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***MODELLING OF COLD START EXCESS
EMISSIONS FOR PASSENGER CARS***

INRETS report LTE 0509
April 2005

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1. Introduction

The Artemis (Assessment and Reliability of Transport Emission Models and Inventory Systems) study is aiming at developing a harmonised emission model for road, rail, air and ship transport to provide consistent emission estimates at the national, international and regional level.

The workpackage 300 entitled "Improved methodology for emission factor building and application to passenger cars and light duty vehicles" is aiming at improving the exhaust emission factors for the passenger cars and light duty vehicles, by investigating the accuracy of the emission measurements, by enlarging the emission factor data base especially for non-regulated pollutants, recent passenger cars and light duty vehicles, and by building emission factors according to the different purposes of Artemis.

One of the sub tasks of this work package 300 is aiming at modelling the cold start excess emissions of the passenger cars. Three methods are till now available in Europe to model excess emission at start:

- The Handbook, applied mainly in Germany and Switzerland (Keller et al., 1995)
- The MEET approach, based on a synthesis of the available cold emission data in Europe (Joumard and Serié, 1999)
- The Copert III approach (Ntziachristos and Samaras, 2000), which is a mixture of the former Copert and MEET approaches.

Samaras et al. (2001) evaluated the values of excess emissions for various situations in Europe, by using the three approaches. He found that, due to the differences between the methodologies of Copert III and MEET, there are discrepancies between the predicted values of the total emissions due to cold start. These effects however are mostly exhibited at very low values of the speed and ambient temperature and become negligible when intermediate values of these parameters are approached. In general, the difference between the results obtained by Copert and those by MEET is reduced for temperatures between 15°C and 25°C and also for high values of the vehicle speed. The agreement between the results of Copert III and those of the model suggested in the German handbook is very good, especially in the case of Euro I vehicles, even though the two models exhibit several differences with respect to the methodology. All these calculations show that the excess emissions depend of course on the methodology used and on the emission data used.

The present study is using cold measurements collected during the MEET project, together with measurements collected recently, and measurements carried out specifically for the Artemis study. The aim of this study consists in modelling the cold start impact on road vehicle emissions as functions of the pollutant and the vehicle type, using all the existing data in Europe. This model is developed empirically, considering the available data for passenger cars: excess emissions indeed, but also ambient temperature, and driving behaviour statistics.

Such model is necessary for large-scale applications - national inventories for instance - but could also be used for smaller scale applications. The geographical and time limits of the applications depend on the quality of the available data and will be presented.

2. The concept of cold start excess emission

As expressed by Duboudin and Crozat (2002), as long as a vehicle does not reach its running temperature, the emissions of atmospheric pollutants (CO, HC, NO_x, PM for instance) are increased. In the case of cars non equipped with a 3-way catalyst, this excess of emission comes from a non-optimal engine running. Therefore the engine temperature is the main parameter. In the case of vehicles equipped with a 3-way catalyst, the catalyst temperature determines the functioning conditions and therefore the emissions. In both cases we define the time needed by a vehicle to reach its normal running temperature, and an over emission before. The concept of over emission is defined below.

The evolution of the instantaneous emission of a vehicle along the time, for a given pollutant, an engine speed and an initial engine temperature, can be split up into a first phase with a decreasing emission due to the progressive increase of the engine or catalyst temperature, followed by a stability phase when the normal engine temperature is reached (Figure 1). The first phase corresponds to the time t_{cold} .

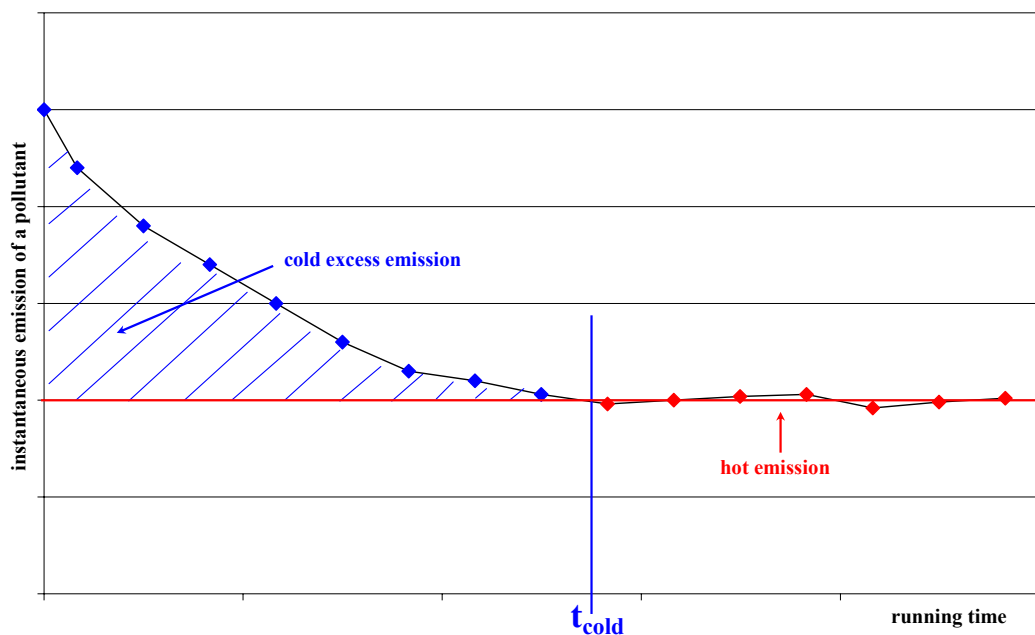


Figure 1: Evolution of the instantaneous emission of a vehicle according to time in given running conditions.

The cold excess emission is defined by the amount of pollutant emitted in excess before t_{cold} as compared the same time travelled with the normal running temperature. It is possible to transform the concept of time into the concept of distance travelled in cold condition through the average vehicle speed, again for the same engine speed (Figure 2).

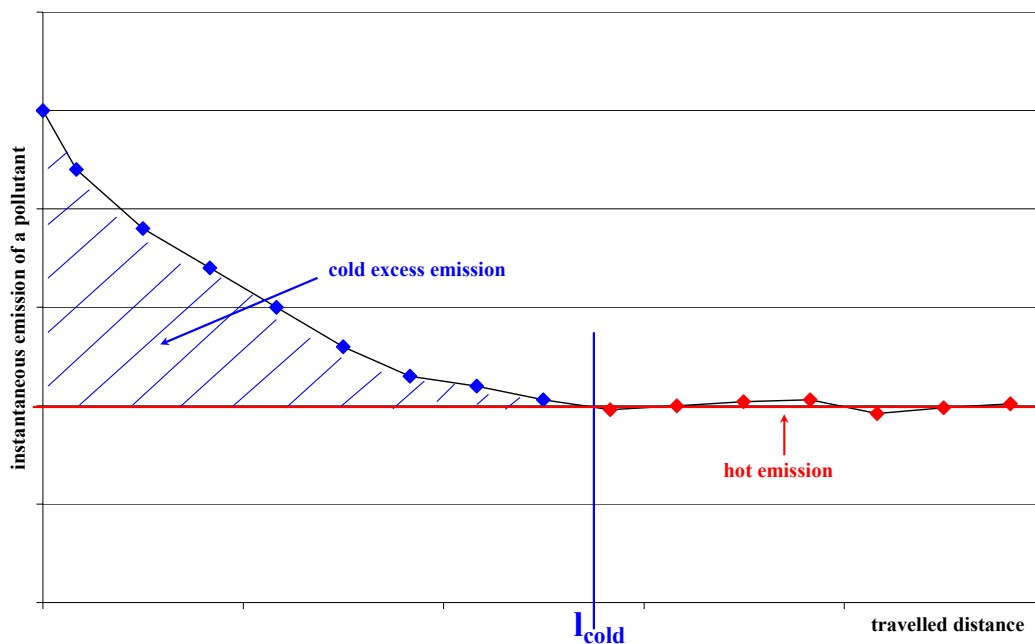


Figure 2: Evolution of the instantaneous emission of a vehicle according to travelled distance in given running conditions.

The distance needed to reach stabilised emissions is called l_{cold} .

When we consider a driving cycle, composed of a succession of different vehicle speeds and therefore different engine speeds, the instantaneous emission is much more complex and unsteady. It depends on the different running phases and on the progressive temperature increase (the Figure 3 is not really an example, but rather an illustration of that, when the engine speed variations are much quicker than the temperature increase).

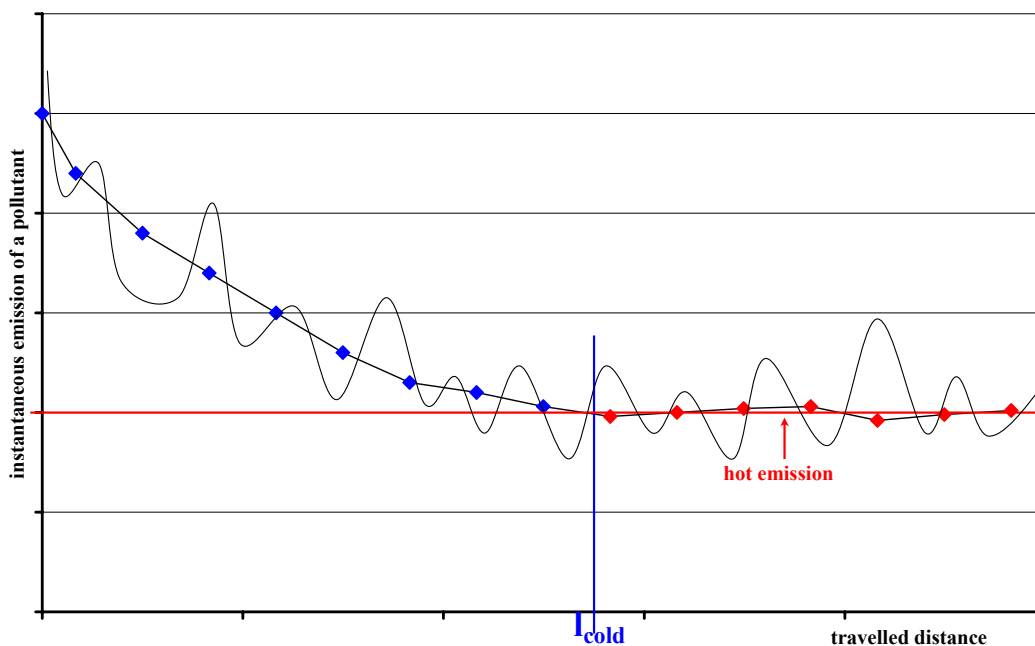


Figure 3: Evolution of the instantaneous emission of a vehicle according to travelled distance in real-world running conditions.

The total cold excess emission for a vehicle and a driving cycle is defined as the excess emission of a vehicle starting at the ambient temperature as compared to a vehicle running in hot conditions. This excess emission depends of course on the ambient temperature (more or less far from the normal running temperature). This definition is meaningful only if the variations of accelerations and decelerations within the cycle are much quicker than the vehicle temperature increase.

This total cold excess emission can be measured as the hot emissions on a vehicle bench, if the used driving cycle is long enough: the stabilisation distance must be reached. The excess emission depends on the pollutant and a priori on the driving cycle. In addition, if we want to assess the relationship between the excess emission and the driving behaviour through the driving cycles, the vehicles must follow the same driving behaviour during the cold and hot phases. To define the cold duration t_{cold} or the cold distance l_{cold} , as a function of the driving cycle, the driving cycle duration must be much shorter than t_{cold} . It is the reason why we developed short driving cycles of 100-200 sec (Joumard et al., 1995b), repeated a lot of times on the bench.

A vehicle does not start only at the ambient temperature or in hot conditions. We can therefore define a cold excess emission as a function of a start engine/catalyst temperature, which can be different from the ambient temperature.

In the same way a vehicle is not always driven during the full cold distance l_{cold} . We can therefore define a cold excess emission as a function of the distance travelled in cold conditions. The upper limit of this excess emission is the total cold excess emission already defined.

The total emission during a driving cycle of a vehicle, which does not start in hot conditions, can be calculated by the sum of the hot emission during the cycle and the cold excess emission during the same cycle:

$$E_{cold} = E_{hot} + EE_{cold}$$

The concept of the relative cold emission can be also defined. It is the ratio of the cold emission during a given driving cycle over the hot emission during the same cycle. This ratio depends on the travelled distance, as, in steady conditions, the cold emission is unsteady and the hot emission is a constant.

In fact there are five different ways of presenting cold effect results. These are:

- ✓ average cold emission factors (g/km) of the first (cold) period
- ✓ absolute emissions (g) of the cold period
- ✓ the difference of average emission factors (g/km) between cold and hot periods, i.e. a unit excess emission
- ✓ the ratio of cold and hot emissions (relative cold emission)
- ✓ absolute excess cold start emissions (g) defined as the additional emission value obtained under cold conditions compared to the emission value that could have been recorded for the same period (cycle) under hot conditions, as described above

In this report, the last excess emissions are addressed.

3. Data

3.1. Initial data

In January 1994 an inquiry was sent to various European laboratories studying vehicles emissions under cold start conditions. Data were obtained from TNO, INRETS, TU-Graz, TÜV, Politecnico di Milano, TRL, EMPA, INTA, VTT, VTI, KTI and LAT (see Annex 1 for laboratory acronyms). Information was asked about cold start tests: number of test vehicles, vehicle type and characteristics (fuel type, model year, engine capacity), driving cycle type, ambient temperature, start condition, emission measurements. Only a few number of laboratories were able to provide data relative to cold start, i.e. measuring cold and hot emissions over a same driving cycle.

16 770 emission factors measured with 1 378 passenger cars were collected. But only 15 616 emission factors measured with 1 229 passenger cars were kept for this work. The vehicles, which have no emission standard or with a “US87” emission standard, were deleted from the database, because they cannot be considered as European emission standard. Data without both hot and cold emission factors were also deleted from the database.

In December 2002, the same inquiry was sent to the same laboratories to get new data. The data from the Artemis project were also added to the existing data. The list of available data is given in Annex 2 on page 54.

Finally we process data from the following laboratories: EMPA, INRETS, IM, TNO and VTT.

A data represents one measurement for one vehicle during a cold or a hot cycle, independently of the pollutant recorded. To obtain the number of data, we have to multiply the number of vehicles by 2 for ECE-15 and FTP72-1 cycle and by 15 for IUFC and IRC cycles.

Passenger cars were divided into ten categories, for which emissions of regulated pollutants (RP) and unregulated pollutants (URP) are available:

- | | |
|---|------------------------------|
| ✓ Euro 0 gasoline without catalyst (RP & URP) | ✓ Euro 2 gasoline (RP & URP) |
| ✓ Euro 0 diesel without catalyst (RP & URP) | ✓ Euro 2 diesel (RP & URP) |
| ✓ Euro 0 gasoline with catalyst (RP) | ✓ Euro 3 gasoline (RP & URP) |
| ✓ Euro 1 gasoline (RP & URP) | ✓ Euro 3 diesel (RP & URP) |
| ✓ Euro 1 diesel (RP & URP) | ✓ Euro 4 gasoline (RP & URP) |

For each vehicle, 3 types of cold and hot cycles were possibly followed (a short description of these cycles is shown in Table 1):

- ✓ Legislative cycles: ECE-15, FTP72-1.
- ✓ Short Inrets cycles: short free-flow urban (Inrets urbain fluide court, so called IUFC) and short road (Inrets route court, so called IRC); each of these cycles was repeated 15 times. These cycles were drawn up from 23 000 travelled kilometres previously recorded all over France by 35 private cars (EUREV study, André, 1989; André, 1998; Joumard et coll., 1999).

- ✓ Artemis urban cycle (André, 2004a and b). This cycle is designed together with Artemis rural and motorway cycles within the Artemis study. The set of 3 driving cycles is designed in order to test the vehicles with driving cycles as representative of the real-world as possible.

Type	Name	Short name	Duration (s)	Distance (m)	Average speed (km/h)
Standard	FTP72-1		505	5779	41.2
	ECE-15		780	4052	18.7
Inrets	Urbain Fluide Court	IUFC	189	999	19.0
	Route Court	IRC	126	1439	41.1
Artemis	Urban	Art. urban	921	4472	17.5

Table 1: Main characteristics of the driving cycles used.

Concerning excess emission data as a function of the cycle, the total number of obtained data is 35 941, all categories and all pollutants merged, i.e. 28 337 and 8 604 data resp. for regulated and unregulated pollutants. These data were measured with 1 766 vehicles, i.e. 1 604 and 102 vehicles resp. for regulated and unregulated pollutants. All vehicle samples were selected by various laboratories, in order the vehicle distribution to be representative, to some extent, of the fleet corresponding to each country. The number of vehicles tested and the corresponding cycles are shown in for the regulated pollutants, and Annex 3 (PAH: page 60) and Annex 4 (VOC: page 61) for the unregulated pollutants.

The Annex 2 (page 54, Table 10) details the number of measurements according to the mean temperature, the minimal and maximal temperatures per cycle and per laboratory.

It should be noted that:

- ✓ For Euro 0 diesel cars with oxidation catalyst, the data are rare and do not allow a full data processing, as for other vehicle categories.
- ✓ For NOx pollutant, some laboratories made standard humidity correction but not all of them. We did not take into account such a correction factor, preferring data without humidity corrections, i.e. actual emissions. Concerning these latter, Annex 5 (page 64) gives the computation of the humidity correction factor.

3.2. Methodology

Once all the data were collected, we had to take into account a number of parameters influencing the general method:

- ✓ Great variety of data:
 - As it can be seen in section 3.1, the number of vehicles analysed with standardised cycles is very significant; but such cycles are not representative since they do not reflect the reality. Comparing, for a same average speed, the standard deviation of acceleration between Inrets and standard cycles (Joumard *et al.*, 1999) yielded significantly differing results, acceleration standard deviation being lower for standardised cycles.

- The short representative cycles (real-world cycles) enabled a fine description of the emission evolution, but there were a limited number of analysed vehicles.

Cycle Name	Emission Standard	Fuel type	CO	CO ₂	HC	NO _x
ECE15-1	Euro 0 w/o cat.	Gasoline	287	266	277	288
	Euro 0 cat.	Gasoline	739	739	739	739
	Euro 1	Diesel	3	3	3	3
		Gasoline	36	36	36	36
	EURO2	Gasoline	26	26	26	26
FTP72-1	Euro 0 w/o cat.	Diesel	50	49	50	50
		Gasoline	18	18	18	18
	Euro 0 cat.	Gasoline	727	727	727	727
	Euro 1	Diesel	2	3	3	3
		Gasoline	3	3	3	3
	Euro 2	Diesel	15	16	15	16
		Gasoline	5	5	5	5
	Euro 3	Diesel	2	2	2	2
		Gasoline	10	10	10	10
IRC	Euro 0 w/o cat.	Diesel	4	4	4	4
		Gasoline	17	16	17	17
	Euro 0 cat.	Gasoline	10	10	10	10
	Euro 1	Diesel	2	3	3	3
		Gasoline	4	4	4	4
	Euro 2	Diesel	13	16	17	17
		Gasoline	8	7	3	7
	Euro 3	Diesel	3	4	4	4
		Gasoline	11	12	10	12
IUFC	Euro 0 w/o cat.	Diesel	5	5	5	5
		Gasoline	29	29	29	29
	Euro 0 cat.	Gasoline	9	10	9	10
	Euro 1	Diesel	2	3	3	2
		Gasoline	2	4	2	4
	Euro 2	Diesel	27	29	28	28
		Gasoline	9	15	11	12
	Euro 3	Diesel	3	4	4	4
		Gasoline	43	45	41	42
	Euro 4	Gasoline	7	7	7	7

Table 2: Vehicle sample size distribution versus driving cycle used to calculate excess emission of regulated pollutants.

- ✓ In the Table 2, we can see that some categories (vehicle type, driving cycle) have not enough vehicles to make a good computation of the cold start influence. So we decided to merge some vehicle categories. The consequences are that some results will be the same for different vehicle categories.
- ✓ When the vehicles are tested using a standard cycle, the engine temperature is not always hot at the end of the cycle, according to Joumard *et al.* (1995b). Therefore, we had to introduce a light adjustment for each pollutant. Thus we obtained excess emissions over the entire cold period for different cycles, whether standard or not. Such an adjustment is needed especially for ECE-15 cycle since it is very short. This correction is presented in section 3.3.4.1.
- ✓ The ambient temperature must be taken into account, if possible, whatever the mean speed may be. Therefore, we have to look for a relationship independent of the average speed, considering that initially the starts are made with a cold engine (engine temperature corresponds to ambient temperature at start).
- ✓ We make the following hypothesis: excess emission depends on the engine start temperature only (as temperature parameter), this one being equal to the ambient temperature (real cold start) or greater than the ambient temperature (semi-cold or semi-hot engine). This hypothesis is necessary due to the lack of data. For instance we have no data for a vehicle starting with an engine temperature of 0°C when the ambient temperature is 10°C.
- ✓ Taking into account the travelled distance after a cold start in order to decrease excess emission levels if the travelled distance is lower than the cold distance (i.e. the distance needed to stabilise the emission).
- ✓ Taking into account the parking duration before a start to decrease excess emission level if the parking duration is lower than the duration needed to completely cooling the engine at the ambient temperature.

It should be noted that some measurements correspond to the same driving cycle. But, they correspond to measurements made by various laboratories using various measuring devices, in various conditions, with various car models, different vehicle ages, etc... So it results in differences for the same cycles themselves.

3.3. Cold start excess emission and distance calculation

3.3.1. Methods for regulated pollutants

We propose hereafter to analyse the different methods used, in Europe, to calculate the cold start emissions and the cold start distances, when emission factor is a continuous signal. It is the case when instantaneous emissions are available, but also when a short cycle is repeated as long as the emissions are stabilized.

3.3.1.1. First method: Standard deviation

This method was developed previously at INRETS (Joumard and Serié, 1999) and consists in calculating the standard deviation on the last two data, then on the last three, etc., then on all the following consecutive cycles. As long as the emissions are stable (i.e. hot), the variations between them occur randomly around a mean, which is the hot emission. The standard deviation is therefore a decreasing function of the number of points considered. However, the standard deviation increases rapidly as soon as cold start emission appears.

The cold start distance is determined when the standard deviation is minimal. The hot emission is calculated by incorporating the values beyond this minimum. The cold start emission is calculated by incorporating the emissions over the entire cold start distance. The cold start excess emission is calculated by subtracting the theoretical hot emission from the cold start emission throughout the cold driving period.

As an example the Figure 4 shows the graphic representation of the emission of CO for Euro 1 Diesel at 18°C. On this figure the standard deviation is also plot. The standard deviation shows that all the cycles equal or higher than the cycle 9 are hot (during the 9th to 15th cycles the average emission factor is 0.50 g/cycle or 0.30 g/km). Thus the cold distance covers 8 cycles (i.e. 13.48 km). By integrating over the 8 first cycles we obtain the cold start emission of 4.92 g, a theoretical hot emission of $8 \times 0.50 = 4.03$ g, and therefore a cold excess emission of $4.92 - 4.03 = 0.89$ g.

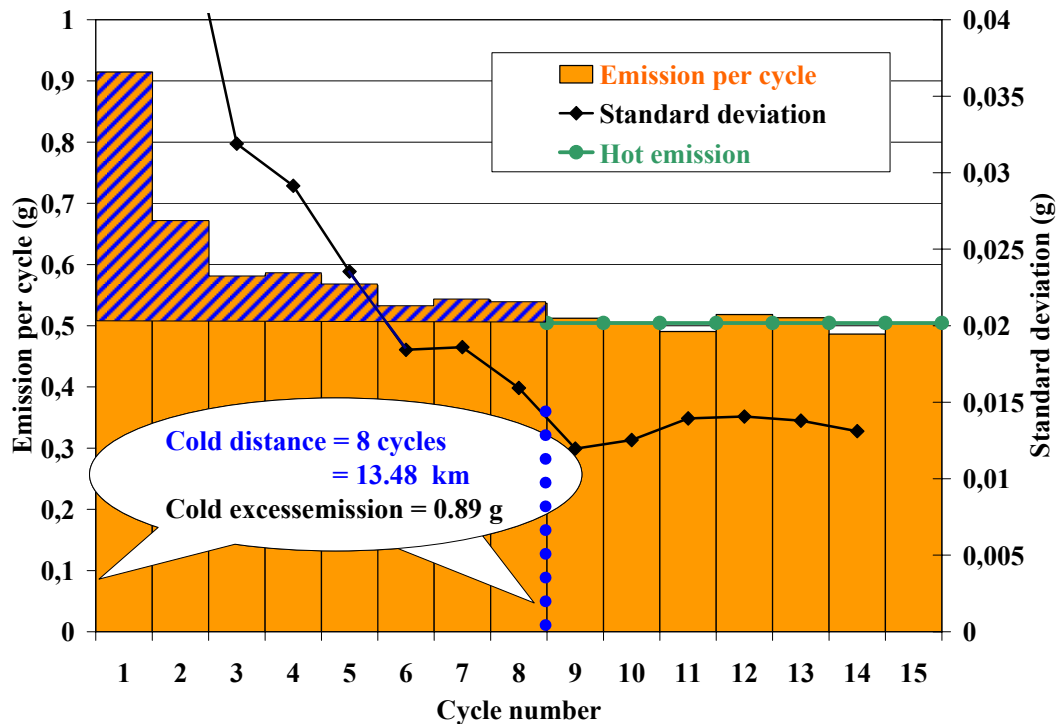


Figure 4: Standard deviation method: Example of cold start distance and emission calculation for Euro 1 diesel vehicle and CO at 18°C. The distance is in km and the emission in g per cycle.

3.3.1.2. Second method: Linear regression

This method developed at EMPA (Weilenmann, 2001) considers the continuous cumulative emission from the start. The linear regression of this cumulative emission is then calculated on the basis of the hot part alone. The regression value at the distance 0 gives the cold start emission value.

The hot/cold limit is calculated from a first rough estimation of the cold distance, and then by plotting two straight lines parallel to the linear regression during the rough hot part. They have the same slope but the constant of the first line is equal to 95% of the emission while the second is equal to 105%. The precise cold driving distance is determined by the last time the total emission falls between these two lines.

This latter method can supply slightly different results in terms of cold driving distance and cold start emission. It is based on a hypothesis on the hot part of the cycle, on which the linear regression is calculated.

As an example the Figure 5 shows us the graphic representation of the emission of CO for Euro 1 Diesel at 18°C. The data are the same than in Figure 4, but we plot in addition the cumulative emission, the cold start emission (0.89 g) calculated from the linear regression (we took the last 7 points because the cumulative emissions curve is like a straight line) and the two lines at 95% and 105% of the cold start emission. Thus the cold distance is the evaluated as 7 cycles (i.e. 10.1 km).

This second method can give slightly different results, in term of cold distance and cold excess emission. The problem of this method is the determination of the hot cycles, over which the hot linear regression is calculated.

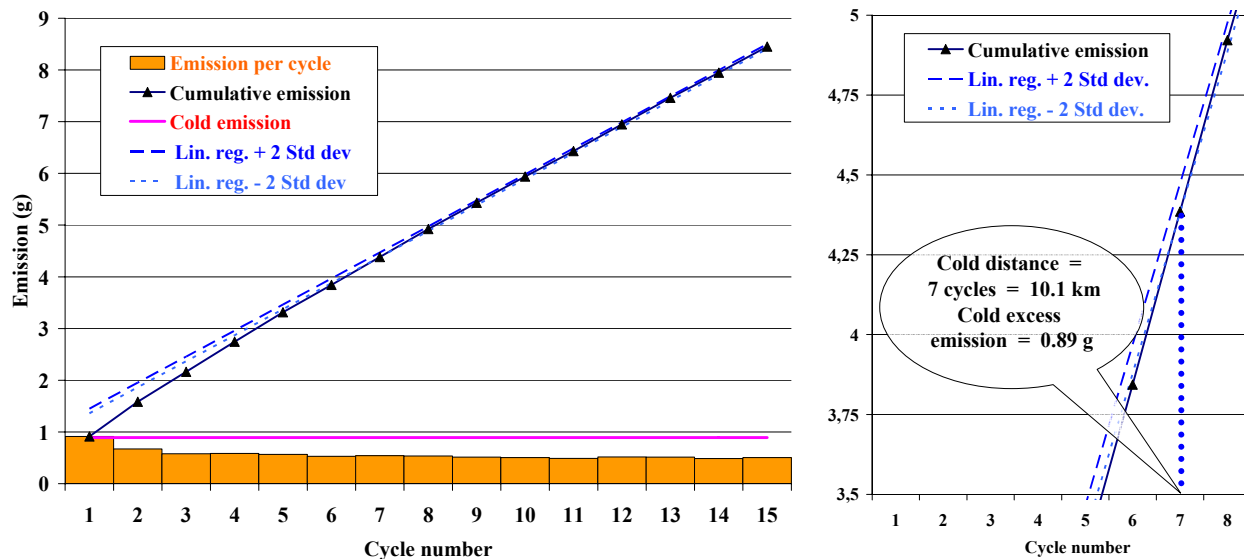


Figure 5: Linear regression method: Example of cold start distance and emission calculation.

3.3.1.3. Artemis method: Linear Regression + standard deviation

This method was specifically developed for this project, by integrating those described above. We first plot the emission per cycle and the standard deviation on the basis of the first method (see Figure 6 and Figure 7).

The rough cold start period is initially determined according to the first method, when the standard deviation is minimal: It is the first 8 cycles. This permits calculating a hot emission (along the 9th - 15th cycles in the example), and a corresponding standard deviation (of 0.017 g in the example). The exact cold driving distance is determined when the curve of the emission cycle after cycle reaches a distance of two standard deviations from the mean when hot (7.2 cycles in the example, see Figure 6). In parallel, the linear regression of the continuous emission over the rough hot start period alone gives the cold start emission at distance 0 (0.9 g in our example, see Figure 7).

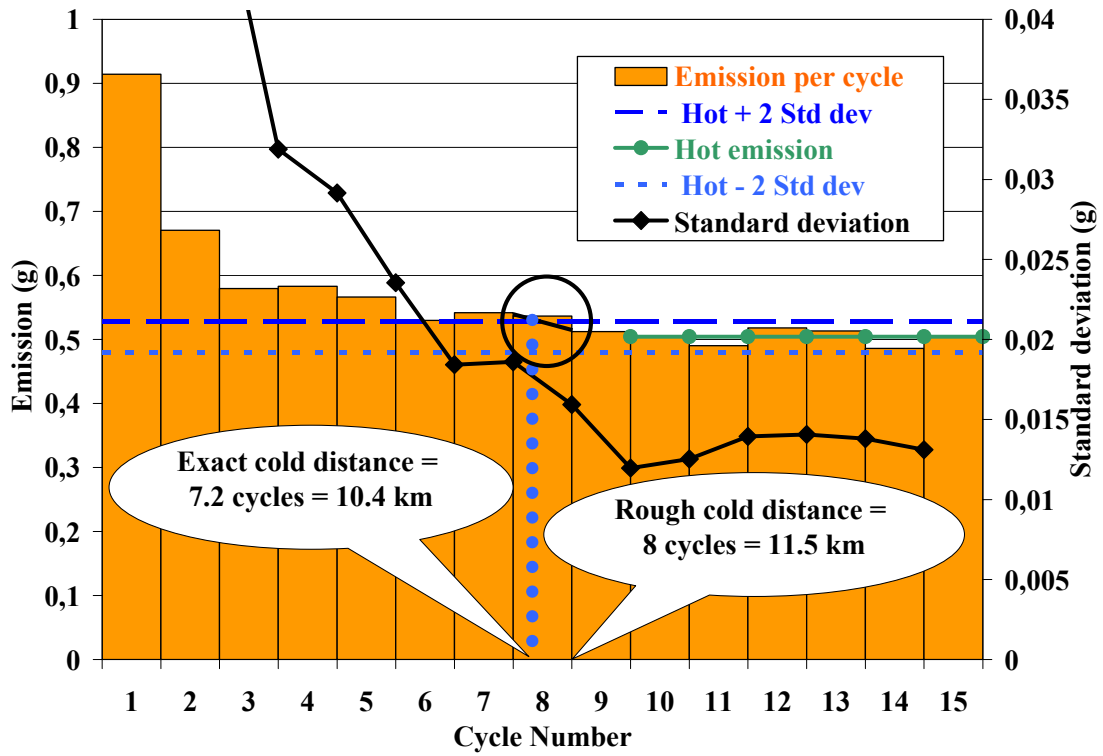


Figure 6: Artemis method: Example of calculation of the rough and exact cold start distances.

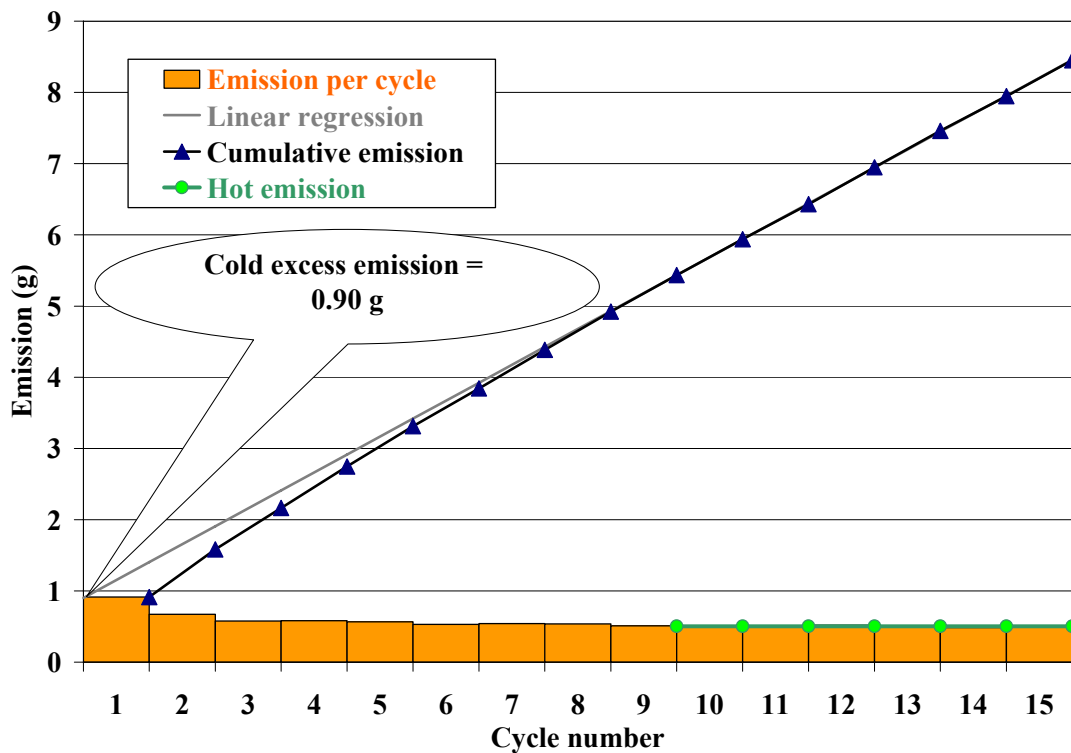


Figure 7: Artemis method: Example of cold start excess emission calculation.

3.3.1.4. Conclusion

The Table 3 shows that, for the same emission data, the three methods give nearly the same cold start excess emission, but not the same cold start distance. The difference between cold distances goes up to 25 %.

With the Artemis method, we can determine:

- ✓ When the cycle is completely hot as in the standard deviation method
- ✓ The cold start emission as in the linear regression method but with more accuracy because we applied the linear regression with the hot emissions
- ✓ The cold start distance with a better accuracy because we are searching when the hot emission cuts the emission by looking at the standard deviation of the hot part.

No assumption is necessary in the linear regression method, and it is a way to calculate the cold start distance precisely by interpolation.

Method	Standard deviation	Linear regression	Artemis
Cold distance (km)	13.48	10.1	10.4
Cold emission (g)	0.89	0.89	0.90

Table 3: Comparison of the cold start distance and the cold start emission calculated with the different methods, in the case of Figure 4 to Figure 7.

3.3.2. Methods for unregulated pollutants

The emissions factors of the unregulated pollutants for the cold start conditions were measured with the short Inrets cycles, the ECE-15 cycle and the Artemis urban cycle, but the pollutant analysis adds constraints in terms of sampling.

The short Inrets emissions were measured with two different conditions. At INRETS the unregulated pollutants emission factors were measured twice with a cold short cycle and with a hot one, both of them repeated 15 times. So the cold start excess emission is the difference between these two values because the cold short cycle is always hot at the end.

The others laboratories measured the unregulated pollutants emission factors with the same short cycle but with three measurements for the cycles 1-5, 6-10, and 11-15. So to calculate the excess emission, we consider that the cold distance is, for all the unregulated pollutants equal to the total HC one; The cold distance of HC is always less than 10 cycles (cf. Annex 6).

With this condition, the excess emission EE is:

$$EE = \text{emission}(\text{cycles 1 to 5}) - \text{emission}(\text{cycles 6 to 10}) - 2 \times \text{emission}(\text{cycles 11 to 15})$$

The excess emission deduced from the ECE-15 and the Artemis urban cycles are calculated as for the regulated pollutant, i.e. a light adjustment for each pollutant to obtain excess emissions over the entire cold period for different cycles, whether standard or not, because the driving cycles are too short to end hot.

3.3.3. PAH in gaseous and particulate phase

At INRETS, the PAH were measured into two phase: gaseous and particulate. So it is possible to deduce from these measurements, the percentage of the total excess emission due to the gaseous and to the particulate phase (see Annex 15.2).

3.3.4. Results

3.3.4.1. ECE-15 emissions correction

A previous study (Joumard *et al.*, 1995b) showed that ECE-15 cycle could not cover entirely the cold period due to the cold start. So, we introduced a correction coefficient for this cycle to transform the measured excess emission during standard cycles into a full cold excess emission. This coefficient is deduced from measurement data recorded using IUFC cycle (because the mean speed is near the ECE-15 mean speed), which covers the whole cold period. Using this “cold” distance (see Annex 6), calculated with the Artemis method on the short Inrets cycle data, we calculate the correction coefficient to be applied to adjust the standardised cycles to the representative cycles.

For example (see Figure 8), the ECE-15 cycle corresponds to an average speed of 18.7 km/h and a distance of 4 052 m. For CO pollutant, the cold distance is equal to 8.7 km for the representative cycle with the nearest average speed, i.e. 19.0 km/h (from Annex 6). Regarding excess emission (normalised by the total excess emission) as a function of the distance, the ECE-15 cycle corresponds to 80 % of the total excess emission of the short free-flow urban cycle. Then the factor is equal to 1.25 ($=1/0.8$). We applied this method to all the pollutants (see Table 4). The correction factors are sometimes important (from 0.77 to 4).

The majority of the correction factors are higher than 1, but sometimes lower than 1. A coefficient lower than 1 is possible when emission partially increasing with distance (rather than always increasing). An example for correction factor lower than 1 is shown in Annex 7.

We consider here that the correction, based on INRETS data for a given temperature, can be extrapolated to other laboratories and ambient temperatures, even these assumptions are wrong. But we have no data to build better assumptions.

3.3.4.2. Cold distance and excess emissions

When applying the whole methodology, we get the cold distance for the 4 regulated pollutants, 2 driving cycles (at 19.0 and 41.1 km/h) and a number of cases (vehicle type, ambient temperature): See Annex 6. Then the excess cold start emissions are calculated from the emission measurements according to different driving cycles, for regulated and unregulated pollutants (see Annex 8 and Annex 9 resp.).

The cold distance covers a large range, from 2 to 9 km, with an average of 5.2 km at 20°C.

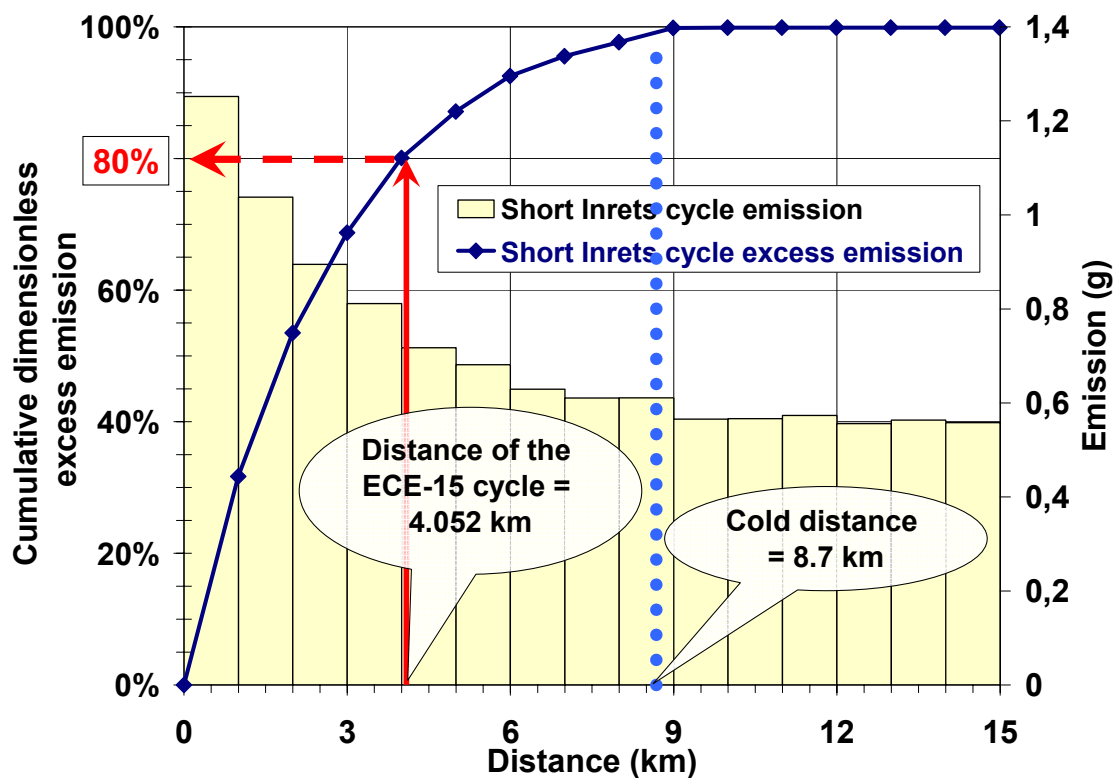


Figure 8: Cumulative dimensionless excess emission (ratio of absolute excess cold start emission to total absolute excess cold start emission) as a function of the distance (km) for the short Inrets free-flow urban cycle. Correction calculation example of ECE-15 cycle for CO pollutant and gasoline cars without catalyst.

Emission standard	Fuel type	Mean temperature	CO	CO ₂	HC	NOx
Euro 0 w/o cat.	Diesel	13	1.239	1	1.349	1.397
		22	1.125	1.051	1.326	1.345
	Gasoline	-20	1.031	1.113	1.023	1.330
		-7	1	0.849	1.019	1.241
		10	1.329	1.270	1.566	0.766
		21	1.120	0.626	0.964	0.986
Euro 0 cat.	Gasoline	11	1	1	1	1
		12	1	1.059	1.003	1.165
		19	1.011	1.117	1.001	0.743
Euro 1	Diesel	18	1.241	1	1	1
		21	1	1.084	1.319	1
	Gasoline	10	1	1	1	1
		12	1	1.052	1	1.026
		20	1	1.090	0.952	0.949
		24	0.890	1	1	1
Euro 2	Diesel	-20	1.051	1.193	1.074	1.026
		-7	1.087	1.134	1.091	0.938
		22	1.052	1	1.140	0.692
		23	1	1.060	1	1
	Gasoline	-20	1.003	1.347	1.010	1
		-8	1	-0.352	1.006	1.168
		12	1	1.142	1	1
		22	1	1.115	1	1
		23	1	1	0.984	1
		25	0.982	1	1	1
Euro 3	Diesel	22	1	1.120	0.895	2.633
		23	0.848	1	1	1
	Gasoline	-19	1.006	1.131	1.006	1.110
		-8	1.009	1.130	1.002	0.935
		14	1	1.263	1	1
		23	1.030	1.062	1.002	1.110
Euro 4	Gasoline	-19	1.016	1.252	1.008	0.903
		-8	1.041	1.240	1.004	1.008
		23	1.049	1	1	4.717

Table 4: Correction factors of cold excess emission for ECE-15 cycle, to take into account the too short distance of the cycle.

4. Influence of various parameters

In this chapter, the influence of the ambient temperature, the average speed, the distance and the parking duration on excess emissions is shown. The aim is to express the excess emission EE as:

$$EE(T, V, \delta) = \omega_{20^{\circ}\text{C}, 20\text{km/h}} \cdot f(T, V) \cdot h(\delta) \cdot g(t) \quad (\text{Equation 1})$$

with:

EE (T, V, δ): excess emission in mass per start

T: temperature ($^{\circ}\text{C}$)

V: average speed (km/h)

$\delta = d/d_c$: dimensionless travelled distance

d: travelled distance

d_c : cold distance (km)

t: parking time

$\omega_{20^{\circ}\text{C}, 20\text{km/h}}$: excess emission at 20 $^{\circ}\text{C}$ and 20 km/h

$f(T, V) = \omega(T, V) / \omega_{20^{\circ}\text{C}, 20\text{km/h}}$: cycle speed and the temperature influence dimensionless function expressed in section 4.1

$h(\delta)$: distance influence function expressed in section 4.2

$g(t)$: parking-time influence function expressed in section 4.3

4.1. Excess emission as a function of the cycle speed and the temperature: $\omega(T, V)$ and $f(T, V)$

Firstly the successive corrections are calculated and applied as follows:

- ✓ Data correction for ECE-15 standard cycle, as explained in section 3.3.4.1.

Then, using the modified data, we applied a 3D linear regression in order to obtain the excess emission level $\omega(T, V)$ in g as a function of the average speed V [km/h] and the temperature T [$^{\circ}\text{C}$] (see Annex 10 page 75, and Table 16 and Table 17 in Annex 9). Another condition must be applied: the excess emission must tend towards zero when T increases.

To apply a 3D linear regression is an assumption quite arbitrary. For instance in Joumard and Sérié (1999), we did another assumption, summing the speed and temperature influences. The present assumption is done to represent at the best the available data, but other modelling could be used.

An example of CO₂ excess emission as a function of the mean speed and ambient temperature for Euro 2 gasoline vehicles is shown Figure 9.

It should be noticed that the regression is calculated using measurement points covering only four speeds and different temperatures (the number of measurements points are indicated Annex 10). One point in Figure 9 is the average of the excess emission for one temperature and one speed. But

the regression was made by weighting each point by the number of vehicles. Using the calculated equations, we determined the correction functions $f(T,V)$ (see Annex 10) corresponding to the functions made dimensionless by dividing them by their values calculated at 20 km/h and 20°C, i.e. $\omega(20^\circ\text{C}, 20\text{km/h})$. It should be noted that the boundaries of the measurements points for the linear regression calculation are $[-20^\circ\text{C}, +30^\circ\text{C}]$ for the ambient temperature and $[18 \text{ km/h}, 42 \text{ km/h}]$ for the mean speed. Outside these boundaries, the values of the regression have to be taken with care. The best way is to take the maximal (or minimal) value of the function at the boundaries outside these ones (Weilenmann, 2001), because this author showed that the speed dependence is not linear but polynomial (2nd degree).

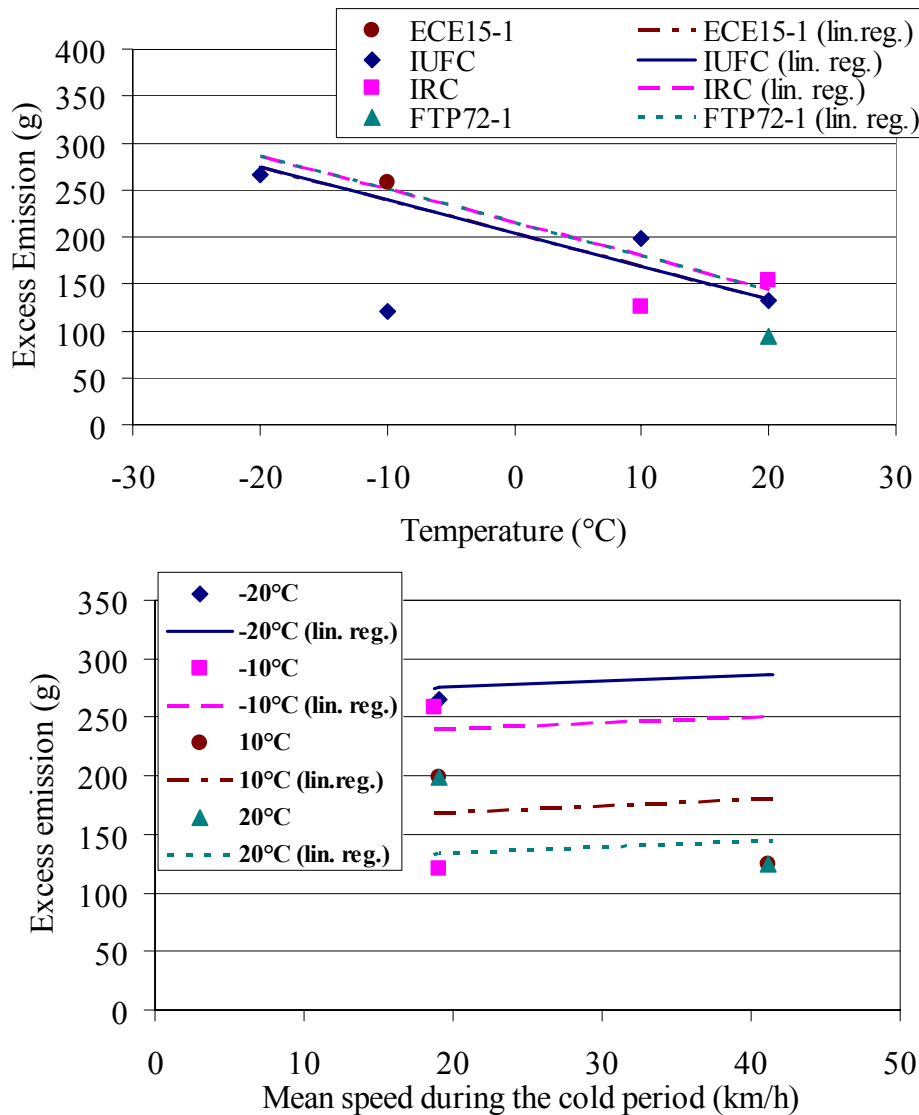


Figure 9: CO₂ excess emission of Euro 2 gasoline vehicles as a function of the mean speed and the ambient temperature.

4.2. Excess emission as a function of the travelled distance $h(\delta)$

The knowledge of the emission evolution during the cold phase, by considering the emissions measured on each Inrets short cycles, allows us to model the excess emission according to the travelled distance. The excess emission is therefore increasing till the end of the cold distance, and then equal to the cold start excess emission presented in section 4.1.

In a first step, we model the cold distance d_c as a function of the vehicle speed V and the ambient temperature T

The Figure 10 shows an example of the cold distance (see Table 5 page 31 and Table 18 and Table 19 in Annex 11 for the data and equations).

Both excess emission and cold distance are therefore expressed as function of V and T . It should be noted that the boundaries of the measurements points for the linear regression calculation are $[-20^{\circ}\text{C}, +30^{\circ}\text{C}]$ for the ambient temperature and $[18 \text{ km/h}, 42 \text{ km/h}]$ for the mean speed. So outside these boundaries, the values of the regression have to be taken with care. The best way is to take the maximal (or minimal) value of the function at the boundaries outside these ones.

It allows us to make dimensionless both excess emission and travelled distance (see an example Figure 11; the others ones in Annex 12) and to look at the influence of the dimensionless travelled distance $\delta=d/d_c$ on the dimensionless excess emission. We express this influence as an exponential function $h(\delta)$. It should be noted that the chosen exponential function is well representative of the majority of the data. But in some cases, especially for NO_x , the shape is much more complex (as shown in Annex 12.4). As we prefer to model only the influence of the distance, we propose to use the exponential function in all the cases.

This function $h(\delta)$ could be influenced by two available parameters, i.e. the ambient temperature T and the average speed V . But in fact the influence of V and T are very low. Therefore $h(\delta)$ can be expressed as:

$$h(\delta) = \frac{1 - e^{a\delta}}{1 - e^a} \quad \text{with } \delta = \frac{d}{d_c} \quad (\text{Equation 2})$$

where a is deduced from the data. a is given in Annex 13 for the different vehicle categories.

For the unregulated pollutants, the emission evolution during the cold phase was not measured. So we will consider that the h function for the unregulated pollutants will be the h function of the HC for the same category.

