a car owner wanted to protect their car against rust and stone chip damage they had to pay to have their car ‘undersealed’ at a garage or workshop. This involved the application of a bituminous coating. The market for this service is no longer very large in much of Western Europe. It may still occur in Eastern Europe, in countries having cold climatic conditions and in the restoration and maintenance of vintage cars, but this activity is likely to be relatively small.

**Situation in Estonia**

There is no statistical information regarding the treatment of vehicles. Therefore expert opinion was asked from representative of the Association of Estonian Automobile Sales and Maintenance Companies “repair unit”. Expert opinion was received from Benefit AS which is the leading car body and car paint shops technology and materials supplier.

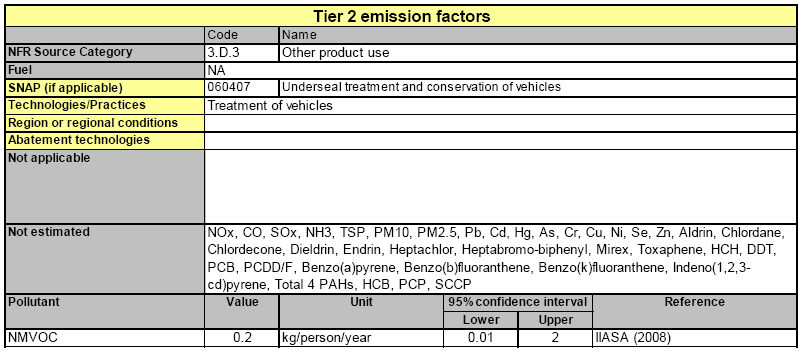
Between 1990 and 2000 a treatment with bituminous materials was wide spread but there is no statistics available. Nowadays treatment with bituminous coating is negligible and if needed, treatment is done by special polymers.

So, NMVOC emission from this activity is calculated for the years 1990 to 2000 and since 2005 emission from treatment of vehicles is considered negligible.

**Emission factor**

Tier 2 emission factor is used for calculations.

Table 80 Tier 2 emission factors for source category 3.D.3 Other product use, Treatment of vehicles

****

As the number of cars in Estonia per inhabitant was smaller than the number of cars per inhabitant in the European Union then a reduction coefficient for emission factor is applied.

Table 81 Motorisation rate - cars per 1 000 inhabitants[[24]](#footnote-24)

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Number of vehicles per 1000 inhabitants | | Coefficient , % |
| Estonia | EU-15 |
| 1995 | 269 | 427 | 63% |
| 2000 | 339 | 472 | 72% |

It means that in 1995 the number of cars per inhabitant accounted for 63% of the average European Union country value and in 2000 for 72%. Information for 1990 was not found but it is estimated to be similar to the value for the 1995.

The customized emission factors are the following

Years 1990 and 1995: 0,2 x 63% = 0,126 kg/person/year

Year 2000: 0,2 x 72% = 0,144 kg/person/year

**Results**

Table 82 NMVOC emission from vehicle treatment (Other product use, NFR 3.D.3) in tons

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NFR | 3.D.3 |  |  |  |  |  |
| SNAP: | 060407 | Activity: | Underseal treatment and conservation of vehicles | | | |
| Year | 1990 | | 1995 | | 2000 | |
| Emission factor, kg/person/year | **0,126** | | **0,126** | | **0,144** | |
|  | Population | VOC emission, t | Population | VOC emission, t | Population | VOC emission, t |
| Estonia | 1570599 | **197,895** | 1448075 | **182,457** | 1372071 | **197,578** |
| *By county* |  |  |  |  |  |  |
| Harju | 607158 | 76,502 | 553193 | 69,702 | 526155 | 75,766 |
| Hiiu | 11332 | 1,428 | 11170 | 1,407 | 10458 | 1,506 |
| Ida-Viru | 221807 | 27,948 | 197899 | 24,935 | 180143 | 25,941 |
| Jõgeva | 42607 | 5,368 | 40598 | 5,115 | 38372 | 5,526 |
| Järva | 43715 | 5,508 | 41152 | 5,185 | 38871 | 5,597 |
| Lääne | 33694 | 4,245 | 30606 | 3,856 | 28695 | 4,132 |
| Lääne-Viru | 79767 | 10,051 | 70604 | 8,896 | 67910 | 9,779 |
| Põlva | 36186 | 4,559 | 34760 | 4,380 | 32743 | 4,715 |
| Pärnu | 99863 | 12,583 | 94424 | 11,897 | 91363 | 13,156 |
| Rapla | 39717 | 5,004 | 38560 | 4,859 | 37671 | 5,425 |
| Saare | 39890 | 5,026 | 38233 | 4,817 | 36010 | 5,185 |
| Tartu | 162924 | 20,528 | 153307 | 19,317 | 149744 | 21,563 |
| Valga | 41515 | 5,231 | 38407 | 4,839 | 35861 | 5,164 |
| Viljandi | 65135 | 8,207 | 62043 | 7,817 | 58087 | 8,365 |
| Võru | 45289 | 5,706 | 43119 | 5,433 | 39988 | 5,758 |