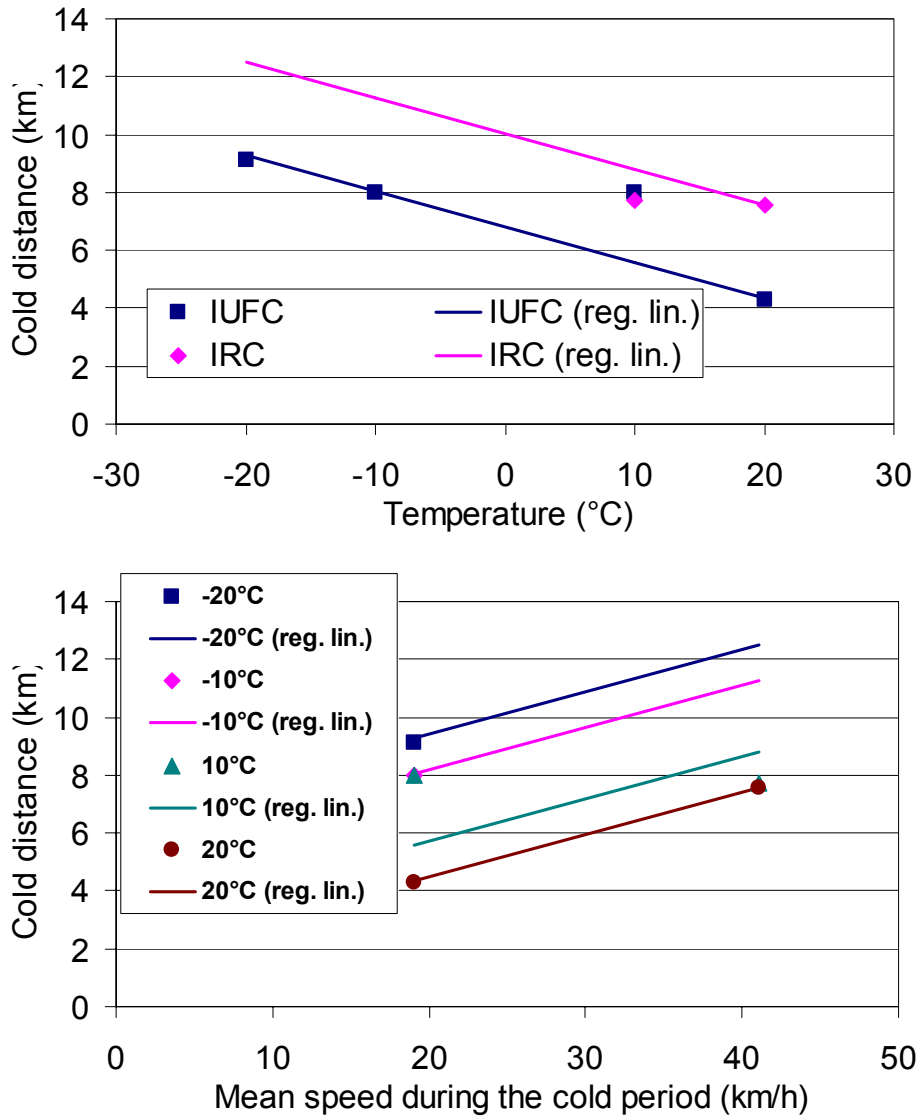


Figure 10: Cold distance d_c (km) as a function of the vehicle mean speed V (km/h) and the ambient temperature T (°C) for CO_2 pollutant of Euro 2 gasoline car.

Pollutant	Emission standard	Fuel Type	# of points	$d_c(T,V)$
CO	Euro 0 w/o cat.	Diesel	27	$10.17 - 0.167*T - 0.049*V$
		Gasoline	350	$2.826 + 0.116*V$
	Euro 0 cat.	Gasoline	95	$1.639 - 0.019*T + 0.054*V$
	Euro 1	Diesel	8	$9.553 - 0.042*V$
		Gasoline	12	$8.805 - 0.132*V$
	Euro 2	Diesel	466	$4.916 - 0.039*T + 0.091*V$
		Gasoline	79	$4.409 - 0.002*T + 0.024*V$
	Euro 3	Diesel	18	$4.891 + 0.078*V$
Gasoline		721	$4.284 - 0.025*T - 0.004*V$	
Euro 4	Gasoline	14	$6.716 - 0.06*T$	
CO ₂	Euro 0 w/o cat.	Diesel	27	$-2.27 + 0.321*V$
		Gasoline	333	$2.807 - 0.024*T + 0.141*V$
	Euro 0 cat.	Gasoline	102	$2.172 + 0.126*V$
	Euro 1	Diesel	18	$3.474 + 0.163*V$
		Gasoline	18	$3.838 + 0.081*V$
	Euro 2	Diesel	617	$4.31 - 0.04*T + 0.125*V$
		Gasoline	142	$4.048 - 0.124*T + 0.145*V$
	Euro 3	Diesel	32	$9.093 - 0.064*V$
Gasoline		781	$2.461 - 0.057*T + 0.173*V$	
Euro 4	Gasoline	14	$5.398 - 0.142*T$	
HC	Euro 0 w/o cat.	Diesel	27	$6.834 + 0.022*V$
		Gasoline	350	$3.578 - 0.052*T + 0.093*V$
	Euro 0 cat.	Gasoline	91	$2.087 - 0.042*T + 0.099*V$
	Euro 1	Diesel	18	$3.444 + 0.226*V$
		Gasoline	14	$7.972 - 0.048*V$
	Euro 2	Diesel	617	$4.79 - 0.021*T + 0.116*V$
		Gasoline	62	$5.201 - 0.037*T + 0.065*V$
	Euro 3	Diesel	32	$7.341 + 0.07*V$
Gasoline		633	$3.552 - 0.092*T + 0.135*V$	
Euro 4	Gasoline	14	$6.97 - 0.16*T$	
NOx	Euro 0 w/o cat.	Diesel	27	$3.18 + 0.087*V$
		Gasoline	350	$2.879 + 0.081*V$
	Euro 0 cat.	Gasoline	102	$1.92 - 0.026*T + 0.101*V$
	Euro 1	Diesel	13	$-4.392 + 0.317*V$
		Gasoline	18	$4.318 - 0.016*V$
	Euro 2	Diesel	617	$0.76 - 0.033*T + 0.158*V$
		Gasoline	105	$-2.515 + 0.238*V$
	Euro 3	Diesel	32	$9.809 - 0.094*V$
Gasoline		708	$1.922 + 0.091*V$	
Euro 4	Gasoline	14	4.523	

Table 5: Formula describing the cold distance d_c (km) as a function of the average speed V (km/h) and the temperature T (°C). The results of this formula must be positive.

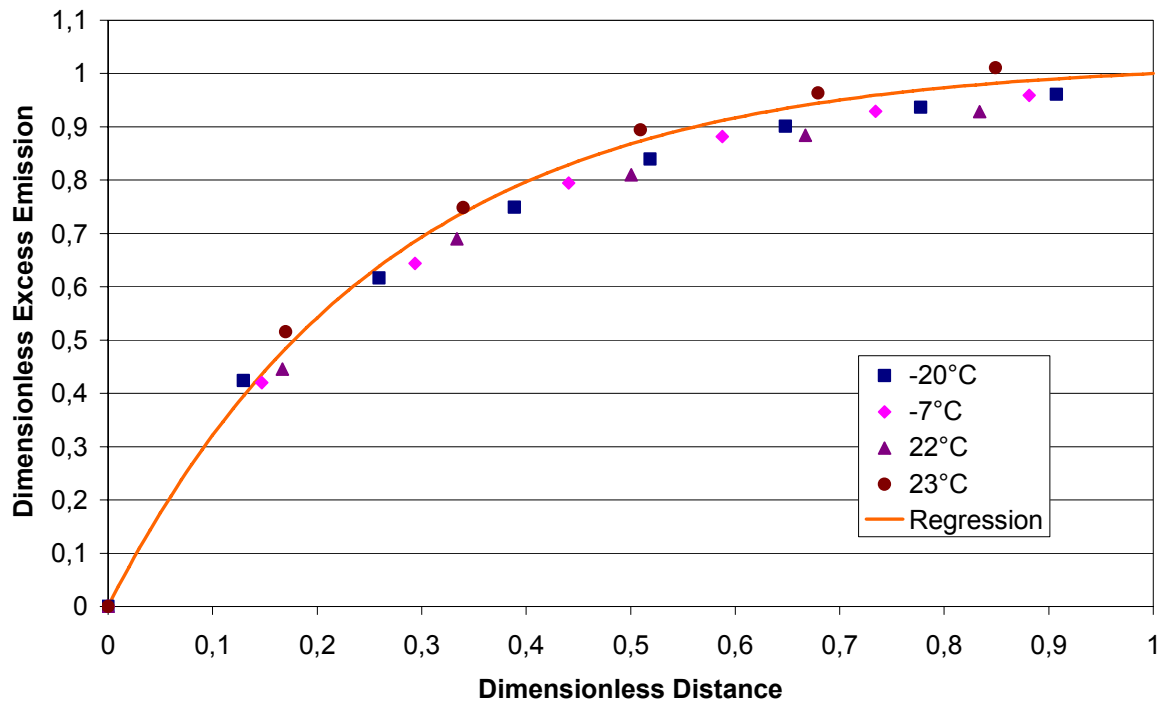


Figure 11: Dimensionless excess emission of CO₂ for Euro 2 diesel cars, according to the dimensionless distance.

4.3. Excess emission as a function of the parking time $g(t)$

As we would like to take into account the parking time, which influences the start engine temperature, we need to know the influence of the parking time on the excess emissions. But, unfortunately, such data are rare. We found only European studies from EMPA, TUG and VTI, and an American study from CARB. We propose hereafter to present these studies and to make a conclusion on the parking time influence.

4.3.1. VTI study

The VTI study (Hammarström, 2002) looks at the short parking time (10' to 60') influence on the excess exhaust emissions. The number of measured vehicles was four, all gasoline cars. Two of them have a catalyst and the two others have not catalyst.

The protocol of the study was:

- At least 12h of engine stop.
- A warm up phase make with 4xFTP72-1 cycles (but only 3 had been recorded)
- Two parts composed each of four groups:
 - Group 1
 - 10 minutes of parking time
 - 3xFTP72-1 cycles
 - Group 2
 - 20 minutes of parking time
 - 3xFTP72-1 cycles

- Group 3
 - 30 minutes of parking time
 - 3xFTP72-1 cycles
- Group 4
 - 60 minutes of parking time
 - 3xFTP72-1 cycles

The measurements were based on the following considerations:

- The fourth FTP72-1 of the warm-up phase reaches a stabilized emission level with no influence on the following measurements
- That start effects should be expected mainly from the first FTP72-1 cycle of each group and that a stabilized emission level should be reached before the third FTP72-1 cycle of each group

The statistical analyse showed that theses two hypotheses are wrong.

4.3.2. EMPA study

The EMPA study (Schweizer et al., 1997) looks at the parking time influence on the emissions by using a city-centre driving cycle T50 (distance: 6.51 km, average speed: 28 km/h). As the FTP cycle, this cycle is too short to consider that the cycle is hot at its end. This study shows that the excess emissions according to the parking time increase rapidly for short parking times and begin to be plate for parking times longer than one hour. The full cold start excess emission is reached after 12 h of parking.

4.3.3. TUG study

The TUG study (Hausberger, 1997) looks at the parking time influence on the emissions by using a driving cycle, which represents the driving behaviour in an underground parking lot.

The tests are made with 5 gasoline catalyst cars (Euro 1), 3 gasoline cars without catalyst (Euro 0 and older) and 4 diesel cars (Euro 1). The parking durations are 0.5 h, 1 h, 2 h, 4 h and 16 h.

4.3.4. CARB study

The CARB study (Sabate, 1996) looks at the parking time influence on the emissions by using a FTP cycle. The difference with the VTI study is that the cold period is defined as to be the first 100 s. Therefore the excess emission is the difference between the cumulative emission during these 100 s and the cumulative emission during the last part of the FTP cycle.

As it is known, the first part of the FTP cycle is not completely hot as the end, and it is of course much more the case after only 100 s. So these data have to be taken with care.

4.3.5. Parking time correction function

With all these studies we can calculate an average table of parking time influence for each pollutant. For that we plot all the data (see an example in Figure 12) and draw the best fit. The results are presented in Annex 14. The function $g(t)$ is equal to 1 for 12 h parking. The function $g(t)$

is equal to 1 for 12 h parking. The CARB data are excluded of the average because they do not represent the European behaviour.

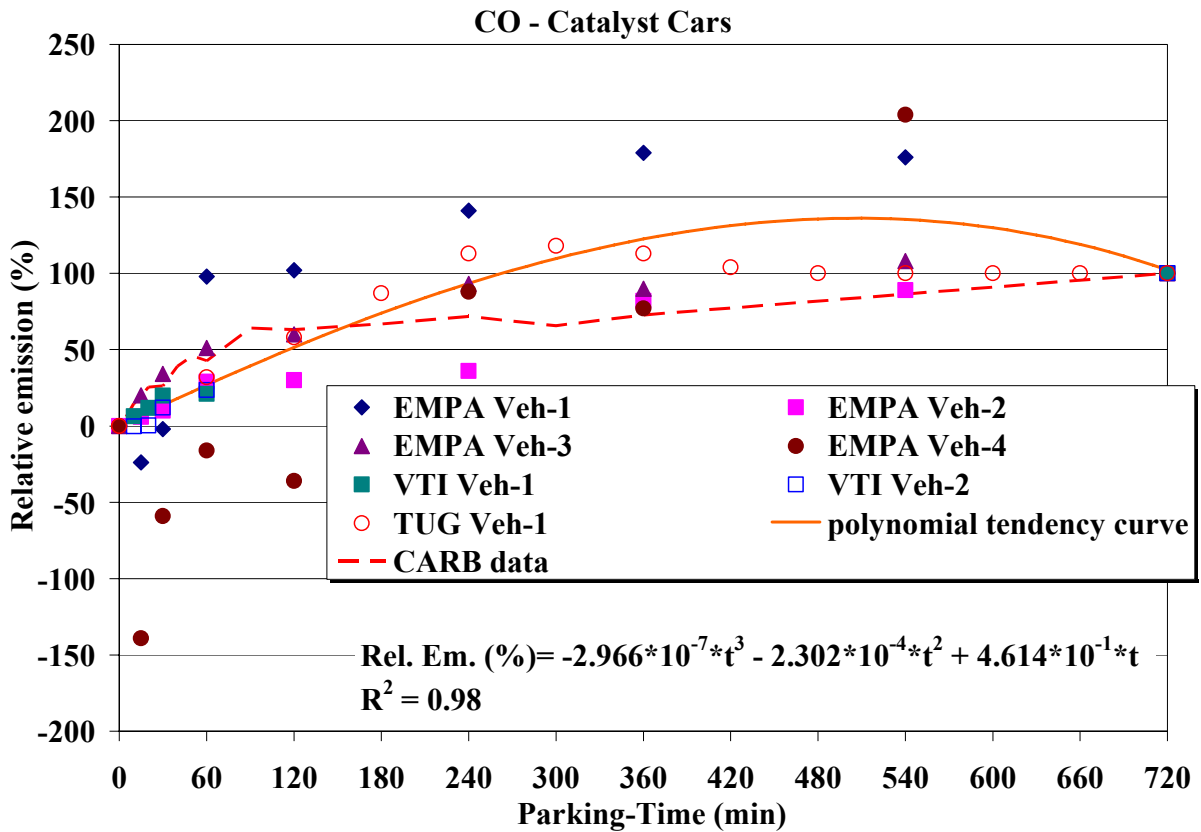


Figure 12: Parking time influence on the total excess CO emission for catalyst cars.

4.4. General formula of cold-start-related excess emissions of a trip

We assumed that the general model of the cold start emission is a function of ambient temperature, average speed, travelled distance and parking duration. Measurements were made using different cycles, these being characterised by their mean speed (see Table 1). The cycles can be characterised by other parameters such as mean product speed time acceleration (dynamics measurement), standard deviation of speed or standard deviation of the product speed time acceleration for example (Hassel and Weber, 1996). But, those parameters cannot be used in the general model due to the fact that there is no available statistics.

With the calculation made in section 4, the equation (1) can be written as:

$$EE(T, V, \delta, t) = \omega_{20^{\circ}\text{C}, 20\text{km/h}} \cdot f(T, V) \cdot \left\{ \frac{1 - e^{a \cdot \delta}}{1 - e^a} \right\} \cdot g(t) \quad (\text{Equation 3})$$

where:

- EE: excess emission for a trip in g
 V: mean speed in km/h during the cold period
 T: ambient temperature in °C
 t: parking time in hours

$\delta = \frac{d}{d_c(T, V)}$: dimensionless travelled distance

d: travelled distance

$d_c(T, V)$: cold distance

$\omega_{20^{\circ}\text{C}, 20\text{km/h}}$: reference excess emission (at 20 °C and 20 km/h).

The functions $\omega_{20^{\circ}\text{C}, 20\text{km/h}}$, $f(T, V)$, a , $d_c(T, V)$ and $g(t)$ can be found respectively in Table 6, Annex 10, Annex 13, Table 5, and Annex 14. The function f is so that f tends toward 0 when T increases.

For example, for CO and Euro 2 gasoline cars:

- ✓ Using Table 6, $\omega_{20^{\circ}\text{C}, 20\text{km/h}} = 17.060$
- ✓ Using Annex 10, $f(T, V) = 1.927 - 0.043 \cdot T + 0.003 \cdot V$
- ✓ Using Annex 13, $a = -9.007$
- ✓ Using Table 5, $d_c(T, V) = 4.409 - 0.002 \cdot T + 0.024 \cdot V$
- ✓ Using Annex 14, $g(t) = -2.916 \cdot 10^{-7} \cdot t^3 - 1.941 \cdot 10^{-4} \cdot t^2 + 4.315 \cdot 10^{-1} \cdot t$

and therefore δ et $h(\delta)$ can be calculated, and finally:

$$\text{Excess Emission}(T, V, \delta, t) = \underbrace{17.060}_{\omega, \text{CO, Euro 2, Gasoline}} \cdot \underbrace{\left[1.927 - 0.043 \cdot T + 0.003 \cdot V \right]}_{f(T,V)} \cdot \underbrace{\left(\frac{1 - e^{-9.007 \cdot \frac{d}{4.409 - 0.002 \cdot T + 0.024 \cdot V}}}{1 - e^{-9.007}} \right)}_{h(d,T,V)} \cdot \underbrace{\left(-2.916 \cdot 10^{-7} \cdot t^3 - 1.941 \cdot 10^{-4} \cdot t^2 + 4.315 \cdot 10^{-1} \cdot t \right)}_{g(t)}$$

(Equation 4)

Pollutant	Emission standard	Fuel type	$\omega_{20^\circ\text{C}, 20\text{km/h}}$ (g)
CO	Euro 0 w/o cat.	Diesel	2.756
		Gasoline	48.004
	Euro 0 cat.	Gasoline	15.916
	Euro 1	Diesel	2.121
		Gasoline	14.686
	Euro 2	Diesel	2.731
		Gasoline	17.060
	Euro 3	Diesel	2.057
Gasoline		8.261	
Euro 4	Gasoline	4.875	
CO ₂	Euro 0 w/o cat.	Diesel	168.273
		Gasoline	82.607
	Euro 0 cat.	Gasoline	126.903
	Euro 1	Diesel	153.954
		Gasoline	61.386
	Euro 2	Diesel	141.134
		Gasoline	133.839
	Euro 3	Diesel	163.893
		Gasoline	124.405
	Euro 4	Gasoline	64.700

Pollutant	Emission standard	Fuel type	$\omega_{20^\circ\text{C}, 20\text{km/h}}$ (g)
HC	Euro 0 w/o cat.	Diesel	1.045
		Gasoline	6.812
	Euro 0 cat.	Gasoline	2.788
	Euro 1	Diesel	0.409
		Gasoline	6.374
	Euro 2	Diesel	0.381
		Gasoline	4.381
	Euro 3	Diesel	0.149
Gasoline		0.905	
Euro 4	Gasoline	0.244	
NO _x	Euro 0 w/o cat.	Diesel	-0.198
		Gasoline	0.099
	Euro 0 cat.	Gasoline	0.746
	Euro 1	Diesel	1.191
		Gasoline	0.846
	Euro 2	Diesel	0.084
		Gasoline	0.705
	Euro 3	Diesel	-0.109
Gasoline		0.349	
Euro 4	Gasoline	0.186	

Table 6: Coefficient $\omega_{20^\circ\text{C}, 20\text{km/h}}$ corresponding to excess emission at 20 °C and 20 km/h (in g), calculated from Annex 10.

A comparison can be made between the temperature and speed influences on total excess emission (i.e. after 12h of parking time). An example of influence of temperature decrease by 30 °C (20 °C to -10 °C) and average speed increase by 30 km/h (20 km/h to 50 km/h) on the f function is shown in Table 7. The joint influence of speed and temperature is ranging from -1.2 to 31, with an average of 4.5. Thus the influence of temperature and speed is very significant, temperature influence being higher than speed influence.

The light duty vehicles (LDV) are not concerned by our data base. Therefore we could consider, if necessary, that LDV excess emissions should be the same as for passenger cars (PC) but it would be much better to build a LDV cold start model using LDV specific data base.

Pollutant	Emission standard	Fuel type	f(-10°C,20 km/h)	f(20°C,20 km/h)	f(20°C,50 km/h)	$\frac{f(-10,20)}{f(20,50)}$
CO	Euro 0	Diesel	1.484	1	0.183	8.1
	Euro 0 w/o cat.	Gasoline	4.367	1	1.812	2.4
	Euro 0 cat.	Gasoline	11.757	1	1.239	9.5
	Euro 1	Diesel	1.932	1	0.128	15.1
		Gasoline	3.47	1	1.893	1.8
	Euro 2	Diesel	3.181	1	0.462	6.9
		Gasoline	2.281	1	0.911	2.5
	Euro 3	Diesel	1	1	0.698	1.4
Gasoline		6.223	1	1.356	4.6	
Euro 4	Gasoline	9.155	1	1	9.2	
CO ₂	Euro 0	Diesel	1	1	0.673	1.5
	Euro 0 w/o cat.	Gasoline	3.365	1	0.97	3.5
	Euro 0 cat.	Gasoline	1	1	0.94	1.1
	Euro 1	Diesel	1	1	0.489	2.0
		Gasoline	3.686	1	1.181	3.1
	Euro 2	Diesel	3.294	1	0.97	3.4
		Gasoline	1.769	1	1.118	1.6
	Euro 3	Diesel	1	1	0.94	1.1
Gasoline		2.295	1	1.542	1.5	
Euro 4	Gasoline	3.407	1	1	3.4	
HC	Euro 0	Diesel	1	1	0.188	5.3
	Euro 0 w/o cat.	Gasoline	6.709	1	2.032	3.3
	Euro 0 cat.	Gasoline	5.65	1	1.385	4.1
	Euro 1	Diesel	1.482	1	0.216	6.9
		Gasoline	1	1	0.458	2.2
	Euro 2	Diesel	8.358	1	0.553	15.1
		Gasoline	1.421	1	0.519	2.7
	Euro 3	Diesel	1	1	1.209	0.8
Gasoline		14.867	1	2.631	5.7	
Euro 4	Gasoline	31.179	1	1	31.2	
NOx	Euro 0	Diesel	1	1	-1.238	-0.8
	Euro 0 w/o cat.	Gasoline	1	1	-5.76	-0.2
	Euro 0 cat.	Gasoline	4.803	1	1.936	2.5
	Euro 1	Diesel	1	1	-0.853	-1.2
		Gasoline	1	1	2.406	0.4
	Euro 2	Diesel	30.458	1	1.723	17.7
		Gasoline	1	1	1.895	0.5
	Euro 3	Diesel	1	1	-10.065	-0.1
Gasoline		1.149	1	1.446	0.8	
Euro 4	Gasoline	1	1	1	1.0	

Table 7: Influence of temperature and speed on the speed and temperature function $f(T,V)$: comparison of 3 cases.

4.5. Near future vehicles

From the future evolution of the European standard of the vehicle emissions, the report number *** (Samaras et al., 2004) proposes cold excess emission reduction rates (see Table 8) for CO, HC, NOx and particulates for Euro 4 and 5 passenger cars.

Emission Standard	Gasoline				Diesel				
	CO	CO ₂	HC	NO _x	CO	CO ₂	HC	NO _x	
Euro3					1	1	1	1	
Euro4	No DISI	1	1	1	1	0.781	1	0.833	0.5
	DISI	1	0.9	1	1	0.781	1	0.833	0.5
Euro5	No DISI	1	0.9	1	1	0.781	1	0.833	0.35
	DISI	1	0.9	1	1	0.781	1	0.833	0.35

Table 8: Reduction rates to apply to the cold excess emissions for gasoline and diesel vehicles (Samaras et al., 2004).

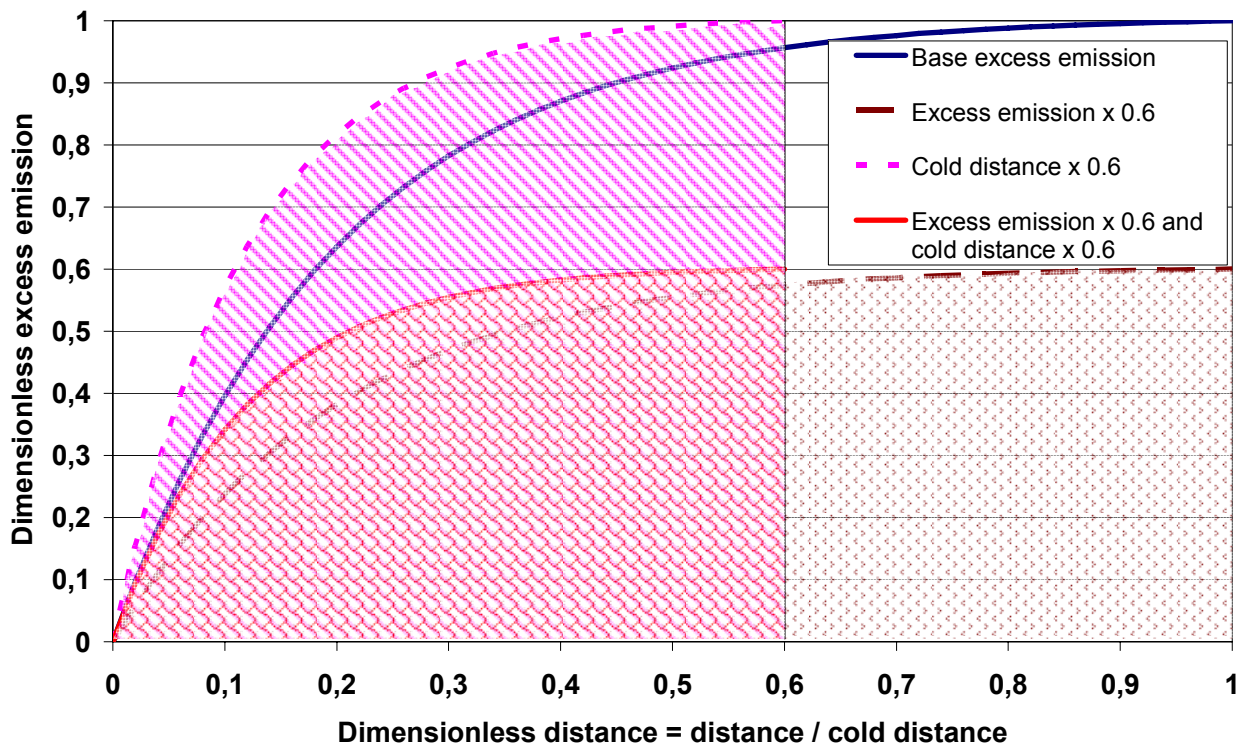


Figure 13: Comparison of ways to decrease excess emission, either by decreasing the total excess emission ω , or by decreasing also the cold distance d_c .

A decrease of the cold excess emission can come either from a decrease of the cold excess emission along the same cold distance, or from the only decrease of the cold distance, as shown Figure 13: the areas of both dotted curves are decreased by 40 % compared to the area of the base curve. Therefore both cold excess emissions ω (in g) are decreased by 64 %.

The equation of the base excess emission in the Figure 13 is defined as (if we do not take into account the parking time influence):

$$f(\delta) = \frac{\text{Excess Emission}(\delta)}{\text{Total Excess Emission}} = \frac{\omega_{20,20} \cdot f(T,V) \cdot h(\delta)}{\omega_{20,20} \cdot f(T,V) \cdot h(1)} = h(\delta)$$

- In this case $f_1 = \int_0^1 f(\delta) d\delta$ is the value of the area of the base curve
- If we apply the rate α only to the excess emission, the area of the new curve becomes:

$$f_2 = \int_0^1 \alpha \cdot f(\delta) d\delta = \alpha \cdot \int_0^1 f(\delta) d\delta = \alpha \cdot f_1$$

- If we apply the rate α only to the cold distance, the area of the new curve becomes:

$$f_3 = \int_0^{\alpha} f\left(\frac{\delta}{\alpha}\right) d\delta = \alpha \cdot \int_0^1 f(x) dx = \alpha \cdot f_1$$

- If we apply the rate α to the excess emission and to the cold distance, the area of the new curve becomes:

$$f_4 = \int_0^{\alpha} \alpha \cdot f\left(\frac{\delta}{\alpha}\right) d\delta = \alpha \cdot \int_0^1 \alpha \cdot f(x) dx = \alpha^2 \cdot f_1$$

So a decrease of 40 % applied both to the excess emission and to the cold distance, gives a total decrease of 64 %.

5. The different models

In this chapter, we propose different models to calculate the cold start excess emission with the different type of information the user could have. All the proposed models are for a pollutant and a vehicle type (i.e. for a given fuel type and a given emission standard).

5.1. Excess emission per start (model 1)

The model 1 gives an excess emission per start (i.e. per trip) in g for a car type and a given pollutant, as a function of the ambient temperature T , the mean speed during the cold period V , the travelled distance d , and the parking time t . It is presented in detail in section 4.4.

$$EE(p, T, V, \delta, t) = \omega_{20^{\circ}\text{C}, 20\text{km/h}}(p) \cdot f(p, T, V) \cdot h(T, \delta(p, T, V, d)) \cdot g(p, t) \quad (\text{Equation 5})$$

with:

EE = Excess emission for a trip (g)

p = Atmospheric pollutant

T = Ambient temperature ($^{\circ}\text{C}$)

V = Mean speed during the cold period (km/h)

$\delta(p, T, V, d) =$ Dimensionless distance $= \frac{d}{d_c(p, T, V)}$

d = Travelled distance (km)

$d_c(p, T, V) =$ Cold distance (km) for the pollutant p

$\omega_{20^{\circ}\text{C}, 20\text{km/h}}(p) =$ Reference excess emission (at 20 $^{\circ}\text{C}$ and 20 km/h) for a trip distance longer than the cold distance, i.e. in any case longer than 15 km (g), for the pollutant p

$f(p, T, V) =$ Plane function of the speed V and the temperature T, for the pollutant p

$h(p, \delta) = \frac{1 - e^{a(p)\delta}}{1 - e^{a(p)}}$

$a(p) =$ Constant coefficient for the pollutant p. It corresponds to the shape of the dimensionless excess emission.

$g(p, t) =$ % of excess emission at 12 h of parking as a function of the parking time t for the pollutant p

t = Parking time (h)

$\omega_{20^{\circ}\text{C}, 20\text{km/h}}(p)$ and $f(p, T, V)$ are given for each pollutant, regulated or unregulated one.

$h(p, \delta)$ and $g(p, t)$ are not available for the unregulated hydrocarbons (URHC). For these components, the functions h and g specific for the total hydrocarbons THC are used:

$h(\text{URHC}, \delta) = h(\text{THC}, \delta)$ and $g(\text{URHC}, t) = g(\text{THC}, t)$

5.2. Full model of excess emission of a traffic (model 2)

In a number of cases, assessing cold-start-related excess emissions for a single trip (for some micro inventories) is sufficient, but most emission inventories require calculating cold-start-related excess emissions not for a single vehicle and over a single trip, but for the whole traffic characterised by a number of parameters such as vehicle flow, average speed and environment conditions (hour, ambient temperature...).

5.2.1. General approach

The model 1 initially applied to a single trip must be extended to the whole traffic using the available statistical data relative to traffic parameters. The excess emission of a traffic due to the cold starts reads therefore as the product of the unit excess emission for a trip EE , defined by the model 1, by the number of trips cold starting:

$$E_c = \text{Number of trips cold starting} \cdot EE$$

The number of trips cold starting is expressed globally as the ratio of the total distance started with a cold start by the average distance of the trips started with a cold start:

$$\text{Number of trips cold starting} = \frac{L_{cold}^{total}}{L_{cold}^{mean}}$$

L_{cold}^{total} is the product of the traffic flow expressed in veh.km by the percentage of mileage started at cold start. This percentage is over the year for instance 69.0 % globally but varies with the global average speed from 61.3 to 75.6 % resp. for speeds lower than 10 km/h and speeds ranging from 40 to 50 km/h (Annex 18). For a given average speed v_i of the traffic, these parameters are tf_i and $cm(v_i)$, and:

$$L_{cold}^{total} = tf_i \cdot cm(v_i)$$

If we consider for instance only the cold started trips of length d_m , their number is expressed in the following way:

$$\text{Number of trips cold starting}(d_m) = L_{cold}^{total} \cdot \frac{p_m}{d_m}$$

where p_m is the share of the total distance started with a cold start corresponding to trips of length d_m . 2.5 % of the mileage started with a cold start correspond for instance to trip length of 11-12 km over the year (Annex 20).

In the same way, if we consider the cold started trips with an average speed v_i , to these trips correspond a number of cold distances of average cold speed v_j .

$$\text{Number of trips cold starting}(d_m, v_i) = \sum_j L_{cold}^{total} \cdot \frac{p_{m,j} \cdot p_{i,j}}{d_m}$$

where $p_{i,j}$ is the distribution (in %) of the cold started distance with an average trip speed v_i among the different speeds v_j during the cold distance. For instance 12.4 % of the mileage starting with a cold start and with an average trip speed of 60 to 70 km/h correspond to a cold speed lower than 10 km/h; this percentage varies from 0.0 to 46.0 according to the different cold and global speed ranges (Annex 19). At the same time p_m has to be related to the speed v_j , and expressed as $p_{m,j}$.

In the same way, if we consider a stop or parking duration t_n , it corresponds to a distance share p_n .

$$\text{Number of trips cold starting}(d_m, v_i, t_n) = \sum_j L_{cold\ total} \cdot \frac{P_{m,j} \cdot P_{i,j} \cdot P_n}{d_m}$$

As we must take into account all the cold started trips lengths d_m and all parking durations t_n , the number of trips cold starting is therefore the summations over m and n of the above expression.

In addition we would like to take into account the obvious influence of the hour (in the day) on the start number and on the parking time. Therefore the traffic flow tf_i and the parking duration share p_n are functions of the hour and are transformed into $tf_{i,h}$ and $p_{n,h}$. At the same time the cold starts must be distributed along the day by introducing the relative number of cold starts of the hour h (relative to the average hourly cold start number) p_h . But for instance if between 8 and 9 o'clock we have 185 % of cold starts related to the hourly average (Annex 21), it is due to the early time when a lot of people begin the day, but at the same time to the fact that the traffic is 16 % higher than the hourly average of the day (Table 9). The only influence of the hour is $185 / 116$. Generally speaking this influence is $p_h / ptf_{i,h}$, where $ptf_{i,h}$ is the relative variation of the traffic of average speed v_i for the hour h .

Finally we get the Equation 6 below, after summing on the hour h and the traffic speed range i , if necessary. For a given hour and a given speed these two summations are unnecessary, but the summations on the cold speed class j , the cold trip length class m and the parking duration class n are necessary.

5.2.2. Equation of the model 2

The model 2 gives an excess emission of a traffic in g , as a function of:

- traffic flow
- season (winter, intermediate, summer, year)
- average speed
- ambient temperature
- hour in the day

Distributions of the distance travelled according to average speed, ambient temperature and parking time are open to the user. Default values are given, but the user can enter his own distributions.

It should be noted that the distributions used in Joumard and Sérié (1999) were trip distributions, and therefore not coherent with the Equation 6. We modify them according to Duboudin and Crozat (2002).

$$E_c(p) = \sum_i \frac{cm(s, v_i)}{100} \cdot \omega_i(p) \cdot \left[\sum_h tf_{i,h} \cdot \frac{p_h}{ptf_{i,h}} \cdot \left(\sum_j \sum_m \sum_n \frac{P_{i,j} \cdot P_{m,j} \cdot P_{n,h}}{10^6 \cdot d_m} \cdot f(p, V_j, T) \cdot h(p, \delta(p, T, V_j, d_m)) \cdot g(p, t_n) \right) \right]$$

Equation 6

$E_c(p) =$	traffic excess emissions with a cold engine for the pollutant p corresponding to a traffic $tf_{i,h}$ (g)
$p =$	atmospheric pollutant
$i =$	vehicle type
$cm(s, v_i) =$	% of mileage recorded under cold start or intermediate temperature conditions for season s and overall speed v_i of vehicle type i
$s =$	season (winter, summer, intermediate, year)
$v_i =$	traffic overall average speed for the vehicle type i (km/h)
$\omega_i(p) =$	reference excess emission for the vehicle type i and the pollutant p (g)
$h =$	hour (1 to 24, day)
$tf_{i,h} =$	traffic flow for the studied vehicle type i and the hour h (km.veh)
$p_h =$	relative cold start number for the hour h (average=1)
$ptf_{i,h} =$	relative traffic for the studied vehicle type i and the hour h (average=1)
$j =$	speed class with a cold engine
$m =$	trip length class
$n =$	class of stops (0 – 1/4, 1/4 – 1/2, 1/2 – 3/4, 3/4 - 1, 1 - 2,... , >12h)
$p_{i,j} =$	% of the distance travelled at speed j with a cold engine, for the overall average speed considered, and for the studied vehicle type i (%)
$p_{m,j} =$	% of the distance started with a cold engine and distance d_m , for speed V_j with a cold engine (%)
$p_{n,h} =$	% of the distance travelled after a stop with a duration of t_n , for the hour h (%)
$d_m =$	average distance of the trips under cold start conditions of class m (km)
$f(p, V_j, T) =$	plane function of the speed V_j and the temperature T, for the pollutant p
$V_j =$	average speed with a cold engine corresponding to class j (km/h)
$T =$	ambient temperature (°C)
$h(p, \delta) =$	$\frac{1 - e^{a(p,T)\delta}}{1 - e^{a(p,T)}}$
$a(p) =$	constant coefficient for a pollutant p
$\delta(p, T, V_j, d_m) =$	Dimensionless distance = $\frac{d_m}{d_c(p, T, V)}$
$d_c(p, V_j, T) =$	cold distance for the pollutant p (km)
$g(p, t_n) =$	% of excess emission at 12h of parking as a function of the parking time t_n for the pollutant p
$t_n =$	parking time (h)

Among all these parameters, we can distinguish different types of parameters:

- some ones are purely internal and should not be modified by the user: $\omega_i(p)$, $f(p, V_j, T)$, $d_c(p, V_j, T)$ and $g(p, t_n)$. They are resp. given in Table 6, Annex 10, Table 5 and Annex 14.
- some parameters are input parameters: i , s , v_i , h , $tf_{i,h}$, $ptf_{i,h}$ and T . An example of $ptf_{i,h}$ is given in Table 9.
- some ones are internal parameters, but could be modified by the advanced user: $cm(s, v_i)$, p_h , $p_{i,j}$, $p_{m,j}$, $p_{h,n}$, d_m and V_j . They are resp. given in Annex 18, Annex 21, Annex 19, Annex 20, Annex 22, Annex 20 and Annex 20.

$\omega_i(p)$ and $f(p, V_j, T)$ are given for each pollutant p , regulated or unregulated one.

$h(p, \delta)$ and $g(p, t_n)$ are not available for the unregulated hydrocarbons (URHC). For these components, the functions h and g specific for the total hydrocarbons THC are used:

$$h(\text{URHC}, \delta) = h(\text{THC}, \delta) \text{ (or } a(\text{URHC}) = a(\text{THC}))$$

$$g(\text{URHC}, t_n) = g(\text{THC}, t_n)$$

According to Duboudin and Crozat (2002), the taking into account of the average speed in the Equation 6 is problematic, because of the possible difference between the average speed during the cold period and the average speed during the whole trip. A trip with an average speed v_i is subdivided into a cold phase and a hot phase. The cold phase can have an average speed V_j different from the global speed v_i . To calculate the global emission we add a hot emission calculated with v_i and a cold excess emission calculated with V_j :

$$E_{total}(trip) = EE_{cold}(V_j) + E_{hot}(v_i) \quad \text{Equation 7}$$

It is not really coherent: if the distance travelled during the cold phase d_c corresponds to an average speed V_j different from the speed of the whole trip v_i , the travelled distance in hot conditions cannot have an average speed v_i , and the global emission should be calculated with the formula:

$$E_{total}(d_c + d_{hot}) = EE_{cold}(V_j, d_c) + E_{hot}(V_j, d_c) + E_{hot}(V_{hot}, d_{hot}) \quad \text{Equation 8}$$

where V_{hot} is the average speed of the hot distance d_{hot} .

Therefore, when we calculate the traffic emission, we should use the Equation 6, but add $(E_{hot}(V_j, d_c) - E_{hot}(v_i, d_c))$. As the difference should be quite small, we do not apply this correction.

5.3. Aggregated model of excess unit emission of a traffic (model 3)

Both models 1 and 2 are not at all easy to be used by a common user: The first model needs to be completed by a model giving the number and the characteristics of the starts. The second model is the most comprehensive and accurate model, the most open to any user data, but is especially complex to use: As a lot of necessary statistics are really not common, to use the model can lead to misunderstandings.

Therefore we apply the second model, with all its default values, and transformed the outputs into an excess emission factor in mass per travelled distance (model 3), but with only few open input data.

The model 3 gives for a given vehicle type and an atmospheric pollutant an excess unit emission of a traffic in g/km, according to the season s , the ambient temperature T , the average speed v_i , and the

hour in the day h . It is a combined table for 4 seasons (winter, summer, intermediate, whole year), 8 speed ranges (5 to 75 km/h), 7 temperature ranges (-25 to 35°C), and 25 hours (24 hours and the whole day): see Annex 20 to Annex 29.

The using of this model 3 allows us to take into account the distribution of the cold starts along the day. But the calculation of the model 3 needs a specific assumption on the relative traffic distribution along the day ($ptf_{i,h}$): we used the so-called base distribution presented in Table 9 and .

But when applying this model 3, if the actual traffic distribution is very different from this base distribution, the overall emission calculated during the day can be wrong. For instance for average traffic distributions representative of USA, Belgium and Switzerland (Table 9 and), the using of the model 3 introduces an error for the whole day between 3 and 7 %. In this case, we recommend not to use the model 3 hour per hour, but:

- ✓ Either to use the model 2: the calculation will be very precise, with a detailed distribution of the cold excess emission along the day and an accurate summation over the day,
- ✓ Or to use the model 3 for the whole day (hour = whole day): the summation over the day of the hourly cold excess emissions will be accurate, but its distribution among the hours will not be accurate.

Applying this model allows us to get, for each pollutant and each vehicle type, a matrix of cold unit excess emissions in g/km, depending on the average speed, the ambient temperature, the season and the hour. The results for the regulated pollutants are presented in Annex 23 to Annex 32 for each season and the whole day. The results for unregulated pollutants are available on demand.

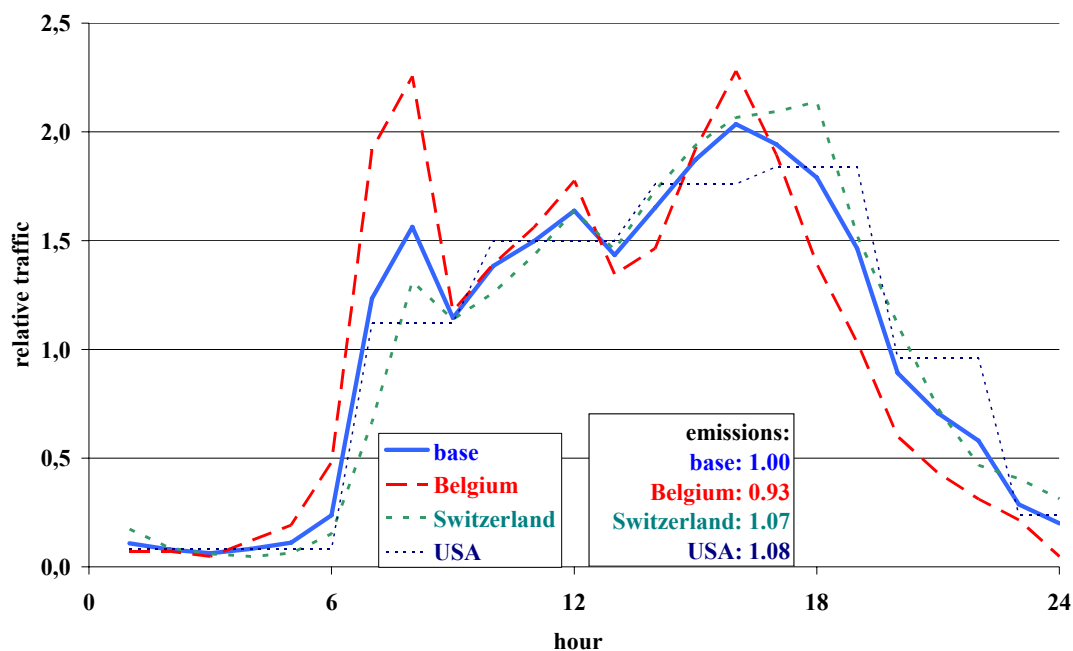


Figure 14: Average traffic distributions representative of 3 countries, and relative base distribution used in the model 3 design. Relative influence of the using of the different distributions on the daily emissions. .

In order to look at the relative influence of the different parameters, we present some illustrations on Figure 15 for the influence of the average speed and vehicle type, on Figure 16 for the influence of the ambient temperature and average speed, on Figure 17 for the season influence, and on Figure

18 for the influence of the hour. Similar results are presented in Annex 38 for PAH and in Annex 39 for VOC

hour	USA	Belgium	Switzerland	base
1	0.08	0.07	0.17	0.12
2	0.08	0.07	0.09	0.08
3	0.08	0.05	0.06	0.05
4	0.08	0.12	0.05	0.08
5	0.08	0.19	0.06	0.13
6	0.08	0.48	0.15	0.32
7	1.12	1.92	0.66	1.29
8	1.12	2.26	1.31	1.78
9	1.12	1.18	1.14	1.16
10	1.50	1.39	1.26	1.33
11	1.50	1.56	1.43	1.50
12	1.50	1.78	1.64	1.71
13	1.50	1.34	1.46	1.40
14	1.76	1.46	1.73	1.60
15	1.76	1.92	1.94	1.93
16	1.76	2.28	2.07	2.17
17	1.84	1.90	2.09	1.99
18	1.84	1.39	2.14	1.76
19	1.84	1.03	1.52	1.28
20	0.96	0.60	1.11	0.86
21	0.96	0.43	0.73	0.58
22	0.96	0.31	0.47	0.39
23	0.24	0.22	0.41	0.31
24	0.24	0.05	0.31	0.18
average	1.00	1.00	1.00	1.00
<i>emission for the whole day</i>	<i>1.03</i>	<i>0.93</i>	<i>1.04</i>	<i>1.00</i>

Table 9: Relative traffic distribution $ptf_{i,h}$ along the day for 3 countries and the base distribution used in the design of the model 3, with the error of the emission calculated with the model 3 for the whole day in case of traffic distributions different from the base case.

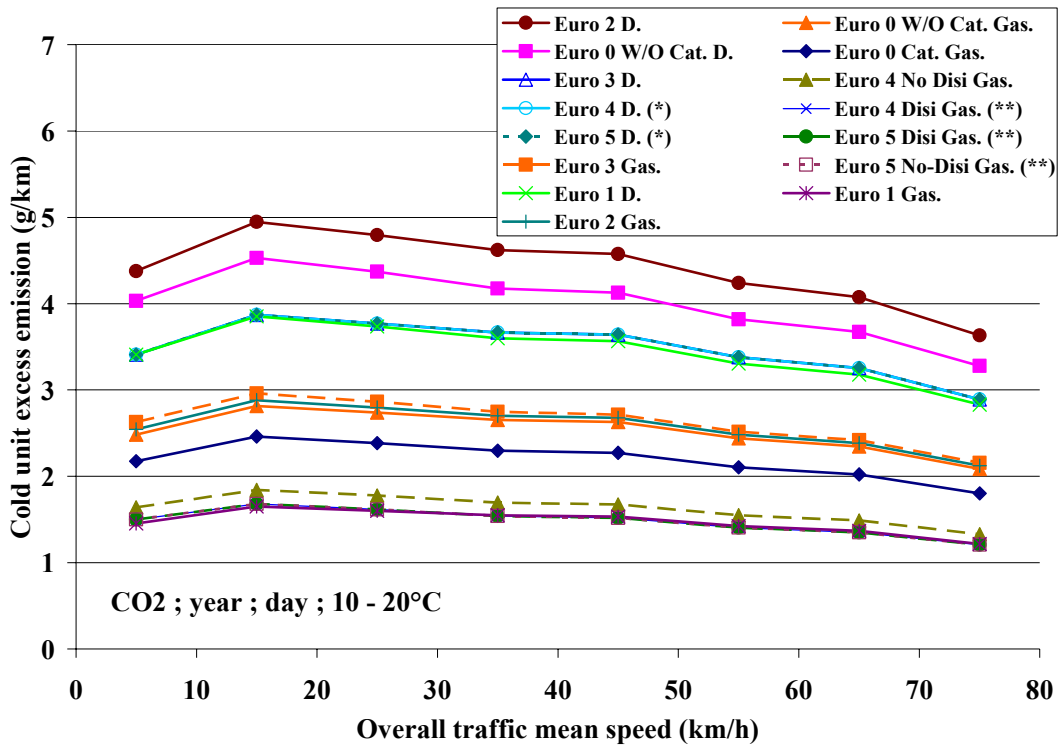


Figure 15: CO₂ cold unit excess emission according to average speed and vehicle technology (ambient temperature: 10-20°C, season: year, hour: whole day) (g/km). * Computed from Euro 3 Diesel. ** Computed from Euro 4 no DISI Gasoline.

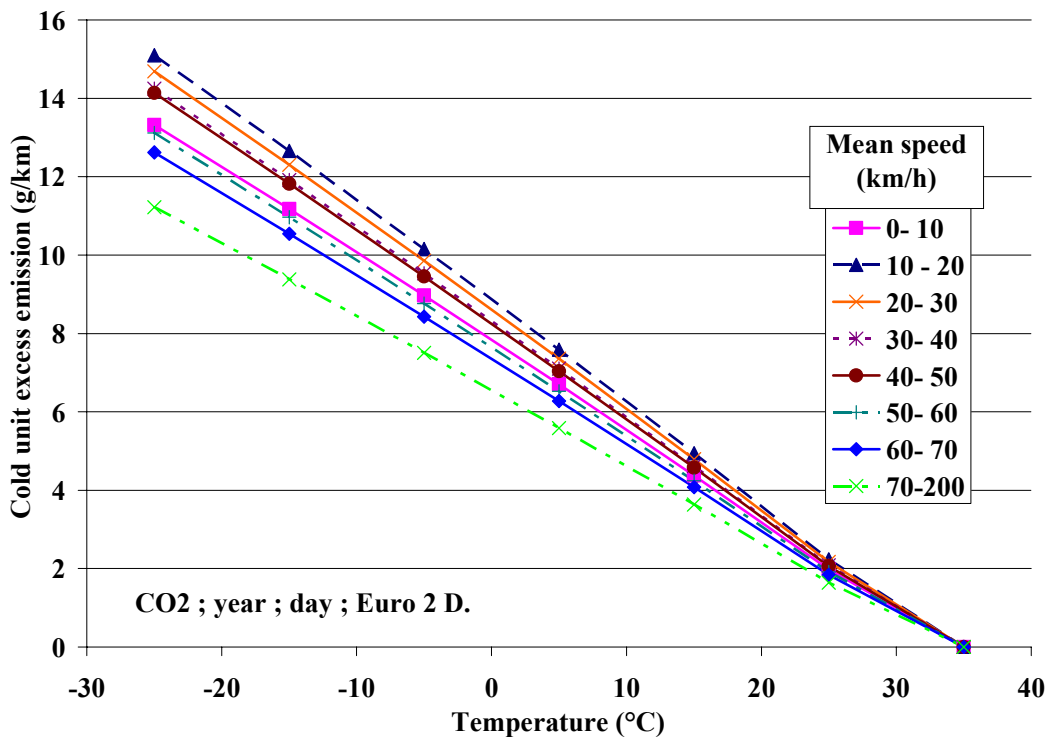


Figure 16: CO₂ cold unit excess emission according to ambient temperature and average speed for Euro 2 gasoline cars (season: year, hour: whole day) (g/km).

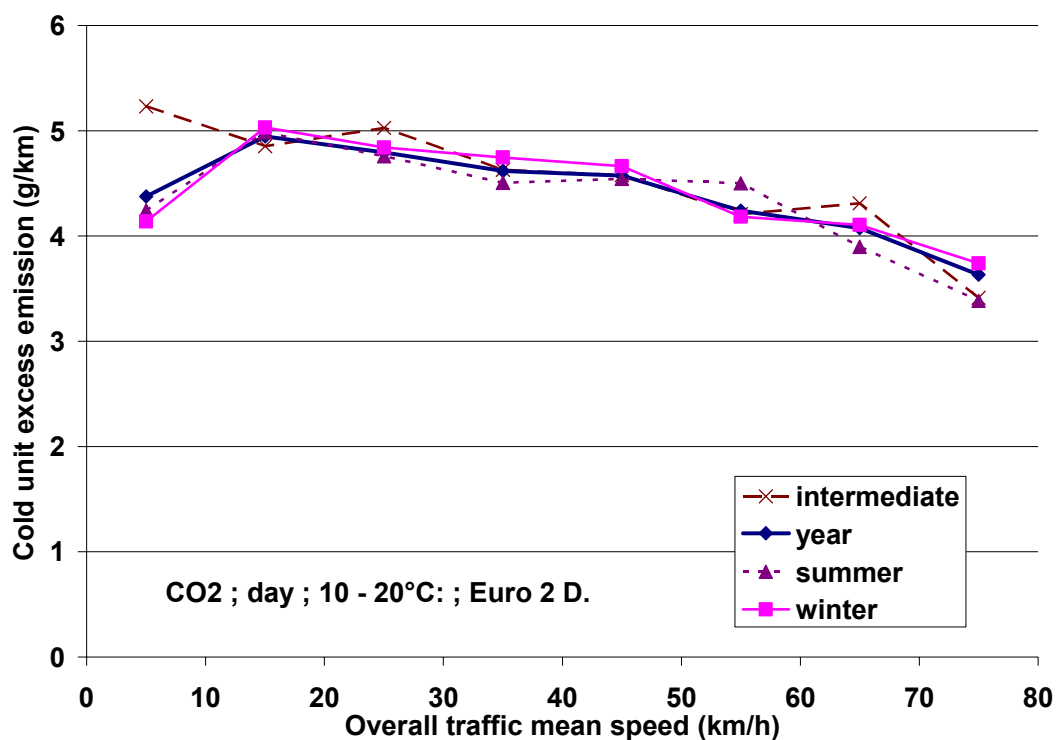


Figure 17: CO₂ cold unit excess emission according to season and average speed (ambient temperature: 10-20°C, gasoline Euro 2) (g/km).

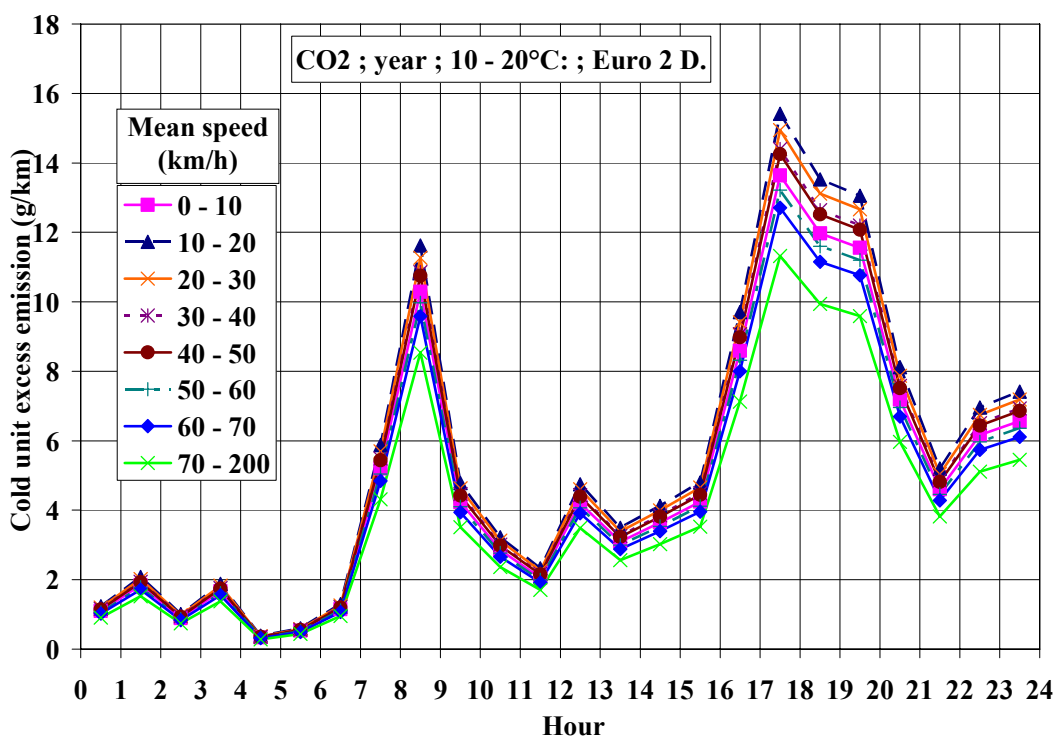


Figure 18: CO₂ cold unit excess emission according to hour and average speed (ambient temperature: 10-20°C, gasoline Euro 2) (g/km).

The influence of all these parameters depends on the pollutant considered. Nevertheless the ambient temperature, the average speed and the hour in the day play the major role. The season, for a same temperature, plays a minor role, with up to 15 % variations.

6. Conclusion

This modelling of excess emission under cold start conditions for passenger cars results from data provided by various European research organisations as part of the MEET and Artemis projects. The models take into account the average speed, ambient temperature and travelled distance, among other parameters. They are based on measurements made over 4 driving cycles at different ambient temperatures. The average speeds of these cycles range from 18.7 km/h to 41.5 km/h, and the temperatures range from -20 °C to 28 °C. The modelling counts in fact three models.

In a first model the cold excess emission is expressed in grams per start. It is given for a prescribed pollutant and a vehicle technology, i.e. for gasoline and diesel cars, from Euro 0 to Euro 4 emission standard. The general formula is written in the form of a reference excess emission multiplied by functions depending on average speed, ambient temperature, travelled distance and parking duration. The shape of the speed-temperature functions is assumed to be 3D-linear. We assumed that the influence of the travelled distance is, in order to simplify the model, an exponential function (with a temperature influence) for all the pollutants, even if the shape seems more complex for NO_x.

A second model is developed to assess the excess emissions of a traffic, and no more for a single vehicle. It uses a lot of driving behaviour statistics, and is therefore very complex. It allows the very experimented user to modify all these default data, in order to model very specific situations;

The third and final model is derived from the second one and provides a unit excess emission in g/km, therefore parallel to the hot emission factor. It takes into account the average speed, the ambient temperature, the hour in the day and the season.

The three models are available for numerous vehicle technologies (fuel + emission standard) covering the European situation, and for regulated as unregulated pollutants.

The models can be applied at different geographic scales: at a macroscopic scale (national inventories) using road traffic indicators and temperature statistics, or at a microscopic scale for a vehicle and a trip. If a model user could not access to necessary statistics, it would be recommended to use the most aggregated model, i.e. the third one.

All these models are improved versions of the former MEET model. The third one should replace the Copert III cold start model within the new inventorying tool Artemis. These models are presented for gasoline and diesel vehicles, the present and the near future ones.

This study corresponds to the state-of-the-art at the present time. In the future, this model could be improved by different ways:

- By updating this model using new data when available, either for the most recent passenger cars, or the light duty vehicles, or the heavy duty vehicles.
- It would be much more precise to have crossed distributions for different speeds and ambient temperatures.
- The number of analysed data has to be increased, especially for different speeds, low or high temperatures, and unregulated pollutants.

Annex 1: Laboratory acronyms, addresses and persons to contact

Lab name	Signification	Contact person	Address	E-Mail (or phone and fax number)
EMPA	Eidgenössische Materialprüfungs- und Forschungsanstalt	M. Weilenmann	Überlandstrasse 129, 8600 Dübendorf, Switzerland	martin.weilenmann@empa.ch
IM CNR	Istituto Motori National Research Council	M. Rapone	viale Marconi 8 80125 Napoli, Italy	mrap@motori.im.na.cnr.it
INFRAS AG	Infrastruktur-, Umwelt- und Wirtschaftsberatung	M. Keller	Mühlemattstrasse 45 CH-3007 Bern Switzerland	mario.keller@infras.ch
INRETS	Institut National de Recherche sur les Transports et leur Sécurité	R. Joumard	Case 24 F-69675 Bron Cedex France	joumard@inrets.fr
INTA	Instituto Nacional de Tecnica Aeroespacial	J. P. Laguna	Ctra de Ajalvir km 4 28850 Torrejón de Ardoz (Madrid) Spain	+34-15201723 +34-15201319
KTI	Institute for Transport Sciences	T. Meretei	XI. Thán Károly u. 3-5 1119 Budapest Hungary	meretei@mercury.kti.hu
LAT	Lab. Applied Thermodynamics	Z. Samaras	Aristotle Univ. Thessaloniki 54006 Thessaloniki Greece	zisis@auth.gr
Politecnico di Milano		S. Cernushi	P.za L. da Vinci, 32 I-20133 Milano Italy	+39-223996411 +39-223996499
TNO	Netherlands org. for applied scientific research	R. Vermeulen	P.O. Box 6033 2600 JA Delft The Netherlands	vermeulen@wt.tno.nl
TRL	Transport Research Laboratory	I. MacCrae	Old Wokingham road Crowthorne Berkshire RG 45 6AU England	imccrae@trl.co.uk
TU-Graz	Graz University of Technology	S. Hausberger	Kopernikusgasse 24 A-8010 Graz Austria	hausberger@vkm.tu- graz.ac.at
TÜV	TÜV Rheinland Sicherheit und Umweltschutz GmbH	D. Hassel	Konstantin Wille Strasse 1 D-51105 Köln Germany	+49-2218062479 +49-2218061756
VTI	Swedish National Road and Transport Research Institute	U. Hammarström	Statens väg- och transportforskninginstitut S-581 95 Linköping Sweden	ulf.hammarstrom@vti.se
VTT	Technical Research Centre of Finland	J. Laurikko	Engine Technology P.O. Box 1601 FIN-02044 VTT Finland	juhani.laurikko@vtt.fi

Annex 2: Vehicles, data and temperature distribution

The next tables give the number of vehicles per pollutant, laboratory, vehicle category and mean ambient temperature (°C) of the measurements.

Cycle Name	Emission Standard	Fuel type	Mean Temperature	CO	CO ₂	HC	NO _x
ECE-15	Euro 0 w/o cat.	Gasoline	11	36	33	34	35
			20	251	233	243	253
	Euro 0 cat.	Gasoline	20	739	739	739	739
			Euro 1	Diesel	-7	3	3
	Gasoline	-7		36	36	36	36
Euro 2	Gasoline	-7	26	26	26	26	
FTP72-1	Euro 0 w/o cat.	Diesel	20	50	49	50	50
		Gasoline	17	18	18	18	18
	Euro 0 cat.	Gasoline	20	727	727	727	727
			Euro 1	Diesel	20	2	
	Gasoline	22			3	3	3
	Euro 2	Gasoline	14	3	3	3	3
			Euro 2	Diesel	21		16
	Gasoline	22		15			
	Euro 3	Gasoline	16	5	5	5	5
			Diesel	17	2	2	2
Gasoline	22	10	10	10	10		
IRC	Euro 0 w/o cat.	Diesel	13	1	1	1	1
			20	3	3	3	3
		Gasoline	11	8	8	8	8
			21	9		9	9
			22		8		
	Euro 0 cat.	Gasoline	13	5	5	5	5
			18	5	5	5	5
	Euro 1	Diesel	18	2			
			21		3	3	3
		Gasoline	14	1	1	1	1
	19		3	3	3	3	
	Euro 2	Diesel	22		16	17	17
			23	13			
		Gasoline	10	1	1		1
			20	7			
			21		6		6
	22			3			
Euro 3	Diesel	22	3	4	4	4	
		Gasoline	22	11	12	10	12

Cycle Name	Emission Standard	Fuel type	Mean Temperature	CO	CO ₂	HC	NO _x
IUFC	Euro 0 w/o cat.	Diesel	13	1	1	1	1
			22	4	4	4	4
		Gasoline	-20	6	6	6	6
			-7	6	6	6	6
			10	7	7	7	7
	Euro 0 cat.	Gasoline	21	10	10	10	10
			11	3			
			12		4	4	4
	Euro 1	Diesel	19	6	6	5	6
			18	2			2
		Gasoline	21		3	3	
			10	1			
			12		2		2
	Euro 2	Diesel	20		2	2	2
			24	1			
			-20	6	6	6	6
		Gasoline	-7	6	6	6	6
			22	15		16	16
			23		17		
			-20	1	1	1	1
			-8	2	2	2	2
			12		1		
	Euro 3	Diesel	22		4	4	4
			23	3			
		Gasoline	-19	12	12	12	12
			-8	12	12	12	12
			14		1		
	Euro 4	Gasoline	23	19	20	17	18
			-19	2	2	2	2
			-8	3	3	3	3
			23	2	2	2	2

Table 10: Number of vehicles per driving cycle (defined in Table 1), regulated pollutant, vehicle category and mean ambient temperature of the measurements.

Cycle Name	Emission Standard	Fuel type	Mean Temperature	EMPA	IM	TNO	VTT	TUG	INRETS	
ECE-15	Euro 0 w/o cat.	Gasoline	11						138	
			20			772			208	
	Euro 0 cat.	Gasoline	20			2956				
			Euro 1	Diesel	-7			12		
	Gasoline	-7				144				
Euro 2	Gasoline	-7				104				
FTP72-1	Euro 0 w/o cat.	Diesel	20			176			23	
		Gasoline	17	24			8		40	
	Euro 0 cat.	Gasoline	20			2868			40	
			Euro 1	Diesel	20					2
	22							9		
	Euro 1	Gasoline	14						12	
			Euro 2	Diesel	21	17				30
	22	6						9		
	Euro 2	Gasoline	16						20	
			Euro 3	Diesel	17					8
	Gasoline	22		24					16	
IRC	Euro 0 w/o cat.	Diesel	13						4	
			20						12	
		Gasoline	11							32
			21	18	3					6
			22	6	1					1
	Euro 0 cat.	Gasoline	13						20	
			18							20
	Euro 1	Diesel	21						9	
			18							2
		Gasoline	19		4					8
			14							4
	Euro 2	Diesel	22	18	3					29
			23	6	1					6
		Gasoline	20		2					5
			21		4					8
			22		2					1
			10							3
Euro 3	Diesel	22		8					7	
	Gasoline	22	24	8					13	

Cycle Name	Emission Standard	Fuel type	Mean Temperature	EMPA	IM	TNO	VTT	TUG	INRETS	
IUFC	Euro 0 w/o cat.	Diesel	13						4	
			22						16	
		Gasoline	-20	24						
			-7	24						
			21	24	4					12
	Euro 0 cat.	Gasoline	10							28
			11							3
			12							12
	Euro 1	Diesel	19							23
			21							6
		Gasoline	18							4
			12							4
			20		3					3
	Euro 2	Diesel	10							1
			24		1					
			-20	24						
			-7	24						
		Gasoline	22	18	3					26
			23	6	1					10
			-20					4		
	Euro 3	Diesel	-8				8			
			12							1
		Gasoline	22		4		2			5
			23		8		4			5
			25		4		2			
			22		6					6
	Euro 4	Diesel	23		2					1
			-19	24			24			
		Gasoline	-8	24			24			
			23	24	20		24			6
			14							1

Table 11: Number of vehicles per driving cycle (defined in Table 1), laboratory, vehicle category and mean ambient temperature (°C) of the measurements for the regulated pollutants.

Cycle Name	Emission standard	Fuel type	T (°C)	EMPA	INRETS	IM	KTI	VTT
Art urban	Euro 3	gasoline	22			75		
IRC	Euro 0 w/o cat.	gasoline	22	16		62		
		gasoline	22			39		
	Euro 2	diesel	22	18		57	48	
		gasoline	22			123	48	
	Euro 3	diesel	22			101		
		gasoline	22	18		184		
IUFC	Euro 0 w/o cat.	diesel	22		133			
		gasoline	-20	13	64			
			-7	10		26		
			22	13		26		
	Euro 1	diesel	22		170			
		gasoline	22		191	35		
	Euro 2	diesel	-20	18	96			
			-7	18	320	26		
			22	18	320	26		
		gasoline	-20		320	26		13
			-7		386	128		13
		22		386	128		13	
	Euro 3	diesel	22		112	66		
		gasoline	-20	18	64	52		39
			-7	18	226	182		39
			22	18	226	182		39
	Euro 4	gasoline	-20		128	97		26
			-7		128	97		39
			22		128	97		26
	ECE-15	Euro 0 w/o cat.	diesel	22		6	26	
gasoline			22		7	26		
Euro 1		diesel	22		9	26		
		gasoline	22		13	26		

Table 12: Number of vehicles per driving cycle (defined in Table 1), laboratory, vehicle category and mean ambient temperature (°C) of the measurements for the unregulated pollutants.

Laboratory	Cycle Name	Temperature	CO	CO ₂	HC	NO _x	
EMPA	FTP72-1	Min	21.9	21.9	22.5	21.9	
		Max	23.4	23.4	23.4	23.4	
	IRC	Min	23.0	23.0	23.0	23.0	
		Max	23.0	23.0	23.0	23.0	
	IUFC	Min	-20.0	-20.0	-20.0	-20.0	
		Max	23.0	23.0	23.0	23.0	
INRETS	ECE-15	Min	8.0	8.0	8.0	8.0	
		Max	27.0	27.0	27.0	27.0	
	FTP72-1	Min	9.0	9.0	9.0	9.0	
		Max	26.0	26.0	26.0	26.0	
	IRC	Min	6.0	6.0	6.0	6.0	
		Max	25.0	28.0	28.0	28.0	
	IUFC	Min	4.0	4.0	4.0	4.0	
		Max	27.0	28.0	27.0	27.0	
	IM	IRC	Min	23.0	23.0	23.0	23.0
			Max	25.0	25.0	25.0	25.0
IUFC		Min	23.5	23.5	23.5	23.5	
		Max	26.0	26.0	26.0	26.0	
TNO	ECE-15	Min	20.0	20.0	20.0	20.0	
		Max	20.0	20.0	20.0	20.0	
	FTP72-1	Min	20.0	20.0	20.0	20.0	
		Max	20.0	20.0	20.0	20.0	
VTT	ECE-15	Min	-7.0	-7.0	-7.0	-7.0	
		Max	-7.0	-7.0	-7.0	-7.0	
	IUFC	Min	-20.0	-20.0	-20.0	-20.0	
		Max	23.7	23.7	23.7	23.7	
TUG	FTP72-1	Min	20.0	20.0	20.0	20.0	
		Max	20.0	20.0	20.0	20.0	

Table 13: Minimal and maximal ambient temperatures of the measurements per laboratory, driving cycle (defined in Table 1) and pollutant.

Annex 3: Vehicle distribution versus driving cycle to calculate PAH excess emission

Cycle Name	Art urban	IRC						IUFC							
Emission Standard	Euro 3	Euro 0 w/o cat	Euro 1	Euro 2		Euro 3		Euro 0 w/o cat		Euro 1		Euro 2		Euro 3	
Fuel Type	gasoline	gasoline	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline
Pollutant															
2,3-benzofluorene	1	1	1		2	2	3		1			1	1	2	4
acenaphthene	1	1	1	1	2	2	3	4	1	6	6	21	11	6	11
acenaphthylene	1	1	1	1	2	2	3	4	1	4	6	21	11	6	11
anthanthrene	1	1	1	1	2	2	3		1			1	1	2	3
anthracene	1	1	1	1	2	2	3	4	1	6	6	21	11	6	12
benz[a]anthracene	1	1	1		2	2	3	4	1	6	6	21	11	6	12
benzo[a]pyrene	1	1	1	7	8	2	3	4	1	6	6	21	11	6	12
benzo[b]chrysene + picene	1	1	1	1	2	2	3		1			1	1	2	3
benzo[b]fluoranthene								4		6	6	20	10	4	8
benzo[b]naphtho[1,2-d]thiophene	1	1	1	1	2	2	3		1			1	1	2	4
benzo[b+k+j]fluoranthene	1	1	1	1	2	2	3		1			1	1	2	4
benzo[c]phenanthrene	1	1	1		2	2	3		1			1	1	2	4
benzo[e]pyrene	1	1	1		2	2	3		1			1	1	2	4
benzo[g,h,i]fluoranthene	1	1	1	1	2	2	3		1			1	1	2	4
benzo[g,h,i]perylene	1	1	1	1	2	2	3	4	1	6	6	21	11	6	11
benzo[k]fluoranthene								4		6	6	20	10	4	8
chrysene								4		6	6	20	10	4	8
chrysene + triphenylene	1	1	1	1	2	2	3		1			1	1	2	4
coronene	1	1	1	1	2	2	3		1			1	1	2	4
cyclopenta[c,d]pyrene	1	1	1	1	2	2	3		1			1	1	2	4
dibenz[a,c]anthracene	1	1	1	1	2	2	3		1			1	1	2	4
dibenz[a,h]anthracene	1	1	1	1	2	2	3	4	1	6	6	21	11	6	12
fluoranthene	1	1	1	1	2	2	3	4	1	6	6	21	11	6	12
fluorene	1	1	1	1	2	2	3	4	1	6	6	21	11	6	11
indeno[1,2,3-c,d]pyrene	1	1	1	1	2	2	3	4	1	6	6	21	11	6	12
naphthalene	1	1		7	8	2	2	4	1	6	6	21	11	6	11
perylene	1	1	1	1	2	2	3		1			1	1	2	4
phenanthrene	1	1	1	1	2	2	3	4	1	6	6	21	11	6	12
pyrene	1	1	1	1	2	2	3	4	1	6	6	21	11	6	12

All the PAH are measured at 22°C.

Table 14: Number of vehicles per driving cycle (defined in Table 1), unregulated pollutant (PAH) and vehicle category.

Annex 4: Vehicle distribution versus driving cycle to calculate VOC excess emission

Cycle Name		Art urban	IRC						IUFC								ECE-15							
Emission Standard	Fuel type	Euro 3	Euro 0 w /o cat		Euro 1		Euro 2		Euro 3		Euro 0 w /o cat		Euro 1		Euro 2		Euro 3		Euro 4		Euro 0 w /o cat		Euro 1	
		gasoline	gasoline	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	gasoline	diesel	gasoline	gasoline	diesel	gasoline	diesel	gasoline
Pollutant	T																							
1,2,4-trimethylbenzene	22											1	2	2			1							
1,2-dimethylcyclohexane cis	22									1		2	2	1			2							
1,2-dimethylcyclohexane trans	22									1	1	2	6	4	1									
1,3,5-trimethylbenzene	22										1	1	5	4	1									
1,3,5-triphenylbenzene	22	1	1	1	1	2	2	3		1			1	1	2	3								
1,3-butadiene	-20													1		3	2							
	-7													1		3	3							
	22	1	1		1	2	1	3		1		1	1	5		5	2							
1,3-dimethyl-4-ethylbenzene	22											1		1										
1,4-diethylbenzene	22											1	1	3										
1,4-dimethyl-2-ethylbenzene	22													1										
1,4-dimethylcyclohexane cis	22									1		1	1	3		1								
1,4-dimethylcyclohexane trans	22											3	1	2		1								
1-butene	22									2		3	7	3	1	1								
1-methyl-2-isopropyl-benzene	22													1										
1-methyl-4-isopropyl-benzene	22													2										
1-methylnaphtalene	22										1		3											
1-pentene	22									2	2	3	10	5	1	4								
2,2,4-trimethylpentane	22	1	1		1	2	1	3		1		1	1	4		2								
2,2-dimethylbutane	22	1	1		1	2	1	3	1	1		2	6	10		5								
2,2-dimethylpropane	22	1	1		1	2	1	3	2	1	1	4	10	9	1	6								
2,5-dimethylbenzaldehyde	22	2	1	1	1	2	2	3		1		1	1	1	1	3								
2-butanone	22									1		3	1	6	4	1	2							
2-ethyltoluene	22											1	3	5	1	1								
2-methylnaphtalene	22										1		3											
2-methylpentane	22	1	1		1	2	1	3		1		1	1	4		2								
2-methylpropane	22									2		1	3	9	6	1	4							
3-ethyltoluene	22											3	2	6	1	1								
3-methylpentane	22	1	1		1	2	1	3		1		1	1	5		2								
4-ethyltoluene	22										1	2	4	4		1								
acetaldehyde	22	2	1	1	1	2	2	3	2	1	3	4	11	7	3	7								
Acetaldehyde + acrolein + formaldehyde	22				6	6																		
acetone	22									2		3	3	9	6	2	4							

Cycle Name		Art urban	IRC						IUFC								ECE-15								
Emission Standard	Fuel type	Euro 3	Euro 0 w/o cat		Euro 1		Euro 2		Euro 3		Euro 0 w/o cat		Euro 1		Euro 2		Euro 3		Euro 4		Euro 0 w/o cat		Euro 1		
		gasoline	gasoline	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel
Pollutant	T																								
acetone + acrolein	22	2	1	1		1	1	2		1	1	1		2											
acrolein	22								1		3		4	1											
benzaldehyde	22	2	1	1	1	2	2	3	2	1	2	1	7	3	1	3									
benzene	-20									5			6	1		9	2								
	-7									4			6	1		9	3								
	22	1	7		13	8	1	9		8		4	12	9	1	12	2								
butyraldehyde	22	2	1	1	1	2	2	3	2	1	3	1	11	2	1	3									
cis-2-butene	22								2		2	3	10	5	1	4									
crotonaldehyde	22	2	1	1	1	2	2	3	1	1	2	2	2	2	1	4									
cyclohexane	22								1		1			1											
ethane	-20													1		3	2								
	-7													1		3	3								
	22	1	1		1	2	1	3	2	1	1	4	11	11	1	7	2								
ethene	-20													1		3	2								
	-7													1		3	3								
	22	1	1		1	2	1	3	2	1	2	2	10	10	1	8	2								
ethylbenzene	-20													1		3	2								
	-7													1		3	3								
	22	1	1		7	8	1	3	1	1	1	2	9	11	1	6	2								
ethyne	-20													1		3	2								
	-7													1		3	3								
	22													1		3	2								
formaldehyde	22	2	1	1	1	2	2	3	2	1	3	4	11	7	3	7									
heptadecane	22										1		2		1										
heptane	22	1	1		1	2	1	3		1		1	1	4		2									
hexaldehyde	22	2	1	1	1	2	2	3	2	1	3	4	9	6	3	7									
hexane	22	1	1		1	2	1	3		1		1	1	4		2									
hexene	22								2		1	1	7	5	1	3									
i-butene	-20													1		3	2								
	-7													1		3	3								
	22													1		3	2								
isobutane	22	1	1		1	2	1	3	2	1		4	7	9	1	5									
isopentane	22	1	1		1	2	1	3		1		1	1	5		2									
isopropylbenzene	22												1		1	1									
isovaleraldehyde	22	2	1	1	1	2	2	3		1		1	1	1	1	3									
m+p+o-tolualdehyde	22	2	1	1	1	2	2	3		1		1	1	1	1	3									
methacrolein	22								2		1		2	1											

Cycle Name		Art urban	IRC						IUFC										ECE-15			
Emission Standard		Euro 3	Euro 0 w/o cat	Euro 1	Euro 2		Euro 3	Euro 0 w/o cat		Euro 1		Euro 2		Euro 3		Euro 4	Euro 0 w/o cat		Euro 1			
Fuel type		gasoline	gasoline	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline		
Pollutant	T																					
methane	-20								3				1		9	2						
	-7								2				1		9	3						
	22	1	5		1	2	1	9		6	1	1	5		11	2	6	7	9	13		
methyl ethyl ketone	22	2	1	1	1	2	2	3		1	1	1	1	1	3							
methylcyclopentane	22	1	1		1	2	1	3		1	1	1	4		2							
m-xylene	-20												1		3	2						
	-7												1		3	3						
	22												1		3	2						
m-xylene + o-xylene + p-xylene + ethylbenzene	-20											6										
	-7											6										
	22				6							6										
m-xylene + p-xylene	22								1	1	2	8	6	1	1							
n-butane	22	1	1		1	2	1	3		1	1	1	3	4	2							
n-decane	22								1	1	1	3	3	1	1							
n-dodecane	22								1	1	1	5	5	1								
NH3	22				6	6																
n-heptane	22														1							
n-hexadecane	22								1	1		5	3	1								
n-nonane	22								1		1	1	2		1							
nonadecane	22											1										
n-pentane	22	1	1		1	2	1	3	1	1	2	4	11	9	1	6						
n-undecane	22								1	1	1	5	1	1								
octadecane	22									1		2		1								
o-xylene	-20												1		3	2						
	-7												1		3	3						
	22								1	1	2	7	7	1	4	2						
pentadecane	22								1	1		4	3	1								
propane	-20												1		3	2						
	-7												1		3	3						
	22	1	1		1	2	1	3	2	1	2	4	11	11	1	9	2					
propene	-20												1		3	2						
	-7												1		3	3						
	22	1	1		1	2	1	3	2	1	2	4	10	11	1	9	2					
propionaldehyde	22	2	1	1	1	2	2	3	2	1	3	3	10	6	2	7						
propylbenzene	22										2	2	4	1	1							
p-tolualdehyde	22								2		3	3	9	4	1							
tert-butylbenzene	22									1		2		1								
tetradecane	22								1	1		5	4	1								
toluene	-20									5			6	1		9	2					
	-7									4			6	1		9	3					
	22	1	7		13	8	1	9	1	8	1	4	15	11	1	12	2					
trans-2-butene	22								2		3	5	3	1	2							
tridecane	22								1	1		4	4	1								
valeraldehyde	22	2	1	1	1	2	2	3	2	1	3	3	11	7	3	6						
xylene	22	1	1		7	8	1	3		1		1	1	4		2						

Table 15: Number of vehicles per driving cycle (defined in Table 1), unregulated pollutant (VOC) pollutant, vehicle category and mean ambient temperature (°C) of the measurements.

Annex 5: Standard correction of NOx emission according to humidity

According to E.P.A. (1976) and Lenner (1994), we present here the standard method to correct NOx emission according to air humidity.

In order to define the hygrometric state of the atmosphere, the mixing ratio r can be used, expressed in grams of water vapour per kilogram of dry air. This ratio depends on the atmospheric humidity, the temperature and the total pressure:

$$r = 6.2198 \cdot \frac{U \cdot e'_w}{P - U \cdot e'_w \cdot 10^{-2}}$$

with

$$\left\{ \begin{array}{l} U : \text{relative humidity in \%} \\ P : \text{atmospheric pressure in kPa} \\ e'_w : \text{saturated vapour pressure in kPa ; } e'_w = 0.61121 \cdot \exp \left[\frac{\left(18.729 - \frac{T}{227.3} \right) \cdot T}{T + 257.87} \right] \\ T : \text{temperature in } ^\circ\text{C} \end{array} \right.$$

In order to compute the correction factor, we have to multiply the emission by the factor K_H equal to:

$$K_H = \frac{1}{1 - 0.0266 \cdot (r - 10.71)} \text{ for FTP cycle}$$

$$K_H = \frac{1}{1 - 0.0329 \cdot (r - 10.71)} \text{ for ECE -15 cycle}$$

The first equation (FTP cycle) is valid for mixing ratio ranging between 2.86 g and 20.00 g of water vapour per kg of dry air, whereas, the second equation (ECE-15 cycle) is valid for ambient temperature between 20 °C and 30 °C and mixing ratio between 5.0 g and 12.2 g of water vapour per kg of dry air.

New correction factors are proposed within the Artemis project, different from the standard ones.

Annex 6: Distance (km) necessary to warm up the engine according to the pollutant and driving cycle

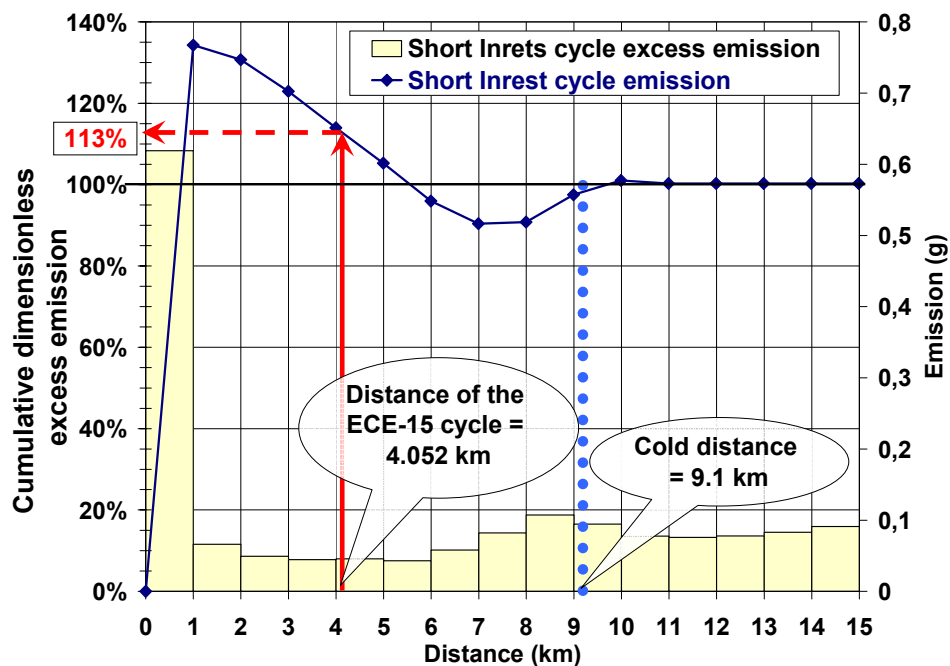
Cycle	Emission Standard	Fuel type	Mean Temperature	CO	CO ₂	HC	NO _x
IUFC	Euro 0 w/o cat.	Diesel	13	8.265	2.472	9.162	6.982
			22	5.863	3.915	7.140	4.699
		Gasoline	-20	5.343	5.140	6.578	5.817
			-7	4.213	5.919	5.972	4.964
			10	5.569	5.444	4.584	4.535
	Euro 0 cat.	Gasoline	21	4.943	5.164	4.339	3.656
			11	2.315			
			12		4.303	4.085	3.174
	Euro 1	Diesel	19	2.334	4.700	2.800	3.509
			18	8.746			1.644
		Gasoline	21		6.566	7.754	
			10	3.294			
			12		3.903		3.336
			20		6.840	7.051	4.702
	Euro 2	Diesel	24	9.311			
			-20	7.803	7.707	7.592	4.087
			-7	6.549	6.801	6.963	4.557
			22	5.884		6.576	3.092
		Gasoline	23		5.883		
			-20	7.215	9.125	9.127	0.500
			-8	4.245	7.994	6.151	4.196
			12		7.995		
	Euro 3	Diesel	22		7.870	8.665	8.021
			23	6.380			
		Gasoline	-19	4.603	6.760	8.565	4.295
			-8	4.624	6.487	6.245	2.480
			14		9.234		
23			3.691	4.595	4.386	3.920	
Euro 4	Gasoline	-19	7.192	7.563	9.634	4.065	
		-8	7.967	7.405	9.060	5.388	
		23	5.269	2.346	3.579	3.684	

Cycle	Emission Standard	Fuel type	Mean Temperature	CO	CO ₂	HC	NOx
IRC	Euro 0 w/o cat.	Diesel	13	5.813	9.764	9.194	5.037
			20	4.910	11.034	7.593	6.942
		Gasoline	11	6.958	10.304	6.381	6.302
			21	7.953		6.685	6.138
			22		6.697		
	Euro 0 cat.	Gasoline	13	3.728	7.965	5.400	6.087
			18	3.425	6.774	5.663	5.299
	Euro 1	Diesel	21		10.155	12.754	8.647
			18	7.809			
		Gasoline	14	4.014	4.282	7.559	5.785
			19	3.331	7.471	5.807	3.437
	Euro 2	Diesel	22		8.627	9.121	6.600
			23	7.875			
		Gasoline	10	3.784	7.723		1.869
			20	5.388			
			21		7.572		7.437
			22			7.125	
	Euro 3	Diesel	22	8.109	6.450	10.202	5.946
Gasoline		22	3.628	8.441	7.253	5.664	

Annex 7: Example of dimensionless excess emissions versus distance (km)

The figure below shows the cumulative dimensionless excess emission (ratio of absolute excess cold start emission to total absolute excess cold start emission) as a function of the distance (km) for short Inrets free-flow urban cycle (IUFC).

This graphic explains why sometimes the correction factor can be less than 1. In this case the emission per cycle is firstly very high then very low, i.e. lower than the hot emission, then increases, and finally decreases. Therefore the excess cold emission is sometimes negative.



Correction calculation: Example of ECE-15 cycle for NO_x pollutant on Euro 3 Gasoline cars (at -19°C).

Annex 8: Cold start excess emission (g) according to the driving cycle for regulated pollutants

Cycle	Emission Standard	Fuel type	Mean Temperature	CO	CO ₂	HC	NO _x
ECE15-1	Euro 0 w/o cat.	Gasoline	11	147	271	30.6	0.360
			20	31.3	69.9	3.91	-0.116
	Euro 0 cat.	Gasoline	20	14.2	127	2.56	0.718
			Euro 1	Diesel	-7	4.20	409
	Gasoline	-7		50.3	228	6.30	0.548
Euro 2	Gasoline	-7	23.4	259	4.57	0.254	
FTP72-1	Euro 0 w/o cat.	Diesel	20	1.19	113	0.442	0.117
		Gasoline	17	121	94.7	60.0	-2.41
	Euro 0 cat.	Gasoline	20	18.3	122	3.60	1.21
			Euro 1	Diesel	20	0.966	
	22			65.5	0.142	-0.378	
	Euro 1	Gasoline	14	41.3	64.7	4.37	1.51
			Euro 2	Diesel	21		112
	22	1.50					
	Euro 2	Gasoline	16	18.9	93.4	2.23	0.328
			Euro 3	Diesel	17	1.22	120
	Gasoline	22		7.91	135	1.15	-6.54E-2
IRC	Euro 0 w/o cat.	Diesel	13	1.38	173	0.358	4.74E-4
			20	1.12	198	0.454	0.107
		Gasoline	11	91.9	116	8.53	-1.25
			21	86.3		10.3	0.594
		22		99.5			
	Euro 0 cat.	Gasoline	13	72.9	102	6.67	3.02
			18	31.6	104	2.95	1.37
	Euro 1	Diesel	18	0.768			
			21		110	0.200	-0.373
		Gasoline	14	61.9	18.8	7.43	7.95E-2
	19		19.3	101	3.42	1.91	
	Euro 2	Diesel	22		140	0.261	0.123
			23	1.69			
		Gasoline	10	23.1	125		0.809
			20	15.6			
			21		153		1.27
	22			3.14			
Euro 3	Diesel	22	1.73	160	0.174	0.783	
	Gasoline	22	10.5	176	2.03	0.498	

Cycle	Emission Standard	Fuel type	Mean Temperature	CO	CO ₂	HC	NOx
IUFC	Euro 0 w/o cat.	Diesel	13	3.52	113	0.932	-0.678
			22	2.81	545	1.08	-0.183
		Gasoline	-20	290	400	72.1	2.10
			-7	171	177	32.2	0.471
			10	98.4	155	13.2	4.45E-2
			21	71.9	84.9	11.7	-0.142
	Euro 0 cat.	Gasoline	11	81.3			
			12		149	9.09	0.331
			19	47.0	127	7.14	1.27
	Euro 1	Diesel	18	2.18			-2.91E-3
			21		156	0.419	
		Gasoline	10	33.8			
			12		75.8		1.07
			20		62.7	8.52	2.79
			24	23.5			
	Euro 2	Diesel	-20	12.4	616	5.54	3.72
			-7	6.56	418	1.36	2.07
			22	2.87		0.452	9.83E-2
			23		143		
		Gasoline	-20	218	266	28.4	0.233
			-8	85.6	121	9.96	0.937
			12		199		
			22		133		
			23			4.61	0.852
			25	19.8			
	Euro 3	Diesel	22		164	0.148	-0.149
			23	2.07			
		Gasoline	-19	74.7	340	20.6	0.405
			-8	40.8	278	9.17	0.416
			14		124		
23			9.40	123	1.44	0.341	
Euro 4	Gasoline	-19	60.2	303	11.3	0.139	
		-8	43.4	192	6.58	0.224	
		23	5.48	75.1	0.645	0.177	

Annex 9: Excess emissions (g) versus vehicle speed (km/h) and ambient temperature (°C): data and regressions

pollutant	Emission Standard	Fuel type	T (°C)	ECE-15	IUFC	IRC	FTP72-1	
				18.7 km/h	19.03 km/h	41.11 km/h	41.5 km/h	
CO	Euro 0 w/o cat.	Diesel	10		3.52 (1)	1.38 (1)		
			20		2.81 (16)	1.12 (9)	1.19 (50)	
		Gasoline	-20		290 (36)			
			-10		171 (36)			
			10	147 (36)	98 (49)	92 (48)		
			20	31 (251)	72 (100)	86 (81)	121 (18)	
	Euro 0 cat.	Gasoline	10		81 (9)	73 (25)		
			20	14 (739)	47 (36)	32 (25)	18 (727)	
	Euro 1	Diesel	-10	4.2 (3)				
			20		2.18 (4)	0.768 (4)	0.966 (2)	
		Gasoline	-10	50 (36)				
			10		34 (1)	62 (1)	41 (3)	
	Euro 2	Diesel	20		23 (1)	19 (9)		
			-20		12 (36)			
			-10		6.56 (36)			
		Gasoline	20		2.87 (225)	1.69 (169)	1.5 (15)	
			-20		218 (1)			
			-10	23 (26)	86 (4)			
	Euro 3	Diesel	10			23 (1)		
			20		20 (24)	16 (49)	19 (5)	
		Gasoline	20		2.07 (9)	1.73 (9)	1.22 (2)	
			-20		75 (144)			
	Euro 4	Gasoline	-10		41 (144)			
			20		9.4 (323)	11 (110)	7.91 (10)	
-20				60 (4)				
			-10		43 (6)			
			20		5.48 (4)			

pollutant	Emission Standard	Fuel type	T (°C)	ECE-15	IUFC	IRC	FTP72-1
				18.7 km/h	19.03 km/h	41.11 km/h	41.5 km/h
CO ₂	Euro 0 w/o cat.	Diesel	10		113 (1)	173 (1)	
			20		545 (16)	198 (9)	113 (49)
		Gasoline	-20		400 (36)		
			-10		177 (36)		
			10	271 (33)	155 (49)	116 (48)	
			20	70 (233)	85 (100)	100 (64)	95 (18)
	Euro 0 cat.	Gasoline	10		149 (16)	102 (25)	
			20	127 (739)	127 (36)	104 (25)	122 (727)
	Euro 1	Diesel	-10	409 (3)			
			20		156 (9)	110 (9)	65 (3)
		Gasoline	-10	228 (36)			
			10		76 (4)	19 (1)	65 (3)
	Euro 2	Diesel	20		63 (4)	101 (9)	
			-20		616 (36)		
			-10		418 (36)		
		Gasoline	20	143 (289)	140 (256)	112 (16)	
			-20		266 (1)		
			-10	259 (26)	121 (4)		
	Euro 3	Diesel	10		199 (1)	125 (1)	
			20		133 (99)	153 (36)	93 (5)
		Gasoline	20		164 (16)	160 (16)	120 (2)
			-20		340 (144)		
	Euro 4	Gasoline	-10		278 (144)		
			10		124 (1)		
Gasoline		20	123 (360)	176 (132)	135 (10)		
		-20		303 (4)			
HC	Euro 0 w/o cat.	Diesel	10		0.932 (1)	0.358 (1)	
			20		1.08 (16)	0.454 (9)	0.442 (50)
		Gasoline	-20		72 (36)		
			-10		32 (36)		
			10	31 (34)	13 (49)	8.53 (48)	
			20	3.91 (243)	12 (100)	10 (81)	60 (18)
	Euro 0 cat.	Gasoline	10		9.09 (16)	6.67 (25)	
			20	2.56 (739)	7.14 (25)	2.95 (25)	3.6 (727)
	Euro 1	Diesel	-10	0.619 (3)			
			20		0.419 (9)	0.2 (9)	0.142 (3)
		Gasoline	-10	6.3 (36)			
			10			7.43 (1)	4.37 (3)
	Euro 2	Diesel	20		8.52 (4)	3.42 (9)	
			-20		5.54 (36)		
			-10		1.36 (36)		
		Gasoline	20	0.452 (256)	0.261 (289)	0.179 (15)	
			-20		28 (1)		
			-10	4.57 (26)	9.96 (4)		
	Euro 3	Diesel	20		4.61 (48)	3.14 (9)	2.23 (5)
			-20		0.148 (16)	0.174 (16)	0.137 (2)
		Gasoline	-10		21 (144)		
			20		9.17 (144)		
	Euro 4	Gasoline	20		1.44 (255)	2.03 (90)	1.15 (10)
			-20		11 (4)		
Gasoline		-10		6.58 (6)			
		20		0.645 (4)			

pollutant	Emission Standard	Fuel type	T (°C)	ECE-15	IUFC	IRC	FTP72-1	
				18.7 km/h	19.03 km/h	41.11 km/h	41.5 km/h	
NO _x	Euro 0 w/o cat.	Diesel	10		-0.678 (1)	0 (1)		
			20		-0.183 (16)	0.107 (9)	0.117 (50)	
		Gasoline	-20		2.1 (36)			
			-10		0.471 (36)			
			10	0.36 (35)	0.045 (49)	-1.25 (48)		
			20	-0.116 (253)	-0.142 (100)	0.594 (81)	-2.41 (18)	
	Euro 0 cat.	Gasoline	10		0.331 (16)	3.02 (25)		
			20	0.718 (739)	1.27 (36)	1.37 (25)	1.21 (727)	
	Euro 1	Diesel	-10	2.95 (3)				
			20		-0.003 (4)	-0.373 (9)	-0.378 (3)	
		Gasoline	-10	0.548 (36)				
			10		1.07 (4)	0.08 (1)	1.51 (3)	
	Euro 2	Diesel	20		2.79 (4)	1.91 (9)		
			-20		3.72 (36)			
			-10		2.07 (36)			
		Gasoline	20	0.098 (256)	0.123 (289)	0.179 (16)		
			-20		0.233 (1)			
			-10	0.254 (26)	0.937 (4)			
	Euro 3	Diesel	10			0.809 (1)		
			20		0.852 (63)	1.27 (36)	0.328 (5)	
		Gasoline	20		-0.149 (16)	0.783 (16)	0.375 (2)	
			-20		0.405 (144)			
	Euro 4	Gasoline	-10		0.416 (144)			
			20		0.341 (288)	0.498 (132)	-0.065 (10)	
-20				0.139 (4)				
			-10		0.224 (6)			
			20		0.177 (4)			

Table 16: Excess emission data (in g) from measurements per pollutant, per vehicle type, per cycle speed and per temperature. The number between brackets is the number of vehicles for each measurement.

pollutant	Emission Standard	Fuel type	T (°C)	ECE-15	IUFC	IRC	FTP72-1
				18.7 km/h	19.03 km/h	41.11 km/h	41.5 km/h
CO	Euro 0 w/o cat.	Diesel	10	3.29	3.26 (0.7%)	1.64 (-1.9%)	1.61
			20	2.85	2.83 (-0.1%)	1.2 (-0.7%)	1.17 (0.2%)
		Gasoline	-20	261	261 (1.0%)	290	290
			-10	207	208 (-2.2%)	236	236
			10	100 (3.2%)	100 (-0.2%)	129 (-4.0%)	129
			20	46 (-4.7%)	47 (3.5%)	75 (1.3%)	76 (3.7%)
	Euro 0 cat.	Gasoline	10	73	73 (1.0%)	76 (-0.4%)	76
			20	16 (-1.3%)	16 (6.6%)	19 (4.0%)	19 (-0.4%)
	Euro 1	Diesel	-10	4.2 (0.0%)	4.18	2.84	2.81
			20	2.2	2.18 (0.0%)	0.843 (-1.0%)	0.819 (1.5%)
		Gasoline	-10	51 (-0.1%)	51	61	61
			10	26	26 (2.3%)	36 (4.2%)	36 (1.3%)
	Euro 2	Diesel	20	14	14 (4.0%)	24 (-2.4%)	24
			-20	11	11 (1.1%)	9.64	9.62
			-10	8.77	8.75 (-3.3%)	7.65	7.63
		Gasoline	20	2.8	2.78 (0.3%)	1.68 (0.1%)	1.66 (-1.1%)
			-20	47	47 (7.8%)	46	46
			-10	39 (-6.6%)	39 (5.4%)	38	38
	Euro 3	Diesel	10	25	25	23 (0.1%)	23
			20	17	17 (1.4%)	16 (-0.3%)	16 (1.5%)
		Gasoline	20	2.08	2.08 (0.0%)	1.64 (0.5%)	1.63 (-3.4%)
			-20	66	66 (1.2%)	68	69
	Euro 4	Gasoline	-10	52	52 (-2.8%)	54	54
			20	8.14	8.17 (1.3%)	10 (0.5%)	10 (-2.6%)
Gasoline		-20	58	58 (0.4%)	58	58	
		-10	45	45 (-0.4%)	45	45	
			20	4.88	4.88 (1.1%)	4.88	4.88
CO ₂	Euro 0 w/o cat.	Diesel	10	171	170 (-5.0%)	127 (2.7%)	127
			20	171	170 (6.9%)	127 (3.6%)	127 (-1.2%)
		Gasoline	-20	344	344 (1.4%)	342	342
			-10	279	279 (-5.8%)	277	277
			10	148 (4.5%)	148 (0.5%)	146 (-2.6%)	146
			20	83 (-1.9%)	83 (0.2%)	81 (1.9%)	81 (1.4%)
	Euro 0 cat.	Gasoline	10	127	127 (1.5%)	120 (-1.8%)	120
			20	127 (0.0%)	127 (0.0%)	120 (-1.5%)	120 (0.1%)
	Euro 1	Diesel	-10	157 (6.2%)	156	99	98
			20	157	156 (0.0%)	99 (1.0%)	98 (-5.0%)
		Gasoline	-10	224 (0.2%)	224	232	232
			10	115	115 (-5.2%)	123 (-55.6%)	123 (-9.0%)
	Euro 2	Diesel	20	61	61 (0.3%)	69 (3.2%)	69
			-20	578	578 (0.6%)	575	575
			-10	469	469 (-1.2%)	466	466
		Gasoline	20	141	141 (0.1%)	138 (0.1%)	138 (-2.4%)
			-20	275	275 (-0.4%)	286	287
			-10	240 (0.7%)	240 (-9.9%)	251	251
	Euro 3	Diesel	10	169	169 (1.5%)	180 (-4.4%)	180
			20	133	133 (0.0%)	144 (0.6%)	145 (-5.5%)
		Gasoline	20	164	164 (0.0%)	156 (0.3%)	156 (-3.0%)
			-20	336	337 (0.1%)	387	388
	Euro 4	Gasoline	-10	282	283 (-0.2%)	334	334
			10	175	176 (-4.1%)	226	227
Gasoline		20	121	122 (0.1%)	173 (0.1%)	173 (-2.8%)	
		-20	271	271 (1.0%)	271	271	
			-10	220	220 (-1.5%)	220	220
			20	65	65 (1.3%)	65	65
pollutant	Emission Standard	Fuel type	T (°C)	ECE-15	IUFC	IRC	FTP72-1
				18.7 km/h	19.03 km/h	41.11 km/h	41.5 km/h

HC	Euro 0 w/o cat.	Diesel	10	1.08	1.07 (-1.5%)	0.451 (-2.6%)	0.44	
			20	1.08	1.07 (0.1%)	0.451 (0.1%)	0.44 (0.0%)	
		Gasoline	-20	58	58 (2.0%)	63	63	
			-10	45	45 (-4.0%)	50	50	
			10	19 (3.8%)	19 (-4.4%)	25 (-19.3%)	25	
	Euro 0 cat.	Gasoline	20	6.51 (-6.7%)	6.59 (4.4%)	12 (-1.7%)	12 (8.0%)	
			10	7.13	7.14 (2.1%)	7.92 (-1.9%)	7.93	
	Euro 1	Diesel	20	2.74 (-0.7%)	2.75 (6.1%)	3.53 (-1.9%)	3.55 (0.2%)	
			-10	0.619 (0.0%)	0.615	0.382	0.378	
		Gasoline	-10	0.422	0.419 (0.0%)	0.186 (0.7%)	0.182 (-2.8%)	
			10	6.52 (-0.3%)	6.48	3.97	3.92	
		Euro 2	Gasoline	10	6.52	6.48	3.97 (4.7%)	3.92 (1.0%)
				20	6.52	6.48 (2.4%)	3.97 (-1.6%)	3.92
	Euro 3	Diesel	-20	4.15	4.15 (2.5%)	4.02	4.02	
			-10	3.21	3.21 (-13.6%)	3.08	3.08	
		Gasoline	20	0.389	0.387 (1.4%)	0.257 (0.1%)	0.255 (-4.3%)	
			-20	6.85	6.82 (7.6%)	5.24	5.22	
		Euro 4	Gasoline	-10	6.25 (-3.7%)	6.23 (3.7%)	4.65	4.62
				20	4.47	4.45 (0.4%)	2.87 (0.9%)	2.84 (-2.7%)
	Euro 4	Diesel	20	0.147	0.148 (0.0%)	0.17 (0.2%)	0.17 (-2.4%)	
			-20	17	17 (1.7%)	19	19	
		Gasoline	-10	13	13 (-4.2%)	14	14	
			20	0.841	0.857 (4.1%)	1.94 (0.5%)	1.96 (-7.0%)	
		Euro 4	Gasoline	-20	10	10 (1.2%)	10	10
-10				7.65	7.65 (-1.6%)	7.65	7.65	
			20	0.244	0.244 (6.2%)	0.244	0.244	
NOx	Euro 0 w/o cat.	Diesel	10	-0.217	-0.213 (6.9%)	0.109 (-2287%)	0.115	
			20	-0.217	-0.213 (-1.6%)	0.109 (-0.1%)	0.115 (0.2%)	
		Gasoline	-20	0.128	0.121 (9.4%)	-0.373	-0.382	
			-10	0.128	0.121 (7.4%)	-0.373	-0.382	
			10	0.128 (6.4%)	0.121 (-17.2%)	-0.373 (7.0%)	-0.382	
	Euro 0 cat.	Gasoline	20	0.128 (21.0%)	0.121 (18.5%)	-0.373	-0.382 (8.4%)	
			10	1.65	1.66 (-40.2%)	2.17 (2.8%)	2.18	
	Euro 1	Diesel	20	0.716 (0.0%)	0.724 (4.3%)	1.23 (1.0%)	1.24 (-0.3%)	
			-10	1.29 (5.6%)	1.26	-0.373	-0.402	
		Gasoline	20	1.29	1.26 (4338%)	-0.373 (0.0%)	-0.402 (-0.6%)	
			-10	0.795 (-4.5%)	0.808	1.68	1.7	
		Euro 2	Gasoline	10	0.795	0.808 (2.5%)	1.68 (-	1.7 (-1.2%)
				20	0.795	0.808 (7.1%)	1.68 (1.2%)	1.7
	Euro 3	Diesel	-20	3.37	3.37 (0.9%)	3.41	3.41	
			-10	2.54	2.55 (-2.3%)	2.59	2.59	
		Gasoline	20	0.081	0.082 (1.7%)	0.126 (-0.3%)	0.126 (3.0%)	
			-20	0.678	0.684 (-19.3%)	1.15	1.15	
		Euro 4	Gasoline	-10	0.678 (-16.7%)	0.684 (2.7%)	1.15	1.15
				10	0.678	0.684	1.15 (-4.2%)	1.15
	Euro 4	Diesel	20	0.678	0.684 (2.0%)	1.15 (0.9%)	1.15 (-25.0%)	
			-20	-0.161	-0.148 (0.0%)	0.735 (0.6%)	0.751 (-10.0%)	
		Gasoline	-20	0.416	0.418 (-0.3%)	0.532	0.534	
			-10	0.397	0.399 (0.4%)	0.513	0.515	
		Euro 4	Gasoline	20	0.342	0.344 (-0.1%)	0.458 (0.8%)	0.46 (80.4%)
				-20	0.186	0.186 (-3.4%)	0.186	0.186
	Euro 4	Gasoline	-10	0.186	0.186 (1.7%)	0.186	0.186	
			20	0.186	0.186 (-0.5%)	0.186	0.186	

Table 17: Excess emission (in g) as calculated from regression per pollutant, per vehicle type, per cycle speed and per temperature. The number between brackets is the relative error between measurement and regression.