### Industrial application of adhesives

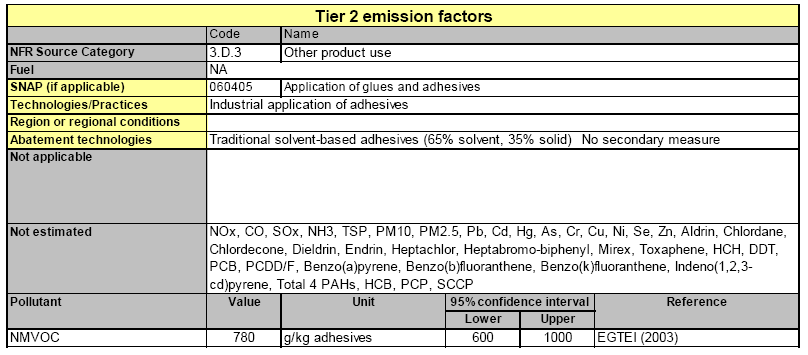
Sectors using adhesives are very diverse as well as production processes and application techniques.

Relevant sectors are the production of adhesive tapes, composite foils, the transportation sector (passenger cars, commercial vehicles, mobile homes, rail vehicles and aircrafts), the manufacture of shoes and leather goods and the wood material and furniture industry (EGTEI, 2003).

**Emission factor**

Tier 2 emission factor is used for calculations.

Table 83 Tier 2 emission factors for source category 3.D.3 Other product use, Industrial application of adhesives, Use of traditional solvent based adhesives

****

**Activity data**

Solvent-borne adhesives have the CN code 35069100 (adhesives based on polymers of heading 3901 to 3913 or on rubber (excl. products suitable for use as glues or adhesives put up for retail sale as glues or adhesives, with a net weight of <= 1 kg)).

As this sector does not cover the domestic use of glues and adhesives, glues and adhesives for retail sale are not included.

The quantity of industrially used adhesives is estimated by import, export and production data (CN code 35069100). Import and export data is available from Statistics Estonia. Production data is available from the OSIS for the years 2006-2008. At the moment there is no information regarding adhesives production between 1995 and 2005 available.

Table 84 Activity data for NMVOC emission calculations from adhesives application in 1995 – 2008 (in tons)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | Adhesives (CN 35069100), t | | | |
| Import | Export | Production | Consumption |
| 1995 | 290,2 | 11,3 |  | 278,9 |
| 2000 | 1147,3 | 214,3 |  | 933,0 |
| 2005 | 3150,6 | 1271,7 |  | 1878,9 |
| 2006 | 3927 | 1192,2 | 618\* | 3352,8 |
| 2007 | 4281,7 | 1084,9 | 706,399 | 3903,2 |
| 2008 | 3012,2 | 1028,5 | 532,799 | 2516,5 |

\*Production is given in m3. the density is estimated to be equal to 1 t/m3.

**Results**

A number of facilities using adhesives are permitted.

In the period from 2006 to 2008, activity data regarding adhesives use in point sources is collected in the OSIS database (SNAP 060405).

For the years 2006-2008 activity data for calculations is calculated as following:

adhesives use in diffuse sources = total adhesive use – adhesive use in point sources

In 2000 and 2005, according to CollectER some companies were reporting as point sources. No activity data is available. Emission from point sources is subtracted from total calculated VOC emission.

Table 85 NMVOC emission from application of adhesives (Other product use, NFR 3.D.3) in tons

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NFR | 3.D.3 |  | | | |
| SNAP: | 060405 | Activity: | Application of glues and adhesives | | |
| Emission factor: | | 780 | g/kg adhesives | | |
| Year | Total use of adhesives, t | Adhesives used in point sources, t | Adhesives used in diffuse sources, t | NMVOC from adhesive application, point sources, t | NMVOC emission from diffuse sources, t |
| 1995 | 278,9 | NA | 278,9 | 0,0 | 217,5 |
| 2000 | 933 | NA | 933,0 | 259,98 | 467,8 |
| 2005 | 1878,9 | NA | 1878,9 | 302,9 | 1162,6 |
| 2006 | 3352,8 | 2118,881 | 1233,9 | NA | 962,5 |
| 2007 | 3903,199 | 2679,022 | 1224,2 | NA | 954,9 |
| 2008 | 2516,499 | 541,844 | 1974,7 | NA | 1540,2 |

As the biggest facilities are permitted, emission from diffuse sources is disaggregated by population.