Annex 10: Equation of the excess emission $\omega(T,V)$ and correction coefficients $f(V,T)$

The equation describes the influence of the mean speed V [km/h] and the ambient temperature T [°C] on excess emission $\omega(T,V)$ [g] and the associated dimensionless correction coefficients $f(V,T)$. This equation results in a 3D linear regression (best fitted plan).

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega(T,V)$	Correction Coefficient $f(T,V)$
CO	Euro 0 w/o cat.	Diesel	77	$5.102 - 0.044 * T - 0.074 * V$	$1.851 - 0.016 * T - 0.027 * V$
		Gasoline	655	$129.521 - 5.361 * T + 1.285 * V$	$2.698 - 0.112 * T + 0.027 * V$
	Euro 0 cat.	Gasoline	1561	$128.022 - 5.731 * T + 0.126 * V$	$8.044 - 0.36 * T + 0.008 * V$
	Euro 1	Diesel	13	$4.662 - 0.067 * T - 0.061 * V$	$2.198 - 0.031 * T - 0.029 * V$
		Gasoline	51	$30.369 - 1.221 * T + 0.437 * V$	$2.068 - 0.083 * T + 0.03 * V$
	Euro 2	Diesel	481	$7.711 - 0.199 * T - 0.05 * V$	$2.824 - 0.073 * T - 0.018 * V$
		Gasoline	110	$32.873 - 0.74 * T - 0.051 * V$	$1.927 - 0.043 * T - 0.003 * V$
	Euro 3	Diesel	20	$2.455 - 0.02 * V$	$1.194 - 0.01 * V$
Gasoline		731	$35.45 - 1.455 * T + 0.096 * V$	$4.291 - 0.176 * T + 0.012 * V$	
Euro 4	Gasoline	14	$31.627 - 1.338 * T$	$6.488 - 0.274 * T$	
CO ₂	Euro 0 w/o cat.	Diesel	76	$854.4 - 17.56 * V$	$1.698 - 0.035 * V$
		Gasoline	617	$214.922 - 6.528 * T - 0.088 * V$	$2.602 - 0.079 * T - 0.001 * V$
	Euro 0 cat.	Gasoline	1568	$133.024 - 0.306 * V$	$1.048 - 0.002 * V$
	Euro 1	Diesel	24	$374.171 - 8.405 * T - 2.606 * V$	$2.43 - 0.055 * T - 0.017 * V$
		Gasoline	57	$162.937 - 5.435 * T + 0.358 * V$	$2.654 - 0.089 * T + 0.006 * V$
	Euro 2	Diesel	633	$362.34 - 10.921 * T - 0.14 * V$	$2.567 - 0.077 * T - 0.001 * V$
		Gasoline	173	$194.662 - 3.546 * T + 0.504 * V$	$1.454 - 0.026 * T + 0.004 * V$
	Euro 3	Diesel	34	$171.52 - 0.381 * V$	$1.047 - 0.002 * V$
Gasoline		791	$186.055 - 5.365 * T + 2.283 * V$	$1.496 - 0.043 * T + 0.018 * V$	
Euro 4	Gasoline	14	$168.005 - 5.165 * T$	$2.597 - 0.08 * T$	
HC	Euro 0 w/o cat.	Diesel	77	$1.607 - 0.028 * V$	$1.538 - 0.027 * V$
		Gasoline	645	$27.712 - 1.278 * T + 0.233 * V$	$4.068 - 0.188 * T + 0.034 * V$
	Euro 0 cat.	Gasoline	1557	$10.853 - 0.439 * T + 0.035 * V$	$3.893 - 0.157 * T + 0.013 * V$
	Euro 1	Diesel	24	$0.75 - 0.007 * T - 0.011 * V$	$1.835 - 0.016 * T - 0.026 * V$
		Gasoline	53	$8.653 - 0.114 * V$	$1.357 - 0.018 * V$
	Euro 2	Diesel	632	$2.38 - 0.094 * T - 0.006 * V$	$6.247 - 0.247 * T - 0.015 * V$
		Gasoline	93	$6.997 - 0.059 * T - 0.071 * V$	$1.597 - 0.014 * T - 0.016 * V$
	Euro 3	Diesel	34	$0.129 + 0.001 * V$	$0.863 + 0.007 * V$
Gasoline		643	$8.229 - 0.415 * T + 0.049 * V$	$9.093 - 0.459 * T + 0.054 * V$	
Euro 4	Gasoline	14	$5.184 - 0.247 * T$	$21.246 - 1.012 * T$	
NO _x	Euro 0 w/o cat.	Diesel	77	$-0.489 + 0.015 * V$	$2.472 - 0.074 * V$
		Gasoline	656	$0.934 - 0.036 * T - 0.017 * V$	$-7.182 + 0.276 * T + 0.133 * V$
	Euro 0 cat.	Gasoline	1568	$2.159 - 0.094 * T + 0.023 * V$	$2.894 - 0.126 * T + 0.031 * V$
	Euro 1	Diesel	19	$2.281 - 0.098 * T - 0.017 * V$	$-120.03 + 5.171 * T + 0.881 * V$
		Gasoline	57	$0.053 + 0.04 * V$	$0.063 + 0.047 * V$
	Euro 2	Diesel	633	$1.686 - 0.082 * T + 0.002 * V$	$20.076 - 0.978 * T + 0.024 * V$
		Gasoline	136	$0.287 + 0.021 * V$	$0.406 + 0.03 * V$
	Euro 3	Diesel	34	$-0.909 + 0.04 * V$	$8.335 - 0.367 * V$
Gasoline		718	$0.282 - 0.002 * T + 0.005 * V$	$0.808 - 0.005 * T + 0.015 * V$	
Euro 4	Gasoline	14	0.186	1	

Annex 11: Experimental cold distance (km) as a function of the vehicle speed (km/h) and the temperature (°C)

pollutant	Emission Standard	Fuel type	T (°C)	IUF	IRC
				19.03 km/h	41.11 km/h
CO	Euro 0 w/o cat.	Diesel	10	8.27 (1)	5.81 (1)
			20	5.86 (16)	4.91 (9)
		Gasoline	-20	5.34 (36)	
			-10	4.21 (36)	
			10	5.57 (49)	6.96 (48)
			20	4.94 (100)	7.95 (81)
	Euro 0 cat.	Gasoline	10	2.31 (9)	3.73 (25)
			20	2.33 (36)	3.42 (25)
	Euro 1	Diesel	20	8.75 (4)	7.81 (4)
			Gasoline	10	3.29 (1)
		20	9.31 (1)	3.33 (9)	
	Euro 2	Diesel	-20	7.8 (36)	
			-10	6.55 (36)	
			20	5.88 (225)	7.88 (169)
		Gasoline	-20	7.22 (1)	
			-10	4.25 (4)	
			10		3.78 (1)
	Euro 3	Diesel	20	6.38 (9)	8.11 (9)
			Gasoline	-20	4.6 (144)
	Euro 3	Gasoline	-10	4.62 (144)	
			20	3.69 (323)	3.63 (110)
			-20	7.19 (4)	
	Euro 4	Gasoline	-10	7.97 (6)	
			20	5.27 (4)	

pollutant	Emission Standard	Fuel type	T (°C)	IUFC	IRC
				19.03 km/h	41.11 km/h
CO ₂	Euro 0 w/o cat.	Diesel	10	2.47 (1)	9.76 (1)
			20	3.91 (16)	11 (9)
		Gasoline	-20	5.14 (36)	
			-10	5.92 (36)	
			10	5.44 (49)	10 (48)
			20	5.16 (100)	6.7 (64)
	Euro 0 cat.	Gasoline	10	4.3 (16)	7.97 (25)
			20	4.7 (36)	6.77 (25)
	Euro 1	Diesel	20	6.57 (9)	10 (9)
			10	3.9 (4)	4.28 (1)
		Gasoline	20	6.84 (4)	7.47 (9)
	Euro 2	Diesel	-20	7.71 (36)	
			-10	6.8 (36)	
			20	5.88 (289)	8.63 (256)
		Gasoline	-20	9.13 (1)	
			-10	7.99 (4)	
			10	7.99 (1)	7.72 (1)
	Euro 3	Diesel	20	7.87 (16)	6.45 (16)
			-20	6.76 (144)	
		Gasoline	-10	6.49 (144)	
			10	9.23 (1)	
	Euro 4	Gasoline	20	4.59 (360)	8.44 (132)
			-20	7.56 (4)	
			-10	7.41 (6)	
HC	Euro 0 w/o cat.	Diesel	10	9.16 (1)	9.19 (1)
			20	7.14 (16)	7.59 (9)
		Gasoline	-20	6.58 (36)	
			-10	5.97 (36)	
			10	4.58 (49)	6.38 (48)
			20	4.34 (100)	6.69 (81)
	Euro 0 cat.	Gasoline	10	4.08 (16)	5.4 (25)
			20	2.8 (25)	5.66 (25)
	Euro 1	Diesel	20	7.75 (9)	13 (9)
			10		7.56 (1)
		Gasoline	20	7.05 (4)	5.81 (9)
	Euro 2	Diesel	-20	7.59 (36)	
			-10	6.96 (36)	
			20	6.58 (256)	9.12 (289)
		Gasoline	-20	9.13 (1)	
			-10	6.15 (4)	
			20	5.71 (48)	7.13 (9)
	Euro 3	Diesel	20	8.67 (16)	10 (16)
			-20	8.57 (144)	
		Gasoline	-10	6.24 (144)	
			20	4.39 (255)	7.25 (90)
	Euro 4	Gasoline	-20	9.63 (4)	
			-10	9.06 (6)	
			20	3.58 (4)	

pollutant	Emission Standard	Fuel type	T (°C)	IUFC	IRC
				19.03 km/h	41.11 km/h
NOx	Euro 0 w/o cat.	Diesel	10	6.98 (1)	5.04 (1)
			20	4.7 (16)	6.94 (9)
		Gasoline	-20	5.82 (36)	
			-10	4.96 (36)	
			10	4.54 (49)	6.3 (48)
			20	3.66 (100)	6.14 (81)
	Euro 0 cat.	Gasoline	10	3.17 (16)	6.09 (25)
			20	3.51 (36)	5.3 (25)
	Euro 1	Diesel	20	1.64 (4)	8.65 (9)
			10	3.34 (4)	5.79 (1)
		Gasoline	20	4.7 (4)	3.44 (9)
	Euro 2	Diesel	-20	4.09 (36)	
			-10	4.56 (36)	
			20	3.09 (256)	6.6 (289)
		Gasoline	-20	0.5 (1)	
			-10	4.2 (4)	
			10		1.87 (1)
	Euro 3	Diesel	20	8.02 (16)	5.95 (16)
			-20	4.3 (144)	
		Gasoline	-10	2.48 (144)	
	Euro 4	Gasoline	20	3.92 (288)	5.66 (132)
			-20	4.07 (4)	
			-10	5.39 (6)	
				20	3.68 (4)

Table 18: Experimental cold distance (in km) per pollutant, per vehicle type, per cycle speed and per temperature. The number between brackets is the number of vehicles for each measurement.

pollutant	Emission Standard	Fuel type	T (°C)	IUFC	IRC
				19.03 km/h	41.11 km/h
CO	Euro 0 w/o cat.	Diesel	10	7.58 (0.8%)	6.5 (-1.2%)
			20	5.91 (-0.1%)	4.83 (0.2%)
		Gasoline	-20	5.03 (0.6%)	7.58
			-10	5.03 (-1.9%)	7.58
			10	5.03 (1.0%)	7.58 (-0.9%)
			20	5.03 (-0.2%)	7.58 (0.5%)
	Euro 0 cat.	Gasoline	10	2.48 (-0.7%)	3.67 (0.2%)
			20	2.29 (0.2%)	3.48 (-0.2%)
	Euro 1	Diesel	20	8.75 (0.0%)	7.81 (0.0%)
			10	6.3 (-9.1%)	3.4 (1.5%)
		Gasoline	20	6.3 (3.2%)	3.4 (-0.2%)
	Euro 2	Diesel	-20	7.43 (0.5%)	9.44
			-10	7.04 (-0.7%)	9.05
			20	5.86 (0.0%)	7.88 (0.0%)
		Gasoline	-20	4.9 (3.2%)	5.43
			-10	4.88 (-1.5%)	5.41
			10	4.85	5.37 (-4.2%)
	Euro 3	Diesel	20	6.38 (0.0%)	8.11 (0.0%)
			-20	4.72 (-0.3%)	4.64
		Gasoline	-10	4.47 (0.3%)	4.39
			20	3.71 (-0.1%)	3.63 (0.0%)
	Euro 4	Gasoline	-20	7.92 (-1.0%)	7.92
			-10	7.32 (0.8%)	7.32
			20	5.51 (-0.5%)	5.51
CO ₂	Euro 0 w/o cat.	Diesel	10	3.83 (-5.5%)	10.9 (-1.2%)
			20	3.83 (0.2%)	10.9 (0.1%)
		Gasoline	-20	5.98 (-1.6%)	9.1
			-10	5.74 (0.3%)	8.86
			10	5.26 (0.3%)	8.38 (1.9%)
			20	5.02 (0.3%)	8.14 (-2.2%)
	Euro 0 cat.	Gasoline	10	4.58 (-0.6%)	7.37 (0.7%)
			20	4.58 (0.3%)	7.37 (-0.9%)
	Euro 1	Diesel	20	6.57 (0.0%)	10.2 (0.0%)
			10	5.37 (-3.8%)	7.15 (-6.7%)
		Gasoline	20	5.37 (2.1%)	7.15 (0.4%)
	Euro 2	Diesel	-20	7.49 (0.3%)	10.2
			-10	7.09 (-0.4%)	9.84
			20	5.87 (0.0%)	8.63 (0.0%)
		Gasoline	-20	9.29 (-0.2%)	12.5
			-10	8.05 (-0.1%)	11.3
			10	5.57 (3.0%)	8.78 (-1.4%)
	Euro 3	Diesel	20	4.33 (0.0%)	7.54 (0.0%)
			20	7.87 (0.0%)	6.45 (0.0%)
		Gasoline	-20	6.89 (-0.2%)	10.7
			-10	6.32 (0.3%)	10.1
	Euro 4	Gasoline	10	5.19 (4.4%)	9.01
			20	4.62 (-0.1%)	8.44 (0.0%)
			-20	8.23 (-0.9%)	8.23
Gasoline		-10	6.81 (0.8%)	6.81	
		-20	2.57 (-1.0%)	2.57	
		20	2.57 (-1.0%)	2.57	

pollutant	Emission Standard	Fuel type	T (°C)	IUFC	IRC
				19.03 km/h	41.11 km/h
HC	Euro 0 w/o cat.	Diesel	10	8.97 (0.2%)	9.39 (-0.2%)
			20	7.15 (0.0%)	7.57 (0.0%)
		Gasoline	-20	6.39 (0.3%)	8.45
			-10	5.87 (0.2%)	7.94
			10	4.84 (-0.6%)	6.9 (-0.8%)
			20	4.32 (0.0%)	6.38 (0.5%)
	Euro 0 cat.	Gasoline	10	3.55 (1.3%)	5.74 (-0.6%)
			20	3.14 (-1.2%)	5.32 (0.6%)
	Euro 1	Diesel	20	7.75 (0.0%)	12.8 (0.0%)
		Gasoline	10	8.8	7.56 (0.0%)
				20	7.05 (0.0%)
	Euro 2	Diesel	-20	7.41 (0.2%)	9.97
			-10	7.2 (-0.3%)	9.75
			20	6.57 (0.0%)	9.12 (0.0%)
		Gasoline	-20	7.17 (2.1%)	8.6
			-10	6.8 (-1.1%)	8.23
			20	5.69 (0.0%)	7.13 (0.0%)
	Euro 3	Diesel	20	8.67 (0.0%)	10.2 (0.0%)
			-20	7.97 (0.7%)	10.9
		Gasoline	-10	7.04 (-1.3%)	10
	20		4.27 (0.3%)	7.25 (0.0%)	
	Euro 4	Gasoline	-20	10.2 (-0.6%)	10.2
			-10	8.58 (0.5%)	8.58
			20	3.76 (-0.5%)	3.76
NOx	Euro 0 w/o cat.	Diesel	10	5.06 (2.8%)	6.96 (-3.8%)
			20	4.82 (-0.3%)	6.73 (0.3%)
		Gasoline	-20	5.68 (0.2%)	7.93
			-10	5.2 (-0.5%)	7.45
			10	4.24 (0.7%)	6.5 (-0.3%)
			20	3.77 (-0.3%)	6.02 (0.2%)
	Euro 0 cat.	Gasoline	10	3.59 (-1.3%)	5.82 (0.4%)
			20	3.33 (0.5%)	5.56 (-0.5%)
	Euro 1	Diesel	20	1.64 (0.0%)	8.65 (0.0%)
			10	4.02 (-2.1%)	3.67 (3.7%)
				20	4.02 (1.4%)
	Euro 2	Diesel	-20	4.43 (-0.8%)	7.92
			-10	4.1 (1.0%)	7.59
			20	3.11 (-0.1%)	6.6 (0.0%)
		Gasoline	-20	3.14 (-52.8%)	8.46
			-10	2.84 (3.2%)	8.17
			10	2.25	7.57 (-30.5%)
	Euro 3	Diesel	20	1.95 (-0.2%)	7.28 (0.2%)
			20	8.02 (0.0%)	5.95 (0.0%)
		Gasoline	-20	3.65 (1.5%)	5.66
	-10		3.65 (-4.7%)	5.66	
			20	3.65 (0.7%)	5.66 (0.0%)
	Euro 4	Gasoline	-20	4.89 (-2.0%)	4.89
			-10	4.66 (1.4%)	4.66
20			3.96 (-0.7%)	3.96	

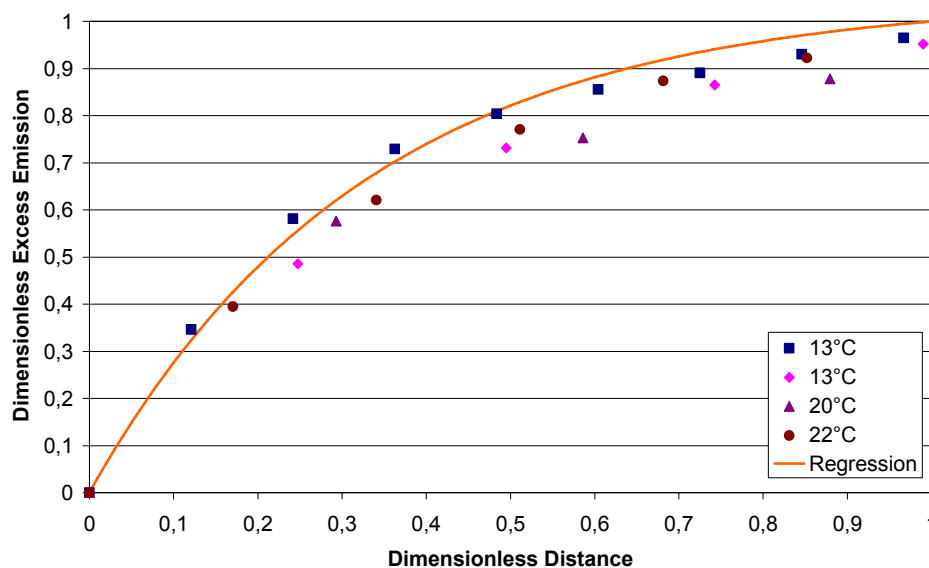
Table 19: Cold distance (in km) as modelled by regression per pollutant, per vehicle type, per cycle speed and per temperature. The number between brackets is the relative error between measurement and regression.

Annex 12: Dimensionless excess emission versus dimensionless distance

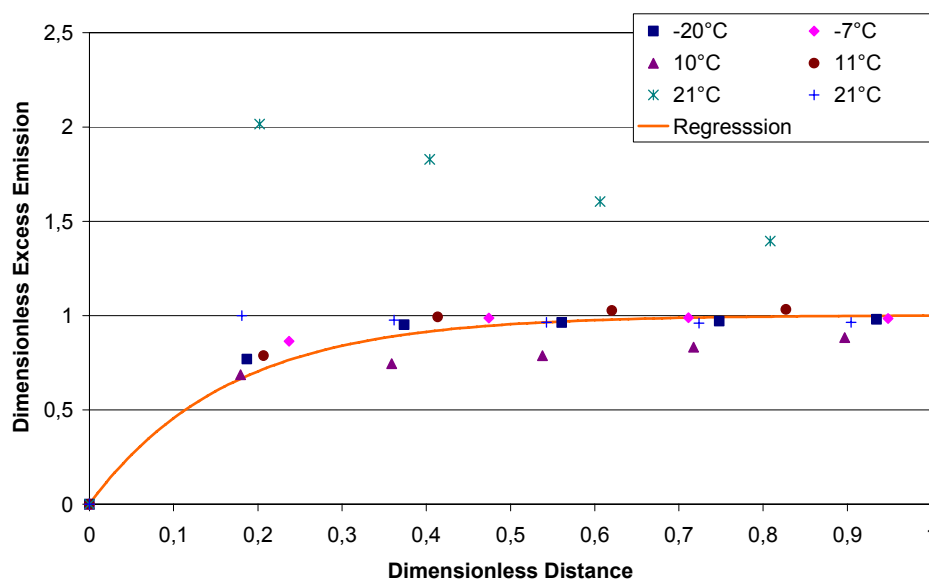
In the figures, one point is for a given dimensionless distance.

Annex 12.1: CO

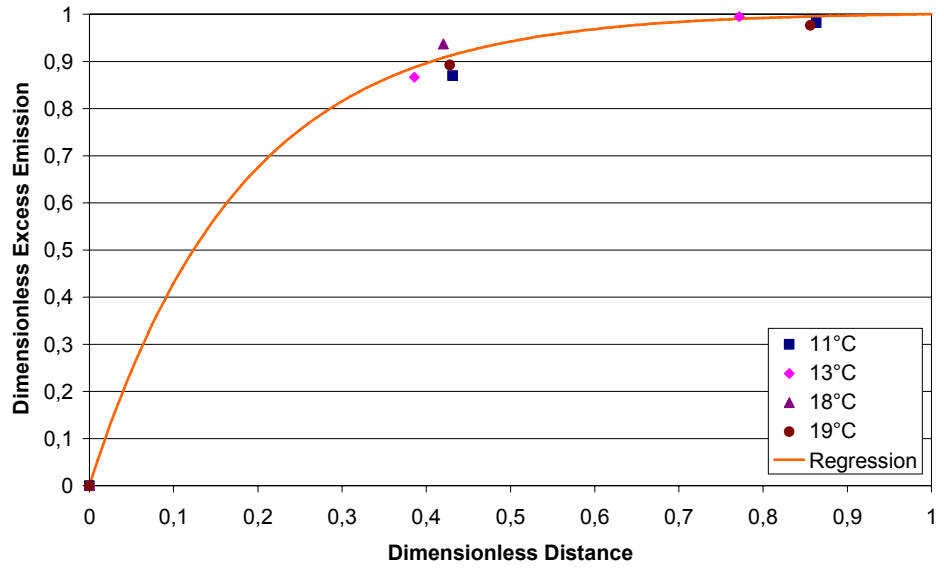
Euro 0 w/o Cat.
diesel



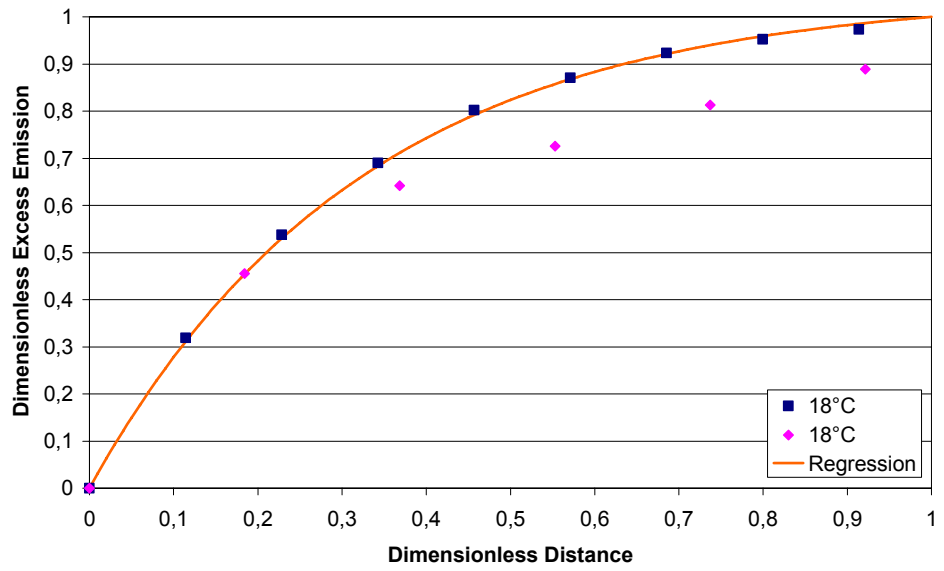
Euro 0 w/o Cat.
Gasoline



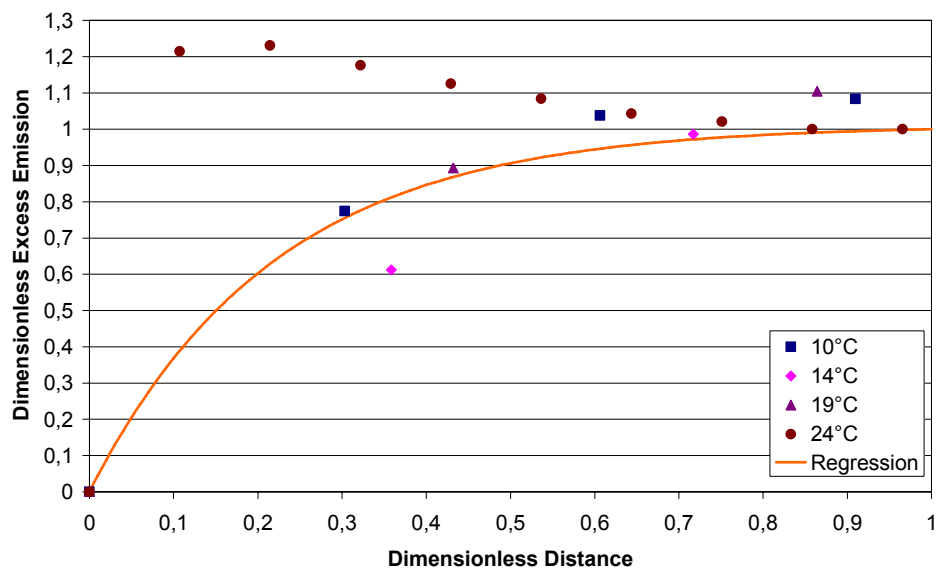
Euro 0 Cat. Gasoline



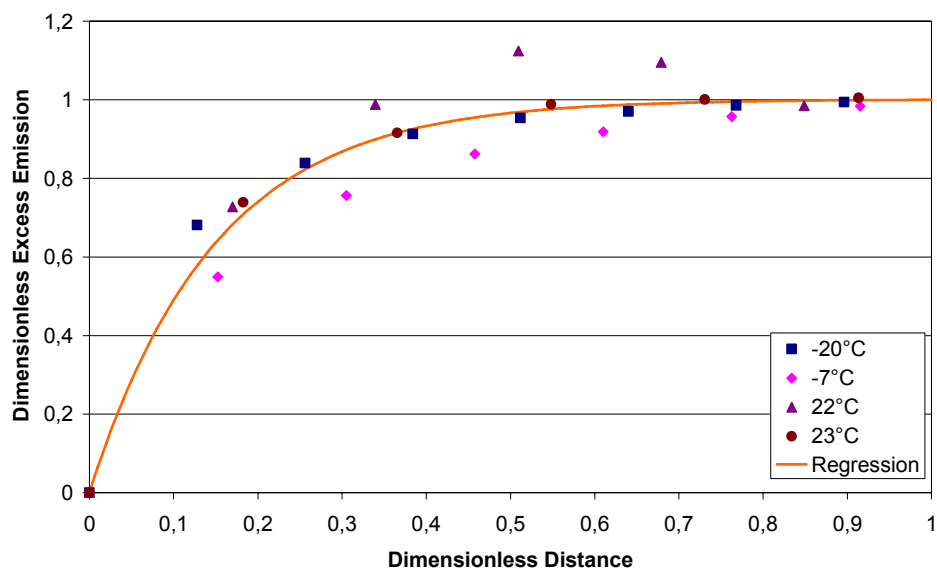
Euro 1 diesel



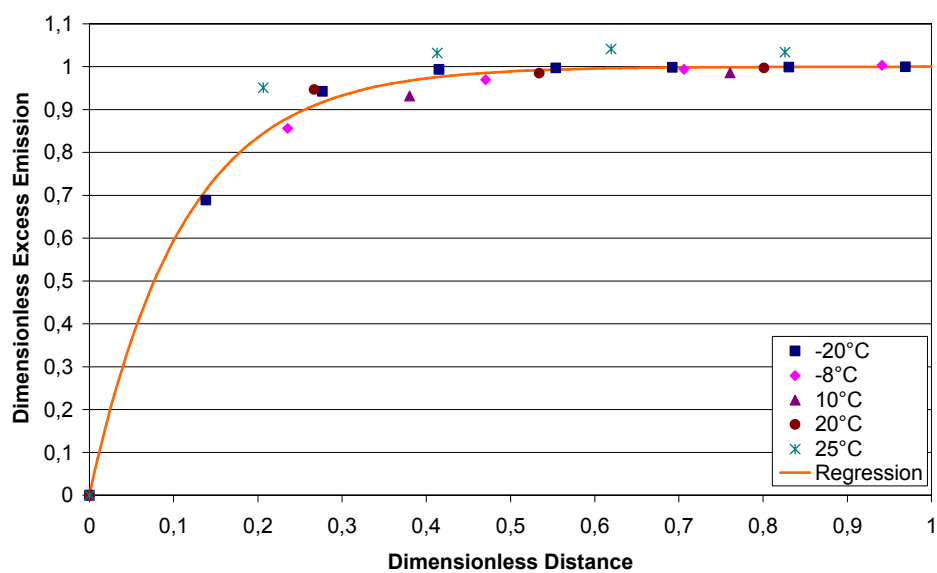
Euro 1 Gasoline



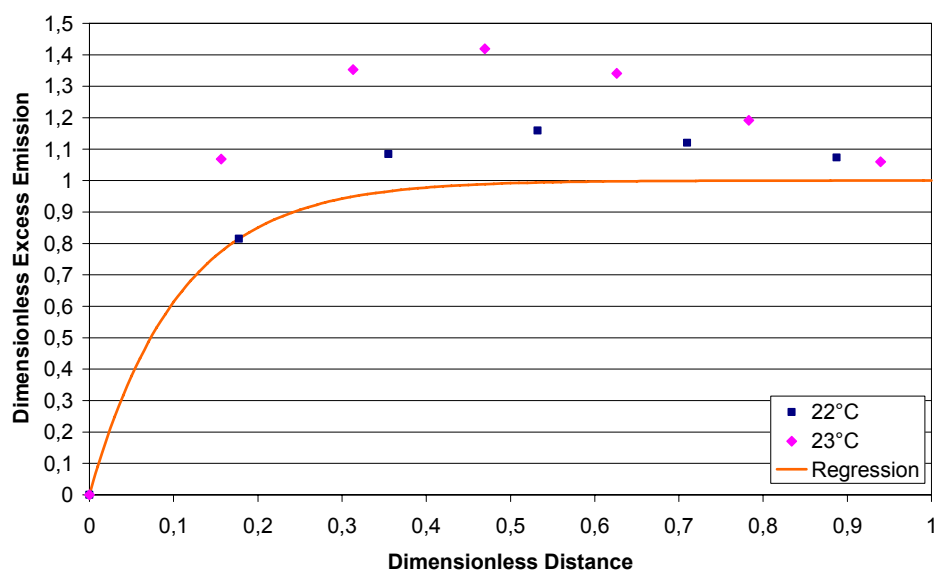
Euro 2 Diesel



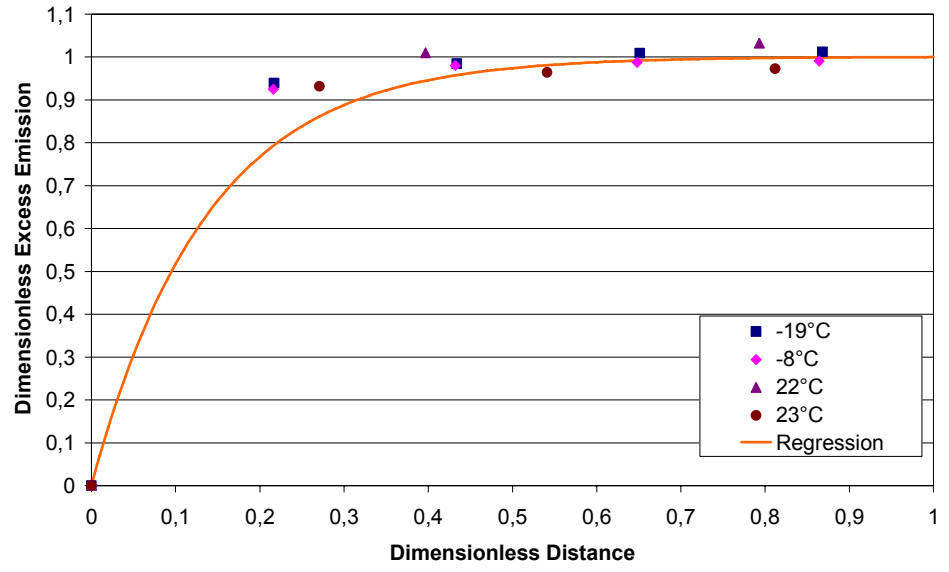
Euro 2 Gasoline



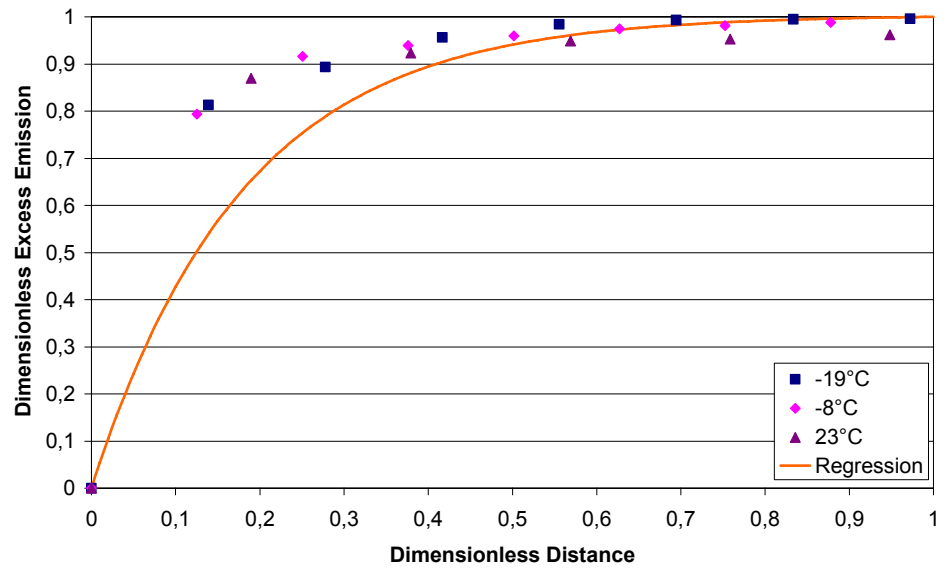
Euro 3 Diesel

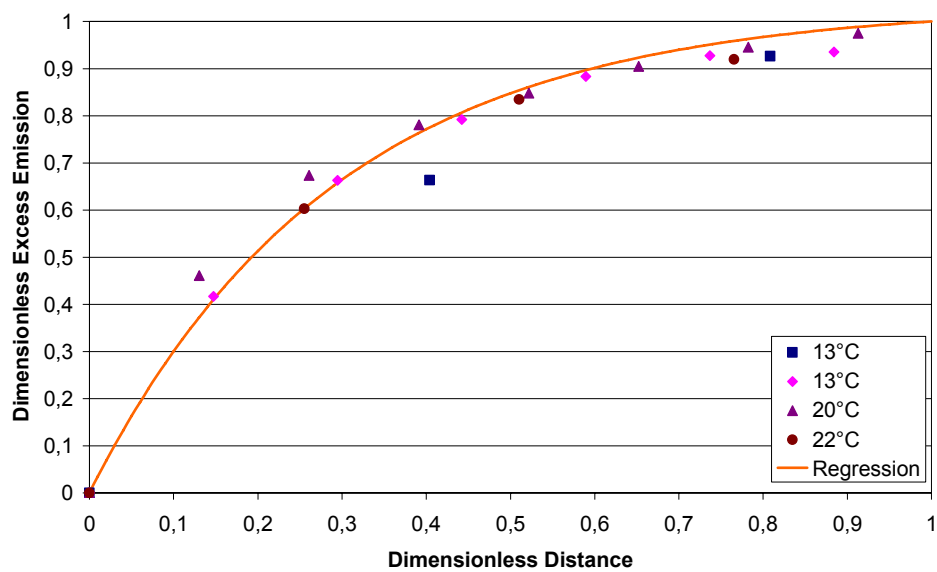
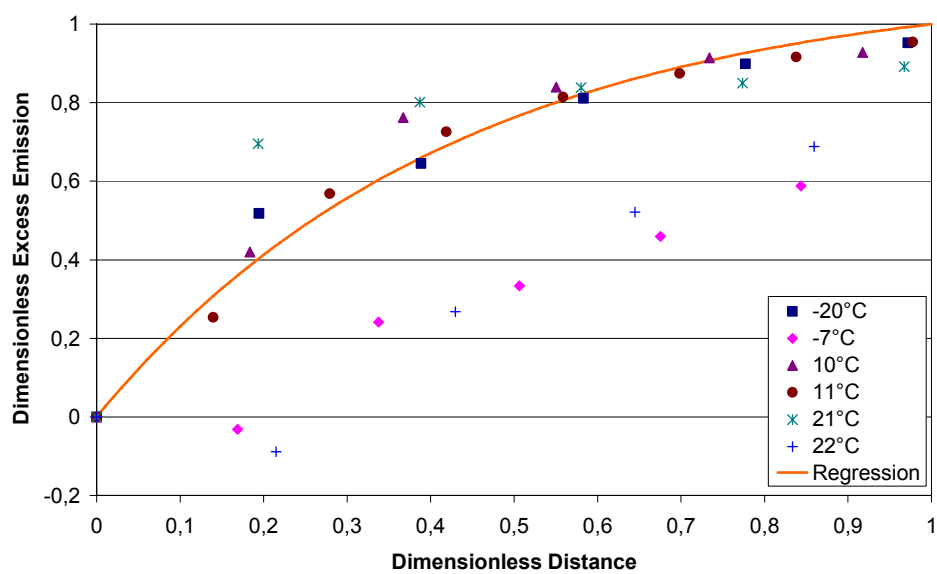


Euro 3 Gasoline

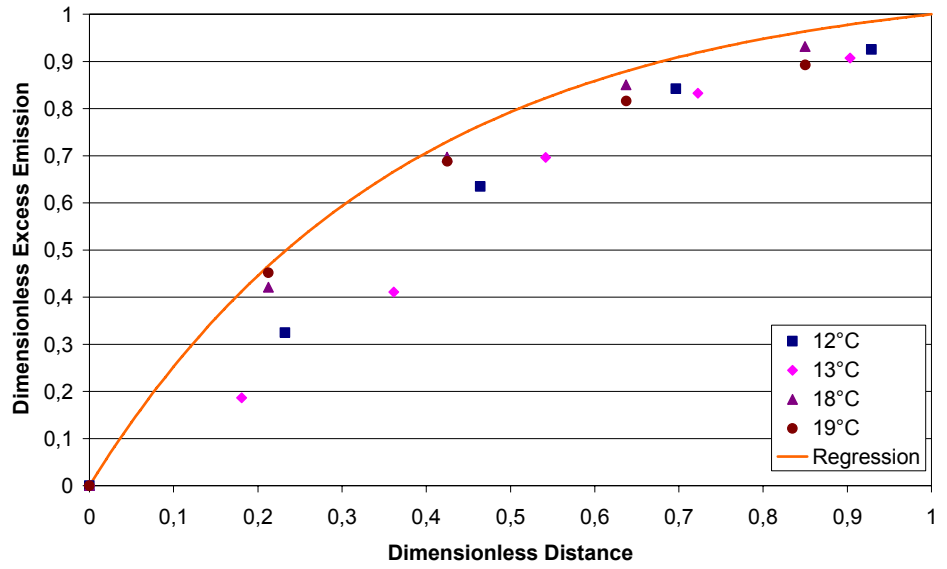


Euro 4 Gasoline

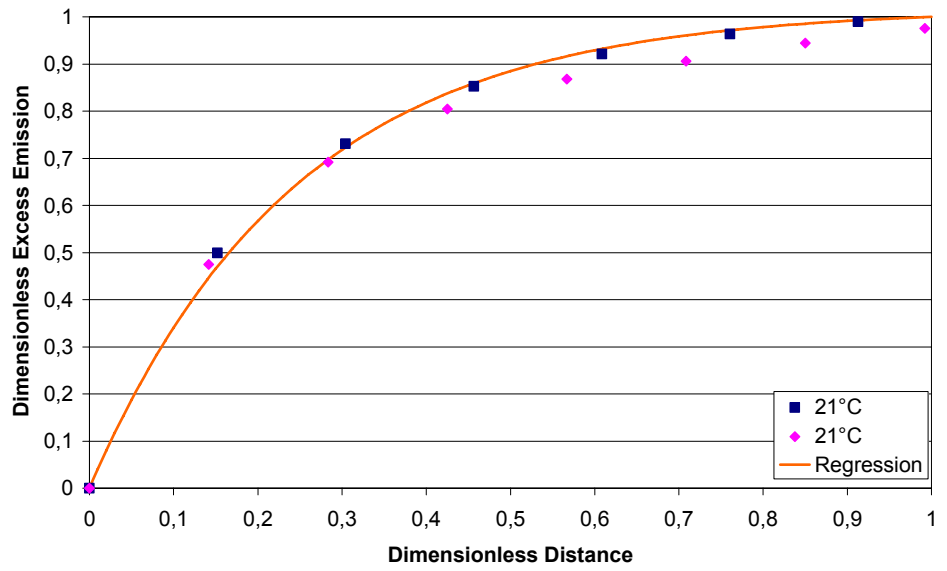


Annex 12.2: CO₂Euro 0 w/o Cat.
dieselEuro 0 w/o Cat.
Gasoline

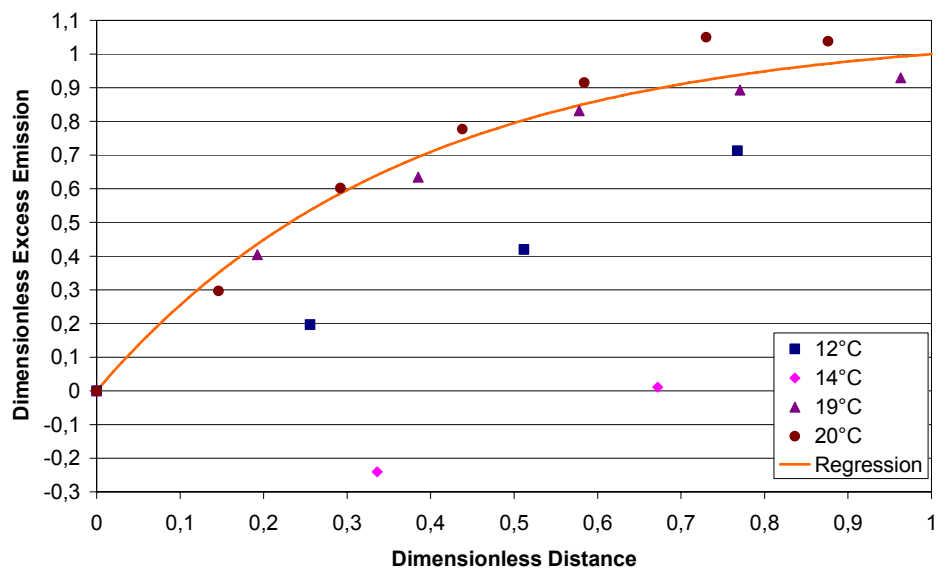
Euro 0 Cat. Gasoline



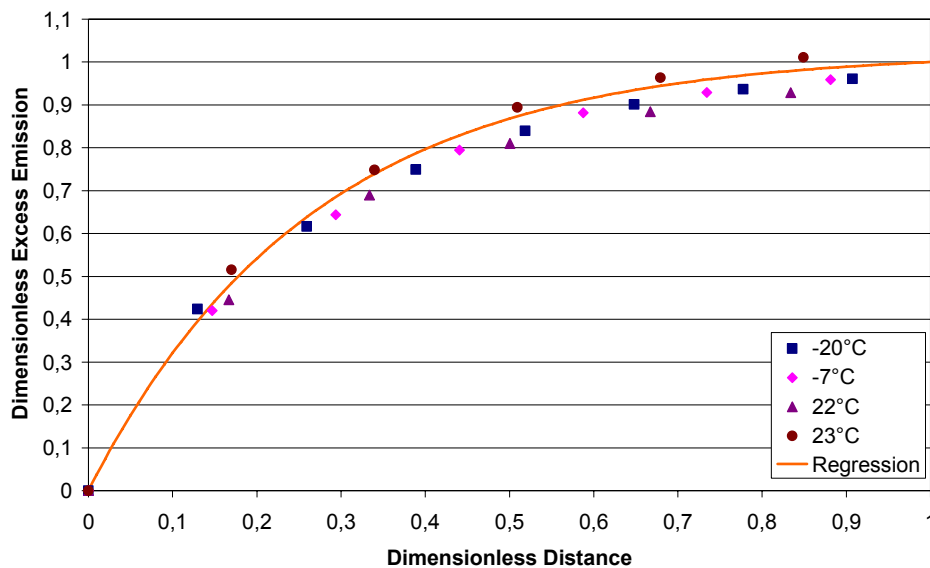
Euro 1 diesel



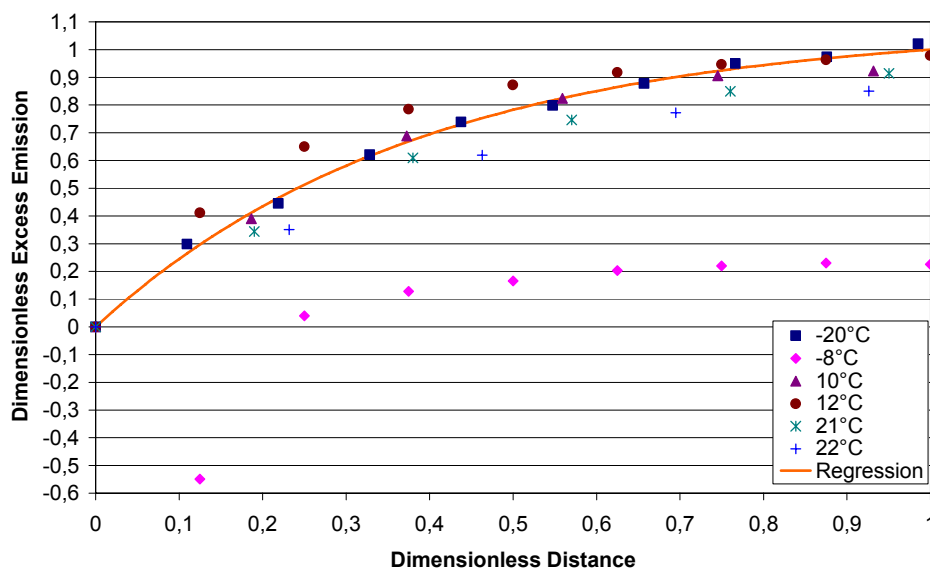
Euro 1 Gasoline



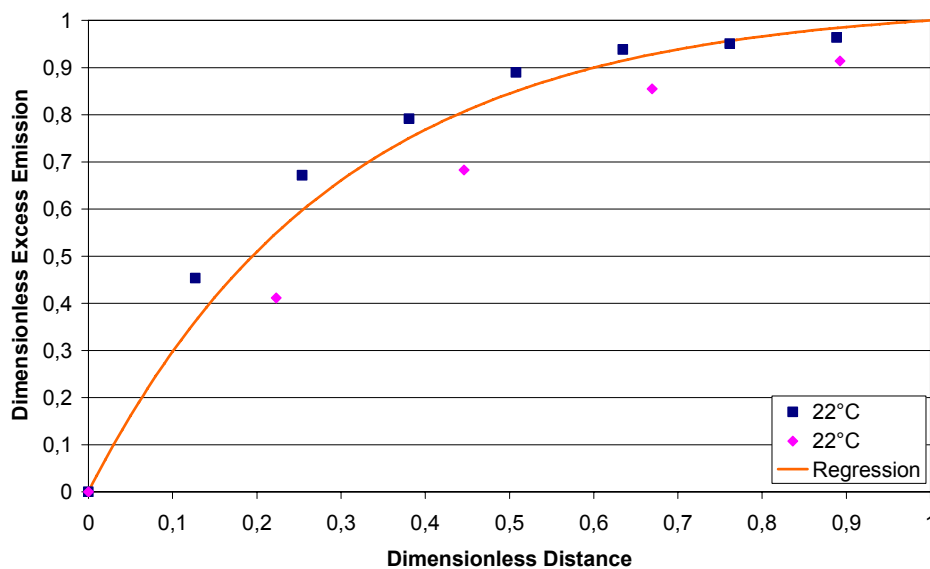
Euro 2 Diesel



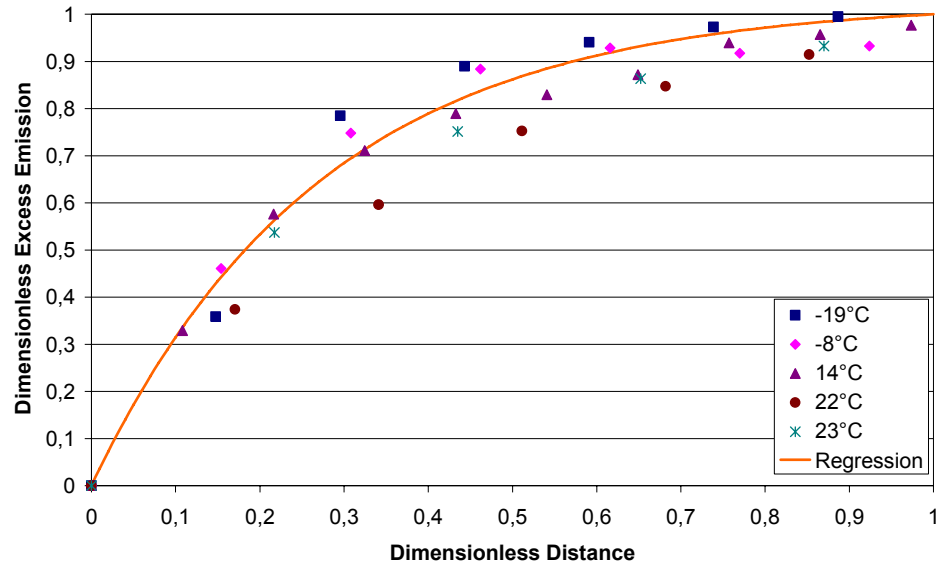
Euro 2 Gasoline



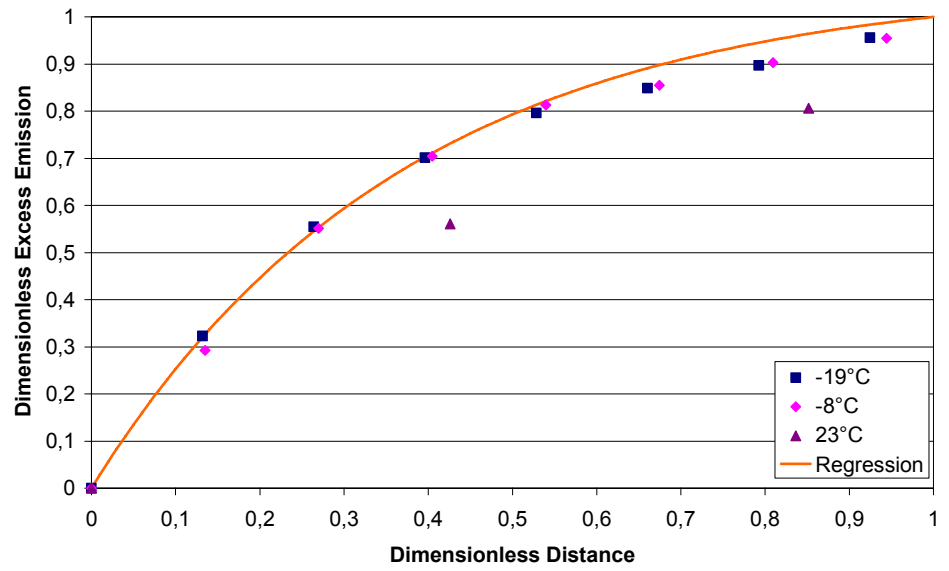
Euro 3 Diesel



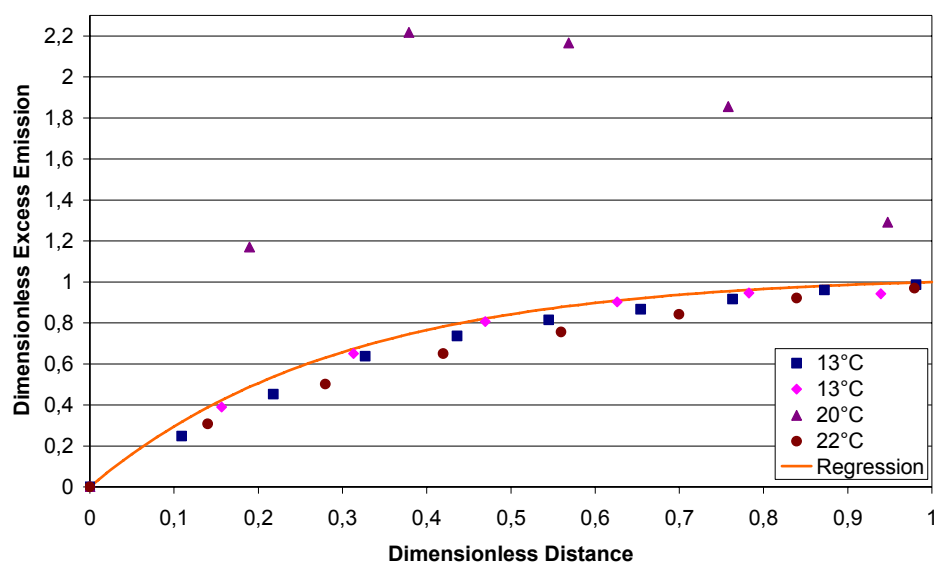
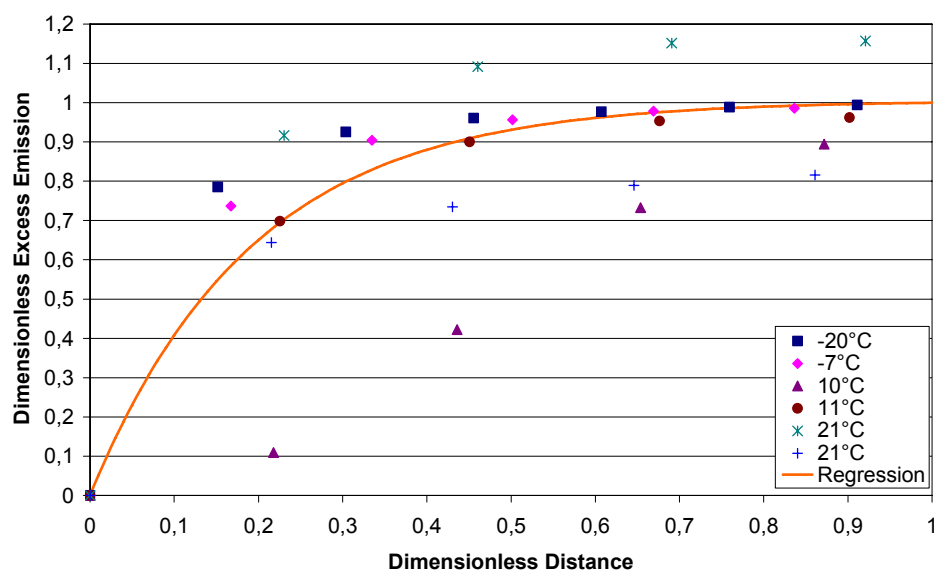
Euro 3 Gasoline



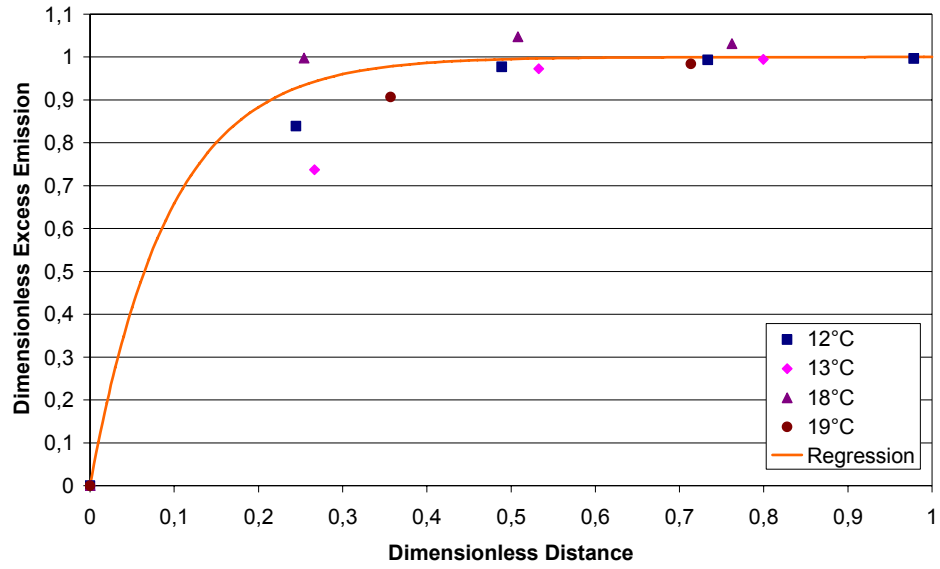
Euro 4 Gasoline



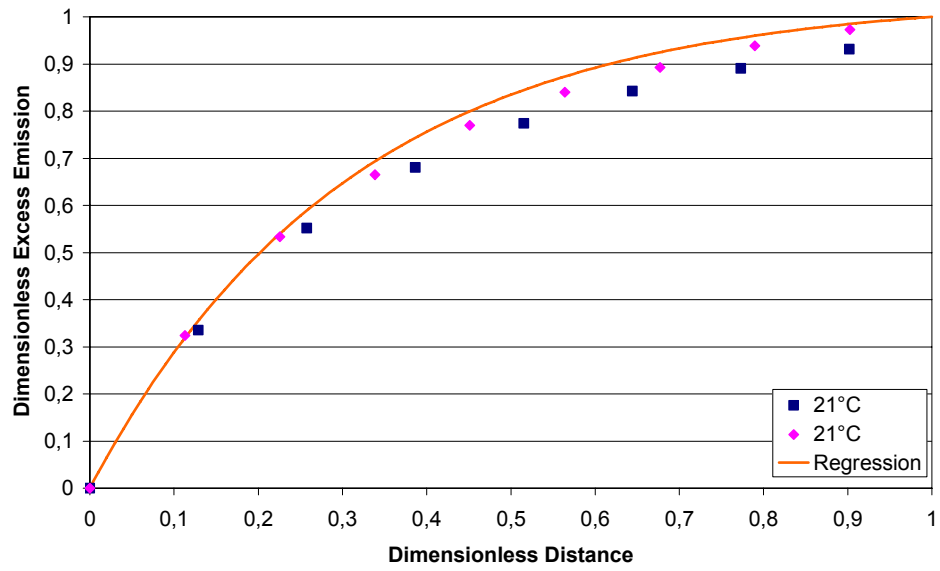
Annex 12.3: HC

Euro 0 w/o Cat.
dieselEuro 0 w/o Cat.
Gasoline

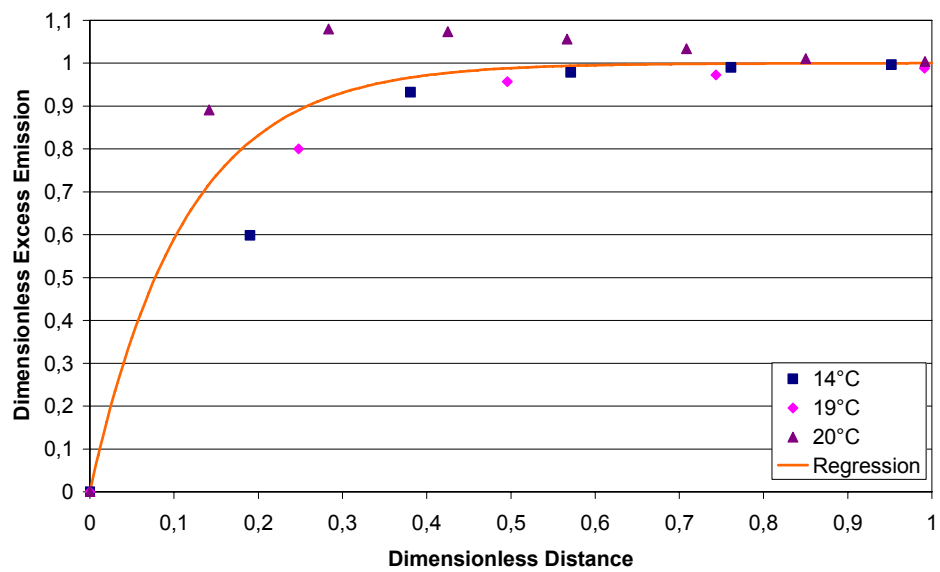
Euro 0 Cat.
Gasoline



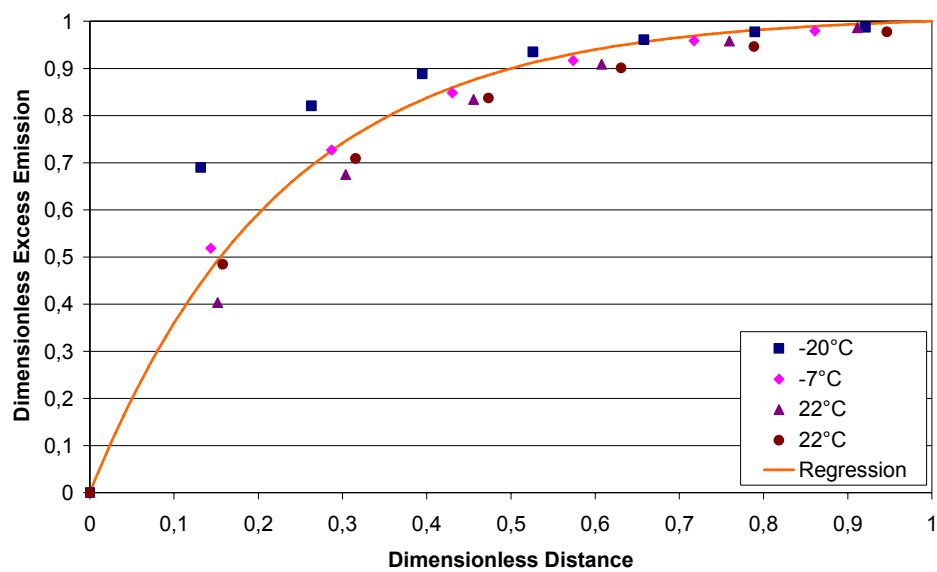
Euro 1 diesel



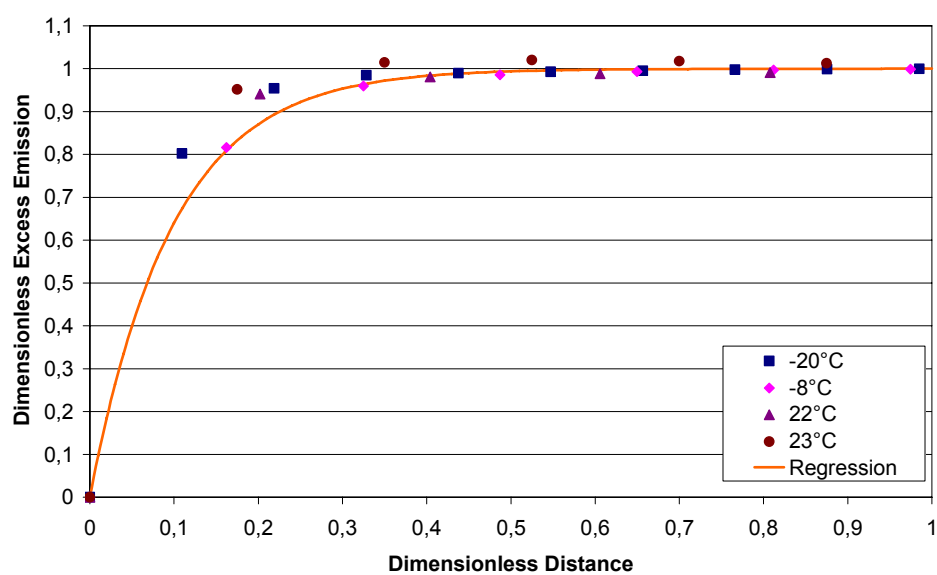
Euro 1 Gasoline



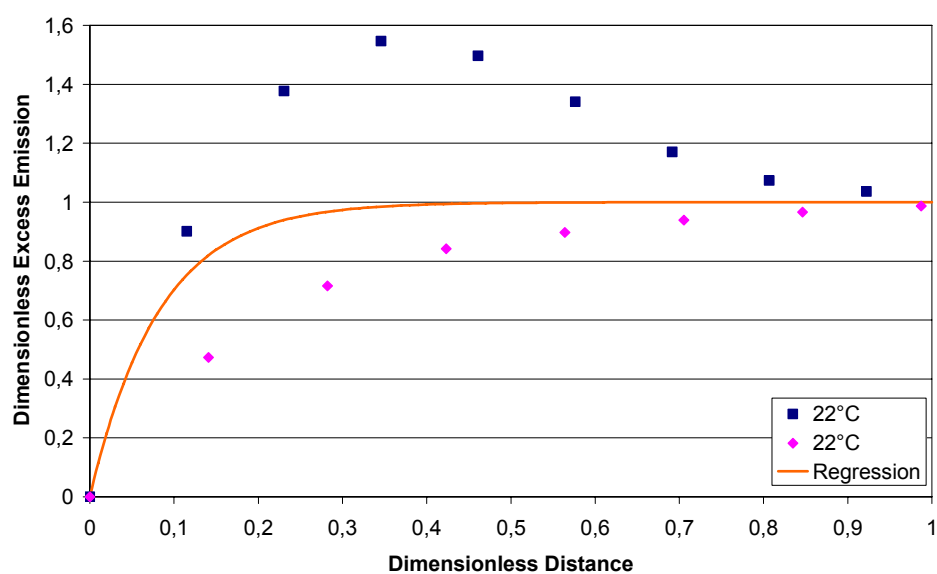
Euro 2 Diesel



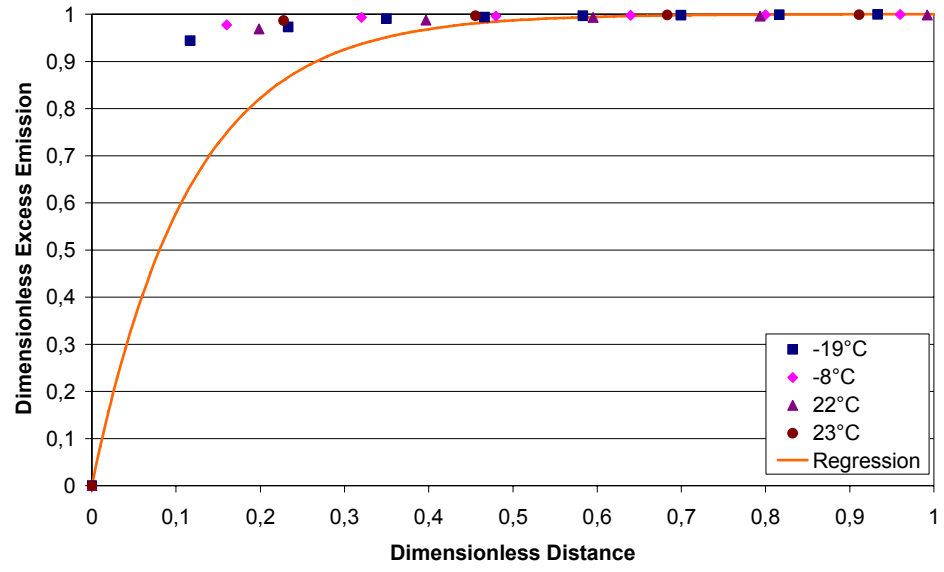
Euro 2 Gasoline



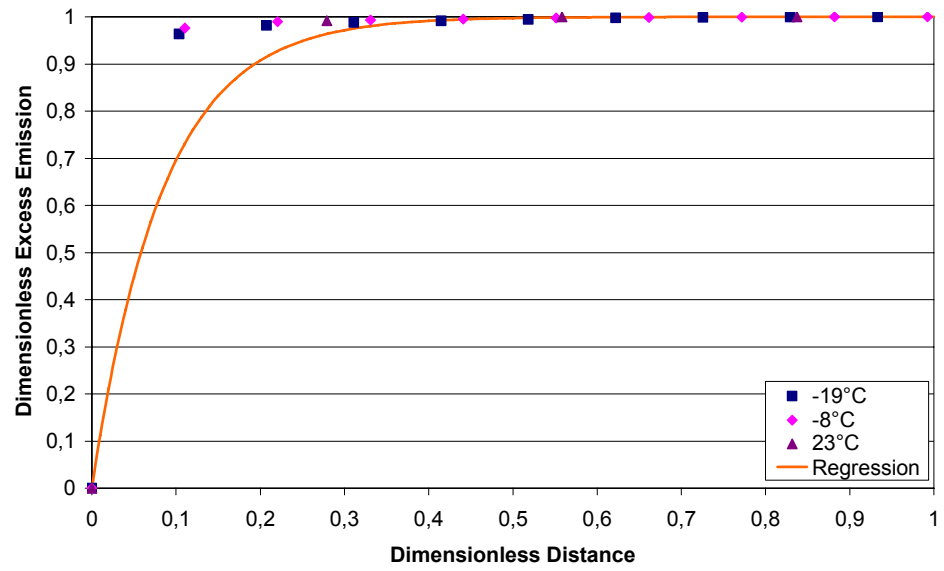
Euro 3 Diesel

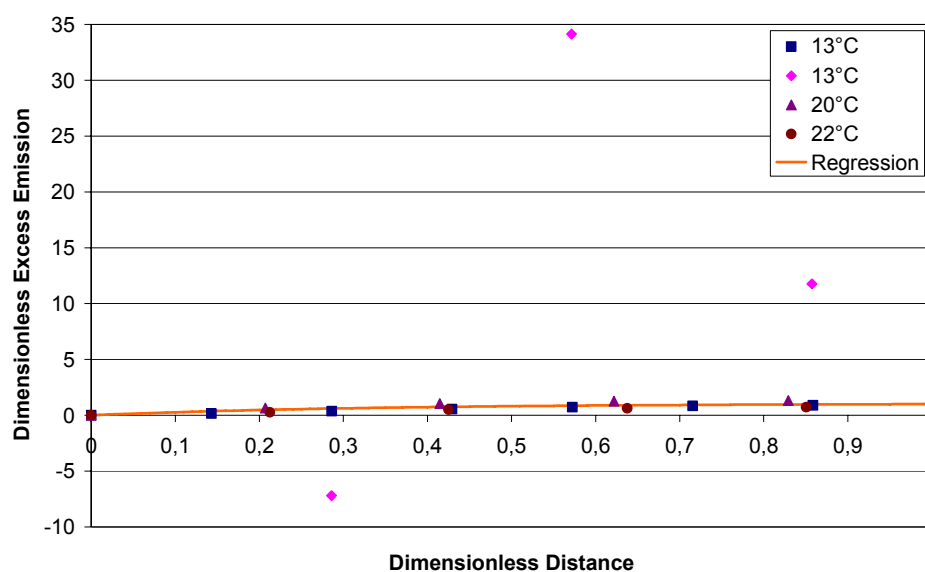
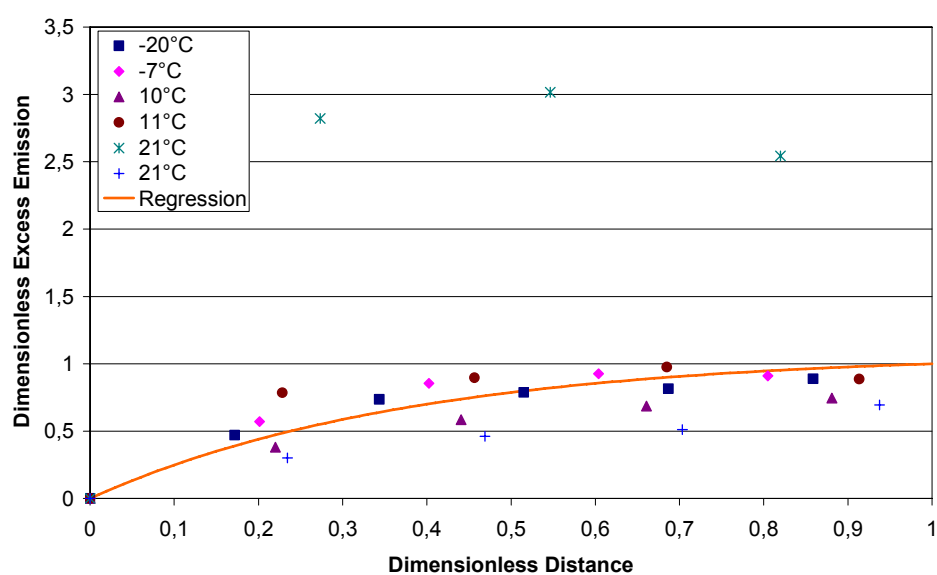


Euro 3 Gasoline

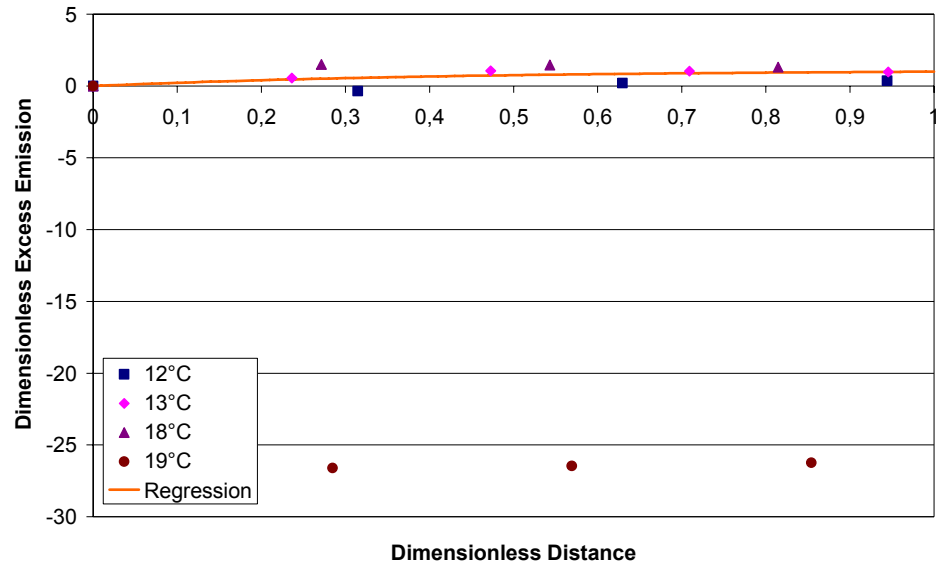


Euro 4 Gasoline

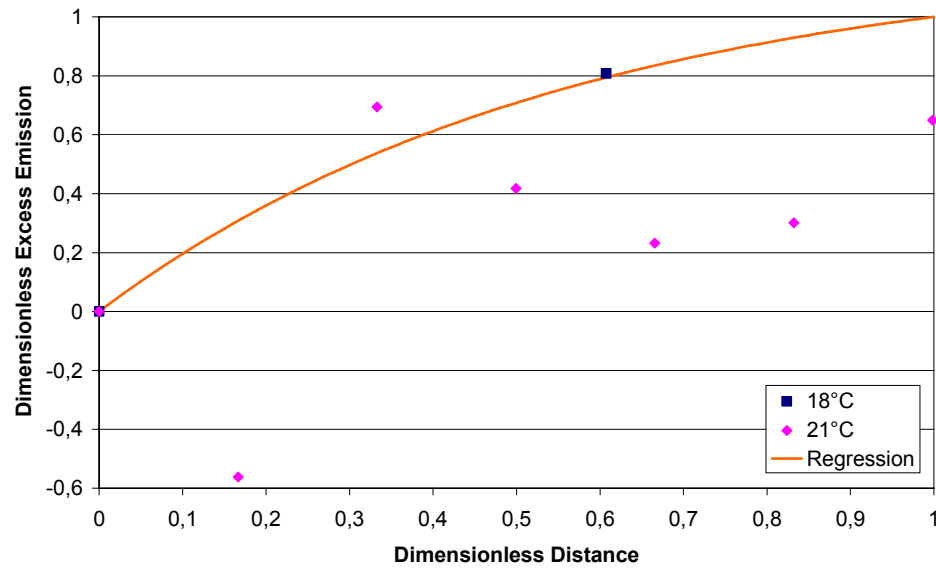


Annex 12.4: NO_xEuro 0 w/o Cat.
dieselEuro 0 w/o Cat.
Gasoline

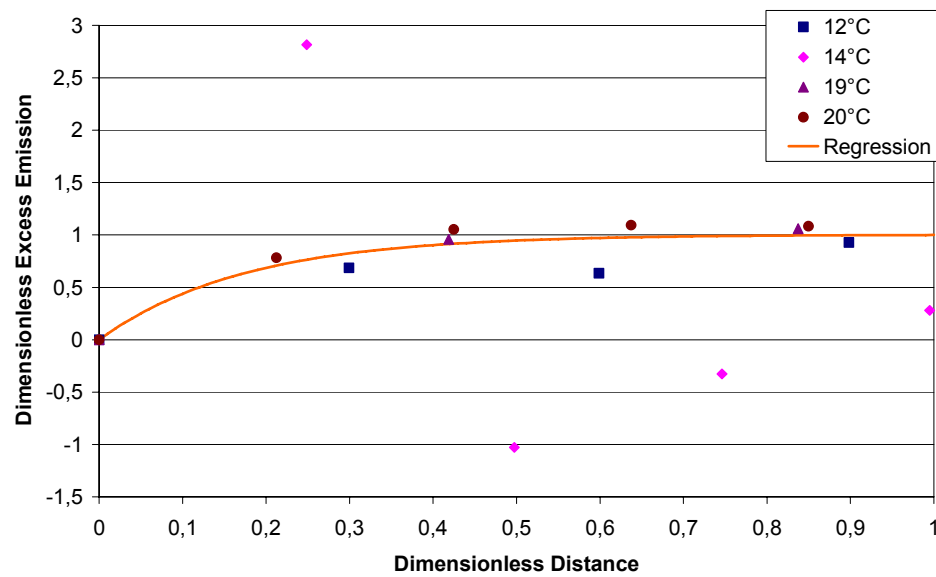
Euro 0 Cat.
Gasoline



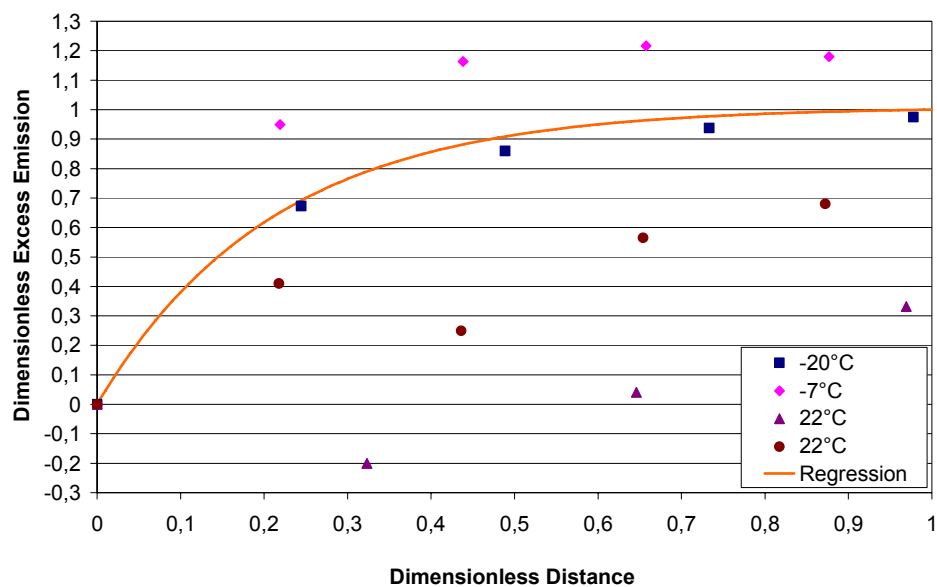
Euro 1 diesel



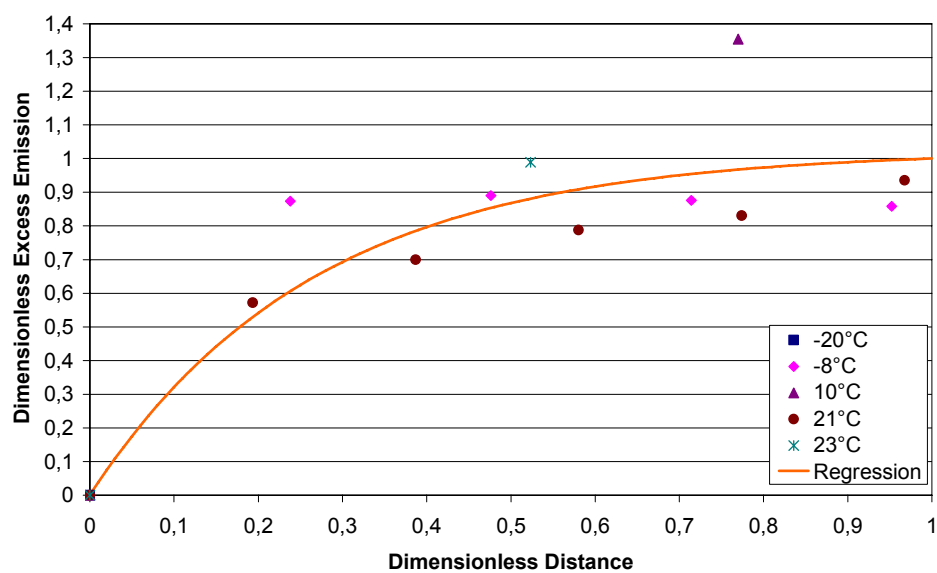
Euro 1 Gasoline



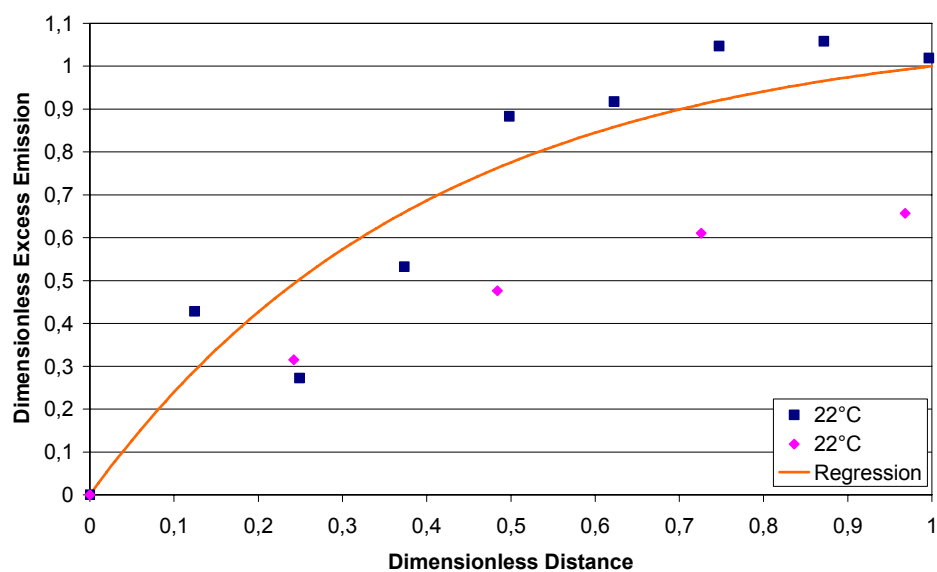
Euro 2 Diesel



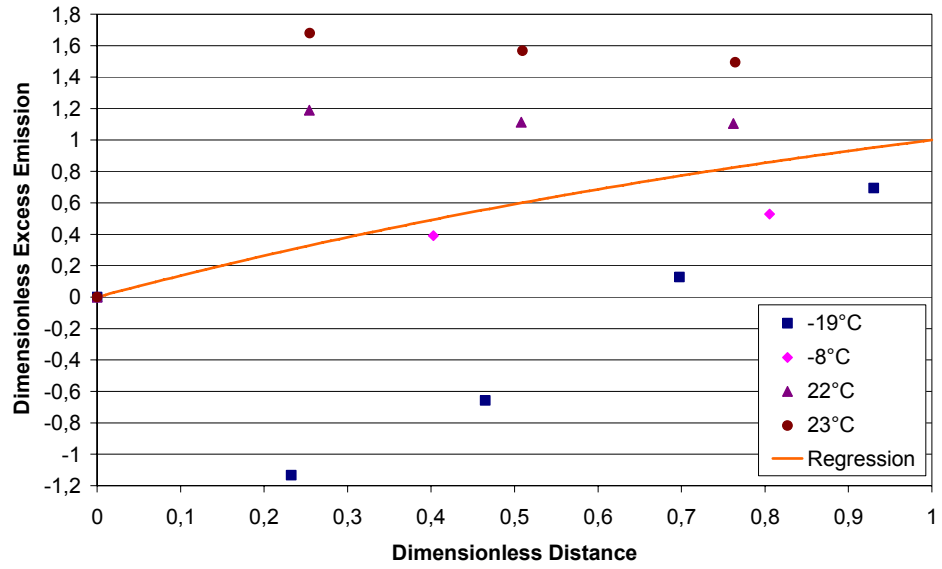
Euro 2 Gasoline



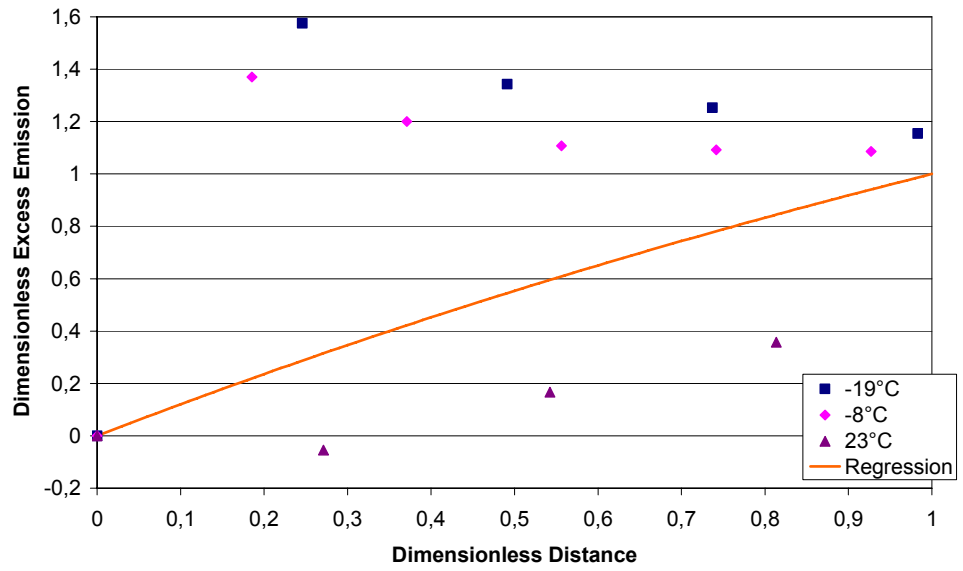
Euro 3 Diesel



Euro 3 Gasoline



Euro 4 Gasoline



Annex 13: Coefficient a in the equation of the dimensionless excess emission as a function of the dimensionless distance δ ($\delta=d/d_c$)

pollutant	Emission standard	Fuel type	a	
CO	Euro 0 cat.	Gasoline	-3.050	
		Diesel	-6.066	
	Euro 0 w/o cat.	Gasoline	-5.579	
		Diesel	-3.083	
	Euro 1	Gasoline	-4.533	
		Diesel	-6.731	
	Euro 2	Gasoline	-9.007	
		Diesel	-9.503	
	Euro 3	Gasoline	-7.280	
		Diesel	-5.544	
	Euro 4	Gasoline	-3.432	
		Diesel	-2.330	
CO ₂	Euro 0 w/o cat.	Gasoline	-2.680	
		Diesel	-4.078	
	Euro 1	Gasoline	-2.714	
		Diesel	-3.767	
	Euro 2	Gasoline	-2.563	
		Diesel	-3.389	
	Euro 3	Gasoline	-3.662	
		Diesel	-2.686	
	Euro 4	Gasoline	-3.352	
		Diesel	-5.204	
	HC	Euro 0 w/o cat.	Gasoline	-10.737
			Diesel	-3.242
Euro 1		Gasoline	-8.923	
		Diesel	-4.388	
Euro 2		Gasoline	-10.209	
		Diesel	-12.140	
Euro 3		Gasoline	-8.624	
		Diesel	-11.898	
NO _x		Euro 0 w/o cat.	Gasoline	-2.246
			Diesel	-2.615
		Euro 1	Gasoline	-5.752
			Diesel	-1.776
	Euro 2	Gasoline	-3.765	
		Diesel	-4.729	
	Euro 3	Gasoline	-0.739	
		Diesel	-2.479	
	Euro 4	Gasoline	-0.432	
		Diesel	-2.926	

Annex 14: Equations describing the parking time influence on the excess emission

The parking time t is in min.

$g(720) = 1$.

Pollutant	Catalyst cars	Without catalyst cars	Diesel cars
CO	<ul style="list-style-type: none"> $g(t) = 4.614 \cdot 10^{-3} \cdot t - 2.302 \cdot 10^{-6} \cdot t^2 - 2.966 \cdot 10^{-9} \cdot t^3$ ($t \leq 720$) $g(t) = 1$ ($t > 720$ min) 	<ul style="list-style-type: none"> $g(t) = -1.504 \cdot 10^{-2} \cdot t + 1.406 \cdot 10^{-4} \cdot t^2 - 2.547 \cdot 10^{-7} \cdot t^3$ ($t \leq 240$) $g(t) = 1$ ($t > 240$ min) 	<ul style="list-style-type: none"> $g(t) = 4.167 \cdot 10^{-3} \cdot t$ ($t \leq 240$ min) $g(t) = 1$ ($t > 240$ min)
CO ₂	<ul style="list-style-type: none"> $g(t) = 0.1349 \cdot t - 2.915 \cdot 10^{-4} \cdot t$ ($t \leq 20$) $g(t) = 0.136 + 0.12 \cdot t$ ($21 \leq t \leq 720$) $g(t) = 1$ ($t \geq 720$) 	<ul style="list-style-type: none"> $g(t) = 5.287 \cdot 10^{-9} \cdot t^3 - 8.864 \cdot 10^{-6} \cdot t^2 + 5.035 \cdot 10^{-3} \cdot t$ ($t < 720$ min) $g(t) = 1$ ($t > 720$ min) 	<ul style="list-style-type: none"> $g(t) = 4.339 \cdot 10^{-3} \cdot t - 4.747 \cdot 10^{-6} \cdot t^2$ ($t \leq 460$) $g(t) = 0.978 + 3.077 \cdot 10^{-5} \cdot t$ ($461 \leq t \leq 715$) $g(t) = 1$ ($t \geq 715$ min)
HC	<ul style="list-style-type: none"> $g(t) = 7.641 \cdot 10^{-3} \cdot t - 2.639 \cdot 10^{-5} \cdot t^2 + 3.128 \cdot 10^{-8} \cdot t^3$ ($t \leq 240$) $g(t) = 0.625 + 5.208 \cdot 10^{-4} \cdot t$ ($241 \leq t \leq 720$) $g(t) = 1$ ($t \geq 720$) 	<ul style="list-style-type: none"> $g(t) = 1.039 \cdot 10^{-3} \cdot t - 7.918 \cdot 10^{-6} \cdot t^2 + 4.211 \cdot 10^{-8} \cdot t^3 - 6.856 \cdot 10^{-11} \cdot t^4 + 3.650 \cdot 10^{-14} \cdot t^5$ ($t \leq 720$) $g(t) = 1$ ($t \geq 720$) 	<ul style="list-style-type: none"> $g(t) = 3.070 \cdot 10^{-4} \cdot t + 4.402 \cdot 10^{-6} \cdot t^2 - 4.030 \cdot 10^{-9} \cdot t^3$ ($t \leq 720$) $g(t) = 1$ ($t > 720$ min)
NOx	<ul style="list-style-type: none"> $g(t) = 7.141 \cdot 10^{-3} \cdot t + 1.568 \cdot 10^{-3} \cdot t^2 - 3.204 \cdot 10^{-5} \cdot t^3 + 1.594 \cdot 10^{-7} \cdot t^4$ ($t \leq 50$ min) $g(t) = 1.290 - 4.030 \cdot 10^{-4} \cdot t$ ($51 \leq t \leq 720$) $g(t) = 1$ ($t \geq 720$) 	<ul style="list-style-type: none"> $g(t) = 3.52 \cdot 10^{-2} \cdot t - 3.705 \cdot 10^{-4} \cdot t^2$ ($t \leq 50$) $g(t) = 0.8170 + 2.537 \cdot 10^{-4} \cdot t$ ($51 \leq t \leq 720$) $g(t) = 1$ ($t \geq 720$) 	<ul style="list-style-type: none"> $g(t) = 0$ ($t \leq 300$ min) $g(t) = -1.11 + 3.703 \cdot 10^{-3} \cdot t$ ($300 \text{ min} < t < 570 \text{ min}$) $g(t) = 1$ ($t \geq 570$ min)

Annex 15: Absolute PAH and VOC excess emissions (g)

Annex 15.1: Absolute PAH excess emission (g)

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3	
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline
Art. urban	2,3-benzofluorene	22								-6.507E-06
	acenaphthene	22								7.021E-05
	acenaphthylene	22								1.538E-04
	anthanthrene	22								-1.784E-06
	anthracene	22								-7.424E-06
	benz[a]anthracene	22								9.481E-07
	benzo[a]pyrene	22								-4.293E-06
	benzo[b]chrysene + picene	22								-1.310E-06
	benzo[b]naphtho[1,2-d]thiophene	22								3.698E-06
	benzo[b+k+j]fluoranthene	22								2.817E-06
	benzo[c]phenanthrene	22								1.766E-06
	benzo[e]pyrene	22								3.041E-06
	benzo[g,h,i]fluoranthene	22								-4.472E-08
	benzo[g,h,i]perylene	22								1.968E-07
	chrysene + triphenylene	22								4.025E-06
	coronene	22								3.667E-08
	cyclopenta[c,d]pyrene	22								-4.070E-07
	dibenz[a,c]anthracene	22								-1.968E-07
	dibenz[a,h]anthracene	22								5.992E-07
fluoranthene	22								1.073E-05	
fluorene	22								1.342E-07	

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3	
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline
Art. urban	indeno[1,2,3-c,d]pyrene	22								1.476E-07
	naphthalene	22								1.431E-03
	perylene	22								3.443E-06
	phenanthrene	22								3.533E-05
	pyrene	22								5.366E-06
IUFC	2,3-benzofluorene	22		5.749E-05			-1.249E-06	5.100E-06	7.592E-06	7.580E-06
	acenaphthene	22	3.792E-05	-1.069E-04	-2.084E-06	2.452E-06	5.592E-06	3.260E-05	-1.386E-04	2.246E-05
	acenaphthylene	22	1.576E-03	-5.195E-04	8.991E-05	2.105E-07	8.390E-05	2.746E-04	1.430E-05	2.365E-04
	anthanthrene	22		2.852E-04			4.783E-05	5.495E-06	-1.778E-06	3.646E-06
	anthracene	22	3.686E-06	2.138E-04	-1.447E-06	5.078E-06	3.833E-06	-3.313E-06	-8.077E-08	2.230E-05
	benz[a]anthracene	22	1.332E-05	6.204E-05	3.160E-07	4.331E-06	5.659E-07	5.533E-06	2.068E-06	4.911E-06
	benzo[a]pyrene	22	7.951E-06	1.444E-04	8.210E-07	4.118E-06	6.908E-07	5.101E-06	-4.174E-07	6.108E-06
	benzo[b]chrysene + picene	22		-1.618E-06			1.069E-06	9.830E-07	-2.248E-08	-7.634E-07
	benzo[b]fluoranthene	22	5.340E-06		4.450E-07	3.656E-06	5.784E-07	3.076E-06	4.016E-08	1.838E-06
	benzo[b]naphtho[1,2-d]thiophene	22		6.399E-06			5.644E-06	8.427E-07	1.191E-07	8.308E-07
	benzo[b+k+j]fluoranthene	22		3.447E-05			2.854E-05	3.331E-05	-3.786E-06	1.166E-05
	benzo[c]phenanthrene	22		1.394E-05			4.046E-07	1.624E-06	5.265E-07	5.325E-06
	benzo[e]pyrene	22		4.545E-05			-2.967E-05	1.490E-05	-3.122E-07	5.518E-06
	benzo[g,h,i]fluoranthene	22		1.059E-04			-1.089E-05	2.273E-05	1.304E-05	9.366E-06
	benzo[g,h,i]perylene	22	9.957E-06	-8.142E-05	1.281E-06	1.107E-05	6.757E-07	1.882E-05	1.723E-06	9.132E-06
	benzo[k]fluoranthene	22	2.185E-06		2.318E-07	1.958E-06	2.243E-07	1.881E-06	8.279E-09	1.048E-06
	chrysene	22	6.475E-06		4.710E-08	5.442E-06	9.989E-07	4.386E-06	1.094E-07	2.573E-06
	chrysene + triphenylene	22		4.500E-05			-1.558E-05	1.179E-05	1.758E-06	9.650E-06
	coronene	22		4.196E-05			4.096E-07	4.279E-05	2.762E-06	1.247E-05
	cyclopenta[c,d]pyrene	22		4.391E-04			-2.298E-06	3.734E-05	4.093E-06	1.652E-05
dibenz[a,c]anthracene	22		1.049E-07			6.893E-07	-8.941E-08	9.740E-08	2.866E-06	
dibenz[a,h]anthracene	22	1.025E-06	2.997E-07	1.089E-07	1.189E-06	1.997E-07	9.601E-07	2.585E-07	4.179E-08	

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3	
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline
IUFC	fluoranthene	22	2.532E-05	6.728E-04	-3.986E-07	1.010E-05	2.347E-06	7.963E-06	3.323E-06	2.002E-05
	fluorene	22	3.404E-05	1.783E-03	-7.051E-06	3.820E-06	-2.813E-05	3.173E-04	4.220E-07	2.457E-05
	indeno[1,2,3-c,d]pyrene	22	7.119E-06	-9.990E-07	8.087E-07	3.986E-06	-3.655E-07	9.963E-06	5.694E-07	6.643E-06
	naphthalene	22	1.293E-03	7.742E-03	2.545E-03	-3.132E-04	6.746E-04	2.353E-04	1.314E-04	1.154E-03
	perylene	22		1.304E-05			5.529E-06	8.242E-07	-6.618E-06	1.501E-05
	phenanthrene	22	2.607E-05	2.498E-04	-5.862E-05	3.711E-05	1.583E-05	-9.829E-06	-1.006E-05	3.638E-05
	pyrene	22	4.382E-05	1.084E-03	-2.167E-06	1.954E-05	7.921E-06	1.355E-05	1.327E-05	1.858E-05
IRC	2,3-benzofluorene	22		1.655E-05		-1.838E-05		2.696E-06	3.048E-06	-2.376E-06
	acenaphthene	22		-3.087E-04		-1.330E-03	7.425E-05	1.690E-04	5.313E-04	3.645E-05
	acenaphthylene	22		4.518E-03		3.756E-04	1.970E-03	5.803E-04	1.057E-04	1.538E-04
	anthanthrene	22		1.050E-04		3.710E-05	6.483E-06	9.710E-06	2.954E-07	9.389E-07
	anthracene	22		-4.461E-05		3.705E-05	5.929E-05	-6.476E-06	1.586E-05	-1.988E-04
	benzo[a]anthracene	22		-3.813E-05		1.103E-05		3.591E-06	8.192E-06	1.794E-06
	benzo[a]pyrene	22		4.317E-05		3.649E-05	1.797E-02	5.157E-02	6.158E-06	2.533E-06
	benzo[b]chrysene + picene	22		-1.676E-06		9.385E-06	7.655E-06	2.349E-07	2.244E-06	3.964E-06
	benzo[b]naphtho[1,2-d]thiophene	22		5.691E-06		2.101E-06	-1.534E-04	-1.599E-06	5.679E-06	1.801E-06
	benzo[b+k+j]fluoranthene	22		5.036E-06		1.250E-04	-4.012E-05	1.600E-05	9.782E-06	1.931E-05
	benzo[c]phenanthrene	22		-5.108E-06		8.174E-06		6.159E-07	3.222E-06	7.531E-07
	benzo[e]pyrene	22		2.878E-05		5.448E-05		7.116E-06	3.617E-06	9.168E-06
	benzo[g,h,i]fluoranthene	22		-3.094E-05		2.885E-05	5.080E-05	6.774E-06	-6.767E-06	-4.101E-07
	benzo[g,h,i]perylene	22		7.411E-05		3.616E-05	4.518E-06	3.596E-05	5.341E-06	1.563E-05
	chrysene + triphenylene	22		2.734E-05		9.713E-05	4.032E-05	-3.928E-06	1.343E-05	-1.650E-05
	coronene	22		3.259E-04		-5.233E-06	4.905E-06	4.150E-05	4.215E-06	6.706E-06
	cyclopenta[c,d]pyrene	22		5.432E-04		1.484E-05	1.757E-05	3.913E-05	6.548E-06	7.052E-06
	dibenz[a,c]anthracene	22		-1.168E-06		8.526E-06	7.479E-06	3.490E-07	1.059E-06	-6.212E-07
	dibenz[a,h]anthracene	22		1.479E-05		1.769E-05	3.608E-06	1.157E-05	2.192E-06	1.003E-06
fluoranthene	22		1.871E-04		1.495E-04	2.373E-04	-1.327E-05	1.111E-04	1.614E-05	

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3	
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline
IRC	Fluorene	22		-1.094E-03		-6.483E-04	3.943E-05	1.461E-04	1.133E-04	7.792E-05
	indeno[1,2,3-c,d]pyrene	22		3.238E-05		2.109E-05	7.871E-06	1.799E-05	4.388E-06	8.418E-06
	naphthalene	22		3.309E-02			1.050E-03	6.751E-03	2.632E-03	2.571E-03
	perylene	22		7.051E-06		-8.058E-06	2.840E-05	9.587E-07	4.136E-06	4.130E-05
	phenanthrene	22		-4.749E-04		1.928E-04	3.238E-04	-2.770E-05	2.659E-04	1.823E-05
	pyrene	22		4.173E-04		9.116E-05	-1.943E-04	8.130E-06	1.212E-04	-7.795E-06

Annex 15.2: Percentage of gaseous and particulate phase relatively to the total PAH excess emission

Pollutant	Emission Standard	Fuel type	Gaseous	Particulate
acenaphthene	Euro 0 w/o cat.	diesel	96%	4%
	Euro 1	diesel	85%	15%
		gasoline	112%	-12%
	Euro 2	diesel	52%	48%
		gasoline	98%	2%
	Euro 3	diesel	-1012%	1112%
gasoline		-1780%	1880%	
acenaphthylene	Euro 0 w/o cat.	diesel	92%	8%
	Euro 1	diesel	100%	0%
		gasoline	143%	-43%
	Euro 2	diesel	100%	0%
		gasoline	100%	0%
	Euro 3	diesel	50,00%	50,00%
gasoline		100%	0%	
anthracene	Euro 0 w/o cat.	diesel	-8%	108%
	Euro 1	diesel	15%	85%
		gasoline	-27%	127%
	Euro 2	diesel	16%	84%
		gasoline	69%	31%
	Euro 3	diesel	11%	89%
gasoline		9%	91%	
benz[a]anthracene	Euro 0 w/o cat.	diesel	5%	95%
	Euro 1	diesel	-6%	106%
		gasoline	4%	96%
	Euro 2	diesel	11%	89%
		gasoline	5%	95%
	Euro 3	diesel	15%	85%
gasoline		9%	91%	