Table 86 NMVOC emission from industrial application of adhesives by counties

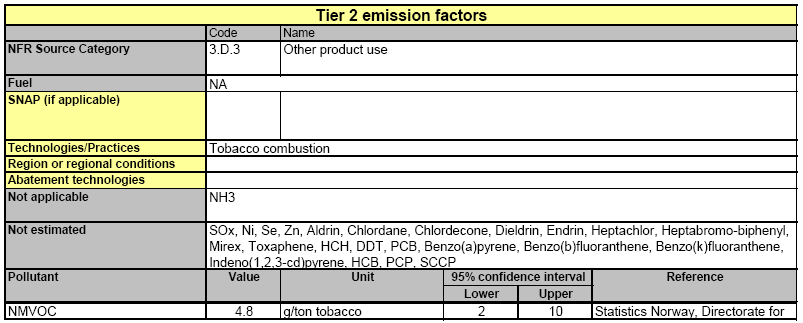
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from industrial application of adhesives, t | | | | | |
| County | Year | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **217,5** | **467,8** | **1162,6** | **962,5** | **954,9** | **1540,2** |
| *By county* | *Share by county* |  |  |  |  |  |  |
| Harju | 38,7% | 84,1 | 180,8 | 449,4 | 372,0 | 369,1 | 595,3 |
| Hiiu | 0,8% | 1,6 | 3,5 | 8,8 | 7,3 | 7,2 | 11,6 |
| Ida-Viru | 13,2% | 28,6 | 61,6 | 153,1 | 126,8 | 125,8 | 202,8 |
| Jõgeva | 2,8% | 6,0 | 13,0 | 32,2 | 26,7 | 26,4 | 42,7 |
| Järva | 2,8% | 6,0 | 13,0 | 32,2 | 26,7 | 26,5 | 42,7 |
| Lääne | 2,1% | 4,5 | 9,8 | 24,3 | 20,1 | 19,9 | 32,2 |
| Lääne-Viru | 5,0% | 10,9 | 23,3 | 58,0 | 48,0 | 47,7 | 76,9 |
| Põlva | 2,4% | 5,1 | 11,0 | 27,3 | 22,6 | 22,4 | 36,2 |
| Pärnu | 6,6% | 14,3 | 30,7 | 76,4 | 63,3 | 62,8 | 101,2 |
| Rapla | 2,7% | 5,9 | 12,6 | 31,4 | 26,0 | 25,8 | 41,6 |
| Saare | 2,6% | 5,7 | 12,2 | 30,3 | 25,1 | 24,9 | 40,1 |
| Tartu | 10,9% | 23,7 | 50,9 | 126,6 | 104,8 | 104,0 | 167,7 |
| Valga | 2,6% | 5,7 | 12,2 | 30,2 | 25,0 | 24,8 | 40,0 |
| Viljandi | 4,2% | 9,1 | 19,6 | 48,8 | 40,4 | 40,1 | 64,7 |
| Võru | 2,9% | 6,3 | 13,5 | 33,5 | 27,8 | 27,6 | 44,4 |

### Tobacco combustion

Emissions arising from the combustion (smoking) of tobacco.

**Emission factor**

Table 87 Tier 2 emission factors for source category 3.D.3 Other product use, Tobacco combustion

****

**Activity data**

The quantity of tobacco combusted (smoked) in Estonia is estimated by the import and export data (CN code 2402) available from Statistics Estonia.

Data regarding import and export and production is not available for 1990.

Tobacco products were produced in Estonia until 1996. Accurate production data was not available.

According to the newspaper[[25]](#footnote-25) in 1995 the turnover of Eesti Tubakas was 215,9 million kroons with a production of approximately 2 billion cigarettes.

The production of cigarettes is estimated by the average weight of cigarettes. Ten cigarettes equal approximately 8,39 g.[[26]](#footnote-26) Thus, the production of cigarettes is estimated at approximately 1680 tons.

Table 88 Activity data for NMVOC emission calculations from tobacco combustion in 1995 – 2008 (in tons)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | Import | Export | Production | Use |
| 1995 | 720,4 | 86,1 | *1680* | 2314,3 |
| 2000 | 2496,7 | 0,3 | - | 2496,4 |
| 2005 | 3224,7 | 49,2 | - | 3175,5 |
| 2006 | 3425,9 | 24,9 | - | 3401 |
| 2007 | 3543,8 | 13,2 | - | 3530,6 |
| 2008 | 1547,3 | 10,6 | - | 1536,7 |

**Results**

Table 89 NMVOC emission from tobacco combustion (Other product use, NFR 3.D.3) in tons

|  |  |  |
| --- | --- | --- |
| **NFR** | **3.D.3** |  |
| **SNAP:** | **NA** |  |
| **Activity:** | **Tobacco combustion** |  |
| Emission factor: | 4,8 | g/ton tobacco |
| Year | Use of tobacco, t | NMVOC emission, t |
| 1995 | 2314,3 | 0,011 |
| 2000 | 2496,4 | 0,012 |
| 2005 | 3175,5 | 0,015 |
| 2006 | 3401 | 0,016 |
| 2007 | 3530,6 | 0,017 |
| 2008 | 1536,7 | 0,007 |

Emission is disaggregated by population.

Table 90 NMVOC emission from tobacco combustion by counties

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | NMVOC emission from tobacco combustion, t | | | | | |
| County | Year | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **0,011** | **0,012** | **0,015** | **0,016** | **0,017** | **0,007** |
| *By county* | *Share by county* |  |  |  |  |  |  |
| Harju | 38,7% | 0,004 | 0,005 | 0,006 | 0,006 | 0,007 | 0,003 |
| Hiiu | 0,8% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Ida-Viru | 13,2% | 0,001 | 0,002 | 0,002 | 0,002 | 0,002 | 0,001 |
| Jõgeva | 2,8% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Järva | 2,8% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne | 2,1% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Lääne-Viru | 5,0% | 0,001 | 0,001 | 0,001 | 0,001 | 0,001 | 0,000 |
| Põlva | 2,4% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Pärnu | 6,6% | 0,001 | 0,001 | 0,001 | 0,001 | 0,001 | 0,000 |
| Rapla | 2,7% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Saare | 2,6% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Tartu | 10,9% | 0,001 | 0,001 | 0,002 | 0,002 | 0,002 | 0,001 |
| Valga | 2,6% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Viljandi | 4,2% | 0,000 | 0,001 | 0,001 | 0,001 | 0,001 | 0,000 |
| Võru | 2,9% | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |

# AGRICULTURE (NFR 4)

## Crop production and agricultural soils (NFR 4.D)

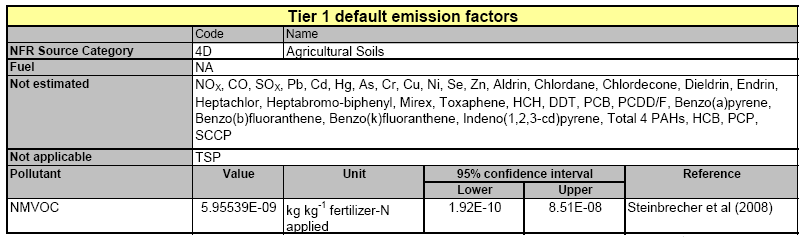
### Source description

Crop production and agricultural soils are currently estimated to emit < 1% of total NMVOC emissions, and therefore do not yet require a methodology for calculation. However, given current uncertainties over the magnitude of NMVOC emissions from agricultural crops, some information is given in this chapter, in order to provide background information and a tool to estimate the order of magnitude of these emissions as well as to highlight current uncertainties.

### Default emission factors

Tier 1 emission factors are used for calculations. Equation 1 is applied.

Table 91 Tier 1 emission factors for source category 4.D crop production and agricultural soils

****

### Activity data

Information on the annual national consumption of total N-fertilizer is required.

Data regarding fertilizers applied is available from Statistics Estonia:

1. mineral fertilizer-N applied, ton
2. organic fertilizer applied, ton

There is no information available regarding the year 1990.

For estimating the amount of organic fertilizer-N applied the average nitrogen content in manure[[27]](#footnote-27) is used.

Table 92 Activity data for NMVOC emission calculations from nitrogen fertilizer use in 1995 – 2008 (in tons)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Years | Mineral fertilizers | Organic fertilizers | | | Fertilizer-N applied, ton |
| Nitrogen (N), ton | Fertilizer, ton | Average nitrogen content, kg/t | Nitrogen (N), ton |
| 1995 | 18905 | 3485000 | 8,5 | 29623 | 48528 |
| 2000 | 22396 | 1863611 | 8,5 | 15841 | 38237 |
| 2005 | 20083 | 2025777 | 8,5 | 17219 | 37302 |
| 2006 | 22610 | 1748634 | 8,5 | 14863 | 37473 |
| 2007 | 24982 | 2704346 | 8,5 | 22987 | 47969 |
| 2008 | 35455 | 2285041 | 8,5 | 19423 | 54878 |

### Results

Table 93 NMVOC emission from agriculture (agricultural soils, NFR 4.D) in tons

|  |  |  |
| --- | --- | --- |
| **NFR** | **4.D** | |
| **SNAP:** | **NA** | |
| **Activity:** | **Agricultural soils** | |
| Emission factor: | 5,95539E-09 | kg/kg fertilizer-N applied |
| Year | Fertilizer-N applied, ton | NMVOC emission, t |
| 1995 | 48528 | 0,000289 |
| 2000 | 38237 | 0,000228 |
| 2005 | 37302 | 0,000222 |
| 2006 | 37473 | 0,000223 |
| 2007 | 47969 | 0,000286 |
| 2008 | 54878 | 0,000327 |

Disaggregation is carried out by agricultural land use.

Table 94 Agricultural land use in counties

|  |  |
| --- | --- |
| County | Agricultural land distribution by counties |
| Harju | 6,3% |
| Hiiu | 1,8% |
| Ida-Viru | 2,9% |
| Jõgeva | 8,2% |
| Järva | 9,5% |
| Lääne | 4,7% |
| Lääne-Viru | 12,1% |
| Põlva | 5,4% |
| Pärnu | 8,8% |
| Rapla | 6,3% |
| Saare | 5,8% |
| Tartu | 8,8% |
| Valga | 4,7% |
| Viljandi | 9,8% |
| Võru | 4,8% |