Pollutant	Emission Standard	Fuel type	Gaseous	Particulate
benzo[a]pyrene	Euro 0 w/o cat.	diesel	3%	97%
	Euro 1	diesel	-2%	102%
		gasoline	6%	94%
	Euro 2	diesel	-30%	130%
		gasoline	4%	96%
	Euro 3	diesel	0%	100%
gasoline		1%	99%	
benzo[b]fluoranthene	Euro 0 w/o cat.	diesel	2%	98%
	Euro 1	diesel	0%	100%
		gasoline	3%	97%
	Euro 2	diesel	12%	88%
		gasoline	5%	95%
	Euro 3	diesel	0%	100%
gasoline		1%	99%	
benzo[g,h,i]perylene	Euro 0 w/o cat.	diesel	11%	89%
	Euro 1	diesel	-1%	101%
		gasoline	8%	92%
	Euro 2	diesel	49%	51%
		gasoline	5%	95%
	Euro 3	diesel	50,00%	50,00%
gasoline		6%	94%	
benzo[k]fluoranthene	Euro 0 w/o cat.	diesel	4%	96%
	Euro 1	diesel	-6%	106%
		gasoline	5%	95%
	Euro 2	diesel	66%	34%
		gasoline	4%	96%
	Euro 3	diesel	0%	100%
gasoline		4%	96%	

Pollutant	Emission Standard	Fuel type	Gaseous	Particulate
chrysene	Euro 0 w/o cat.	diesel	5%	95%
	Euro 1	diesel	-152%	252%
		gasoline	4%	96%
	Euro 2	diesel	-85%	185%
		gasoline	5%	95%
	Euro 3	diesel	-13%	113%
gasoline		2%	98%	
dibenz[a,h]anthracene	Euro 0 w/o cat.	diesel	2%	98%
	Euro 1	diesel	-3%	103%
		gasoline	6%	94%
	Euro 2	diesel	1%	99%
		gasoline	4%	96%
	Euro 3	diesel	50,00%	50,00%
gasoline		0%	100%	
fluoranthene	Euro 0 w/o cat.	diesel	16%	84%
	Euro 1	diesel	36%	64%
		gasoline	22%	78%
	Euro 2	diesel	-1%	101%
		gasoline	27%	73%
	Euro 3	diesel	7%	93%
gasoline		17%	83%	
fluorene	Euro 0 w/o cat.	diesel	81%	19%
	Euro 1	diesel	71%	29%
		gasoline	423%	-323%
	Euro 2	diesel	-17%	117%
		gasoline	16%	84%
	Euro 3	diesel	106%	-6%
gasoline		49%	51%	

Pollutant	Emission Standard	Fuel type	Gaseous	Particulate
indeno[1,2,3-c,d]pyrene	Euro 0 w/o cat.	diesel	31%	69%
	Euro 1	diesel	0%	100%
		gasoline	2%	98%
	Euro 2	diesel	0%	100%
		gasoline	1%	99%
	Euro 3	diesel	50,00%	50,00%
gasoline		0%	100%	
naphthalene	Euro 0 w/o cat.	diesel	605%	-505%
	Euro 1	diesel	54%	46%
		gasoline	33%	67%
	Euro 2	diesel	101%	-1%
		gasoline	99%	1%
	Euro 3	diesel	28%	72%
gasoline		235%	-135%	
phenanthrene	Euro 0 w/o cat.	diesel	177%	-77%
	Euro 1	diesel	11%	89%
		gasoline	204%	-104%
	Euro 2	diesel	43%	57%
		gasoline	63%	37%
	Euro 3	diesel	5%	95%
gasoline		-314%	414%	
pyrene	Euro 0 w/o cat.	diesel	12%	88%
	Euro 1	diesel	-29%	129%
		gasoline	20%	80%
	Euro 2	diesel	12%	88%
		gasoline	25%	75%
	Euro 3	diesel	13%	87%
gasoline		10%	90%	

Annex 15.3: Absolute VOC excess emission (g)

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3		Euro 4
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	gasoline
Art. urban	1,3,5-triphenylbenzene	22								-2.683E-07	
	1,3-butadiene	22								0.000E+00	
	2,2,4-trimethylpentane	22								0.000E+00	
	2,2-dimethylbutane	22								0.000E+00	
	2,2-dimethylpropane	22								0.000E+00	
	2,5-dimethylbenzaldehyde	22								0.000E+00	
	2-methylpentane	22								0.000E+00	
	3-methylpentane	22								0.000E+00	
	acetaldehyde	22								-1.172E-04	
	acetone + acrolein	22								2.124E-05	
	benzaldehyde	22								3.153E-04	
	benzene	22								9.346E-03	
	butyraldehyde	22								0.000E+00	
	crotonaldehyde	22								0.000E+00	
	ethane	22								-5.814E-04	
	ethene	22								0.000E+00	
	ethylbenzene	22								0.000E+00	
	formaldehyde	22								2.786E-03	
	heptane	22								0.000E+00	
	hexaldehyde	22								0.000E+00	
hexane	22								0.000E+00		
isobutane	22								0.000E+00		
isopentane	22								9.391E-04		

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3		Euro 4
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	gasoline
	isovaleraldehyde	22								0.000E+00	
	m+p+o-tolualdehyde	22								0.000E+00	
	methane	22								7.602E-03	
	methyl ethyl ketone	22								1.565E-06	
	methylcyclopentane	22								0.000E+00	
	n-butane	22								4.025E-04	
	n-pentane	22								0.000E+00	
	propane	22								0.000E+00	
	propene	22								0.000E+00	
	propionaldehyde	22								-4.629E-05	
	toluene	22								0.000E+00	
	valeraldehyde	22								0.000E+00	
xylene	22								0.000E+00		
ECE-15	methane	22	9.266E-03	1.159E-01	4.154E-03	1.494E-01					
IUFC	1,2,4-trimethylbenzene	22				9.441E-01	4.905E-01	3.395E+00		5.810E+00	
	1,2-dimethylcyclohexane cis	22	5.395E-04			6.008E-02	1.561E-02	-4.029E-02		1.194E-02	
	1,2-dimethylcyclohexane trans	22	6.354E-04		6.743E-04	3.899E-03	-3.472E-04	7.201E-02	2.697E-05		
	1,3,5-trimethylbenzene	22			2.811E-01	2.997E-01	-1.262E-01	3.212E+00	3.671E-01		
	1,3,5-triphenylbenzene	22		6.993E-07			-2.597E-06	3.052E-05	1.673E-06	-3.114E-06	
	1,3-butadiene	-20						1.074E-01		9.701E-02	7.692E-02
		-7						4.540E-02		4.897E-02	3.884E-02
		22		-2.632E-01		0.000E+00	0.000E+00	8.551E-02		4.013E-03	2.772E-03
	1,3-dimethyl-4-ethylbenzene	22				-8.751E-02		1.289E-01			
	1,4-diethylbenzene	22				-1.903E-01	-4.496E-05	3.078E-01			
	1,4-dimethyl-2-ethylbenzene	22						1.739E-01			
1,4-dimethylcyclohexane cis	22	6.691E-02			2.847E-04	1.330E-02	5.024E-02		9.950E-03		
1,4-dimethylcyclohexane trans	22				1.840E-04	-1.074E-02	2.459E+00		1.143E-02		

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3		Euro 4
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	gasoline
IUFC	1-butene	22	8.834E-03			1.438E-02	5.528E-03	4.027E-01	1.319E-03	5.470E-03	
	1-methyl-2-isopropyl-benzene	22						2.961E-01			
	1-methyl-4-isopropyl-benzene	22					8.152E-03				
	1-methylnaphtalene	22			-1.543E-03		6.943E-03				
	1-pentene	22	9.066E-02		-8.501E-02	-9.978E-04	1.392E-01	5.761E-01	4.945E-04	-5.535E-02	
	2,2,4-trimethylpentane	22		2.697E-01		1.663E-01	-4.945E-03	1.009E-01		2.480E-02	
	2,2-dimethylbutane	22	1.379E-03	0.000E+00		1.319E-03	-1.015E-02	9.162E-01		1.840E-02	
	2,2-dimethylpropane	22	3.372E-03	0.000E+00	8.377E-03	5.315E-02	-1.096E-03	4.299E-01	-1.139E-03	9.136E-03	
	2,5-dimethylbenzaldehyde	22		-5.744E-03		0.000E+00	1.863E-04	2.298E-04	3.841E-05	7.726E-04	
	2-butanone	22	1.699E-02		6.918E-03	-2.364E-05	-1.720E-02	-6.365E-03	4.960E-03	4.720E-03	
	2-ethyltoluene	22				-1.244E+00	1.676E+00	1.139E+01	1.373E+00	2.485E+01	
	2-methylnaphtalene	22			-1.289E-03		4.146E-04				
	2-methylpentane	22		8.991E-02		5.594E-02	0.000E+00	2.947E-02		1.169E-02	
	2-methylpropane	22	4.720E-04		-1.304E-02	3.258E-02	-2.609E-03	4.050E-02	5.874E-03	-1.952E-03	
	3-ethyltoluene	22				4.324E+00	2.341E-01	7.469E+00	7.343E-01	1.567E+01	
	3-methylpentane	22		1.998E-02		3.676E-02	3.736E-03	6.103E-02		4.820E-03	
	4-ethyltoluene	22			1.456E-01	6.452E-01	-1.384E-01	3.039E+00		4.263E+00	
	acetaldehyde	22	3.664E-02	5.270E-02	2.073E-02	1.242E-02	-4.104E-02	7.942E-03	1.168E-02	7.107E-03	
	acetone	22	2.090E-02		1.381E-02	7.440E-03	-3.363E-02	1.828E-03	1.454E-02	-3.808E-02	
	acetone + acrolein	22		2.428E-02		2.742E-03	1.548E-03	-4.046E-03		1.636E-03	
	acrolein	22	-2.308E-03		7.023E-03		7.627E-04	1.029E-02			
	benzaldehyde	22	-1.041E-02	7.043E-03	1.259E-03	5.220E-03	-3.833E-03	-2.559E-03	1.094E-04	9.098E-04	
	benzene	-20		1.975E+00			2.336E-01	1.444E+00		1.542E+00	5.944E-01
		-7		1.002E+00			3.019E-02	4.216E-01		5.817E-01	3.392E-01
		22		3.567E-01		7.049E-02	2.279E-02	4.185E-01	1.049E-02	9.921E-02	3.554E-02
	butyraldehyde	22	1.343E-02	0.000E+00	4.610E-03	8.017E-03	-3.753E-03	6.322E-04	-1.034E-04	-1.660E-04	

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3		Euro 4
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	gasoline
IUFC	Cis-2-butene	22	1.471E-01		2.691E-02	1.907E-02	2.203E-01	2.912E-01	4.765E-03	1.532E-02	
	crotonaldehyde	22	3.249E-02	5.894E-03	1.184E-03	3.334E-03	-5.332E-03	-9.980E-04	2.967E-04	1.406E-03	
	cyclohexane	22	-1.596E-03		-3.052E-02			-3.881E-04			
	ethane	-20						2.423E-01		1.074E-01	9.540E-02
		-7						8.762E-02		6.816E-02	5.559E-02
		22	1.776E-03	2.697E-02	1.409E-02	8.070E-04	-1.447E-03	1.480E-02	-7.043E-04	1.276E-02	1.054E-02
	ethene	-20						2.413E+00		9.667E-01	8.017E-01
		-7						7.043E-01		4.953E-01	4.296E-01
		22	-3.506E-03	3.497E-02	1.457E-02	2.668E-03	6.016E-04	5.120E-02	2.967E-03	2.780E-02	4.318E-02
	ethylbenzene	-20						1.139E+00		5.057E-01	4.940E-01
		-7						3.432E-01		2.105E-01	2.639E-01
		22	5.544E-02	0.000E+00	9.141E-03	5.245E-01	3.416E-01	1.623E+00	-4.496E-02	5.226E-01	1.513E-02
	ethyne	-20						7.214E-01		2.401E-01	2.522E-01
		-7						4.147E-01		1.269E-01	1.065E-01
		22						6.489E-02		2.233E-02	1.127E-03
	formaldehyde	22	-1.349E-02	1.104E-01	8.591E-03	7.342E-03	-3.179E-02	5.107E-03	1.752E-02	4.770E-03	
	heptadecane	22			-2.248E-02		1.043E-02		-3.412E-01		
	heptane	22		7.493E-02		4.725E-02	-5.095E-03	1.553E-02		3.072E-02	
	hexaldehyde	22	2.690E-02	-2.547E-03	7.408E-03	-8.657E-03	-8.379E-03	-7.358E-05	-3.263E-04	2.485E-04	
	hexane	22		-7.493E-02		4.925E-02	0.000E+00	2.599E-02		1.154E-02	
	hexene	22	-5.350E-03		2.329E-02	4.496E-04	2.036E-03	7.946E-02	8.841E-04	1.089E-03	
	i-butene	-20						5.744E-01		4.441E-01	2.782E-01
		-7						1.683E-01		1.942E-01	4.839E-01
22							6.194E-02		2.416E-02	1.496E-02	
isobutane	22	5.087E-03	4.396E-02		2.439E-02	-5.396E-03	2.210E-01	5.844E-03	1.157E-02		
isopentane	22		1.748E-01		1.928E-01	-1.718E-02	6.650E-02		7.280E-02		
isopropylbenzene	22					-1.918E-01		8.390E-01	2.321E+00		

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3		Euro 4
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	gasoline
IUFC	isovaleraldehyde	22		0.000E+00		0.000E+00	-1.249E-04	9.540E-04	-8.292E-04	6.161E-05	
	m+p+o-tolualdehyde	22		9.191E-03		6.484E-03	8.991E-05	5.042E-03	2.013E-04	1.331E-03	
	methacrolein	22	-3.139E-03		3.042E-03		-3.746E-03	4.581E-04			
	methane	-20		4.881E+00				2.143E+00		1.478E+00	7.985E-01
		-7		2.395E+00				6.592E-01		5.064E-01	4.420E-01
		22		1.897E+00		1.748E-01	-4.745E-03	1.549E-01		8.050E-02	7.189E-02
	methyl ethyl ketone	22		4.845E-03		1.565E-03	1.099E-03	1.208E-03	-8.142E-04	5.564E-04	
	methylcyclopentane	22		-6.094E-02		2.927E-02	0.000E+00	2.650E-02		5.320E-03	
	m-xylene	-20						3.636E+00		1.580E+00	1.439E+00
		-7						1.114E+00		6.460E-01	7.927E-01
		22						3.771E-01		1.016E-01	4.870E-02
	m-xylene + o-xylene + p-xylene + ethylbenzene	-20					4.201E-02				
		-7					1.606E-02				
		22					9.434E-03				
	m-xylene + p-xylene	22	-1.708 ^E -01		2.952 ^E -01	8.419 ^E +00	2.349 ^E -01	1.185 ^E +01	2.080 ^E +00	3.700 ^E +01	
	n-butane	22		1.848 ^E -01	2.069 ^E -02	7.243 ^E -02	1.635 ^E -03	1.992 ^E -02		1.531 ^E -02	
	n-decane	22	-9.740 ^E -02		4.146 ^E -01		-8.806 ^E -03	5.227 ^E -01	1.659 ^E -01	7.492 ^E -03	
	n-dodecane	22	5.514 ^E -01		1.599 ^E -01		-1.540 ^E -02	4.593 ^E -02	-1.199 ^E -02		
	n-heptane	22								1.439 ^E -01	
	n-hexadecane	22	-1.002 ^E -01		4.510 ^E -02		1.919 ^E -02	8.621 ^E -02	-6.159 ^E -01		
n-nonane	22	-2.248 ^E -01			1.226 ^E -03	-4.840 ^E -02	7.990 ^E -02		1.499 ^E -04		
nonadecane	22					2.383 ^E -01					
n-pentane	22	1.056 ^E +00	1.548 ^E -01	3.641 ^E -02	2.806 ^E -02	1.485 ^E -02	-1.853 ^E -01	4.496 ^E -04	4.719 ^E -02		
n-undecane	22	1.274 ^E -01		4.160 ^E -01	8.718 ^E -04	-8.449 ^E -02	-1.326 ^E +00	4.945 ^E -02			
octadecane	22			2.682 ^E -02		-2.416 ^E -02		-7.493 ^E -01			

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3		Euro 4
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	gasoline
IUFC	o-xylene	-20						1.479 ^{E+00}		6.177 ^{E-01}	5.644 ^{E-01}
		-7						4.481 ^{E-01}		2.574 ^{E-01}	3.112 ^{E-01}
		22	7.193 ^{E-02}		5.080 ^{E-02}	1.179 ^{E+00}	3.724 ^{E-01}	4.775 ^{E+00}	-5.425 ^{E-01}	1.539 ^{E+00}	2.055 ^{E-02}
	pentadecane	22	-1.025 ^{E-01}		1.094 ^{E-01}		6.931 ^{E-02}	8.631 ^{E-02}	-1.708 ^{E-01}		
	propane	-20						2.033 ^{E-02}		1.332 ^{E-02}	1.136 ^{E-02}
		-7						6.943 ^{E-03}		-9.291 ^{E-04}	6.611 ^{E-03}
		22	4.331 ^{E-03}	-2.597 ^{E-02}	-8.309 ^{E-03}	3.934 ^{E-03}	-1.372 ^{E-03}	3.064 ^{E-02}	3.671 ^{E-03}	9.108 ^{E-04}	3.510 ^{E-03}
	propene	-20						6.993 ^{E-01}		3.362 ^{E-01}	2.770 ^{E-01}
		-7						2.408 ^{E-01}		1.805 ^{E-01}	1.521 ^{E-01}
		22	3.994 ^{E-02}	0.000 ^{E+00}	1.551 ^{E-02}	3.841 ^{E-02}	1.499 ^{E-03}	3.245 ^{E-01}	6.728 ^{E-03}	1.457 ^{E-02}	1.788 ^{E-02}
	propionaldehyde	22	4.945 ^{E-03}	6.543 ^{E-03}	-4.442 ^{E-03}	-7.224 ^{E-05}	-5.572 ^{E-03}	5.443 ^{E-02}	2.453 ^{E-03}	4.852 ^{E-04}	
	propylbenzene	22				1.360 ^{E+00}	1.903 ^{E-01}	8.941 ^{E+00}	2.712 ^{E-02}	6.460 ^{E+00}	
	p-tolualdehyde	22	5.994 ^{E-04}		7.243 ^{E-03}	5.310 ^{E-05}	-1.706 ^{E-03}	-2.389 ^{E-03}		5.470 ^{E-03}	
	tert-butylbenzene	22			5.065 ^{E-02}		3.111 ^{E-02}		2.802 ^{E-01}		
	tetradecane	22	-1.056 ^{E-01}		1.073 ^{E-01}		-1.909 ^{E-02}	4.065 ^{E-01}	-1.034 ^{E-01}		
	toluene	-20		1.221E+01			4.504E-02	5.241E+00		7.420E+00	2.104E+00
		-7		6.563E+00			1.036E-02	1.576E+00		3.071E+00	1.111E+00
		22	-9.441E-02	2.235E+00	5.350E-01	1.560E+00	5.762E-02	1.459E+00	3.222E-01	8.092E-01	9.257E-02
trans-2-butene	22	1.214E-03			1.194E-02	-4.358E-03	5.006E-01	1.034E-03	1.813E-03		
tridecane	22	8.841E-02		1.406E-01		-8.616E-03	2.855E-01	5.994E-03			
valeraldehyde	22	5.387E-03	0.000E+00	1.424E-02	8.157E-05	-8.483E-03	1.474E-04	2.777E-04	3.628E-04		
xylene	22		0.000E+00		0.000E+00	0.000E+00	0.000E+00		0.000E+00		
IRC	1,3,5-triphenylbenzene	22		4.677E-06		-6.591E-05	-1.504E-04	-2.914E-06	2.501E-05	1.631E-05	
	1,3-butadiene	22		-2.561E-01			0.000E+00	0.000E+00	0.000E+00	0.000E+00	
	2,2,4-trimethylpentane	22		-8.274E-01			0.000E+00	1.259E-01	0.000E+00	3.758E-02	
	2,2-dimethylbutane	22		0.000E+00			0.000E+00	0.000E+00	0.000E+00	2.386E-03	
	2,2-dimethylpropane	22		0.000E+00			0.000E+00	0.000E+00	0.000E+00	1.938E-03	

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3		Euro 4
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	gasoline
IRC	2,5-dimethylbenzaldehyde	22		1.107E-02		0.000E+00	-3.101E-04	4.403E-04	5.072E-05	7.771E-04	
	2-methylpentane	22		-4.195E-01			0.000E+00	2.518E-02	0.000E+00	4.005E-03	
	3-methylpentane	22		-3.986E-01			0.000E+00	3.043E-02	0.000E+00	1.895E-03	
	acetaldehyde	22		6.691E-03		9.332E-03	1.439E-02	7.825E-03	3.156E-02	2.453E-03	
	acetaldehyde+acrolein +formaldehyde	22					-1.887E+01	1.246E-01			
	acetone + acrolein	22		3.540E-02		7.274E-03		5.209E-03	-2.806E-03	1.928E-03	
	benzaldehyde	22		3.079E-02		4.917E-03	1.216E-03	4.999E-03	4.944E-04	1.778E-03	
	benzene	22		1.723E-01			6.903E-03	2.702E-01	3.864E-02	9.209E-02	
	butyraldehyde	22		-1.727E-04		8.310E-04	2.101E-03	1.267E-03	7.443E-04	1.211E-04	
	crotonaldehyde	22		1.259E-02		3.024E-03	3.238E-03	1.487E-03	3.070E-03	1.034E-03	
	ethane	22		-1.374E-01			-3.526E-04	3.756E-02	1.166E-02	1.446E-02	
	ethene	22		-3.087E-01			0.000E+00	0.000E+00	0.000E+00	0.000E+00	
	ethylbenzene	22		0.000E+00			4.965E-04	9.687E-02	0.000E+00	0.000E+00	
	formaldehyde	22		-2.878E-03		6.979E-03	3.209E-02	1.643E-02	4.023E-02	4.847E-03	
	heptane	22		-8.346E-02			-7.123E-03	3.943E-02	2.813E-02	1.557E-02	
	hexaldehyde	22		1.121E-02		0.000E+00	8.879E-04	2.170E-04	2.867E-04	-5.660E-04	
	hexane	22		-1.842E-01			0.000E+00	1.559E-02	0.000E+00	1.106E-02	
	isobutane	22		-7.771E-02			1.115E-03	6.109E-03	0.000E+00	6.571E-03	
	isopentane	22		-			3.115E-03	1.045E-01	1.266E-02	5.549E-02	
	isovaleraldehyde	22		0.000E+00		0.000E+00	-9.138E-05	1.953E-03	1.928E-03	5.104E-04	
m+p+o-tolualdehyde	22		5.396E-02		2.923E-03	1.655E-04	3.519E-03	4.745E-04	2.568E-03		
methane	22		4.508E-01			9.354E-04	1.536E-01	1.087E-02	6.207E-02		
methyl ethyl ketone	22		1.633E-02		-2.504E-04	9.138E-04	1.463E-03	7.706E-04	1.013E-04		
methylcyclopentane	22		-1.223E-01			0.000E+00	1.680E-02	0.000E+00	5.852E-03		

Cycle Name	Pollutant	T (°C)	Euro 0 w/o cat.		Euro 1		Euro 2		Euro 3		Euro 4
			diesel	gasoline	diesel	gasoline	diesel	gasoline	diesel	gasoline	gasoline
IRC	m-xylene + o-xylene + p-xylene + ethylbenzene	22					5.255E-03				
	n-butane	22		-3.857E-01			-3.813E-04	1.834E-02	6.684E-04	1.574E-02	
	NH3	22					3.680E-01	-7.148E-01			
	n-pentane	22		-2.892E-01			0.000E+00	2.702E-02	6.123E-03	3.952E-02	
	propane	22		-1.662E-02			-2.087E-03	5.267E-03	0.000E+00	0.000E+00	
	propene	22		0.000E+00			0.000E+00	0.000E+00	0.000E+00	0.000E+00	
	propionaldehyde	22		-7.195E-06		6.260E-04	3.008E-03	1.243E-03	3.310E-03	2.624E-04	
	toluene	22		1.622E+00			5.492E-03	7.182E-01	1.055E-01	4.862E-01	
	valeraldehyde	22		0.000E+00		0.000E+00	8.130E-04	0.000E+00	1.363E-04	5.929E-05	
xylene	22		0.000E+00			6.452E-04	4.472E-01	0.000E+00	0.000E+00		

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Annex 16: Excess emissions $\omega_{T,V}$ and correction functions $f(T,V)$ for PAH

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
2,3-benzofluorene	Euro 0 w/o cat.	gasoline	2	$9.269E-5-1.853E-6*V$	(22°C, V)	5.564E-5	$1.666-0.033*V$
	Euro 1	gasoline	1	-1.838E-5	(22°C, 41.1km/h)	-1.838E-5	1
	Euro 2	diesel	1	-1.249E-6	(22°C, 19km/h)	-1.249E-6	1
		gasoline	3	$7.167E-6-1.088E-7*V$	(22°C, V)	4.991E-6	$1.436-0.022*V$
	Euro 3	diesel	4	$1.150E-5-2.056E-7*V$	(22°C, V)	7.387E-6	$1.557-0.028*V$
		gasoline	8	$1.022E-5-3.002E-7*V$	(22°C, V)	4.216E-6	$2.424-0.071*V$
acenaphthene	Euro 0 w/o cat.	diesel	2	3.792E-5	(22°C, 19km/h)	3.792E-5	1
		gasoline	2	$6.658E-5-9.130E-6*V$	(22°C, V)	-1.160E-4	$-0.574+0.079*V$
	Euro 1	diesel	3	-2.084E-6	(22°C, 19km/h)	-2.084E-6	1
		gasoline	4	$1.148E-3-6.031E-5*V$	(22°C, V)	-5.786E-5	$-19.847+1.042*V$
	Euro 2	diesel	12	$-5.344E-5+3.107E-6*V$	(22°C, V)	8.699E-6	$-6.143+0.357*V$
		gasoline	8	$-8.471E-5+6.174E-6*V$	(22°C, V)	3.877E-5	$-2.185+0.159*V$
	Euro 3	diesel	6	$-7.145E-4+3.031E-5*V$	(22°C, V)	-1.083E-4	$6.599+-0.280*V$
		gasoline	11	$2.311E-5+3.015E-7*V$	(22°C, V)	2.914E-5	$0.793+0.010*V$
acenaphthylene	Euro 0 w/o cat.	diesel	2	1.576E-3	(22°C, 19km/h)	1.576E-3	1
		gasoline	2	$-4.851E-3+2.280E-4*V$	(22°C, V)	-2.915E-4	$16.640-0.782*V$
	Euro 1	diesel	2	8.991E-5	(22°C, 19km/h)	8.991E-5	1
		gasoline	4	$-3.225E-4+1.698E-5*V$	(22°C, V)	1.720E-5	$-18.755+0.988*V$
	Euro 2	diesel	12	$-1.537E-3+8.533E-5*V$	(22°C, V)	1.692E-4	$-9.084+0.504*V$
		gasoline	8	$1.187E-5+1.383E-5*V$	(22°C, V)	2.885E-4	$0.041+0.048*V$
	Euro 3	diesel	6	$-6.431E-5+4.137E-6*V$	(22°C, V)	1.844E-5	$-3.488+0.224*V$
		gasoline	11	$2.847E-4-3.142E-6*V$	(22°C, V)	2.218E-4	$1.283-0.014*V$

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
anthanthrene	Euro 0 w/o cat.	gasoline	2	4.402E-4-8.156E-6*V	(22°C, V)	2.771E-4	1.589-0.029*V
	Euro 1	gasoline	1	3.710E-5	(22°C, 41.1km/h)	3.710E-5	1
	Euro 2	diesel	2	8.337E-5-1.871E-6*V	(22°C, V)	4.596E-5	1.814-0.041*V
		gasoline	3	1.871E-6+1.907E-7*V	(22°C, V)	5.685E-6	0.329+0.034*V
	Euro 3	diesel	4	-3.561E-6+9.383E-8*V	(22°C, V)	-1.684E-6	2.114+-0.056*V
		gasoline	7	3.205E-6-5.290E-8*V	(22°C, V)	2.147E-6	1.493-0.025*V
anthracene	Euro 0 w/o cat.	diesel	2	3.686E-6	(22°C, 19km/h)	3.686E-6	1
		gasoline	2	4.359E-4-1.169E-5*V	(22°C, V)	2.021E-4	2.157-0.058*V
	Euro 1	diesel	3	-1.447E-6	(22°C, 19km/h)	-1.447E-6	1
		gasoline	4	-2.241E-5+1.447E-6*V	(22°C, V)	6.525E-6	-3.435+0.222*V
	Euro 2	diesel	12	-4.384E-5+2.509E-6*V	(22°C, V)	6.343E-6	-6.912+0.396*V
		gasoline	8	-5.933E-7-1.431E-7*V	(22°C, V)	-3.456E-6	0.172+0.041*V
Euro 3	diesel	6	-1.378E-5+7.212E-7*V	(22°C, V)	6.404E-7	-21.522+1.126*V	
	gasoline	12	2.020E-4-9.731E-6*V	(22°C, V)	7.354E-6	27.463-1.323*V	
benz[a]anthracene	Euro 0 w/o cat.	diesel	2	1.332E-5	(22°C, 19km/h)	1.332E-5	1
		gasoline	2	1.482E-4-4.533E-6*V	(22°C, V)	5.751E-5	2.576-0.079*V
	Euro 1	diesel	3	3.160E-7	(22°C, 19km/h)	3.160E-7	1
		gasoline	4	-1.428E-6+3.031E-7*V	(22°C, V)	4.634E-6	-0.308+0.065*V
	Euro 2	diesel	11	5.659E-7	(22°C, 19km/h)	5.659E-7	1
		gasoline	8	7.203E-6-8.789E-8*V	(22°C, V)	5.445E-6	1.323-0.016*V
Euro 3	diesel	6	-3.196E-6+2.771E-7*V	(22°C, V)	2.345E-6	-1.363+0.118*V	
	gasoline	12	6.614E-6-1.153E-7*V	(22°C, V)	4.309E-6	1.535-0.027*V	
benzo[a]pyrene	Euro 0 w/o cat.	diesel	2	7.951E-6	(22°C, 19km/h)	7.951E-6	1
		gasoline	2	2.313E-4-4.579E-6*V	(22°C, V)	1.398E-4	1.655-0.033*V
	Euro 1	diesel	3	8.210E-7	(22°C, 19km/h)	8.210E-7	1
		gasoline	4	-2.372E-5+1.465E-6*V	(22°C, V)	5.583E-6	-4.248+0.262*V
	Euro 2	diesel	18	-1.545E-2+8.131E-4*V	(22°C, V)	8.138E-4	-18.983+0.999*V
		gasoline	14	-4.433E-2+2.333E-3*V	(22°C, V)	2.339E-3	-18.956+0.998*V
Euro 3	diesel	6	-6.071E-6+2.975E-7*V	(22°C, V)	-1.199E-7	50.639-2.482*V	
	gasoline	12	6.691E-6-9.605E-8*V	(22°C, V)	4.770E-6	1.403-0.020*V	

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
benzo[b]chrysene + picene	Euro 0 w/o cat.	gasoline	2	-1.568E-6-2.627E-9*V	(22°C, V)	-1.621E-6	0.968+0.002*V
	Euro 1	gasoline	1	9.385E-6	(22°C, 41.1km/h)	9.385E-6	1
	Euro 2	diesel	2	-4.594E-6+2.980E-7*V	(22°C, V)	1.367E-6	-3.361+0.218*V
		gasoline	3	1.626E-6-3.385E-8*V	(22°C, V)	9.492E-7	1.713-0.036*V
	Euro 3	diesel	4	-1.971E-6+1.026E-7*V	(22°C, V)	8.008E-8	-24.614+1.281*V
		gasoline	7	-4.940E-6+2.167E-7*V	(22°C, V)	-6.049E-7	8.166-0.358*V
benzo[b]fluoranthene	Euro 0 w/o cat.	diesel	2	5.340E-6	(22°C, 19km/h)	5.340E-6	1
	Euro 1	diesel	3	4.450E-7	(22°C, 19km/h)	4.450E-7	1
		gasoline	3	3.656E-6	(22°C, 19km/h)	3.656E-6	1
	Euro 2	diesel	10	5.784E-7	(22°C, 19km/h)	5.784E-7	1
		gasoline	5	3.076E-6	(22°C, 19km/h)	3.076E-6	1
	Euro 3	diesel	2	4.016E-8	(22°C, 19km/h)	4.016E-8	1
gasoline		4	1.838E-6	(22°C, 19km/h)	1.838E-6	1	
benzo[b]naphtho[1,2-d]thiophene	Euro 0 w/o cat.	gasoline	2	7.007E-6-3.201E-8*V	(22°C, V)	6.367E-6	1.101-0.005*V
	Euro 1	gasoline	1	2.101E-6	(22°C, 41.1km/h)	2.101E-6	1
	Euro 2	diesel	2	1.424E-4-7.198E-6*V	(22°C, V)	-1.553E-6	-91.670+4.634*V
		gasoline	3	2.942E-6-1.105E-7*V	(22°C, V)	7.322E-7	4.018-0.151*V
	Euro 3	diesel	4	-4.661E-6+2.516E-7*V	(22°C, V)	3.707E-7	-12.573+0.679*V
		gasoline	8	1.173E-6+1.404E-8*V	(22°C, V)	1.454E-6	0.807+0.010*V
benzo[b+k+j]fluoranthene	Euro 0 w/o cat.	gasoline	2	5.977E-5-1.332E-6*V	(22°C, V)	3.313E-5	1.804-0.040*V
	Euro 1	gasoline	1	1.250E-4	(22°C, 41.1km/h)	1.250E-4	1
	Euro 2	diesel	2	8.757E-5-3.107E-6*V	(22°C, V)	2.543E-5	3.443-0.122*V
		gasoline	3	4.818E-5-7.830E-7*V	(22°C, V)	3.252E-5	1.482-0.024*V
	Euro 3	diesel	4	-1.545E-5+6.139E-7*V	(22°C, V)	-3.172E-6	4.871-0.194*V
		gasoline	8	1.746E-6+4.309E-7*V	(22°C, V)	1.036E-5	0.168+0.042*V

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
benzo[c]phenanthrene	Euro 0 w/o cat.	gasoline	2	$3.031E-5-8.617E-7*V$	(22°C, V)	1.307E-5	$2.318-0.066*V$
	Euro 1	gasoline	1	8.174E-6	(22°C, 41.1km/h)	8.174E-6	1
	Euro 2	diesel	1	4.046E-7	(22°C, 19km/h)	4.046E-7	1
		gasoline	3	$2.490E-6-4.561E-8*V$	(22°C, V)	1.578E-6	$1.578-0.029*V$
	Euro 3	diesel	4	$-1.791E-6+1.220E-7*V$	(22°C, V)	6.484E-7	$-2.762+0.188*V$
		gasoline	8	$7.704E-6-1.675E-7*V$	(22°C, V)	4.355E-6	$1.769-0.038*V$
benzo[e]pyrene	Euro 0 w/o cat.	gasoline	2	$5.979E-5-7.545E-7*V$	(22°C, V)	4.470E-5	$1.338-0.017*V$
	Euro 1	gasoline	1	5.448E-5	(22°C, 41.1km/h)	5.448E-5	1
	Euro 2	diesel	1	-2.967E-5	(22°C, 19km/h)	-2.967E-5	1
		gasoline	3	$2.158E-5-3.520E-7*V$	(22°C, V)	1.454E-5	$1.484-0.024*V$
	Euro 3	diesel	4	$-3.690E-6+1.778E-7*V$	(22°C, V)	-1.344E-7	$27.457-1.323*V$
		gasoline	8	$1.486E-6+1.879E-7*V$	(22°C, V)	5.243E-6	$0.283+0.036*V$
benzo[g,h,i]fluoranthene	Euro 0 w/o cat.	gasoline	2	$2.235E-4-6.192E-6*V$	(22°C, V)	9.970E-5	$2.242-0.062*V$
	Euro 1	gasoline	1	2.885E-5	(22°C, 41.1km/h)	2.885E-5	1
	Euro 2	diesel	2	$-6.392E-5+2.791E-6*V$	(22°C, V)	-8.098E-6	$7.894-0.345*V$
		gasoline	3	$3.644E-5-7.219E-7*V$	(22°C, V)	2.201E-5	$1.656-0.033*V$
	Euro 3	diesel	4	$3.006E-5-8.961E-7*V$	(22°C, V)	1.214E-5	$2.476-0.074*V$
		gasoline	8	$1.373E-5-3.397E-7*V$	(22°C, V)	6.936E-6	$1.980-0.049*V$
benzo[g,h,i]perylene	Euro 0 w/o cat.	diesel	2	9.957E-6	(22°C, 19km/h)	9.957E-6	1
		gasoline	2	$-2.151E-4+7.037E-6*V$	(22°C, V)	-7.438E-5	$2.892+-0.095*V$
	Euro 1	diesel	3	1.281E-6	(22°C, 19km/h)	1.281E-6	1
		gasoline	4	$-1.051E-5+1.136E-6*V$	(22°C, V)	1.220E-5	$-0.861+0.093*V$
	Euro 2	diesel	12	$-2.628E-6+1.739E-7*V$	(22°C, V)	8.496E-7	$-3.093+0.205*V$
		gasoline	8	$4.088E-6+7.755E-7*V$	(22°C, V)	1.960E-5	$0.209+0.040*V$
	Euro 3	diesel	6	$-1.387E-6+1.637E-7*V$	(22°C, V)	1.887E-6	$-0.735+0.087*V$
		gasoline	11	$1.331E-6+3.520E-7*V$	(22°C, V)	8.371E-6	$0.159+0.042*V$

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
benzo[k]fluoranthene	Euro 0 w/o cat.	diesel	2	2.185E-6	(22°C, 19km/h)	2.185E-6	1
	Euro 1	diesel	3	2.318E-7	(22°C, 19km/h)	2.318E-7	1
		gasoline	3	1.958E-6	(22°C, 19km/h)	1.958E-6	1
	Euro 2	diesel	10	2.243E-7	(22°C, 19km/h)	2.243E-7	1
		gasoline	5	1.881E-6	(22°C, 19km/h)	1.881E-6	1
	Euro 3	diesel	2	8.279E-9	(22°C, 19km/h)	8.279E-9	1
gasoline		4	1.048E-6	(22°C, 19km/h)	1.048E-6	1	
chrysene	Euro 0 w/o cat.	diesel	2	6.475E-6	(22°C, 19km/h)	6.475E-6	1
	Euro 1	diesel	3	4.710E-8	(22°C, 19km/h)	4.710E-8	1
		gasoline	3	5.442E-6	(22°C, 19km/h)	5.442E-6	1
	Euro 2	diesel	10	9.989E-7	(22°C, 19km/h)	9.989E-7	1
		gasoline	5	4.386E-6	(22°C, 19km/h)	4.386E-6	1
	Euro 3	diesel	2	1.094E-7	(22°C, 19km/h)	1.094E-7	1
gasoline		4	2.573E-6	(22°C, 19km/h)	2.573E-6	1	
chrysene + triphenylene	Euro 0 w/o cat.	gasoline	2	6.019E-5-7.993E-7*V	(22°C, V)	4.421E-5	1.362-0.018*V
	Euro 1	gasoline	1	9.713E-5	(22°C, 41.1km/h)	9.713E-5	1
	Euro 2	diesel	2	-6.365E-5+2.530E-6*V	(22°C, V)	-1.305E-5	4.875+-0.194*V
		gasoline	3	2.530E-5-7.112E-7*V	(22°C, V)	1.108E-5	2.284-0.064*V
	Euro 3	diesel	4	-8.276E-6+5.281E-7*V	(22°C, V)	2.286E-6	-3.620+0.231*V
		gasoline	8	2.916E-5-1.108E-6*V	(22°C, V)	7.007E-6	4.162-0.158*V
coronene	Euro 0 w/o cat.	gasoline	2	-2.022E-4+1.285E-5*V	(22°C, V)	5.481E-5	-3.689+0.234*V
	Euro 1	gasoline	1	-5.233E-6	(22°C, 41.1km/h)	-5.233E-6	1
	Euro 2	diesel	2	-3.455E-6+2.034E-7*V	(22°C, V)	6.130E-7	-5.636+0.332*V
		gasoline	3	4.389E-5-5.821E-8*V	(22°C, V)	4.273E-5	1.027-0.001*V
	Euro 3	diesel	4	1.513E-6+6.573E-8*V	(22°C, V)	2.828E-6	0.535+0.023*V
		gasoline	8	1.228E-5-1.302E-7*V	(22°C, V)	9.679E-6	1.269-0.013*V

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
cyclopenta[c,d]pyrene	Euro 0 w/o cat.	gasoline	2	$3.495E-4+4.713E-6*V$	(22°C, V)	4.438E-4	$0.788+0.011*V$
	Euro 1	gasoline	1	1.484E-5	(22°C, 41.1km/h)	1.484E-5	1
	Euro 2	diesel	2	$-1.938E-5+8.990E-7*V$	(22°C, V)	-1.399E-6	$13.855-0.643*V$
		gasoline	3	$3.580E-5+8.104E-8*V$	(22°C, V)	3.742E-5	$0.957+0.002*V$
	Euro 3	diesel	4	$1.983E-6+1.111E-7*V$	(22°C, V)	4.204E-6	$0.472+0.026*V$
		gasoline	8	$1.761E-5-2.495E-7*V$	(22°C, V)	1.262E-5	$1.395-0.020*V$
dibenz[a,c]anthracene	Euro 0 w/o cat.	gasoline	2	$1.199E-6-5.759E-8*V$	(22°C, V)	4.731E-8	$25.344-1.217*V$
	Euro 1	gasoline	1	8.526E-6	(22°C, 41.1km/h)	8.526E-6	1
	Euro 2	diesel	2	$-5.148E-6+3.072E-7*V$	(22°C, V)	9.965E-7	$-5.166+0.308*V$
		gasoline	3	$-4.663E-7+1.984E-8*V$	(22°C, V)	-6.957E-8	$6.702-0.285*V$
	Euro 3	diesel	4	$-7.294E-7+4.352E-8*V$	(22°C, V)	1.409E-7	$-5.176+0.309*V$
		gasoline	8	$4.541E-6-1.242E-7*V$	(22°C, V)	2.057E-6	$2.207-0.060*V$
dibenz[a,h]anthracene	Euro 0 w/o cat.	diesel	2	1.025E-6	(22°C, 19km/h)	1.025E-6	1
		gasoline	2	$-1.216E-5+6.558E-7*V$	(22°C, V)	9.555E-7	$-12.727+0.686*V$
	Euro 1	diesel	3	1.089E-7	(22°C, 19km/h)	1.089E-7	1
		gasoline	4	$-1.299E-5+7.464E-7*V$	(22°C, V)	1.935E-6	$-6.714+0.386*V$
	Euro 2	diesel	12	$-2.731E-6+1.542E-7*V$	(22°C, V)	3.540E-7	$-7.714+0.436*V$
		gasoline	8	$-8.158E-6+4.799E-7*V$	(22°C, V)	1.440E-6	$-5.665+0.333*V$
	Euro 3	diesel	6	$-1.403E-6+8.747E-8*V$	(22°C, V)	3.460E-7	$-4.057+0.253*V$
		gasoline	12	$-6.385E-7+3.963E-8*V$	(22°C, V)	1.541E-7	$-4.144+0.257*V$
fluoranthene	Euro 0 w/o cat.	diesel	2	2.532E-5	(22°C, 19km/h)	2.532E-5	1
		gasoline	2	$1.090E-3-2.198E-5*V$	(22°C, V)	6.508E-4	$1.675-0.034*V$
	Euro 1	diesel	3	-3.986E-7	(22°C, 19km/h)	-3.986E-7	1
		gasoline	4	$-1.098E-4+6.308E-6*V$	(22°C, V)	1.641E-5	$-6.691+0.385*V$
	Euro 2	diesel	12	$-1.996E-4+1.063E-5*V$	(22°C, V)	1.298E-5	$-15.383+0.819*V$
		gasoline	8	$2.622E-5-9.610E-7*V$	(22°C, V)	7.002E-6	$3.745-0.137*V$
	Euro 3	diesel	6	$-8.933E-5+4.876E-6*V$	(22°C, V)	8.200E-6	$-10.894+0.595*V$
		gasoline	12	$2.112E-5-1.165E-7*V$	(22°C, V)	1.879E-5	$1.124-0.006*V$

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
fluorene	Euro 0 w/o cat.	diesel	2	3.404E-5	(22°C, 19km/h)	3.404E-5	1
		gasoline	2	4.257E-3-1.302E-4*V	(22°C, V)	1.653E-3	2.575-0.079*V
	Euro 1	diesel	3	-7.051E-6	(22°C, 19km/h)	-7.051E-6	1
		gasoline	4	5.644E-4-2.951E-5*V	(22°C, V)	-2.569E-5	-21.975+1.149*V
	Euro 2	diesel	12	-8.621E-5+3.057E-6*V	(22°C, V)	-2.507E-5	3.438+-0.122*V
		gasoline	8	4.645E-4-7.747E-6*V	(22°C, V)	3.095E-4	1.501-0.025*V
	Euro 3	diesel	6	-9.661E-5+5.107E-6*V	(22°C, V)	5.529E-6	-17.474+0.924*V
		gasoline	11	-2.672E-5+2.556E-6*V	(22°C, V)	2.440E-5	-1.095+0.105*V
indeno[1,2,3-c,d]pyrene	Euro 0 w/o cat.	diesel	2	7.119E-6	(22°C, 19km/h)	7.119E-6	1
		gasoline	2	-2.969E-5+1.510E-6*V	(22°C, V)	5.112E-7	-58.081+2.954*V
	Euro 1	diesel	3	8.087E-7	(22°C, 19km/h)	8.087E-7	1
		gasoline	4	-1.072E-5+7.739E-7*V	(22°C, V)	4.759E-6	-2.252+0.163*V
	Euro 2	diesel	12	-7.447E-6+3.727E-7*V	(22°C, V)	7.166E-9	-1039.214+52.011*V
		gasoline	8	3.065E-6+3.631E-7*V	(22°C, V)	1.033E-5	0.297+0.035*V
	Euro 3	diesel	6	-2.713E-6+1.728E-7*V	(22°C, V)	7.422E-7	-3.655+0.233*V
		gasoline	12	3.626E-6+1.197E-7*V	(22°C, V)	6.019E-6	0.602+0.020*V
naphthalene	Euro 0 w/o cat.	diesel	2	1.293E-3	(22°C, 19km/h)	1.293E-3	1
		gasoline	2	-1.405E-2+1.147E-3*V	(22°C, V)	8.889E-3	-1.581+0.129*V
	Euro 1	diesel	3	-4.674E-4	(22°C, 19km/h)	-4.674E-4	1
		gasoline	3	-3.132E-4	(22°C, 19km/h)	-3.132E-4	1
	Euro 2	diesel	18	2.235E-5+2.501E-5*V	(22°C, V)	5.225E-4	0.043+0.048*V
		gasoline	14	-5.367E-3+2.948E-4*V	(22°C, V)	5.301E-4	-10.124+0.556*V
	Euro 3	diesel	6	-2.018E-3+1.131E-4*V	(22°C, V)	2.446E-4	-8.253+0.463*V
		gasoline	10	3.568E-5+6.143E-5*V	(22°C, V)	1.264E-3	0.028+0.049*V
perylene	Euro 0 w/o cat.	gasoline	2	1.818E-5-2.709E-7*V	(22°C, V)	1.277E-5	1.424-0.021*V
	Euro 1	gasoline	1	-8.058E-6	(22°C, 41.1km/h)	-8.058E-6	1
		diesel	2	-1.413E-5+1.035E-6*V	(22°C, V)	6.564E-6	-2.153+0.158*V
	Euro 2	gasoline	3	7.085E-7+6.089E-9*V	(22°C, V)	8.303E-7	0.853+0.007*V
		diesel	4	-1.586E-5+4.866E-7*V	(22°C, V)	-6.132E-6	2.587-0.079*V
	Euro 3	gasoline	8	-1.151E-5+1.289E-6*V	(22°C, V)	1.427E-5	-0.807+0.090*V

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
phenanthrene	Euro 0 w/o cat.	diesel	2	2.607E-5	(22°C, 19km/h)	2.607E-5	1
		gasoline	2	8.727E-4-3.279E-5*V	(22°C, V)	2.170E-4	4.022-0.151*V
	Euro 1	diesel	3	-5.862E-5	(22°C, 19km/h)	-5.862E-5	1
		gasoline	4	-9.676E-5+7.046E-6*V	(22°C, V)	4.416E-5	-2.191+0.160*V
	Euro 2	diesel	12	-2.489E-4+1.393E-5*V	(22°C, V)	2.977E-5	-8.362+0.468*V
		gasoline	8	5.535E-6-8.087E-7*V	(22°C, V)	-1.064E-5	-0.520+0.076*V
	Euro 3	diesel	6	-2.473E-4+1.249E-5*V	(22°C, V)	2.433E-6	-101.670+5.134*V
		gasoline	12	5.145E-5-8.073E-7*V	(22°C, V)	3.531E-5	1.457-0.023*V
pyrene	Euro 0 w/o cat.	diesel	2	4.382E-5	(22°C, 19km/h)	4.382E-5	1
		gasoline	2	1.657E-3-3.016E-5*V	(22°C, V)	1.054E-3	1.572-0.029*V
	Euro 1	diesel	3	-2.167E-6	(22°C, 19km/h)	-2.167E-6	1
		gasoline	4	-4.203E-5+3.241E-6*V	(22°C, V)	2.278E-5	-1.845+0.142*V
	Euro 2	diesel	12	1.817E-4-9.149E-6*V	(22°C, V)	-1.228E-6	-148.057+7.453*V
		gasoline	8	1.820E-5-2.450E-7*V	(22°C, V)	1.330E-5	1.368-0.018*V
	Euro 3	diesel	6	-7.956E-5+4.885E-6*V	(22°C, V)	1.815E-5	-4.382+0.269*V
		gasoline	12	3.774E-5-1.101E-6*V	(22°C, V)	1.573E-5	2.400-0.070*V

Annex 17: Excess emissions $\omega_{T,V}$ and correction functions $f(T,V)$ for VOC

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
1,2,4-trimethylbenzene	Euro 1	gasoline	1	9.441E-1	(22°C, 19km/h)	9.441E-1	1
	Euro 2	diesel	2	4.905E-1	(22°C, 19km/h)	4.905E-1	1
		gasoline	2	3.395E+0	(22°C, 19km/h)	3.395E+0	1
	Euro 3	gasoline	1	5.810E+0	(22°C, 19km/h)	5.810E+0	1
1,2-dimethylcyclohexane cis	Euro 0 w/o cat.	diesel	1	5.395E-4	(22°C, 19km/h)	5.395E-4	1
	Euro 1	gasoline	2	6.008E-2	(22°C, 19km/h)	6.008E-2	1
		diesel	2	1.561E-2	(22°C, 19km/h)	1.561E-2	1
	Euro 2	gasoline	1	-4.029E-2	(22°C, 19km/h)	-4.029E-2	1
1,2-dimethylcyclohexane trans	Euro 3	gasoline	2	1.194E-2	(22°C, 19km/h)	1.194E-2	1
	Euro 0 w/o cat.	diesel	1	6.354E-4	(22°C, 19km/h)	6.354E-4	1
		gasoline	1	6.743E-4	(22°C, 19km/h)	6.743E-4	1
	Euro 1	diesel	1	6.743E-4	(22°C, 19km/h)	6.743E-4	1
		gasoline	2	3.899E-3	(22°C, 19km/h)	3.899E-3	1
Euro 2	diesel	6	-3.472E-4	(22°C, 19km/h)	-3.472E-4	1	
	gasoline	4	7.201E-2	(22°C, 19km/h)	7.201E-2	1	
1,3,5-trimethylbenzene	Euro 1	diesel	1	2.811E-1	(22°C, 19km/h)	2.811E-1	1
		gasoline	1	2.997E-1	(22°C, 19km/h)	2.997E-1	1
	Euro 2	diesel	5	-1.262E-1	(22°C, 19km/h)	-1.262E-1	1
		gasoline	4	3.212E+0	(22°C, 19km/h)	3.212E+0	1
Euro 3	diesel	1	3.671E-1	(22°C, 19km/h)	3.671E-1	1	
1,3,5-triphenylbenzene	Euro 0 w/o cat.	gasoline	2	-2.720E-6+1.800E-7*V	(22°C, V)	8.793E-7	-3.094+0.205*V
	Euro 1	gasoline	1	-6.591E-5	(22°C, 41.1km/h)	-6.591E-5	1
	Euro 2	diesel	2	1.245E-4-6.690E-6*V	(22°C, V)	-9.287E-6	-13.407+0.720*V
		gasoline	3	5.926E-5-1.513E-6*V	(22°C, V)	2.901E-5	2.043-0.052*V
	Euro 3	diesel	4	-1.839E-5+1.056E-6*V	(22°C, V)	2.729E-6	-6.738+0.387*V
		gasoline	7	-1.776E-5+8.272E-7*V	(22°C, V)	-1.214E-6	14.631-0.682*V