Table 95 NMVOC emission from agriculture by county

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| County | Year | NMVOC emission from agriculture, t | | | | | |
| 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | 100% | **0,000289** | **0,000228** | **0,000222** | **0,000223** | **0,000286** | **0,000327** |
| *By county* | *Share by county* |  |  |  |  |  |  |
| Harju | 6,3% | 0,0000183 | 0,0000144 | 0,0000141 | 0,0000141 | 0,0000181 | 0,0000207 |
| Hiiu | 1,8% | 0,0000052 | 0,0000041 | 0,0000040 | 0,0000041 | 0,0000052 | 0,0000059 |
| Ida-Viru | 2,9% | 0,0000084 | 0,0000066 | 0,0000065 | 0,0000065 | 0,0000083 | 0,0000095 |
| Jõgeva | 8,2% | 0,0000237 | 0,0000187 | 0,0000182 | 0,0000183 | 0,0000234 | 0,0000268 |
| Järva | 9,5% | 0,0000274 | 0,0000216 | 0,0000211 | 0,0000212 | 0,0000271 | 0,0000310 |
| Lääne | 4,7% | 0,0000135 | 0,0000106 | 0,0000104 | 0,0000104 | 0,0000133 | 0,0000152 |
| Lääne-Viru | 12,1% | 0,0000350 | 0,0000275 | 0,0000269 | 0,0000270 | 0,0000346 | 0,0000395 |
| Põlva | 5,4% | 0,0000157 | 0,0000124 | 0,0000121 | 0,0000121 | 0,0000155 | 0,0000178 |
| Pärnu | 8,8% | 0,0000254 | 0,0000200 | 0,0000195 | 0,0000196 | 0,0000251 | 0,0000287 |
| Rapla | 6,3% | 0,0000181 | 0,0000142 | 0,0000139 | 0,0000140 | 0,0000179 | 0,0000204 |
| Saare | 5,8% | 0,0000167 | 0,0000132 | 0,0000128 | 0,0000129 | 0,0000165 | 0,0000189 |
| Tartu | 8,8% | 0,0000255 | 0,0000201 | 0,0000196 | 0,0000197 | 0,0000252 | 0,0000288 |
| Valga | 4,7% | 0,0000137 | 0,0000108 | 0,0000105 | 0,0000106 | 0,0000135 | 0,0000155 |
| Viljandi | 9,8% | 0,0000285 | 0,0000224 | 0,0000219 | 0,0000220 | 0,0000281 | 0,0000322 |
| Võru | 4,8% | 0,0000140 | 0,0000110 | 0,0000108 | 0,0000108 | 0,0000138 | 0,0000158 |

Emissions from this sector are less than 1 kg per year. This sector does not contribute to the total NMVOC emission.

# LAND USE CHANGE AND FORESTRY (NFR 11)

## Other natural sources (NFR 11C)

### Source description

Natural sources include non-managed deciduous/ coniferous forests and managed deciduous/coniferous forests as well as emissions of grassland and other low vegetation including crops. Foliage is primarily a source of VOC, and it is distinguished between isoprene, monoterpenes and 'other VOC'.

### Methodology

#### Algorithm

All methodologies for calculating biogenic emissions essentially involve multiplying an emissions factor for a type of vegetation by a statistic giving the amount of vegetation in the country or grid square. Two major alternatives for this are:

* to perform these calculations at a genera or preferably species specific level (applied for forests in this report), or
* to perform the calculations for different ecosystem types (applied for grassland and crops).

Based on the EMEP/EEA air pollutant emission inventory guidebook (2009), in conclusion, total VOC emissions per year from these activities can be calculated based on the following equation:



where:

* A (m²) - area used per vegetation type;
* D (g/m²) - foliar biomass density per vegetation type;
* Γ- the integrated value of a unitless environmental correction factor over the growing season of the vegetation concerned;
* ε-iso (µg/g.h)- isoprenes standard emission potential[[28]](#footnote-28) per vegetation type;
* ε-mts (µg/g.h)- monoterpenes standard emission potential per vegetation type;
* ε-ovoc (µg/g.h)- other VOC standard emission potential per vegetation type.

Average data on Γ, D and ε for European trees and other vegetation are given in the EMEP/EEA air pollutant emission inventory guidebook (2009).

#### Default emission factors

Using meteorological data from the EMEP MSC-W models the integrated values, Γ-iso and Γ-mts, have been calculated for both six monthly (May-October) and 12 monthly growing seasons, as averages over Estonia:

* Γ-mts = Γ-ovoc - 565 hours (6-month) and 669 hours (12-month)
* Γ-iso - 422 hours (6-month) and 491 hours (12-month).

Table 96 gives an overview of the input parameters for trees and ecosystem types used to calculate emission factors. There are also emission factors for Estonia included in the table.

Table 96 Standard emission potentials and biomass densities for European trees (EMEP/EEA, 2009)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Common name | Latin name | Type (1) | Biomass density D, g/m² | Isoprenes ε-iso, µg/g\*h | Monoterpenes ε-mts, µg/g\*h | o-VOC ε-ovoc, µg/g\*h | Emission factor, t/km2 |
| Pine | Pinus sylvestris | e | 700 | 0 | 1.5 | 1.5 | 1.41 |
| Spruce | Picea abies | e | 1400 | 1 | 1.5 | 1.5 | 3.50 |
| Birch | Betula | d | 320 | 0 | 0.2 | 1.5 | 0.31 |
| Asp | Populus |  | 320 | 60 | 0 | 1.5 | 8.37 |
| Common Alder | Alnus | d | 320 | 0 | 1.5 | 1.5 | 0.54 |
| Ash | Fraxinus | d | 320 | 0 | 0 | 1.5 | 0.27 |
| Oak | Quercus robur | d | 320 | 60 | 0.2 | 1.5 | 8.41 |
| Grassland (meadows/ pastures) | - | - | 400 | 0 | 0.1 | 1.5 | 0.36 |
| Grass related crops | - | - | 800 | 0.002 | 0.1 | 1.5 | 0.72 |

*(1) D=deciduous; E=evergreen*

### Activity data

The area used per vegetation type can be obtained from Statistics Estonia. For the years 1990 and 1995 information on forest land is not available, therefore the information from the Yearbook FORESTS (2008) was used. From this reference the available information about the closest years - 1988 and 1994 was applied accordingly for the years 1990 and 1995. The distribution of forest land area by dominant tree species in counties is performed using information from the Forest register (Centre of Forest Protection and Silviculture).

Statistics about agriculture lands obtained from Statistics Estonia contain information on crop fields and cereal field area for years 1990 – 2008. These data were used for calculating the total emission. Information on permanent grasslands is available for the years 2005 – 2008. There is no information in the Statistical database for the years 1990 – 2000. For calculating the total emission areas were calculated using data from CORINE Land Cover 1990 and 2000.

Table 97 Activity data used for NMVOC emission calculation in 1990 – 2008 (thousand ha)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Forest land area by dominant tree species | **1990** | **1995** | **2000** | **2005** | **2006** | **2007** | **2008** |
| Area of pine-woods | 749.6 | 731.7 | 724.0 | 682.0 | 667.1 | 674.3 | 706.6 |
| Area of spruce-woods | 454.2 | 457.6 | 370.5 | 370.4 | 360.4 | 362.7 | 362.9 |
| Area of birch-woods | 540.4 | 585.3 | 649.4 | 654.0 | 649.1 | 659.0 | 646.8 |
| Area of aspen-woods | 30.1 | 31.5 | 114.0 | 109.9 | 113.0 | 115.1 | 116.7 |
| Area of common alder-woods | 28.9 | 28.2 | 61.6 | 65.0 | 57.5 | 64.4 | 67.5 |
| Area of grey alder-woods | 90.1 | 82.9 | 164.0 | 178.6 | 173.5 | 197.5 | 199.6 |
| Area of other stands | 23.1 | 20.6 | 31.0 | 31.3 | 31.3 | 39.8 | 38.4 |

Table 98 **Activity data used for NMVOC emission calculation in 1990 – 2008 (thousand ha)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Forest land area by dominant tree species | **1990** | **1995** | **2000** | **2005** | **2006** | **2007** | **2008** |
| Area of cereals | 397,0 | 304,3 | 329,3 | 282,1 | 280,3 | 292,3 | 309,3 |
| Area of permanent grasslands | 278,9 | 257,9 | 257,9 | 231,0 | 193,6 | 215,7 | 196,6 |

### Results

The species distribution in different ecosystem types is obtained from the Forest register (Centre of Forest Protection and Silviculture). The disaggregation is based on information from CORINE Land Cover.

Table 99 NMVOC emission from non-managed deciduous/ coniferous forests and managed deciduous/coniferous forests (NFR 11C) in tons

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| County | NMVOC emission from non-managed deciduous/ coniferous forests and managed deciduous/coniferous forests, t | | | | | | |
| 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | **31 548.2** | **31 594.9** | **36 304.7** | **35 597.0** | **35 486.5** | **34 762.9** | **35 034.8** |
| *By county* |  |  |  |  |  |  |  |
| Harju | 2 730.5 | 2 721.1 | 2 744.4 | 2 693.3 | 2 689.5 | 2 645.4 | 2 624.7 |
| Hiiu | 771.0 | 767.2 | 835.3 | 819.9 | 822.1 | 820.2 | 813.2 |
| Ida-Viru | 2 534.9 | 2 533.3 | 2 906.3 | 2 846.5 | 2 845.8 | 2 809.9 | 2 816.3 |
| Jõgeva | 1 899.4 | 1 918.6 | 2 486.6 | 2 435.9 | 2 417.5 | 2 349.2 | 2 406.3 |
| Järva | 1 984.8 | 1 993.2 | 2 144.6 | 2 100.9 | 2 084.1 | 2 024.1 | 2 041.2 |
| Lääne | 906.5 | 904.1 | 1 186.3 | 1 171.7 | 1 175.3 | 1 156.8 | 1 170.8 |
| Lääne-Viru | 3 280.4 | 3 289.2 | 3 571.5 | 3 497.6 | 3 474.0 | 3 381.5 | 3 408.7 |
| Põlva | 1 749.0 | 1 744.2 | 1 929.6 | 1 884.2 | 1 885.6 | 1 865.8 | 1 861.9 |
| Pärnu | 3 504.0 | 3 511.8 | 4 017.3 | 3 945.4 | 3 933.5 | 3 858.2 | 3 882.1 |
| Rapla | 2 278.1 | 2 284.9 | 2 471.4 | 2 422.3 | 2 407.8 | 2 348.1 | 2 362.0 |
| Saare | 1 487.4 | 1 473.4 | 2 064.5 | 2 023.8 | 2 044.6 | 2 035.1 | 2 059.2 |
| Tartu | 1 680.9 | 1 696.5 | 2 247.5 | 2 198.3 | 2 185.2 | 2 135.5 | 2 186.1 |
| Valga | 1 967.4 | 1 969.4 | 2 208.4 | 2 165.1 | 2 157.4 | 2 109.6 | 2 122.8 |
| Viljandi | 2 627.6 | 2 640.2 | 3 133.1 | 3 086.4 | 3 067.3 | 2 974.1 | 3 020.3 |
| Võru | 2 146.2 | 2 147.9 | 2 358.0 | 2 305.6 | 2 296.7 | 2 249.4 | 2 259.2 |

Total emissions from agricultural lands were calculated based on the Statistical database and CORINE Land Cover. Emissions where disaggregated by counties based on the CORINE Land Cover database for years 1990, 2000 and 2006.