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
1,3-butadiene	Euro 0 w/o cat.	gasoline	2	$-2.693E-1+3.210E-4*V$	(22°C, V)	-2.629E-1	$1.024-0.001*V$
	Euro 1	gasoline	1	0	(22°C, 19km/h)	0	1
	Euro 2	diesel	2	0	(22°C, 19km/h)	0	1
		gasoline	9	$1.542E-1-3.752E-3*V$	(22°C, V)	7.916E-2	$1.948-0.047*V$
	Euro 3	diesel	1	0	(22°C, 41.1km/h)	0	1
		gasoline	15	$4.811E-2-2.072E-3*T-6.090E-5*V$	F(T,V)	5.462E-3	$8.809-0.379*T-0.011*V$
Euro 4	gasoline	7	$3.540E-2-1.655E-3*T$	(T, 19km/h)	2.301E-3	$15.381-0.719*T$	
1,3-dimethyl-4-ethylbenzene	Euro 1	gasoline	1	-8.751E-2	(22°C, 19km/h)	-8.751E-2	1
	Euro 2	gasoline	1	1.289E-1	(22°C, 19km/h)	1.289E-1	1
1,4-diethylbenzene	Euro 1	gasoline	1	-1.903E-1	(22°C, 19km/h)	-1.903E-1	1
	Euro 2	diesel	1	-4.496E-5	(22°C, 19km/h)	-4.496E-5	1
		gasoline	3	3.078E-1	(22°C, 19km/h)	3.078E-1	1
1,4-dimethyl-2-ethylbenzene	Euro 2	gasoline	1	1.739E-1	(22°C, 19km/h)	1.739E-1	1
1,4-dimethylcyclohexane cis	Euro 0 w/o cat.	diesel	1	6.691E-2	(22°C, 19km/h)	6.691E-2	1
	Euro 1	gasoline	1	2.847E-4	(22°C, 19km/h)	2.847E-4	1
	Euro 2	diesel	1	1.330E-2	(22°C, 19km/h)	1.330E-2	1
		gasoline	3	5.024E-2	(22°C, 19km/h)	5.024E-2	1
	Euro 3	gasoline	1	9.950E-3	(22°C, 19km/h)	9.950E-3	1
1,4-dimethylcyclohexane trans	Euro 1	gasoline	3	1.840E-4	(22°C, 19km/h)	1.840E-4	1
	Euro 2	diesel	1	-1.074E-2	(22°C, 19km/h)	-1.074E-2	1
		gasoline	2	2.459E+0	(22°C, 19km/h)	2.459E+0	1
	Euro 3	gasoline	1	1.143E-2	(22°C, 19km/h)	1.143E-2	1
1-butene	Euro 0 w/o cat.	diesel	2	8.834E-3	(22°C, 19km/h)	8.834E-3	1
	Euro 1	gasoline	3	1.438E-2	(22°C, 19km/h)	1.438E-2	1
	Euro 2	diesel	7	5.528E-3	(22°C, 19km/h)	5.528E-3	1
		gasoline	3	4.027E-1	(22°C, 19km/h)	4.027E-1	1
	Euro 3	diesel	1	1.319E-3	(22°C, 19km/h)	1.319E-3	1
		gasoline	1	5.470E-3	(22°C, 19km/h)	5.470E-3	1

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
1-methyl-2-isopropyl-benzene	Euro 2	gasoline	1	2.961E-1	(22°C, 19km/h)	2.961E-1	1
1-methyl-4-isopropyl-benzene	Euro 2	diesel	2	8.152E-3	(22°C, 19km/h)	8.152E-3	1
1-methylnaphtalene	Euro 1	diesel	1	-1.543E-3	(22°C, 19km/h)	-1.543E-3	1
	Euro 2	diesel	3	6.943E-3	(22°C, 19km/h)	6.943E-3	1
1-pentene	Euro 0 w/o cat.	diesel	2	9.066E-2	(22°C, 19km/h)	9.066E-2	1
	Euro 1	diesel	2	-8.501E-2	(22°C, 19km/h)	-8.501E-2	1
		gasoline	3	-9.978E-4	(22°C, 19km/h)	-9.978E-4	1
	Euro 2	diesel	10	1.392E-1	(22°C, 19km/h)	1.392E-1	1
		gasoline	5	5.761E-1	(22°C, 19km/h)	5.761E-1	1
	Euro 3	diesel	1	4.945E-4	(22°C, 19km/h)	4.945E-4	1
gasoline		4	-5.535E-2	(22°C, 19km/h)	-5.535E-2	1	
2,2,4-trimethylpentane	Euro 0 w/o cat.	gasoline	2	1.213E+0-4.965E-2*V	(22°C, V)	2.201E-1	5.511-0.226*V
	Euro 1	gasoline	1	1.663E-1	(22°C, 19km/h)	1.663E-1	1
	Euro 2	diesel	2	-9.196E-3+2.238E-4*V	(22°C, V)	-4.721E-3	1.948-0.047*V
		gasoline	6	7.933E-2+1.133E-3*V	(22°C, V)	1.020E-1	0.778+0.011*V
	Euro 3	diesel	1	0	(22°C, 41.1km/h)	0	1
		gasoline	6	-1.605E-3+9.618E-4*V	(22°C, V)	1.763E-2	-0.091+0.055*V
2,2-dimethylbutane	Euro 0 w/o cat.	diesel	1	1.379E-3	(22°C, 19km/h)	1.379E-3	1
		gasoline	2	0	(22°C, 19km/h)	0	1
	Euro 1	gasoline	2	1.319E-3	(22°C, 19km/h)	1.319E-3	1
	Euro 2	diesel	7	-1.888E-2+4.593E-4*V	(22°C, V)	-9.691E-3	1.948-0.047*V
		gasoline	12	1.704E+0-4.146E-2*V	(22°C, V)	8.748E-1	1.948-0.047*V
	Euro 3	diesel	1	0	(22°C, 41.1km/h)	0	1
		gasoline	9	2.557E-2-5.554E-4*V	(22°C, V)	1.446E-2	1.768-0.038*V

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
2,2-dimethylpropane	Euro 0 w/o cat.	diesel	2	3.372E-3	(22°C, 19km/h)	3.372E-3	1
		gasoline	2	0	(22°C, 19km/h)	0	1
	Euro 1	diesel	1	8.377E-3	(22°C, 19km/h)	8.377E-3	1
		gasoline	4	5.315E-2	(22°C, 19km/h)	5.315E-2	1
	Euro 2	diesel	11	-2.038E-3+4.959E-5*V	(22°C, V)	-1.046E-3	1.948-0.047*V
		gasoline	11	7.995E-1-1.945E-2*V	(22°C, V)	4.104E-1	1.948-0.047*V
	Euro 3	diesel	2	-2.118E-3+5.153E-5*V	(22°C, V)	-1.087E-3	1.948-0.047*V
		gasoline	10	1.249E-2-2.524E-4*V	(22°C, V)	7.446E-3	1.678-0.034*V
2,5-dimethylbenzaldehyde	Euro 0 w/o cat.	gasoline	2	-2.020E-2+7.606E-4*V	(22°C, V)	-4.984E-3	4.053-0.153*V
	Euro 1	gasoline	2	0	(22°C, 19km/h)	0	1
	Euro 2	diesel	2	6.131E-4-2.246E-5*V	(22°C, V)	1.639E-4	3.742-0.137*V
		gasoline	3	4.880E-5+9.525E-6*V	(22°C, V)	2.393E-4	0.204+0.040*V
	Euro 3	diesel	3	2.783E-5+5.572E-7*V	(22°C, V)	3.897E-5	0.714+0.014*V
		gasoline	8	1.718E-4+1.521E-5*V	(22°C, V)	4.760E-4	0.361+0.032*V
2-butanone	Euro 0 w/o cat.	diesel	1	1.699E-2	(22°C, 19km/h)	1.699E-2	1
	Euro 1	diesel	3	6.918E-3	(22°C, 19km/h)	6.918E-3	1
		gasoline	1	-2.364E-5	(22°C, 19km/h)	-2.364E-5	1
	Euro 2	diesel	6	-1.720E-2	(22°C, 19km/h)	-1.720E-2	1
		gasoline	4	-6.365E-3	(22°C, 19km/h)	-6.365E-3	1
	Euro 3	diesel	1	4.960E-3	(22°C, 19km/h)	4.960E-3	1
gasoline		2	4.720E-3	(22°C, 19km/h)	4.720E-3	1	
2-ethyltoluene	Euro 1	gasoline	1	-1.244E+0	(22°C, 19km/h)	-1.244E+0	1
	Euro 2	diesel	3	1.676E+0	(22°C, 19km/h)	1.676E+0	1
		gasoline	5	1.139E+1	(22°C, 19km/h)	1.139E+1	1
	Euro 3	diesel	1	1.373E+0	(22°C, 19km/h)	1.373E+0	1
gasoline		1	2.485E+1	(22°C, 19km/h)	2.485E+1	1	
2-methylnaphtalene	Euro 1	diesel	1	-1.289E-3	(22°C, 19km/h)	-1.289E-3	1
	Euro 2	diesel	3	4.146E-4	(22°C, 19km/h)	4.146E-4	1

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
2-methylpentane	Euro 0 w/o cat.	gasoline	2	$5.278E-1-2.305E-2*V$	(22°C, V)	6.686E-2	$7.895-0.345*V$
	Euro 1	gasoline	1	5.594E-2	(22°C, 19km/h)	5.594E-2	1
	Euro 2	diesel	2	0	(22°C, 19km/h)	0	1
		gasoline	6	$3.316E-2-1.940E-4*V$	(22°C, V)	2.928E-2	$1.133-0.007*V$
	Euro 3	diesel	1	0	(22°C, 41.1km/h)	0	1
		gasoline	6	$1.043E-2-1.520E-4*V$	(22°C, V)	7.388E-3	$1.411-0.021*V$
2-methylpropane	Euro 0 w/o cat.	diesel	2	4.720E-4	(22°C, 19km/h)	4.720E-4	1
	Euro 1	diesel	1	-1.304E-2	(22°C, 19km/h)	-1.304E-2	1
		gasoline	3	3.258E-2	(22°C, 19km/h)	3.258E-2	1
	Euro 2	diesel	9	-2.609E-3	(22°C, 19km/h)	-2.609E-3	1
		gasoline	6	4.050E-2	(22°C, 19km/h)	4.050E-2	1
	Euro 3	diesel	1	5.874E-3	(22°C, 19km/h)	5.874E-3	1
gasoline		4	-1.952E-3	(22°C, 19km/h)	-1.952E-3	1	
3-ethyltoluene	Euro 1	gasoline	3	4.324E+0	(22°C, 19km/h)	4.324E+0	1
	Euro 2	diesel	2	2.341E-1	(22°C, 19km/h)	2.341E-1	1
		gasoline	6	7.469E+0	(22°C, 19km/h)	7.469E+0	1
	Euro 3	diesel	1	7.343E-1	(22°C, 19km/h)	7.343E-1	1
gasoline		1	1.567E+1	(22°C, 19km/h)	1.567E+1	1	
3-methylpentane	Euro 0 w/o cat.	gasoline	2	$3.798E-1-1.894E-2*V$	(22°C, V)	1.040E-3	$365.381-18.219*V$
	Euro 1	gasoline	1	3.676E-2	(22°C, 19km/h)	3.676E-2	1
	Euro 2	diesel	2	$6.948E-3-1.691E-4*V$	(22°C, V)	3.567E-3	$1.948-0.047*V$
		gasoline	7	$8.733E-2-1.384E-3*V$	(22°C, V)	5.965E-2	$1.464-0.023*V$
	Euro 3	diesel	1	0	(22°C, 41.1km/h)	0	1
		gasoline	6	$4.102E-3-5.196E-5*V$	(22°C, V)	3.063E-3	$1.339-0.017*V$
4-ethyltoluene	Euro 1	diesel	1	1.456E-1	(22°C, 19km/h)	1.456E-1	1
		gasoline	2	6.452E-1	(22°C, 19km/h)	6.452E-1	1
	Euro 2	diesel	4	-1.384E-1	(22°C, 19km/h)	-1.384E-1	1
		gasoline	4	3.039E+0	(22°C, 19km/h)	3.039E+0	1
	Euro 3	gasoline	1	4.263E+0	(22°C, 19km/h)	4.263E+0	1

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
acetaldehyde	Euro 0 w/o cat.	diesel	2	3.664E-2	(22°C, 19km/h)	3.664E-2	1
		gasoline	2	9.225E-2-2.082E-3*V	(22°C, V)	5.062E-2	1.823-0.041*V
	Euro 1	diesel	3	2.073E-2	(22°C, 19km/h)	2.073E-2	1
		gasoline	5	1.508E-2-1.399E-4*V	(22°C, V)	1.228E-2	1.228-0.011*V
	Euro 2	diesel	12	-8.870E-2+2.508E-3*V	(22°C, V)	-3.853E-2	2.302-0.065*V
		gasoline	9	8.044E-3-5.332E-6*V	(22°C, V)	7.937E-3	1.013-0.001*V
	Euro 3	diesel	5	-5.409E-3+8.996E-4*V	(22°C, V)	1.258E-2	-0.430+0.071*V
		gasoline	12	7.668E-3-1.206E-4*V	(22°C, V)	5.255E-3	1.459-0.023*V
acetaldehyde+acrolein +formaldehyde	Euro 2	diesel	6	-1.887E+1	(22°C, 41.1km/h)	-1.887E+1	1
		gasoline	6	1.246E-1	(22°C, 41.1km/h)	1.246E-1	1
acetone	Euro 0 w/o cat.	diesel	2	2.090E-2	(22°C, 19km/h)	2.090E-2	1
	Euro 1	diesel	3	1.381E-2	(22°C, 19km/h)	1.381E-2	1
		gasoline	3	7.440E-3	(22°C, 19km/h)	7.440E-3	1
	Euro 2	diesel	9	-3.363E-2	(22°C, 19km/h)	-3.363E-2	1
		gasoline	6	1.828E-3	(22°C, 19km/h)	1.828E-3	1
	Euro 3	diesel	2	1.454E-2	(22°C, 19km/h)	1.454E-2	1
		gasoline	4	-3.808E-2	(22°C, 19km/h)	-3.808E-2	1
	acetone + acrolein	Euro 0 w/o cat.	gasoline	2	1.471E-2+5.033E-4*V	(22°C, V)	2.478E-2
Euro 1		gasoline	2	-1.154E-3+2.051E-4*V	(22°C, V)	2.947E-3	-0.392+0.070*V
Euro 2		diesel	1	1.548E-3	(22°C, 19km/h)	1.548E-3	1
		gasoline	2	-1.200E-2+4.188E-4*V	(22°C, V)	-3.627E-3	3.309-0.115*V
Euro 3		diesel	1	-2.806E-3	(22°C, 41.1km/h)	-2.806E-3	1
		gasoline	6	-1.355E-4+5.144E-5*V	(22°C, V)	8.933E-4	-0.152+0.058*V
acrolein	Euro 0 w/o cat.	diesel	1	-2.308E-3	(22°C, 19km/h)	-2.308E-3	1
	Euro 1	diesel	3	7.023E-3	(22°C, 19km/h)	7.023E-3	1
	Euro 2	diesel	4	7.627E-4	(22°C, 19km/h)	7.627E-4	1
		gasoline	1	1.029E-2	(22°C, 19km/h)	1.029E-2	1

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
benzaldehyde	Euro 0 w/o cat.	diesel	2	-1.041E-2	(22°C, 19km/h)	-1.041E-2	1
		gasoline	2	-1.338E-2+1.075E-3*V	(22°C, V)	8.118E-3	-1.648+0.132*V
	Euro 1	diesel	2	1.259E-3	(22°C, 19km/h)	1.259E-3	1
		gasoline	2	5.480E-3-1.370E-5*V	(22°C, V)	5.206E-3	1.053-0.003*V
	Euro 2	diesel	8	-8.173E-3+2.284E-4*V	(22°C, V)	-3.604E-3	2.268-0.063*V
		gasoline	5	-9.056E-3+3.420E-4*V	(22°C, V)	-2.217E-3	4.085-0.154*V
	Euro 3	diesel	3	-2.216E-4+1.742E-5*V	(22°C, V)	1.268E-4	-1.748+0.137*V
		gasoline	8	-2.510E-4+4.971E-5*V	(22°C, V)	7.433E-4	-0.338+0.067*V
benzene	Euro 0 w/o cat.	gasoline	24	1.199E+0-3.541E-2*T-6.033E-3*V	F(T,V)	3.704E-1	3.238-0.096*T-0.016*V
	Euro 1	gasoline	4	7.049E-2	(22°C, 19km/h)	7.049E-2	1
	Euro 2	diesel	37	9.537E-2-3.864E-3*T-8.429E-5*V	F(T,V)	1.641E-2	5.812-0.235*T-0.005*V
		gasoline	19	8.899E-1-1.700E-2*T-5.975E-3*V	F(T,V)	4.303E-1	2.068-0.040*T-0.014*V
	Euro 3	diesel	2	-1.371E-2+1.274E-3*V	(22°C, V)	1.176E-2	-1.165+0.108*V
		gasoline	40	6.373E-1-3.074E-2*T+3.192E-3*V	F(T,V)	8.628E-2	7.386-0.356*T+0.037*V
	Euro 4	gasoline	7	2.945E-1-1.270E-2*T	(T, 19km/h)	4.040E-2	7.289-0.314*T
butyraldehyde	Euro 0 w/o cat.	diesel	2	1.343E-2	(22°C, 19km/h)	1.343E-2	1
		gasoline	2	1.485E-4-7.814E-6*V	(22°C, V)	-7.814E-6	-19.000+1.000*V
	Euro 1	diesel	3	4.610E-3	(22°C, 19km/h)	4.610E-3	1
		gasoline	2	1.420E-2-3.252E-4*V	(22°C, V)	7.692E-3	1.845-0.042*V
	Euro 2	diesel	12	-8.786E-3+2.649E-4*V	(22°C, V)	-3.488E-3	2.519-0.076*V
		gasoline	4	8.641E-5+2.873E-5*V	(22°C, V)	6.609E-4	0.131+0.043*V
	Euro 3	diesel	3	-8.322E-4+3.836E-5*V	(22°C, V)	-6.504E-5	12.796-0.590*V
		gasoline	8	-2.695E-4+9.388E-6*V	(22°C, V)	-8.172E-5	3.297-0.115*V

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
cis-2-butene	Euro 0 w/o cat.	diesel	2	1.471E-1	(22°C, 19km/h)	1.471E-1	1
		gasoline	2	2.691E-2	(22°C, 19km/h)	2.691E-2	1
	Euro 1	diesel	2	1.907E-2	(22°C, 19km/h)	1.907E-2	1
		gasoline	3	2.203E-1	(22°C, 19km/h)	2.203E-1	1
	Euro 2	diesel	10	2.912E-1	(22°C, 19km/h)	2.912E-1	1
		gasoline	5	4.765E-3	(22°C, 19km/h)	4.765E-3	1
Euro 3	diesel	1	1.532E-2	(22°C, 19km/h)	1.532E-2	1	
	gasoline	4					
crotonaldehyde	Euro 0 w/o cat.	diesel	1	3.249E-2	(22°C, 19km/h)	3.249E-2	1
		gasoline	2	1.364E-4+3.030E-4*V	(22°C, V)	6.197E-3	0.022+0.049*V
	Euro 1	diesel	2	1.184E-3	(22°C, 19km/h)	1.184E-3	1
		gasoline	3	3.600E-3-1.401E-5*V	(22°C, V)	3.320E-3	1.084-0.004*V
	Euro 2	diesel	3	-1.270E-2+3.878E-4*V	(22°C, V)	-4.944E-3	2.569-0.078*V
		gasoline	4	-3.135E-3+1.125E-4*V	(22°C, V)	-8.855E-4	3.540-0.127*V
	Euro 3	diesel	3	-2.088E-3+1.255E-4*V	(22°C, V)	4.222E-4	-4.945+0.297*V
		gasoline	9	7.874E-4+7.005E-6*V	(22°C, V)	9.275E-4	0.849+0.008*V
cyclohexane	Euro 0 w/o cat.	diesel	1	-1.596E-3	(22°C, 19km/h)	-1.596E-3	1
	Euro 1	diesel	1	-3.052E-2	(22°C, 19km/h)	-3.052E-2	1
	Euro 2	gasoline	1	-3.881E-4	(22°C, 19km/h)	-3.881E-4	1
ethane	Euro 0 w/o cat.	diesel	2	1.776E-3	(22°C, 19km/h)	1.776E-3	1
		gasoline	2	1.683E-1-7.439E-3*V	(22°C, V)	1.953E-2	8.616-0.381*V
	Euro 1	diesel	1	1.409E-2	(22°C, 19km/h)	1.409E-2	1
		gasoline	4	8.070E-4	(22°C, 19km/h)	8.070E-4	1
	Euro 2	diesel	12	-2.389E-3+4.954E-5*V	(22°C, V)	-1.398E-3	1.709-0.035*V
		gasoline	15	9.174E-2-4.521E-3*T+1.102E-3*V	F(T,V)	2.335E-2	3.929-0.194*T+0.047*V
	Euro 3	diesel	2	-1.133E-2+5.593E-4*V	(22°C, V)	-1.450E-4	78.137-3.857*V
		gasoline	17	5.515E-2-2.209E-3*T+1.984E-4*V	F(T,V)	1.493E-2	3.693-0.148*T+0.013*V
Euro 4	gasoline	7	4.943E-2-1.921E-3*T	(T, 19km/h)	1.100E-2	4.494-0.175*T	

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
ethene	Euro 0 w/o cat.	diesel	2	-3.506E-3	(22°C, 19km/h)	-3.506E-3	1
		gasoline	2	3.304E-1-1.555E-2*V	(22°C, V)	1.942E-2	17.016-0.801*V
	Euro 1	diesel	2	1.457E-2	(22°C, 19km/h)	1.457E-2	1
		gasoline	2	2.668E-3	(22°C, 19km/h)	2.668E-3	1
	Euro 2	diesel	11	1.119E-3-2.722E-5*V	(22°C, V)	5.744E-4	1.948-0.047*V
		gasoline	14	1.067E+0-4.590E-2*T-1.396E-3*V	F(T,V)	1.212E-1	8.801-0.379*T-0.012*V
	Euro 3	diesel	2	5.518E-3-1.343E-4*V	(22°C, V)	2.833E-3	1.948-0.047*V
		gasoline	18	4.794E-1-2.077E-2*T-5.399E-4*V	F(T,V)	5.322E-2	9.007-0.390*T-0.010*V
	Euro 4	gasoline	7	3.841E-1-1.705E-2*T	(T, 19km/h)	4.299E-2	8.935-0.397*T
	ethylbenzene	Euro 0 w/o cat.	diesel	1	5.544E-2	(22°C, 19km/h)	5.544E-2
gasoline			2	0	(22°C, 19km/h)	0	1
Euro 1		diesel	1	9.141E-3	(22°C, 19km/h)	9.141E-3	1
		gasoline	2	5.245E-1	(22°C, 19km/h)	5.245E-1	1
Euro 2		diesel	16	6.349E-1-1.543E-2*V	(22°C, V)	3.262E-1	1.946-0.047*V
		gasoline	21	2.683E+0-6.292E-2*V	(22°C, V)	1.425E+0	1.883-0.044*V
Euro 3		diesel	2	-8.360E-2+2.034E-3*V	(22°C, V)	-4.292E-2	1.948-0.047*V
		gasoline	16	7.396E-1-1.776E-2*V	(22°C, V)	3.844E-1	1.924-0.046*V
Euro 4		gasoline	7	2.323E-1-1.080E-2*T	(T, 19km/h)	1.628E-2	14.273-0.664*T
ethyne		Euro 2	gasoline	3	3.753E-1-1.503E-2*T	(T, 19km/h)	7.459E-2
	Euro 3	gasoline	9	1.216E-1-4.920E-3*T	(T, 19km/h)	2.316E-2	5.248-0.212*T
	Euro 4	gasoline	7	1.047E-1-5.481E-3*T	(T, 19km/h)	-4.896E-3	-21.389+1.119*T
formaldehyde	Euro 0 w/o cat.	diesel	2	-1.349E-2	(22°C, 19km/h)	-1.349E-2	1
		gasoline	2	2.078E-1-5.125E-3*V	(22°C, V)	1.053E-1	1.974-0.049*V
	Euro 1	diesel	3	8.591E-3	(22°C, 19km/h)	8.591E-3	1
		gasoline	5	7.654E-3-1.643E-5*V	(22°C, V)	7.326E-3	1.045-0.002*V
	Euro 2	diesel	12	-8.670E-2+2.890E-3*V	(22°C, V)	-2.890E-2	3.000-0.100*V
		gasoline	9	-4.624E-3+5.122E-4*V	(22°C, V)	5.619E-3	-0.823+0.091*V
	Euro 3	diesel	5	-2.010E-3+1.028E-3*V	(22°C, V)	1.854E-2	-0.108+0.055*V
		gasoline	12	3.801E-3+2.708E-5*V	(22°C, V)	4.343E-3	0.875+0.006*V

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
heptadecane	Euro 1	diesel	1	-2.248E-2	(22°C, 19km/h)	-2.248E-2	1
	Euro 2	diesel	2	1.043E-2	(22°C, 19km/h)	1.043E-2	1
	Euro 3	diesel	1	-3.412E-1	(22°C, 19km/h)	-3.412E-1	1
heptane	Euro 0 w/o cat.	gasoline	2	2.111E-1-7.167E-3*V	(22°C, V)	6.776E-2	3.115-0.106*V
	Euro 1	gasoline	1	4.725E-2	(22°C, 19km/h)	4.725E-2	1
		diesel	2	-3.351E-3-9.177E-5*V	(22°C, V)	-5.187E-3	0.646+0.018*V
	Euro 2	gasoline	6	-5.020E-3+1.081E-3*V	(22°C, V)	1.661E-2	-0.302+0.065*V
		diesel	1	2.813E-2	(22°C, 41.1km/h)	2.813E-2	1
	Euro 3	gasoline	6	2.330E-2-1.770E-4*V	(22°C, V)	1.976E-2	1.179-0.009*V
hexaldehyde	Euro 0 w/o cat.	diesel	2	2.690E-2	(22°C, 19km/h)	2.690E-2	1
		gasoline	2	-1.437E-2+6.225E-4*V	(22°C, V)	-1.925E-3	7.468-0.323*V
	Euro 1	diesel	3	7.408E-3	(22°C, 19km/h)	7.408E-3	1
		gasoline	5	-1.610E-2+3.917E-4*V	(22°C, V)	-8.265E-3	1.948-0.047*V
	Euro 2	diesel	10	-1.635E-2+4.193E-4*V	(22°C, V)	-7.960E-3	2.054-0.053*V
		gasoline	8	-3.234E-4+1.315E-5*V	(22°C, V)	-6.043E-5	5.351-0.218*V
	Euro 3	diesel	5	-8.534E-4+2.774E-5*V	(22°C, V)	-2.986E-4	2.858-0.093*V
		gasoline	12	8.101E-4-3.323E-5*V	(22°C, V)	1.455E-4	5.568-0.228*V
hexane	Euro 0 w/o cat.	gasoline	2	1.901E-2-4.944E-3*V	(22°C, V)	-7.987E-2	-0.238+0.062*V
	Euro 1	gasoline	1	4.925E-2	(22°C, 19km/h)	4.925E-2	1
		diesel	2	0	(22°C, 19km/h)	0	1
	Euro 2	gasoline	6	3.493E-2-4.705E-4*V	(22°C, V)	2.552E-2	1.369-0.018*V
		diesel	1	0	(22°C, 41.1km/h)	0	1
	Euro 3	gasoline	6	4.499E-3+1.636E-4*V	(22°C, V)	7.771E-3	0.579+0.021*V

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
hexene	Euro 0 w/o cat.	diesel	2	-5.350E-3	(22°C, 19km/h)	-5.350E-3	1
	Euro 1	diesel	1	2.329E-2	(22°C, 19km/h)	2.329E-2	1
		gasoline	1	4.496E-4	(22°C, 19km/h)	4.496E-4	1
	Euro 2	diesel	7	2.036E-3	(22°C, 19km/h)	2.036E-3	1
		gasoline	5	7.946E-2	(22°C, 19km/h)	7.946E-2	1
	Euro 3	diesel	1	8.841E-4	(22°C, 19km/h)	8.841E-4	1
gasoline		3	1.089E-3	(22°C, 19km/h)	1.089E-3	1	
i-butene	Euro 2	gasoline	3	2.503E-1-1.077E-2*T	(T, 19km/h)	3.478E-2	7.196-0.310*T
	Euro 3	gasoline	9	2.053E-1-9.308E-3*T	(T, 19km/h)	1.917E-2	10.713-0.486*T
	Euro 4	gasoline	7	2.708E-1-8.370E-3*T	(T, 19km/h)	1.034E-1	2.619-0.081*T
isobutane	Euro 0 w/o cat.	diesel	2	5.087E-3	(22°C, 19km/h)	5.087E-3	1
		gasoline	2	1.486E-1-5.505E-3*V	(22°C, V)	3.845E-2	3.863-0.143*V
	Euro 1	gasoline	4	2.439E-2	(22°C, 19km/h)	2.439E-2	1
	Euro 2	diesel	8	-1.099E-2+2.946E-4*V	(22°C, V)	-5.101E-3	2.155-0.058*V
		gasoline	11	4.058E-1-9.724E-3*V	(22°C, V)	2.113E-1	1.920-0.046*V
	Euro 3	diesel	2	1.087E-2-2.644E-4*V	(22°C, V)	5.580E-3	1.948-0.047*V
gasoline		9	1.183E-2-1.226E-4*V	(22°C, V)	9.377E-3	1.261-0.013*V	
isopentane	Euro 0 w/o cat.	gasoline	2	1.439E+0-6.651E-2*V	(22°C, V)	1.083E-1	13.282-0.614*V
	Euro 1	gasoline	1	1.928E-1	(22°C, 19km/h)	1.928E-1	1
	Euro 2	diesel	2	-3.463E-2+9.185E-4*V	(22°C, V)	-1.626E-2	2.129-0.056*V
		gasoline	7	3.383E-2+1.720E-3*V	(22°C, V)	6.822E-2	0.496+0.025*V
	Euro 3	diesel	1	1.266E-2	(22°C, 41.1km/h)	1.266E-2	1
		gasoline	6	4.064E-2+3.871E-4*V	(22°C, V)	4.838E-2	0.840+0.008*V
isopropylbenzene	Euro 2	diesel	1	-1.918E-1	(22°C, 19km/h)	-1.918E-1	1
	Euro 3	diesel	1	8.390E-1	(22°C, 19km/h)	8.390E-1	1
		gasoline	1	2.321E+0	(22°C, 19km/h)	2.321E+0	1

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
isovaleraldehyde	Euro 0 w/o cat.	gasoline	2	0	(22°C, 19km/h)	0	1
	Euro 1	gasoline	2	0	(22°C, 19km/h)	0	1
	Euro 2	diesel	2	$-1.537E-4+1.516E-6*V$	(22°C, V)	$-1.234E-4$	$1.246-0.012*V$
		gasoline	3	$9.483E-5+4.522E-5*V$	(22°C, V)	$9.993E-4$	$0.095+0.045*V$
	Euro 3	diesel	3	$-3.200E-3+1.248E-4*V$	(22°C, V)	$-7.044E-4$	$4.543-0.177*V$
gasoline		8	$-3.483E-4+2.091E-5*V$	(22°C, V)	$6.994E-5$	$-4.980+0.299*V$	
m+p+o-tolualdehyde	Euro 0 w/o cat.	gasoline	2	$-2.930E-2+2.026E-3*V$	(22°C, V)	$1.122E-2$	$-2.612+0.181*V$
	Euro 1	gasoline	2	$9.544E-3-1.611E-4*V$	(22°C, V)	$6.322E-3$	$1.510-0.025*V$
	Euro 2	diesel	2	$2.494E-5+3.420E-6*V$	(22°C, V)	$9.333E-5$	$0.267+0.037*V$
		gasoline	3	$6.352E-3-6.892E-5*V$	(22°C, V)	$4.974E-3$	$1.277-0.014*V$
	Euro 3	diesel	3	$-3.359E-5+1.236E-5*V$	(22°C, V)	$2.137E-4$	$-0.157+0.058*V$
gasoline		8	$-6.963E-4+8.021E-5*V$	(22°C, V)	$9.079E-4$	$-0.767+0.088*V$	
methacrolein	Euro 0 w/o cat.	diesel	2	$-3.139E-3$	(22°C, 19km/h)	$-3.139E-3$	1
	Euro 1	diesel	1	$3.042E-3$	(22°C, 19km/h)	$3.042E-3$	1
	Euro 2	diesel	2	$-3.746E-3$	(22°C, 19km/h)	$-3.746E-3$	1
		gasoline	1	$4.581E-4$	(22°C, 19km/h)	$4.581E-4$	1
methane	Euro 0 w/o cat.	diesel	6	$9.266E-3$	(22°C, 18.7km/h)	$9.266E-3$	1
		gasoline	23	$3.109E+0-8.477E-2*T-1.895E-2*V$	F(T,V)	$1.035E+0$	$3.004-0.082*T-0.018*V$
	Euro 1	diesel	9	$4.154E-3$	(22°C, 18.7km/h)	$4.154E-3$	1
		gasoline	14	$-1.436E+0+8.476E-2*V$	(22°C, V)	$2.596E-1$	$-5.530+0.327*V$
	Euro 2	diesel	2	$-9.629E-3+2.570E-4*V$	(22°C, V)	$-4.488E-3$	$2.145-0.057*V$
		gasoline	9	$9.395E-1-3.865E-2*T+1.568E-3*V$	F(T,V)	$1.978E-1$	$4.749-0.195*T+0.008*V$
	Euro 3	diesel	1	$1.087E-2$	(22°C, 41.1km/h)	$1.087E-2$	1
		gasoline	39	$5.879E-1-2.962E-2*T+3.057E-3*V$	F(T,V)	$5.667E-2$	$10.373-0.523*T+0.054*V$
Euro 4	gasoline	7	$3.984E-1-1.634E-2*T$	(T, 19km/h)	$7.170E-2$	$5.557-0.228*T$	

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
methyl ethyl ketone	Euro 0 w/o cat.	gasoline	2	$-5.031E-3+5.198E-4*V$	(22°C, V)	5.365E-3	$-0.938+0.097*V$
	Euro 1	gasoline	2	$3.126E-3-8.214E-5*V$	(22°C, V)	1.483E-3	$2.108-0.055*V$
	Euro 2	diesel	2	$1.258E-3-8.377E-6*V$	(22°C, V)	1.091E-3	$1.154-0.008*V$
		gasoline	3	$9.883E-4+1.155E-5*V$	(22°C, V)	1.219E-3	$0.811+0.009*V$
	Euro 3	diesel	3	$-2.177E-3+7.171E-5*V$	(22°C, V)	-7.425E-4	$2.932-0.097*V$
		gasoline	8	$4.950E-4-9.215E-6*V$	(22°C, V)	3.107E-4	$1.593-0.030*V$
methylcyclopentane	Euro 0 w/o cat.	gasoline	2	$-8.172E-3-2.777E-3*V$	(22°C, V)	-6.372E-2	$0.128+0.044*V$
	Euro 1	gasoline	1	2.927E-2	(22°C, 19km/h)	2.927E-2	1
	Euro 2	diesel	2	0	(22°C, 19km/h)	0	1
		gasoline	6	$3.483E-2-4.387E-4*V$	(22°C, V)	2.606E-2	$1.337-0.017*V$
	Euro 3	diesel	1	0	(22°C, 41.1km/h)	0	1
		gasoline	6	$1.459E-3+1.087E-4*V$	(22°C, V)	3.634E-3	$0.401+0.030*V$
m-xylene	Euro 2	gasoline	3	$1.594E+0-6.887E-2*T$	(T, 19km/h)	2.169E-1	$7.349-0.317*T$
	Euro 3	gasoline	9	$7.218E-1-3.245E-2*T$	(T, 19km/h)	7.270E-2	$9.928-0.446*T$
	Euro 4	gasoline	7	$6.881E-1-3.151E-2*T$	(T, 19km/h)	5.786E-2	$11.892-0.545*T$
m-xylene + o-xylene + p-xylene + ethylbenzene	Euro 2	diesel	24	$2.227E-2-6.841E-4*T-4.780E-5*V$	F(T,V)	7.632E-3	$2.918-0.090*T-0.006*V$
m-xylene + p-xylene	Euro 0 w/o cat.	diesel	1	-1.708E-1	(22°C, 19km/h)	-1.708E-1	1
	Euro 1	diesel	1	2.952E-1	(22°C, 19km/h)	2.952E-1	1
		gasoline	2	8.419E+0	(22°C, 19km/h)	8.419E+0	1
	Euro 2	diesel	8	2.349E-1	(22°C, 19km/h)	2.349E-1	1
		gasoline	6	1.185E+1	(22°C, 19km/h)	1.185E+1	1
	Euro 3	diesel	1	2.080E+0	(22°C, 19km/h)	2.080E+0	1
gasoline		1	3.700E+1	(22°C, 19km/h)	3.700E+1	1	

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
n-butane	Euro 0 w/o cat.	gasoline	2	$6.753E-1-2.581E-2*V$	(22°C, V)	1.590E-1	$4.247-0.162*V$
	Euro 1	diesel	1	2.069E-2	(22°C, 19km/h)	2.069E-2	1
		gasoline	1	7.243E-2	(22°C, 19km/h)	7.243E-2	1
	Euro 2	diesel	4	$3.369E-3-9.124E-5*V$	(22°C, V)	1.544E-3	$2.182-0.059*V$
		gasoline	6	$2.127E-2-7.138E-5*V$	(22°C, V)	1.985E-2	$1.072-0.004*V$
	Euro 3	diesel	1	6.684E-4	(22°C, 41.1km/h)	6.684E-4	1
gasoline		6	$5.354E-3+2.580E-4*V$	(22°C, V)	1.051E-2	$0.509+0.025*V$	
n-decane	Euro 0 w/o cat.	diesel	1	-9.740E-2	(22°C, 19km/h)	-9.740E-2	1
	Euro 1	diesel	1	4.146E-1	(22°C, 19km/h)	4.146E-1	1
	Euro 2	diesel	3	-8.806E-3	(22°C, 19km/h)	-8.806E-3	1
		gasoline	3	5.227E-1	(22°C, 19km/h)	5.227E-1	1
	Euro 3	diesel	1	1.659E-1	(22°C, 19km/h)	1.659E-1	1
		gasoline	1	7.492E-3	(22°C, 19km/h)	7.492E-3	1
n-dodecane	Euro 0 w/o cat.	diesel	1	5.514E-1	(22°C, 19km/h)	5.514E-1	1
	Euro 1	diesel	1	1.599E-1	(22°C, 19km/h)	1.599E-1	1
	Euro 2	diesel	5	-1.540E-2	(22°C, 19km/h)	-1.540E-2	1
		gasoline	5	4.593E-2	(22°C, 19km/h)	4.593E-2	1
	Euro 3	diesel	1	-1.199E-2	(22°C, 19km/h)	-1.199E-2	1
NH3	Euro 2	diesel	6	3.680E-1	(22°C, 41.1km/h)	3.680E-1	1
		gasoline	6	-7.148E-1	(22°C, 41.1km/h)	-7.148E-1	1
n-heptane	Euro 3	gasoline	1	1.439E-1	(22°C, 19km/h)	1.439E-1	1
n-hexadecane	Euro 0 w/o cat.	diesel	1	-1.002E-1	(22°C, 19km/h)	-1.002E-1	1
	Euro 1	diesel	1	4.510E-2	(22°C, 19km/h)	4.510E-2	1
	Euro 2	diesel	5	1.919E-2	(22°C, 19km/h)	1.919E-2	1
		gasoline	3	8.621E-2	(22°C, 19km/h)	8.621E-2	1
	Euro 3	diesel	1	-6.159E-1	(22°C, 19km/h)	-6.159E-1	1

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
n-nonane	Euro 0 w/o cat.	diesel	1	-2.248E-1	(22°C, 19km/h)	-2.248E-1	1
	Euro 1	gasoline	1	1.226E-3	(22°C, 19km/h)	1.226E-3	1
	Euro 2	diesel	1	-4.840E-2	(22°C, 19km/h)	-4.840E-2	1
		gasoline	2	7.990E-2	(22°C, 19km/h)	7.990E-2	1
	Euro 3	gasoline	1	1.499E-4	(22°C, 19km/h)	1.499E-4	1
nonadecane	Euro 2	diesel	1	2.383E-1	(22°C, 19km/h)	2.383E-1	1
n-pentane	Euro 0 w/o cat.	diesel	1	1.056E+0	(22°C, 19km/h)	1.056E+0	1
		gasoline	2	5.366E-1-2.009E-2*V	(22°C, V)	1.348E-1	3.982-0.149*V
	Euro 1	diesel	2	3.641E-2	(22°C, 19km/h)	3.641E-2	1
		gasoline	4	2.806E-2	(22°C, 19km/h)	2.806E-2	1
	Euro 2	diesel	12	2.762E-2-6.720E-4*V	(22°C, V)	1.418E-2	1.948-0.047*V
		gasoline	11	-3.679E-1+9.609E-3*V	(22°C, V)	-1.757E-1	2.094-0.055*V
	Euro 3	diesel	2	-4.428E-3+2.567E-4*V	(22°C, V)	7.063E-4	-6.270+0.363*V
gasoline		10	3.976E-2+1.620E-5*V	(22°C, V)	4.008E-2	0.992+0.000*V	
n-undecane	Euro 0 w/o cat.	diesel	1	1.274E-1	(22°C, 19km/h)	1.274E-1	1
	Euro 1	diesel	1	4.160E-1	(22°C, 19km/h)	4.160E-1	1
		gasoline	1	8.718E-4	(22°C, 19km/h)	8.718E-4	1
	Euro 2	diesel	5	-8.449E-2	(22°C, 19km/h)	-8.449E-2	1
		gasoline	1	-1.326E+0	(22°C, 19km/h)	-1.326E+0	1
Euro 3	diesel	1	4.945E-2	(22°C, 19km/h)	4.945E-2	1	
octadecane	Euro 1	diesel	1	2.682E-2	(22°C, 19km/h)	2.682E-2	1
	Euro 2	diesel	2	-2.416E-2	(22°C, 19km/h)	-2.416E-2	1
	Euro 3	diesel	1	-7.493E-1	(22°C, 19km/h)	-7.493E-1	1

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
o-xylene	Euro 0 w/o cat.	diesel	1	7.193E-2	(22°C, 19km/h)	7.193E-2	1
	Euro 1	diesel	1	5.080E-2	(22°C, 19km/h)	5.080E-2	1
		gasoline	2	1.179E+0	(22°C, 19km/h)	1.179E+0	1
	Euro 2	diesel	7	3.724E-1	(22°C, 19km/h)	3.724E-1	1
		gasoline	9	3.928E+0	(22°C, 19km/h)	3.928E+0	1
	Euro 3	diesel	1	-5.425E-1	(22°C, 19km/h)	-5.425E-1	1
		gasoline	10	8.780E-1	(22°C, 19km/h)	8.780E-1	1
Euro 4	gasoline	7	2.706E-1-1.233E-2*T (T, 19km/h)		2.400E-2	11.272-0.514*T	
pentadecane	Euro 0 w/o cat.	diesel	1	-1.025E-1	(22°C, 19km/h)	-1.025E-1	1
	Euro 1	diesel	1	1.094E-1	(22°C, 19km/h)	1.094E-1	1
	Euro 2	diesel	4	6.931E-2	(22°C, 19km/h)	6.931E-2	1
		gasoline	3	8.631E-2	(22°C, 19km/h)	8.631E-2	1
	Euro 3	diesel	1	-1.708E-1	(22°C, 19km/h)	-1.708E-1	1
propane	Euro 0 w/o cat.	diesel	2	4.331E-3	(22°C, 19km/h)	4.331E-3	1
		gasoline	2	-3.402E-2+4.232E-4*V (22°C, V)		-2.555E-2	1.331-0.017*V
	Euro 1	diesel	2	-8.309E-3	(22°C, 19km/h)	-8.309E-3	1
		gasoline	4	3.934E-3	(22°C, 19km/h)	3.934E-3	1
	Euro 2	diesel	12	-7.583E-4-3.232E-5*V (22°C, V)		-1.405E-3	0.540+0.023*V
		gasoline	15	4.760E-2-1.030E-3*V (22°C, V)		2.700E-2	1.763-0.038*V
	Euro 3	diesel	2	6.828E-3-1.661E-4*V (22°C, V)		3.505E-3	1.948-0.047*V
		gasoline	19	4.717E-3-1.996E-4*T-7.818E-6*V F(T,V)		5.684E-4	8.298-0.351*T-0.014*V
Euro 4	gasoline	7	6.670E-3-1.700E-4*T (T, 19km/h)		3.270E-3	2.040-0.052*T	

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
propene	Euro 0 w/o cat.	diesel	2	3.994E-2	(22°C, 19km/h)	3.994E-2	1
		gasoline	2	0	(22°C, 19km/h)	0	1
	Euro 1	diesel	2	1.551E-2	(22°C, 19km/h)	1.551E-2	1
		gasoline	4	3.841E-2	(22°C, 19km/h)	3.841E-2	1
	Euro 2	diesel	11	2.787E-3-6.781E-5*V	(22°C, V)	1.431E-3	1.948-0.047*V
		gasoline	15	7.077E-1-5.289E-3*T-1.439E-2*V	F(T,V)	3.142E-1	2.253-0.017*T-0.046*V
	Euro 3	diesel	2	1.251E-2-3.044E-4*V	(22°C, V)	6.424E-3	1.948-0.047*V
		gasoline	19	1.753E-1-7.169E-3*T-4.215E-4*V	F(T,V)	2.346E-2	7.471-0.306*T-0.018*V
	Euro 4	gasoline	7	1.352E-1-5.842E-3*T	(T, 19km/h)	1.841E-2	7.348-0.317*T
	propionaldehyde	Euro 0 w/o cat.	diesel	2	4.945E-3	(22°C, 19km/h)	4.945E-3
gasoline			2	1.218E-2-2.964E-4*V	(22°C, V)	6.247E-3	1.949-0.047*V
Euro 1		diesel	3	-4.442E-3	(22°C, 19km/h)	-4.442E-3	1
		gasoline	4	-6.725E-4+3.159E-5*V	(22°C, V)	-4.065E-5	16.544-0.777*V
Euro 2		diesel	11	-1.295E-2+3.882E-4*V	(22°C, V)	-5.184E-3	2.498-0.075*V
		gasoline	8	1.002E-1-2.407E-3*V	(22°C, V)	5.202E-2	1.925-0.046*V
Euro 3		diesel	4	1.716E-3+3.879E-5*V	(22°C, V)	2.491E-3	0.689+0.016*V
		gasoline	12	4.274E-4-3.563E-6*V	(22°C, V)	3.562E-4	1.200-0.010*V
propylbenzene	Euro 1	gasoline	2	1.360E+0	(22°C, 19km/h)	1.360E+0	1
	Euro 2	diesel	2	1.903E-1	(22°C, 19km/h)	1.903E-1	1
		gasoline	4	8.941E+0	(22°C, 19km/h)	8.941E+0	1
	Euro 3	diesel	1	2.712E-2	(22°C, 19km/h)	2.712E-2	1
gasoline		1	6.460E+0	(22°C, 19km/h)	6.460E+0	1	
p-tolualdehyde	Euro 0 w/o cat.	diesel	2	5.994E-4	(22°C, 19km/h)	5.994E-4	1
	Euro 1	diesel	3	7.243E-3	(22°C, 19km/h)	7.243E-3	1
		gasoline	3	5.310E-5	(22°C, 19km/h)	5.310E-5	1
	Euro 2	diesel	9	-1.706E-3	(22°C, 19km/h)	-1.706E-3	1
		gasoline	4	-2.389E-3	(22°C, 19km/h)	-2.389E-3	1
	Euro 3	gasoline	1	5.470E-3	(22°C, 19km/h)	5.470E-3	1

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
tert-butylbenzene	Euro 1	diesel	1	5.065E-2	(22°C, 19km/h)	5.065E-2	1
	Euro 2	diesel	2	3.111E-2	(22°C, 19km/h)	3.111E-2	1
	Euro 3	diesel	1	2.802E-1	(22°C, 19km/h)	2.802E-1	1
tetradecane	Euro 0 w/o cat.	diesel	1	-1.056E-1	(22°C, 19km/h)	-1.056E-1	1
	Euro 1	diesel	1	1.073E-1	(22°C, 19km/h)	1.073E-1	1
		diesel	5	-1.909E-2	(22°C, 19km/h)	-1.909E-2	1
		gasoline	4	4.065E-1	(22°C, 19km/h)	4.065E-1	1
Euro 3	diesel	1	-1.034E-1	(22°C, 19km/h)	-1.034E-1	1	
toluene	Euro 0 w/o cat.	diesel	1	-9.441E-2	(22°C, 19km/h)	-9.441E-2	1
		gasoline	24	$7.099E+0-2.205E-1*T-1.523E-2*V$	F(T,V)	2.384E+0	$2.978-0.093*T-0.006*V$
	Euro 1	diesel	1	5.350E-1	(22°C, 19km/h)	5.350E-1	1
		gasoline	4	1.560E+0	(22°C, 19km/h)	1.560E+0	1
	Euro 2	diesel	40	$7.771E-2-1.757E-3*V$	(22°C, V)	4.257E-2	$1.826-0.041*V$
		gasoline	21	$3.407E+0-6.356E-2*T-3.140E-2*V$	F(T,V)	1.508E+0	$2.259-0.042*T-0.021*V$
	Euro 3	diesel	2	$5.085E-1-9.805E-3*V$	(22°C, V)	3.124E-1	$1.628-0.031*V$
		gasoline	40	$3.503E+0-1.422E-1*T+2.775E-3*V$	F(T,V)	7.152E-1	$4.898-0.199*T+0.004*V$
Euro 4	gasoline	7	$9.941E-1-4.519E-2*T$	(T, 19km/h)	9.031E-2	$11.007-0.500*T$	
trans-2-butene	Euro 0 w/o cat.	diesel	2	1.214E-3	(22°C, 19km/h)	1.214E-3	1
	Euro 1	gasoline	3	1.194E-2	(22°C, 19km/h)	1.194E-2	1
		diesel	5	-4.358E-3	(22°C, 19km/h)	-4.358E-3	1
		gasoline	3	5.006E-1	(22°C, 19km/h)	5.006E-1	1
	Euro 3	diesel	1	1.034E-3	(22°C, 19km/h)	1.034E-3	1
gasoline		2	1.813E-3	(22°C, 19km/h)	1.813E-3	1	
tridecane	Euro 0 w/o cat.	diesel	1	8.841E-2	(22°C, 19km/h)	8.841E-2	1
	Euro 1	diesel	1	1.406E-1	(22°C, 19km/h)	1.406E-1	1
		diesel	4	-8.616E-3	(22°C, 19km/h)	-8.616E-3	1
		gasoline	4	2.855E-1	(22°C, 19km/h)	2.855E-1	1
	Euro 3	diesel	1	5.994E-3	(22°C, 19km/h)	5.994E-3	1

Pollutant	Emission Standard	Fuel Type	# of points	Excess Emission Equation $\omega_{T,V}$		$\omega(20,20)$	Correction Coefficient $f(T,V)$
valeraldehyde	Euro 0 w/o cat.	diesel	2	5.387E-3	(22°C, 19km/h)	5.387E-3	1
		gasoline	2	0	(22°C, 19km/h)	0	1
	Euro 1	diesel	3	1.424E-2	(22°C, 19km/h)	1.424E-2	1
		gasoline	4	1.517E-4-3.691E-6*V	(22°C, V)	7.788E-5	1.948-0.047*V
	Euro 2	diesel	12	-1.648E-2+4.206E-4*V	(22°C, V)	-8.062E-3	2.043-0.052*V
		gasoline	9	2.741E-4-6.669E-6*V	(22°C, V)	1.407E-4	1.948-0.047*V
	Euro 3	diesel	5	3.993E-4-6.397E-6*V	(22°C, V)	2.713E-4	1.472-0.024*V
		gasoline	11	4.295E-4-8.702E-6*V	(22°C, V)	2.554E-4	1.681-0.034*V
xylene	Euro 0 w/o cat.	gasoline	2	0	(22°C, 19km/h)	0	1
	Euro 1	gasoline	1	0	(22°C, 19km/h)	0	1
	Euro 2	diesel	8	-5.547E-4+2.919E-5*V	(22°C, V)	2.919E-5	-19.000+1.000*V
		gasoline	12	-3.844E-1+2.023E-2*V	(22°C, V)	2.023E-2	-19.000+1.000*V
	Euro 3	diesel	1	0	(22°C, 41.1km/h)	0	1
		gasoline	6	0	(22°C, 17.5km/h)	0	1

Annex 18: Mileage percentage of the trips started at cold or intermediate engine temperature $cm(s, v_i)$