**Table 100 NMVOC emission permanent grasslands and cereal fields (NFR 11C) in tons**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| County | NMVOC emission permanent grasslands and cereal fields, t | | | | | | |
| 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 |
| Estonia | **3890,0** | **3135,0** | **3316,0** | **2877,0** | **2729,0** | **2896,0** | **2950,0** |
| *By county* |  |  |  |  |  |  |  |
| Harju | 351,2 | 274,8 | 291,3 | 250,8 | 238,8 | 253,1 | 258,6 |
| Hiiu | 47,1 | 39,0 | 40,9 | 35,6 | 33,4 | 35,6 | 36,0 |
| Ida-Viru | 169,7 | 134,4 | 142,9 | 123,2 | 117,9 | 124,7 | 127,9 |
| Järva | 335,4 | 269,0 | 284,9 | 246,8 | 235,5 | 249,4 | 255,3 |
| Jõgeva | 328,6 | 261,2 | 278,1 | 239,8 | 230,5 | 243,4 | 250,6 |
| Lääne | 201,5 | 156,0 | 166,4 | 143,4 | 138,5 | 146,0 | 150,9 |
| Lääne-Viru | 433,9 | 351,9 | 371,0 | 322,7 | 304,3 | 323,7 | 328,0 |
| Pärnu | 373,2 | 294,9 | 313,5 | 270,0 | 259,0 | 273,7 | 281,4 |
| Põlva | 165,2 | 138,0 | 144,0 | 126,6 | 116,6 | 125,2 | 124,3 |
| Rapla | 314,5 | 243,8 | 261,1 | 223,3 | 217,3 | 228,3 | 237,6 |
| Saare | 177,8 | 152,4 | 158,2 | 141,5 | 128,8 | 138,9 | 136,6 |
| Tartu | 335,1 | 273,1 | 288,7 | 250,8 | 237,5 | 252,2 | 256,5 |
| Valga | 171,3 | 147,2 | 153,6 | 136,9 | 125,9 | 135,2 | 134,1 |
| Viljandi | 334,1 | 270,7 | 287,1 | 247,4 | 236,3 | 250,1 | 256,2 |
| Võru | 151,4 | 128,7 | 134,4 | 118,0 | 108,8 | 116,7 | 116,2 |

# Annex I Disaggregation by county

In many cases emission disaggregation by counties is carried out partly or entirely by population.

Population distribution by counties has been changed slightly over the years, average distribution within years 1990-2008 is used in calculations.

Table Population distribution by counties 1990-2008

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1990 | | 1995 | | 2000 | | 2005 | | 2006 | | 2007 | | 2008 | | Average distribution by counties |
|  | Population | % | Population | % | Population | % | Population | % | Population | % | Population | % | Population | % | % |
| Estonia | 1570599 | 100,0% | 1448075 | 100,0% | 1372071 | 100,0% | 1347510 | 100,0% | 1344684 | 100,0% | 1342409 | 100,0% | 1340935 | 100,0% | 100% |
| By counties | | | | | | | | | | | | | | | |
| Harju | 607158 | 38,7% | 553193 | 38,2% | 526155 | 38,3% | 521038 | 38,7% | 521313 | 38,8% | 522147 | 38,9% | 523277 | 39,0% | 38,7% |
| Hiiu | 11332 | 0,7% | 11170 | 0,8% | 10458 | 0,8% | 10246 | 0,8% | 10222 | 0,8% | 10168 | 0,8% | 10118 | 0,8% | 0,8% |
| Ida-Viru | 221807 | 14,1% | 197899 | 13,7% | 180143 | 13,1% | 173777 | 12,9% | 172775 | 12,8% | 171748 | 12,8% | 170719 | 12,7% | 13,2% |
| Jõgeva | 42607 | 2,7% | 40598 | 2,8% | 38372 | 2,8% | 37473 | 2,8% | 37305 | 2,8% | 37108 | 2,8% | 36922 | 2,8% | 2,8% |
| Järva | 43715 | 2,8% | 41152 | 2,8% | 38871 | 2,8% | 38141 | 2,8% | 36457 | 2,7% | 36328 | 2,7% | 36208 | 2,7% | 2,8% |
| Lääne | 33694 | 2,1% | 30606 | 2,1% | 28695 | 2,1% | 27990 | 2,1% | 27853 | 2,1% | 27713 | 2,1% | 27552 | 2,1% | 2,1% |
| Lääne-Viru | 79767 | 5,1% | 70604 | 4,9% | 67910 | 4,9% | 66464 | 4,9% | 67770 | 5,0% | 67560 | 5,0% | 67375 | 5,0% | 5,0% |
| Põlva | 36186 | 2,3% | 34760 | 2,4% | 32743 | 2,4% | 31752 | 2,4% | 31547 | 2,3% | 31387 | 2,3% | 31175 | 2,3% | 2,4% |
| Pärnu | 99863 | 6,4% | 94424 | 6,5% | 91363 | 6,7% | 89343 | 6,6% | 89017 | 6,6% | 88727 | 6,6% | 88563 | 6,6% | 6,6% |
| Rapla | 39717 | 2,5% | 38560 | 2,7% | 37671 | 2,7% | 37032 | 2,7% | 36869 | 2,7% | 36743 | 2,7% | 36684 | 2,7% | 2,7% |
| Saare | 39890 | 2,5% | 38233 | 2,6% | 36010 | 2,6% | 35208 | 2,6% | 35076 | 2,6% | 34978 | 2,6% | 34845 | 2,6% | 2,6% |
| Tartu | 162924 | 10,4% | 153307 | 10,6% | 149744 | 10,9% | 148886 | 11,0% | 148969 | 11,1% | 149001 | 11,1% | 149283 | 11,1% | 10,9% |
| Valga | 41515 | 2,6% | 38407 | 2,7% | 35861 | 2,6% | 34867 | 2,6% | 34661 | 2,6% | 34455 | 2,6% | 34265 | 2,6% | 2,6% |
| Viljandi | 65135 | 4,1% | 62043 | 4,3% | 58087 | 4,2% | 56616 | 4,2% | 56370 | 4,2% | 56075 | 4,2% | 55877 | 4,2% | 4,2% |
| Võru | 45289 | 2,9% | 43119 | 3,0% | 39988 | 2,9% | 38677 | 2,9% | 38480 | 2,9% | 38271 | 2,9% | 38072 | 2,8% | 2,9% |

1. Emission levels of pollutants and capacities of plants used beyond which an ambient air pollution and permit a special pollution permit is required. Regulation No. 101 of the Minister of Environment of 2 August 2004 [↑](#footnote-ref-1)
2. www.emhi.ee [↑](#footnote-ref-2)
3. EMEP/EEA emission inventory guidebook 2009 [↑](#footnote-ref-3)
4. http://www.gaas.ee/index.php?page=95& [↑](#footnote-ref-4)
5. Eesti Gaas. Annual Report 2006. [↑](#footnote-ref-5)
6. Annual Report 2008. http://www.mnt.ee/atp/failid/2008/ar\_www.pdf

   Annual Report 2007. http://www.mnt.ee/atp/failid/ar\_2007.pdf

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   Annual Reports 1990, 1995 and 2000 are available in Estonian Road Administration office as paper copy [↑](#footnote-ref-6)
7. Pagaritööstuste turujaotus (2002). http://paber.ekspress.ee/viewdoc/7B355BE693F6E5DAC2256ED7003EF1A9 [↑](#footnote-ref-7)
8. [Turu osalused Leivaliidus (.xls)](http://www.leivaliit.ee/files/1191491036.xls). http://www.leivaliit.ee/leib.php?id=13 [↑](#footnote-ref-8)
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    www-1.mtk.ut.ee/varska/2001/Str\_ettevotluspol/Hinno.pdf [↑](#footnote-ref-11)
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13. Eesti Alkoholiturg 2006. aastal [↑](#footnote-ref-13)
14. Eesti õlleturg 2007. a. http://www.eestiolu.ee/alam.php?cat=lmenu&page=5&parent=12 [↑](#footnote-ref-14)
15. http://www.beerguide.ee/uudised\_2001\_veebr.html [↑](#footnote-ref-15)
16. Eesti alkoholiturg 2007. aastal. http://www.agri.ee/public/juurkataloog/UURINGUD/eki\_alkoholiuuringud/Eesti\_alkoholiturg\_2007\_aastal.pdf [↑](#footnote-ref-16)
17. Eesti alkoholiturg 2008. aastal http://www.agri.ee/public/juurkataloog/Pollumajandus\_ja\_toiduturg/2008/Eesti\_alkoholiturg\_2008.\_aastal.pdf [↑](#footnote-ref-17)
18. EMEP Guidebook 2009 [↑](#footnote-ref-18)
19. AP 42, Fifth Edition. Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. http://www.epa.gov/ttn/chief/ap42/ch04/final/c4s06.pdf [↑](#footnote-ref-19)
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21. Association of Estonian Printing Industry http://www.trykiliit.ee/index.php?lang=est&main\_id=3 [↑](#footnote-ref-21)
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23. Other use of solvents & related activities. Emission Inventory Guidebook. December 2006. [↑](#footnote-ref-23)
24. EUROSTAT - http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=tsdpc340&plugin=0 [↑](#footnote-ref-24)
25. http://www.postimees.ee/leht/96/04/26/kuum.htm [↑](#footnote-ref-25)
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27. Methods for determination of emission levels of pollutants from animal and poultry production. Regulation No. 48 of the Minister of Environment of 5 December 2008. [↑](#footnote-ref-27)
28. Emission potential at 30°C and PAR(photosynthetically active radiation)=1000 µmol.m-2.s-1 [↑](#footnote-ref-28)