(André et al., 1999)

	speed range	min. speed	max. speed	season s (duration in month)			
				year (12)	winter (4)	summer (4)	intermediate (4)
average speed over the whole trip v_i (km/h)	<10	0	10	61.3	61.7	62.7	58.9
	10 to 20	10	20	67.7	71.9	71.1	56.9
	20 to 30	20	30	67.7	71.8	67.1	62.8
	30 to 40	30	40	72.2	78.8	68.6	64.8
	40 to 50	40	50	75.6	80.9	76.3	66.5
	50 to 60	50	60	71.7	77.0	76.7	60.6
	60 to 70	60	70	72.9	74.6	67.9	76.6
	> 70	70	200	62.9	67.3	58.9	57.6
	total	0	200	69.0	73.4	67.3	63.2

Annex 19: Distribution $p_{i,j}$ of the mileage as regards the cold average speed V_j and the overall average speed v_i (%)

(André et al., 1999)

Year	average cold speed (km/h)							
	class	< 10	10 to 20	20 to 30	30 to 40	40 to 50	> 50	total
	Average V_j	5.4	15.3	24.9	34.6	44.3	60.9	
average speed over the whole trip (km/h)	<10	54.3	39.6	2.9	3.2	0.0	0.0	100
	10 to 20	19.4	46.0	25.7	7.0	1.5	0.4	100
	20 to 30	11.3	30.0	39.3	15.2	3.3	0.9	100
	30 to 40	8.4	17.4	26.7	31.2	12.6	3.6	100
	40 to 50	6.1	17.6	21.8	25.1	21.3	8.1	100
	50 to 60	3.8	14.9	26.4	22.8	16.6	15.5	100
	60 to 70	12.4	16.0	13.1	17.0	20.8	20.7	100
	> 70	15.0	11.5	23.1	15.9	13.5	21.0	100
	total	11.0	19.0	25.1	20.1	13.4	11.3	100

Winter	average cold speed (km/h)							
	class	< 10	10 to 20	20 to 30	30 to 40	40 to 50	> 50	total
	Average V_j	5.2	15.4	24.9	34.6	44.4	59.6	
average speed over the whole trip (km/h)	<10	58.8	33.7	1.9	5.6	0	0	100
	10 to 20	21.2	38.1	28.9	10.4	0.5	0.7	100
	20 to 30	12.6	27.8	36.1	17.6	4	1.9	100
	30 to 40	7.9	15.5	27.2	28.3	14.8	6.2	100
	40 to 50	7.1	17.3	19.5	24.5	21.7	9.9	100
	50 to 60	4.3	14.2	22.9	15.7	20.4	22.4	100
	60 to 70	7.4	15.1	18.8	19.2	20.4	19.2	100
	> 70	22.8	6.8	21.3	19.9	10.1	19.1	100
	total	13.7	16.2	24.3	20.7	13.0	12.2	100

Summer	average cold speed (km/h)							
	class	< 10	10 to 20	20 to 30	30 to 40	40 to 50	> 50	total
	Average V_j	5.9	15.4	24.9	34.3	44.1	64.3	
average speed over the whole trip (km/h)	<10	44.4	55.6	0	0	0	0	100
	10 to 20	16.1	57.9	26	0	0	0	100
	20 to 30	8.1	36.4	44.9	9.4	1.2	0	100
	30 to 40	6.6	32.1	28.3	24.4	8.5	0.1	100
	40 to 50	5.5	18.1	21.5	30.2	20.7	4	100
	50 to 60	0.3	18.2	24.5	29.4	17.7	9.8	100
	60 to 70	18.1	25.7	12	10.6	23.5	10	100
	> 70	7.9	19.7	23	14.3	19.8	15.3	100
	total	8.3	25.9	25	18.2	15.2	7.3	100

Intermediate	average cold speed (km/h)							
	class	< 10	10 to 20	20 to 30	30 to 40	40 to 50	> 50	total
	Average V_j	5.4	14.9	25	34.7	44.1	61.3	
average speed over the whole trip (km/h)	<10	51.6	40.1	8.3	0	0	0	100
	10 to 20	18.6	52.5	17.7	6	5.2	0	100
	20 to 30	11.4	29	40.1	15.7	3.8	0	100
	30 to 40	10.8	9.8	24.6	41.6	11.6	1.6	100
	40 to 50	4.8	17.7	26.7	21.3	21.1	8.5	100
	50 to 60	7	12.2	34.3	27.1	9	10.4	100
	60 to 70	12.9	6.8	6.3	21.1	18.3	34.5	100
	> 70	2.7	13.9	28.2	7	14.7	33.6	100
	total	8.6	17.5	26.9	20.7	12.6	13.7	100

Annex 20: Percentage $p_{m,j}$ of mileage started with a cold engine and distance d_m , for speed V_j with a cold engine (%)

(André et al., 1999)

Year			average speed to reach hot conditions (km/h): class and average V_j (cold-started trips)						total
Class (km)	Average d_m (km)	< 10	10 to 20	20 to 30	30 to 40	40 to 50	> 50		
				<i>5.4</i>	<i>15.3</i>	<i>24.9</i>	<i>34.6</i>	<i>44.3</i>	<i>60.9</i>
< 0.5	<i>0.214</i>	0.3	0.1	0.0	0.0	0.0	0.0	0.1	
0.5 - 1	<i>0.753</i>	0.6	0.5	0.2	0.0	0.0	0.0	0.2	
1 - 2	<i>1.462</i>	2.2	2.4	1.7	0.6	0.1	0.0	1.2	
2 - 3	<i>2.487</i>	3.0	4.3	3.9	1.3	0.5	0.0	2.5	
3 - 4	<i>3.436</i>	2.2	3.0	3.2	2.6	1.2	0.2	2.3	
4 - 5	<i>4.500</i>	3.2	4.7	4.7	2.9	1.6	0.7	3.3	
5 - 6	<i>5.505</i>	3.9	5.6	4.9	3.9	1.8	1.2	3.9	
6 - 7	<i>6.511</i>	3.9	4.9	4.2	4.0	1.9	0.8	3.5	
7 - 8	<i>7.443</i>	2.3	3.3	3.4	2.4	3.4	0.7	2.8	
8 - 9	<i>8.492</i>	1.9	2.1	2.3	2.6	1.1	0.7	1.9	
9 - 10	<i>9.540</i>	1.0	1.7	3.1	4.3	2.1	1.3	2.5	
10 - 11	<i>10.462</i>	1.2	3.7	2.4	4.6	3.6	0.9	3.0	
11 - 12	<i>11.474</i>	2.2	2.4	2.8	4.0	1.5	0.9	2.5	
> 12	<i>34.629</i>	71.9	61.3	63.1	66.8	81.4	92.5	70.3	
total	9.113	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

Winter			average speed to reach hot conditions (km/h): class and average V_j (cold-started trips)							
trip length (cold trips)	Class (km)	Average d_m (km)	< 10	10 to 20	20 to 30	30 to 40	40 to 50	> 50	total	
				5.2	15.4	24.9	34.6	44.4	59.6	
	< 0.5	0.222	0.3	0.1	0	0	0	0	0.1	
	0.5 - 1	0.762	0.4	0.6	0.2	0	0	0	0.2	
	1 - 2	1.454	1.9	2.5	1.6	0.6	0.1	0	1.2	
	2 - 3	2.459	2.5	3.1	3.2	1.2	0.5	0	1.9	
	3 - 4	3.454	2.7	3.5	3.1	2.6	1	0.1	2.4	
	4 - 5	4.565	2	4.1	4.2	2.9	1.4	0.9	2.8	
	5 - 6	5.481	3.2	7.3	4.7	3.3	1.8	0.7	3.8	
	6 - 7	6.519	3.2	5	3.1	3.9	0.4	0.7	2.9	
	7 - 8	7.421	1	3.8	3.4	2.2	1.4	0.9	2.3	
	8 - 9	8.472	1.3	3.5	2.8	2.2	1.3	0.9	2.2	
	9 - 10	9.387	0.9	1.7	3	3.6	1.9	2	2.4	
	10 - 11	10.362	1.1	3.5	2.3	4.5	5	1.3	3	
11 - 12	11.429	2.2	1.6	2.2	1.4	0.8	0.8	1.6		
> 12	33.294	77.5	59.6	66.2	71.7	84.5	91.7	73.3		
total			100	100	100	100	100	100	100	

Summer			average speed to reach hot conditions (km/h): class and average V_j (cold-started trips)							
trip length (cold trips)	Class (km)	Average d_m (km)	< 10	10 to 20	20 to 30	30 to 40	40 to 50	> 50	total	
				5.9	15.4	24.9	34.3	44.1	64.3	
	< 0.5	0.186	0.2	0	0	0	0	0	0	
	0.5 - 1	0.729	0.3	0.5	0.2	0	0	0	0.2	
	1 - 2	1.459	2.4	2.1	1.6	0.7	0	0.2	1.3	
	2 - 3	2.511	2.6	3.5	3.1	1.3	0.5	0	2.2	
	3 - 4	3.417	1.3	1.4	3.2	2.5	0.6	0.4	1.8	
	4 - 5	4.432	4.9	5	6.9	3.9	2.4	0.9	4.6	
	5 - 6	5.531	6.9	4.4	6.6	4.4	0.9	2.9	4.5	
	6 - 7	6.533	3.1	3.7	5.1	4.5	2.6	1.5	3.8	
	7 - 8	7.452	5.1	2.8	4.9	2.1	2.3	0.9	3.2	
	8 - 9	8.603	3.4	1	1.5	1.9	0.7	1	1.5	
	9 - 10	9.685	0	1.2	3.1	1.5	1.6	1.1	1.7	
	10 - 11	10.512	0.9	3.6	3.4	5.5	2.6	0	3.3	
11 - 12	11.522	0	2.5	3.3	4.3	1.3	0.8	2.5		
> 12	38.253	69	68.3	57.1	67.6	84.6	90.1	69.5		
total			100	100	100	100	100	100	100	

Intermediate saison			average speed to reach hot conditions (km/h): class and average Vj (cold-started trips)						
trip length (cold trips)	Class (km)	Average dm(km)	< 10	10 to 20	20 to 30	30 to 40	40 to 50	> 50	total
			5.4	14.9	25	34.7	44.1	61.3	
	< 0.5	0.22	0.3	0.1	0	0	0	0	0.1
	0.5 - 1	0.755	1.6	0.5	0.2	0	0	0	0.3
	1 - 2	1.476	3	2.8	1.9	0.5	0.1	0	1.4
	2 - 3	2.493	5.2	7.7	6	1.6	0.4	0	3.8
	3 - 4	3.431	1.6	4.5	3.5	2.6	2.4	0.3	2.8
	4 - 5	4.512	5.6	5.4	3.4	2.2	0.8	0.3	2.9
	5 - 6	5.513	3.4	4.2	3.7	4.7	2.8	1.3	3.5
	6 - 7	6.481	6.8	6.3	5.1	3.5	4.3	0.5	4.4
	7 - 8	7.46	3.7	2.9	2.2	3.2	8.7	0.5	3.2
	8 - 9	8.462	2.4	1.2	2.2	3.9	1	0	1.9
	9 - 10	9.61	2.5	2.4	3.4	8.2	3	0	3.6
	10 - 11	10.535	1.9	4.1	1.7	4.2	2	0.8	2.6
	11 - 12	11.475	4.5	3.5	3.5	8.9	3.2	1.2	4.4
> 12	33.604	57.3	54.3	63.1	56.4	71.3	95.1	65.1	
total		100	100	100	100	100	100	100	

Annex 21: Relative cold start number p_h for the hour h

Hour of the day	Year	Winter	Summer	Intermediate
0 - 1	26%	27%	24%	25%
1 - 2	14%	18%	12%	12%
2 - 3	11%	14%	8%	10%
3 - 4	7%	8%	4%	6%
4 - 5	8%	11%	4%	6%
5 - 6	15%	15%	14%	15%
6 - 7	51%	49%	75%	39%
7 - 8	109%	110%	141%	85%
8 - 9	146%	148%	174%	123%
9 - 10	157%	164%	151%	150%
10 - 11	148%	150%	124%	160%
11 - 12	161%	163%	144%	170%
12 - 13	164%	167%	149%	172%
13 - 14	157%	159%	156%	154%
14 - 15	144%	142%	135%	152%
15 - 16	149%	144%	154%	152%
16 - 17	168%	158%	178%	176%
17 - 18	176%	170%	195%	172%
18 - 19	167%	161%	175%	170%
19 - 20	137%	134%	126%	147%
20 - 21	107%	110%	88%	116%
21 - 22	80%	81%	67%	86%
22 - 23	59%	60%	59%	59%
23 - 24	40%	38%	42%	41%
Whole day	100%	100%	100%	100%

Annex 22: Percentage $p_{n,h}$ of mileage after a stop with a duration t_n at the hour h (%)

Year

Hour of the day	Parking time (h)														
	.25	.5	.75	1	2	3	4	5	6	7	8	9	10	11	12
0 - 1	0.792	0.599	1.371	1.134	2.018	2.008	4.297	2.215	1.100	1.848	1.391	0.811	0.034	1.032	0.070
1 - 2	0.490	0.540	0.707	0.799	0.927	1.059	2.280	1.597	0.665	0.213	1.357	0.000	0.000	0.000	0.066
2 - 3	0.152	0.535	0.415	0.506	1.189	1.125	2.182	1.203	1.004	4.085	0.657	0.076	0.059	0.000	0.060
3 - 4	0.104	0.677	0.238	0.297	0.981	0.815	1.539	1.630	1.319	3.872	0.140	0.076	0.059	3.406	0.000
4 - 5	0.071	0.541	0.282	0.000	1.492	0.576	0.630	1.682	1.281	4.569	0.360	1.240	0.840	3.755	0.068
5 - 6	0.258	0.329	0.073	0.067	0.636	0.162	0.428	1.812	1.698	1.968	2.075	3.972	4.279	7.387	2.331
6 - 7	1.288	0.142	0.045	0.207	1.129	0.028	0.021	0.632	1.740	3.158	5.586	7.133	7.286	13.735	7.969
7 - 8	3.786	0.831	0.836	0.758	0.727	1.029	0.041	0.367	1.517	2.521	5.368	8.870	11.330	17.433	15.631
8 - 9	7.251	3.054	1.573	1.856	1.501	1.215	0.070	0.060	0.627	1.361	4.681	8.233	9.834	16.054	17.346
9 - 10	9.244	4.144	4.427	4.306	2.162	1.777	0.098	0.186	0.553	0.926	1.104	5.154	7.437	9.299	14.023
10 - 11	8.906	5.383	5.655	6.392	3.564	2.297	1.202	0.705	0.466	1.214	1.820	2.360	2.613	5.613	7.490
11 - 12	7.675	5.532	8.367	7.241	4.337	3.538	3.869	3.371	1.148	1.628	0.718	0.207	0.753	3.671	4.797
12 - 13	6.708	6.772	9.803	7.691	5.820	4.510	5.479	4.534	1.435	1.130	1.080	0.124	1.335	0.672	3.991
13 - 14	6.061	6.995	11.704	8.259	6.981	5.886	5.128	7.104	4.179	1.875	2.556	0.712	1.357	0.431	4.658
14 - 15	5.990	6.921	9.875	7.421	7.665	7.966	6.034	5.635	5.145	3.860	6.904	4.205	1.409	0.219	4.371
15 - 16	6.763	7.177	8.087	6.533	7.896	9.625	7.737	6.396	11.751	6.055	12.539	8.587	3.166	0.283	3.917
16 - 17	7.127	10.364	7.567	5.816	8.209	8.974	10.144	8.856	14.142	10.720	13.159	13.867	8.923	1.728	3.312
17 - 18	7.579	12.778	9.333	8.703	8.945	7.633	8.840	12.750	16.767	10.869	10.655	14.275	13.431	2.742	3.027
18 - 19	6.021	11.894	7.640	10.444	8.080	6.437	8.531	12.943	13.081	10.781	8.496	10.711	12.788	4.860	2.181
19 - 20	5.545	7.720	5.063	9.782	7.164	7.337	7.313	8.649	9.005	8.075	6.758	4.909	7.580	3.316	1.675
20 - 21	3.280	3.341	1.883	6.515	5.618	8.409	5.943	5.209	5.031	6.138	5.060	1.554	3.410	2.202	1.211
21 - 22	2.413	1.930	1.721	2.721	5.247	8.135	5.631	4.798	2.355	5.563	2.997	0.736	1.228	0.047	1.182
22 - 23	1.347	0.961	1.520	1.527	4.270	6.175	6.595	4.374	2.079	4.147	1.955	1.375	0.691	1.058	0.432
23 - 24	1.149	0.844	1.814	1.024	3.443	3.286	5.969	3.292	1.914	3.425	2.583	0.811	0.159	1.058	0.190
Whole day	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167

Winter

Hour of the day	Parking time (h)														
	.25	.5	.75	1	2	3	4	5	6	7	8	9	10	11	12
0 - 1	1.409	0.862	1.023	1.449	0.840	1.064	4.298	1.538	1.197	3.743	1.666	2.299	0.083	2.081	0.130
1 - 2	0.695	0.593	0.662	0.910	0.916	0.947	2.456	1.382	1.695	0.000	1.666	0.000	0.000	0.001	0.130
2 - 3	0.191	0.726	0.236	0.729	2.226	1.695	2.472	1.340	2.714	1.060	0.000	0.000	0.000	0.000	0.130
3 - 4	0.110	1.113	0.067	0.575	2.174	1.233	2.971	3.387	3.790	1.060	0.000	0.000	0.000	0.000	0.000
4 - 5	0.088	1.061	0.168	0.000	3.307	1.115	1.260	3.580	2.700	1.060	0.474	1.999	0.278	0.226	0.088
5 - 6	0.221	0.724	0.168	0.133	1.410	0.024	0.856	3.937	4.047	0.000	0.861	3.481	0.278	3.431	0.910
6 - 7	0.902	0.015	0.101	0.395	2.470	0.064	0.042	1.373	4.171	2.051	3.422	6.984	4.521	18.855	7.487
7 - 8	4.101	0.197	0.703	1.031	1.573	2.611	0.083	0.797	4.221	2.244	2.948	9.140	11.857	22.948	14.996
8 - 9	7.757	2.160	0.867	2.225	2.063	2.905	0.139	0.131	1.397	2.340	2.650	8.888	15.296	21.555	20.260
9 - 10	9.385	4.491	5.953	6.455	1.860	3.615	0.139	0.131	0.051	2.611	0.089	5.620	11.955	7.006	16.478
10 - 11	8.711	6.331	7.627	6.856	2.902	3.189	1.517	0.000	0.000	2.642	0.089	1.767	4.342	3.055	10.030
11 - 12	6.311	8.105	12.157	6.562	4.201	3.852	3.894	0.237	0.574	3.863	0.000	0.586	0.902	1.244	4.883
12 - 13	5.576	8.550	15.243	4.040	6.555	5.222	6.312	1.649	1.896	2.023	0.547	0.352	0.000	0.368	3.611
13 - 14	4.789	8.995	13.645	7.941	6.314	4.694	5.370	7.386	5.808	2.604	1.977	0.343	0.053	0.000	5.173
14 - 15	6.573	8.099	9.702	7.726	6.322	5.525	7.950	7.459	9.250	1.954	9.794	0.818	0.053	0.000	4.595
15 - 16	7.724	7.155	4.559	8.135	5.676	5.438	8.625	8.298	12.478	7.431	12.446	5.960	0.733	0.129	3.390
16 - 17	7.317	9.407	5.745	4.548	7.192	7.914	10.743	6.709	9.920	8.607	14.057	10.898	5.398	1.012	1.609
17 - 18	7.575	8.650	7.475	8.869	8.054	7.074	7.087	11.923	6.484	13.502	10.065	14.330	11.705	2.328	1.459
18 - 19	5.790	8.257	4.757	9.650	7.486	7.503	5.875	12.631	7.336	9.501	10.753	11.139	14.990	4.841	1.205
19 - 20	5.605	5.620	3.743	10.275	7.759	9.022	4.813	10.180	6.874	8.821	8.839	6.180	11.164	3.958	0.761
20 - 21	3.212	3.714	1.593	5.678	6.556	10.281	4.483	4.937	6.466	4.116	5.014	2.931	5.016	2.642	1.066
21 - 22	2.436	2.890	1.629	2.634	6.273	9.193	5.071	4.327	2.416	4.913	4.410	0.980	1.050	0.053	1.032
22 - 23	2.027	1.130	1.039	1.772	3.372	3.840	7.090	3.299	2.115	7.355	3.284	3.007	0.241	2.133	0.547
23 - 24	1.494	1.157	1.134	1.413	2.501	1.976	6.453	3.370	2.401	6.499	4.950	2.299	0.083	2.134	0.031
Whole day	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167

Summer

Hour of the day	Parking time (h)														
	.25	.5	.75	1	2	3	4	5	6	7	8	9	10	11	12
0 - 1	0.339	0.261	4.215	0.659	1.480	2.344	4.358	3.065	0.114	1.453	1.161	0.000	0.000	0.000	0.031
1 - 2	0.356	0.204	1.938	0.386	0.560	0.815	1.369	1.961	0.114	0.627	1.041	0.000	0.000	0.000	0.019
2 - 3	0.103	0.116	0.479	0.000	0.184	0.256	1.017	1.162	0.000	5.224	1.041	0.000	0.000	0.000	0.000
3 - 4	0.107	0.000	0.000	0.000	0.000	0.000	0.066	0.202	0.000	4.597	0.000	0.000	0.000	0.000	0.000
4 - 5	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.096	0.000	4.753	0.000	0.120	0.123	0.931	0.059
5 - 6	0.289	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.155	0.782	5.627	1.433	5.274	3.820
6 - 7	1.589	0.350	0.000	0.027	0.046	0.000	0.000	0.000	0.000	1.764	6.547	9.535	3.309	8.543	9.654
7 - 8	4.598	1.573	1.892	0.839	0.047	0.122	0.000	0.000	0.128	1.609	6.554	9.714	3.781	12.475	17.072
8 - 9	5.781	4.273	2.262	2.007	1.683	0.335	0.000	0.000	0.128	1.609	5.908	7.522	3.884	10.831	15.429
9 - 10	8.662	4.180	3.481	2.390	3.285	0.583	0.105	0.041	0.128	0.000	0.143	3.614	2.852	17.027	10.871
10 - 11	7.434	4.775	3.603	9.133	5.569	1.656	0.826	0.254	0.054	0.818	2.556	3.315	2.257	12.316	5.011
11 - 12	7.921	2.910	6.659	11.100	4.911	4.257	3.307	6.235	0.421	1.147	2.420	0.000	1.348	9.617	4.646
12 - 13	5.217	4.310	6.653	17.516	5.558	5.459	3.444	7.344	0.991	1.459	2.420	0.000	0.505	0.153	4.870
13 - 14	5.202	3.642	5.515	11.470	8.805	7.534	2.791	8.223	3.157	1.568	2.305	0.000	0.505	0.000	3.962
14 - 15	5.085	4.891	5.331	8.933	10.965	10.379	1.102	3.193	3.477	1.238	2.608	4.854	0.000	0.392	3.989
15 - 16	7.146	4.714	5.012	2.796	11.463	13.463	5.191	4.877	17.127	1.858	15.620	11.339	7.342	0.392	4.226
16 - 17	7.691	11.489	7.756	3.276	9.178	11.940	9.749	12.854	26.222	16.044	17.757	18.746	20.760	2.795	5.323
17 - 18	9.384	17.293	9.422	5.849	8.487	8.785	13.362	17.396	26.793	18.063	17.453	14.711	25.533	4.218	3.866
18 - 19	7.876	18.511	10.541	8.369	7.961	6.538	14.268	15.653	14.858	19.066	6.564	8.227	18.191	7.180	2.356
19 - 20	7.266	10.978	8.247	7.490	5.721	5.548	10.586	7.335	3.658	5.690	2.236	0.908	5.302	4.815	1.847
20 - 21	4.017	3.556	3.343	4.675	4.623	5.303	7.306	2.064	2.401	3.680	2.742	0.619	0.901	3.000	1.552
21 - 22	2.397	1.008	3.432	1.577	3.541	4.947	5.901	2.151	0.116	3.136	0.878	0.619	1.134	0.038	1.327
22 - 23	0.767	0.673	4.381	0.741	3.453	5.718	8.011	2.610	0.000	2.225	0.884	0.531	0.606	0.000	0.040
23 - 24	0.752	0.231	5.838	0.770	2.480	4.019	7.240	3.284	0.114	2.217	0.379	0.000	0.234	0.000	0.031
Whole day	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167

Intermediate

Hour of the day	Parking time (h)														
	.25	.5	.75	1	2	3	4	5	6	7	8	9	10	11	12
0 - 1	0.473	0.741	0.043	0.945	4.319	2.789	4.223	2.272	2.326	0.523	1.144	0.000	0.000	0.000	0.000
1 - 2	0.374	0.959	0.000	0.962	1.268	1.391	2.981	1.435	0.173	0.000	1.144	0.000	0.000	0.000	0.000
2 - 3	0.143	0.891	0.598	0.531	0.473	1.214	2.939	0.942	0.310	5.704	1.447	0.278	0.193	0.000	0.000
3 - 4	0.097	1.082	0.598	0.017	0.000	1.030	0.163	0.000	0.137	5.704	0.569	0.278	0.193	13.625	0.000
4 - 5	0.086	0.635	0.598	0.000	0.000	0.455	0.000	0.000	1.315	7.563	0.569	1.802	2.268	13.625	0.041
5 - 6	0.274	0.190	0.000	0.000	0.000	0.455	0.000	0.000	1.178	5.526	5.878	2.326	12.356	17.385	3.200
6 - 7	1.475	0.009	0.002	0.000	0.011	0.010	0.000	0.000	1.178	5.526	8.542	4.013	14.733	8.858	6.629
7 - 8	2.969	0.592	0.347	0.139	0.018	0.010	0.000	0.000	0.149	3.667	8.542	7.356	17.609	11.535	14.945
8 - 9	7.679	2.470	2.019	0.981	0.468	0.050	0.000	0.000	0.378	0.233	7.073	8.364	7.919	10.450	13.989
9 - 10	9.472	3.631	3.124	1.800	1.636	0.710	0.000	0.595	1.737	0.310	4.143	6.677	5.542	5.991	13.324
10 - 11	10.020	5.012	4.483	2.916	2.816	1.833	0.961	3.303	1.588	0.310	4.219	1.810	0.591	3.869	5.686
11 - 12	8.852	5.934	4.734	5.009	4.038	2.580	4.484	5.682	2.829	0.077	0.076	0.000	0.000	2.440	4.830
12 - 13	8.748	7.991	5.020	5.844	4.914	2.908	6.087	6.331	1.487	0.000	0.514	0.000	3.919	1.802	3.556
13 - 14	7.842	9.213	13.131	5.910	6.398	5.839	7.394	4.286	3.609	1.516	3.943	2.174	3.919	1.724	4.561
14 - 15	5.989	8.307	12.901	5.407	6.822	8.685	7.735	5.766	2.470	8.155	6.494	7.704	4.558	0.477	4.438
15 - 16	5.584	10.774	14.356	6.810	8.178	11.109	8.839	4.578	3.548	8.926	9.101	8.200	2.606	0.477	4.578
16 - 17	6.587	9.996	9.705	10.710	8.928	7.668	9.303	6.578	2.771	7.410	6.074	10.989	2.748	2.063	4.040
17 - 18	6.449	11.689	11.578	11.025	10.733	7.292	7.274	5.983	15.502	1.430	3.795	13.604	4.563	2.063	5.101
18 - 19	5.084	7.108	9.414	13.960	9.109	5.151	7.489	8.573	17.586	3.815	6.504	13.585	4.785	2.539	3.955
19 - 20	4.407	5.772	4.726	10.930	7.520	6.946	8.878	7.355	18.860	9.738	8.137	8.781	4.817	0.518	3.322
20 - 21	2.884	2.535	1.337	9.895	5.045	8.914	7.512	11.845	6.885	10.378	7.864	1.057	3.552	0.518	1.037
21 - 22	2.400	1.998	0.776	3.957	5.167	9.627	6.534	10.985	5.334	8.529	2.816	0.580	1.554	0.042	1.291
22 - 23	1.048	1.153	0.344	1.767	6.385	9.192	3.816	10.376	4.868	3.129	0.706	0.421	1.381	0.000	0.738
23 - 24	1.062	1.317	0.167	0.486	5.755	4.145	3.389	3.115	3.782	1.830	0.706	0.000	0.192	0.000	0.738
Whole day	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167	4.167

Annex 23: Cold excess unit emission according to average speed and ambient temperature for Euro 0 gasoline cars with catalyst according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	8.736	9.676	9.248	8.740	8.604	7.952	7.673	6.871
-20 - -10°C:	-15	6.945	7.683	7.338	6.929	6.820	6.302	6.084	5.449
-10 - 0°C:	-5	5.135	5.672	5.413	5.108	5.027	4.645	4.486	4.018
0 - 10°C:	5	3.305	3.646	3.477	3.278	3.226	2.980	2.879	2.579
10 - 20°C:	15	1.455	1.602	1.527	1.439	1.416	1.307	1.264	1.132
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.176	2.460	2.384	2.295	2.272	2.106	2.023	1.804
-20 - -10°C:	-15	2.176	2.460	2.384	2.295	2.272	2.106	2.023	1.804
-10 - 0°C:	-5	2.176	2.460	2.384	2.295	2.272	2.106	2.023	1.804
0 - 10°C:	5	2.176	2.460	2.384	2.295	2.272	2.106	2.023	1.804
10 - 20°C:	15	2.176	2.460	2.384	2.295	2.272	2.106	2.023	1.804
20 - 30°C:	25	2.176	2.460	2.384	2.295	2.272	2.106	2.023	1.804
30 - 40°C:	35	2.176	2.460	2.384	2.295	2.272	2.106	2.023	1.804

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.810E-1	6.412E-1	6.116E-1	5.770E-1	5.678E-1	5.245E-1	5.068E-1	4.539E-1
-20 - -10°C:	-15	4.711E-1	5.189E-1	4.946E-1	4.661E-1	4.586E-1	4.236E-1	4.095E-1	3.669E-1
-10 - 0°C:	-5	3.597E-1	3.955E-1	3.766E-1	3.547E-1	3.489E-1	3.221E-1	3.116E-1	2.792E-1
0 - 10°C:	5	2.469E-1	2.709E-1	2.577E-1	2.425E-1	2.385E-1	2.202E-1	2.132E-1	1.910E-1
10 - 20°C:	15	1.327E-1	1.453E-1	1.380E-1	1.298E-1	1.276E-1	1.178E-1	1.141E-1	1.023E-1
20 - 30°C:	25	1.690E-2	1.850E-2	1.760E-2	1.650E-2	1.620E-2	1.500E-2	1.450E-2	1.300E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.729E-1	1.958E-1	1.901E-1	1.834E-1	1.816E-1	1.684E-1	1.617E-1	1.441E-1
-20 - -10°C:	-15	1.419E-1	1.606E-1	1.557E-1	1.500E-1	1.485E-1	1.377E-1	1.322E-1	1.179E-1
-10 - 0°C:	-5	1.102E-1	1.246E-1	1.207E-1	1.160E-1	1.148E-1	1.064E-1	1.022E-1	9.110E-2
0 - 10°C:	5	7.770E-2	8.770E-2	8.490E-2	8.150E-2	8.060E-2	7.470E-2	7.170E-2	6.400E-2
10 - 20°C:	15	4.430E-2	5.000E-2	4.830E-2	4.630E-2	4.580E-2	4.240E-2	4.070E-2	3.640E-2
20 - 30°C:	25	1.010E-2	1.130E-2	1.100E-2	1.050E-2	1.030E-2	9.600E-3	9.200E-3	8.200E-3
30 - 40°C:	35	0	0	0	0	0	0	0	0

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	8.207	9.783	9.293	8.941	8.750	7.805	7.677	7.070
-20 - -10°C:	-15	6.523	7.766	7.373	7.088	6.936	6.185	6.085	5.607
-10 - 0°C:	-5	4.823	5.734	5.440	5.225	5.113	4.559	4.486	4.136
0 - 10°C:	5	3.104	3.685	3.493	3.353	3.281	2.924	2.878	2.655
10 - 20°C:	15	1.366	1.620	1.534	1.472	1.440	1.283	1.263	1.166
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.056	2.502	2.406	2.357	2.315	2.076	2.037	1.856
-20 - -10°C:	-15	2.056	2.502	2.406	2.357	2.315	2.076	2.037	1.856
-10 - 0°C:	-5	2.056	2.502	2.406	2.357	2.315	2.076	2.037	1.856
0 - 10°C:	5	2.056	2.502	2.406	2.357	2.315	2.076	2.037	1.856
10 - 20°C:	15	2.056	2.502	2.406	2.357	2.315	2.076	2.037	1.856
20 - 30°C:	25	2.056	2.502	2.406	2.357	2.315	2.076	2.037	1.856
30 - 40°C:	35	2.056	2.502	2.406	2.357	2.315	2.076	2.037	1.856

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.457E-1	6.482E-1	6.147E-1	5.902E-1	5.775E-1	5.148E-1	5.066E-1	4.673E-1
-20 - -10°C:	-15	4.424E-1	5.245E-1	4.970E-1	4.768E-1	4.666E-1	4.158E-1	4.092E-1	3.778E-1
-10 - 0°C:	-5	3.378E-1	3.997E-1	3.785E-1	3.627E-1	3.549E-1	3.162E-1	3.113E-1	2.876E-1
0 - 10°C:	5	2.319E-1	2.738E-1	2.590E-1	2.480E-1	2.427E-1	2.161E-1	2.129E-1	1.968E-1
10 - 20°C:	15	1.246E-1	1.468E-1	1.387E-1	1.327E-1	1.299E-1	1.156E-1	1.139E-1	1.054E-1
20 - 30°C:	25	1.590E-2	1.870E-2	1.760E-2	1.690E-2	1.650E-2	1.470E-2	1.450E-2	1.340E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.634E-1	1.993E-1	1.919E-1	1.885E-1	1.851E-1	1.662E-1	1.630E-1	1.483E-1
-20 - -10°C:	-15	1.341E-1	1.633E-1	1.571E-1	1.541E-1	1.513E-1	1.357E-1	1.331E-1	1.212E-1
-10 - 0°C:	-5	1.040E-1	1.266E-1	1.217E-1	1.191E-1	1.169E-1	1.048E-1	1.028E-1	9.370E-2
0 - 10°C:	5	7.330E-2	8.910E-2	8.550E-2	8.360E-2	8.200E-2	7.350E-2	7.210E-2	6.580E-2
10 - 20°C:	15	4.180E-2	5.070E-2	4.870E-2	4.750E-2	4.660E-2	4.170E-2	4.090E-2	3.740E-2
20 - 30°C:	25	9.500E-3	1.150E-2	1.100E-2	1.070E-2	1.050E-2	9.400E-3	9.200E-3	8.400E-3
30 - 40°C:	35	0	0	0	0	0	0	0	0

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	8.353	9.690	9.118	8.556	8.499	8.390	7.387	6.353
-20 - -10°C:	-15	6.634	7.690	7.232	6.783	6.735	6.648	5.858	5.035
-10 - 0°C:	-5	4.900	5.676	5.333	5.001	4.963	4.898	4.320	3.711
0 - 10°C:	5	3.151	3.646	3.424	3.209	3.183	3.141	2.773	2.381
10 - 20°C:	15	1.385	1.602	1.503	1.409	1.396	1.377	1.217	1.045
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.111	2.481	2.369	2.241	2.259	2.238	1.936	1.682
-20 - -10°C:	-15	2.111	2.481	2.369	2.241	2.259	2.238	1.936	1.682
-10 - 0°C:	-5	2.111	2.481	2.369	2.241	2.259	2.238	1.936	1.682
0 - 10°C:	5	2.111	2.481	2.369	2.241	2.259	2.238	1.936	1.682
10 - 20°C:	15	2.111	2.481	2.369	2.241	2.259	2.238	1.936	1.682
20 - 30°C:	25	2.111	2.481	2.369	2.241	2.259	2.238	1.936	1.682
30 - 40°C:	35	2.111	2.481	2.369	2.241	2.259	2.238	1.936	1.682

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.541E-1	6.414E-1	6.024E-1	5.648E-1	5.604E-1	5.529E-1	4.880E-1	4.191E-1
-20 - -10°C:	-15	4.487E-1	5.187E-1	4.868E-1	4.563E-1	4.524E-1	4.463E-1	3.944E-1	3.385E-1
-10 - 0°C:	-5	3.421E-1	3.951E-1	3.705E-1	3.471E-1	3.440E-1	3.393E-1	3.002E-1	2.574E-1
0 - 10°C:	5	2.345E-1	2.704E-1	2.534E-1	2.373E-1	2.351E-1	2.318E-1	2.053E-1	1.760E-1
10 - 20°C:	15	1.258E-1	1.448E-1	1.356E-1	1.270E-1	1.257E-1	1.239E-1	1.099E-1	9.410E-2
20 - 30°C:	25	1.600E-2	1.840E-2	1.720E-2	1.610E-2	1.600E-2	1.570E-2	1.400E-2	1.200E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.679E-1	1.976E-1	1.890E-1	1.790E-1	1.807E-1	1.791E-1	1.547E-1	1.345E-1
-20 - -10°C:	-15	1.378E-1	1.621E-1	1.549E-1	1.466E-1	1.478E-1	1.464E-1	1.266E-1	1.100E-1
-10 - 0°C:	-5	1.068E-1	1.256E-1	1.199E-1	1.134E-1	1.142E-1	1.131E-1	9.790E-2	8.500E-2
0 - 10°C:	5	7.520E-2	8.830E-2	8.430E-2	7.960E-2	8.010E-2	7.930E-2	6.870E-2	5.960E-2
10 - 20°C:	15	4.290E-2	5.030E-2	4.790E-2	4.530E-2	4.540E-2	4.500E-2	3.900E-2	3.380E-2
20 - 30°C:	25	9.700E-3	1.140E-2	1.090E-2	1.020E-2	1.030E-2	1.020E-2	8.800E-3	7.600E-3
30 - 40°C:	35	0	0	0	0	0	0	0	0

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.068E+1	9.663	9.833	8.792	8.698	8.028	8.088	6.455
-20 - -10°C:	-15	8.497	7.675	7.804	6.971	6.896	6.365	6.412	5.117
-10 - 0°C:	-5	6.285	5.668	5.759	5.140	5.084	4.693	4.728	3.771
0 - 10°C:	5	4.047	3.644	3.699	3.299	3.262	3.012	3.035	2.420
10 - 20°C:	15	1.782	1.602	1.625	1.448	1.431	1.322	1.332	1.062
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.604	2.417	2.501	2.299	2.274	2.092	2.137	1.695
-20 - -10°C:	-15	2.604	2.417	2.501	2.299	2.274	2.092	2.137	1.695
-10 - 0°C:	-5	2.604	2.417	2.501	2.299	2.274	2.092	2.137	1.695
0 - 10°C:	5	2.604	2.417	2.501	2.299	2.274	2.092	2.137	1.695
10 - 20°C:	15	2.604	2.417	2.501	2.299	2.274	2.092	2.137	1.695
20 - 30°C:	25	2.604	2.417	2.501	2.299	2.274	2.092	2.137	1.695
30 - 40°C:	35	2.604	2.417	2.501	2.299	2.274	2.092	2.137	1.695

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	7.113E-1	6.407E-1	6.506E-1	5.805E-1	5.740E-1	5.300E-1	5.341E-1	4.258E-1
-20 - -10°C:	-15	5.770E-1	5.187E-1	5.261E-1	4.690E-1	4.637E-1	4.282E-1	4.316E-1	3.439E-1
-10 - 0°C:	-5	4.407E-1	3.954E-1	4.007E-1	3.569E-1	3.527E-1	3.257E-1	3.285E-1	2.615E-1
0 - 10°C:	5	3.026E-1	2.709E-1	2.742E-1	2.440E-1	2.412E-1	2.227E-1	2.247E-1	1.788E-1
10 - 20°C:	15	1.626E-1	1.453E-1	1.469E-1	1.306E-1	1.290E-1	1.192E-1	1.203E-1	9.560E-2
20 - 30°C:	25	2.080E-2	1.850E-2	1.870E-2	1.660E-2	1.640E-2	1.510E-2	1.530E-2	1.210E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.062E-1	1.919E-1	1.989E-1	1.835E-1	1.815E-1	1.668E-1	1.709E-1	1.353E-1
-20 - -10°C:	-15	1.697E-1	1.577E-1	1.633E-1	1.502E-1	1.486E-1	1.367E-1	1.396E-1	1.107E-1
-10 - 0°C:	-5	1.321E-1	1.226E-1	1.267E-1	1.163E-1	1.151E-1	1.058E-1	1.079E-1	8.570E-2
0 - 10°C:	5	9.330E-2	8.650E-2	8.930E-2	8.170E-2	8.090E-2	7.440E-2	7.570E-2	6.020E-2
10 - 20°C:	15	5.340E-2	4.940E-2	5.100E-2	4.650E-2	4.600E-2	4.240E-2	4.300E-2	3.430E-2
20 - 30°C:	25	1.220E-2	1.120E-2	1.160E-2	1.050E-2	1.040E-2	9.600E-3	9.700E-3	7.800E-3
30 - 40°C:	35	0	0	0	0	0	0	0	0

Annex 24: Cold excess unit emission according to average speed and ambient temperature for Euro 0 diesel cars without catalyst according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	8.440E-2	9.610E-2	9.450E-2	9.380E-2	9.400E-2	8.750E-2	8.470E-2	7.480E-2
-20 - -10°C:	-15	8.040E-2	9.160E-2	8.990E-2	8.890E-2	8.890E-2	8.260E-2	7.990E-2	7.060E-2
-10 - 0°C:	-5	7.610E-2	8.670E-2	8.490E-2	8.350E-2	8.330E-2	7.740E-2	7.460E-2	6.610E-2
0 - 10°C:	5	7.140E-2	8.120E-2	7.930E-2	7.750E-2	7.710E-2	7.160E-2	6.890E-2	6.120E-2
10 - 20°C:	15	6.620E-2	7.500E-2	7.300E-2	7.080E-2	7.030E-2	6.520E-2	6.270E-2	5.580E-2
20 - 30°C:	25	6.010E-2	6.790E-2	6.580E-2	6.330E-2	6.270E-2	5.810E-2	5.580E-2	4.980E-2
30 - 40°C:	35	5.320E-2	5.970E-2	5.740E-2	5.470E-2	5.400E-2	5.000E-2	4.810E-2	4.300E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.031	4.531	4.371	4.177	4.125	3.820	3.672	3.280
-20 - -10°C:	-15	4.031	4.531	4.371	4.177	4.125	3.820	3.672	3.280
-10 - 0°C:	-5	4.031	4.531	4.371	4.177	4.125	3.820	3.672	3.280
0 - 10°C:	5	4.031	4.531	4.371	4.177	4.125	3.820	3.672	3.280
10 - 20°C:	15	4.031	4.531	4.371	4.177	4.125	3.820	3.672	3.280
20 - 30°C:	25	4.031	4.531	4.371	4.177	4.125	3.820	3.672	3.280
30 - 40°C:	35	4.031	4.531	4.371	4.177	4.125	3.820	3.672	3.280

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.380E-2	1.570E-2	1.530E-2	1.480E-2	1.470E-2	1.370E-2	1.310E-2	1.170E-2
-20 - -10°C:	-15	1.380E-2	1.570E-2	1.530E-2	1.480E-2	1.470E-2	1.370E-2	1.310E-2	1.170E-2
-10 - 0°C:	-5	1.380E-2	1.570E-2	1.530E-2	1.480E-2	1.470E-2	1.370E-2	1.310E-2	1.170E-2
0 - 10°C:	5	1.380E-2	1.570E-2	1.530E-2	1.480E-2	1.470E-2	1.370E-2	1.310E-2	1.170E-2
10 - 20°C:	15	1.380E-2	1.570E-2	1.530E-2	1.480E-2	1.470E-2	1.370E-2	1.310E-2	1.170E-2
20 - 30°C:	25	1.380E-2	1.570E-2	1.530E-2	1.480E-2	1.470E-2	1.370E-2	1.310E-2	1.170E-2
30 - 40°C:	35	1.380E-2	1.570E-2	1.530E-2	1.480E-2	1.470E-2	1.370E-2	1.310E-2	1.170E-2

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-2.300E-3	-2.500E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.100E-3	-1.900E-3
-20 - -10°C:	-15	-2.300E-3	-2.500E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.100E-3	-1.900E-3
-10 - 0°C:	-5	-2.300E-3	-2.500E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.100E-3	-1.900E-3
0 - 10°C:	5	-2.300E-3	-2.500E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.100E-3	-1.900E-3
10 - 20°C:	15	-2.300E-3	-2.500E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.100E-3	-1.900E-3
20 - 30°C:	25	-2.300E-3	-2.500E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.100E-3	-1.900E-3
30 - 40°C:	35	-2.300E-3	-2.500E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.100E-3	-1.900E-3

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	8.110E-2	9.930E-2	9.680E-2	9.780E-2	9.700E-2	8.810E-2	8.620E-2	7.780E-2
-20 - -10°C:	-15	7.710E-2	9.440E-2	9.180E-2	9.230E-2	9.150E-2	8.290E-2	8.110E-2	7.330E-2
-10 - 0°C:	-5	7.270E-2	8.900E-2	8.650E-2	8.650E-2	8.550E-2	7.730E-2	7.570E-2	6.840E-2
0 - 10°C:	5	6.800E-2	8.320E-2	8.050E-2	8.010E-2	7.900E-2	7.120E-2	6.980E-2	6.320E-2
10 - 20°C:	15	6.270E-2	7.660E-2	7.390E-2	7.300E-2	7.180E-2	6.460E-2	6.330E-2	5.750E-2
20 - 30°C:	25	5.680E-2	6.910E-2	6.640E-2	6.500E-2	6.380E-2	5.730E-2	5.620E-2	5.120E-2
30 - 40°C:	35	5.010E-2	6.040E-2	5.780E-2	5.610E-2	5.490E-2	4.910E-2	4.820E-2	4.420E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.798	4.594	4.399	4.281	4.197	3.756	3.688	3.373
-20 - -10°C:	-15	3.798	4.594	4.399	4.281	4.197	3.756	3.688	3.373
-10 - 0°C:	-5	3.798	4.594	4.399	4.281	4.197	3.756	3.688	3.373
0 - 10°C:	5	3.798	4.594	4.399	4.281	4.197	3.756	3.688	3.373
10 - 20°C:	15	3.798	4.594	4.399	4.281	4.197	3.756	3.688	3.373
20 - 30°C:	25	3.798	4.594	4.399	4.281	4.197	3.756	3.688	3.373
30 - 40°C:	35	3.798	4.594	4.399	4.281	4.197	3.756	3.688	3.373

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.310E-2	1.600E-2	1.550E-2	1.530E-2	1.500E-2	1.350E-2	1.330E-2	1.210E-2
-20 - -10°C:	-15	1.310E-2	1.600E-2	1.550E-2	1.530E-2	1.500E-2	1.350E-2	1.330E-2	1.210E-2
-10 - 0°C:	-5	1.310E-2	1.600E-2	1.550E-2	1.530E-2	1.500E-2	1.350E-2	1.330E-2	1.210E-2
0 - 10°C:	5	1.310E-2	1.600E-2	1.550E-2	1.530E-2	1.500E-2	1.350E-2	1.330E-2	1.210E-2
10 - 20°C:	15	1.310E-2	1.600E-2	1.550E-2	1.530E-2	1.500E-2	1.350E-2	1.330E-2	1.210E-2
20 - 30°C:	25	1.310E-2	1.600E-2	1.550E-2	1.530E-2	1.500E-2	1.350E-2	1.330E-2	1.210E-2
30 - 40°C:	35	1.310E-2	1.600E-2	1.550E-2	1.530E-2	1.500E-2	1.350E-2	1.330E-2	1.210E-2

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-2.100E-3	-2.600E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.100E-3	-2.100E-3	-1.900E-3
-20 - -10°C:	-15	-2.100E-3	-2.600E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.100E-3	-2.100E-3	-1.900E-3
-10 - 0°C:	-5	-2.100E-3	-2.600E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.100E-3	-2.100E-3	-1.900E-3
0 - 10°C:	5	-2.100E-3	-2.600E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.100E-3	-2.100E-3	-1.900E-3
10 - 20°C:	15	-2.100E-3	-2.600E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.100E-3	-2.100E-3	-1.900E-3
20 - 30°C:	25	-2.100E-3	-2.600E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.100E-3	-2.100E-3	-1.900E-3
30 - 40°C:	35	-2.100E-3	-2.600E-3	-2.500E-3	-2.400E-3	-2.400E-3	-2.100E-3	-2.100E-3	-1.900E-3

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	8.220E-2	9.690E-2	9.340E-2	9.000E-2	9.290E-2	9.240E-2	7.920E-2	6.920E-2
-20 - -10°C:	-15	7.830E-2	9.240E-2	8.900E-2	8.550E-2	8.800E-2	8.740E-2	7.500E-2	6.550E-2
-10 - 0°C:	-5	7.420E-2	8.750E-2	8.420E-2	8.060E-2	8.250E-2	8.200E-2	7.040E-2	6.140E-2
0 - 10°C:	5	6.950E-2	8.200E-2	7.870E-2	7.510E-2	7.650E-2	7.600E-2	6.540E-2	5.700E-2
10 - 20°C:	15	6.430E-2	7.570E-2	7.260E-2	6.890E-2	6.990E-2	6.930E-2	5.980E-2	5.200E-2
20 - 30°C:	25	5.830E-2	6.850E-2	6.530E-2	6.180E-2	6.230E-2	6.170E-2	5.340E-2	4.640E-2
30 - 40°C:	35	5.120E-2	5.990E-2	5.680E-2	5.350E-2	5.350E-2	5.290E-2	4.610E-2	3.990E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.893	4.558	4.331	4.084	4.092	4.050	3.523	3.051
-20 - -10°C:	-15	3.893	4.558	4.331	4.084	4.092	4.050	3.523	3.051
-10 - 0°C:	-5	3.893	4.558	4.331	4.084	4.092	4.050	3.523	3.051
0 - 10°C:	5	3.893	4.558	4.331	4.084	4.092	4.050	3.523	3.051
10 - 20°C:	15	3.893	4.558	4.331	4.084	4.092	4.050	3.523	3.051
20 - 30°C:	25	3.893	4.558	4.331	4.084	4.092	4.050	3.523	3.051
30 - 40°C:	35	3.893	4.558	4.331	4.084	4.092	4.050	3.523	3.051

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.350E-2	1.580E-2	1.520E-2	1.440E-2	1.460E-2	1.450E-2	1.250E-2	1.090E-2
-20 - -10°C:	-15	1.350E-2	1.580E-2	1.520E-2	1.440E-2	1.460E-2	1.450E-2	1.250E-2	1.090E-2
-10 - 0°C:	-5	1.350E-2	1.580E-2	1.520E-2	1.440E-2	1.460E-2	1.450E-2	1.250E-2	1.090E-2
0 - 10°C:	5	1.350E-2	1.580E-2	1.520E-2	1.440E-2	1.460E-2	1.450E-2	1.250E-2	1.090E-2
10 - 20°C:	15	1.350E-2	1.580E-2	1.520E-2	1.440E-2	1.460E-2	1.450E-2	1.250E-2	1.090E-2
20 - 30°C:	25	1.350E-2	1.580E-2	1.520E-2	1.440E-2	1.460E-2	1.450E-2	1.250E-2	1.090E-2
30 - 40°C:	35	1.350E-2	1.580E-2	1.520E-2	1.440E-2	1.460E-2	1.450E-2	1.250E-2	1.090E-2

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-2.200E-3	-2.600E-3	-2.500E-3	-2.300E-3	-2.300E-3	-2.300E-3	-2.000E-3	-1.700E-3
-20 - -10°C:	-15	-2.200E-3	-2.600E-3	-2.500E-3	-2.300E-3	-2.300E-3	-2.300E-3	-2.000E-3	-1.700E-3
-10 - 0°C:	-5	-2.200E-3	-2.600E-3	-2.500E-3	-2.300E-3	-2.300E-3	-2.300E-3	-2.000E-3	-1.700E-3
0 - 10°C:	5	-2.200E-3	-2.600E-3	-2.500E-3	-2.300E-3	-2.300E-3	-2.300E-3	-2.000E-3	-1.700E-3
10 - 20°C:	15	-2.200E-3	-2.600E-3	-2.500E-3	-2.300E-3	-2.300E-3	-2.300E-3	-2.000E-3	-1.700E-3
20 - 30°C:	25	-2.200E-3	-2.600E-3	-2.500E-3	-2.300E-3	-2.300E-3	-2.300E-3	-2.000E-3	-1.700E-3
30 - 40°C:	35	-2.200E-3	-2.600E-3	-2.500E-3	-2.300E-3	-2.300E-3	-2.300E-3	-2.000E-3	-1.700E-3

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	9.690E-2	9.140E-2	9.670E-2	9.350E-2	9.220E-2	8.440E-2	9.060E-2	6.990E-2
-20 - -10°C:	-15	9.300E-2	8.760E-2	9.230E-2	8.870E-2	8.740E-2	8.010E-2	8.530E-2	6.600E-2
-10 - 0°C:	-5	8.860E-2	8.330E-2	8.750E-2	8.340E-2	8.220E-2	7.540E-2	7.950E-2	6.180E-2
0 - 10°C:	5	8.380E-2	7.850E-2	8.210E-2	7.750E-2	7.650E-2	7.010E-2	7.330E-2	5.730E-2
10 - 20°C:	15	7.840E-2	7.310E-2	7.610E-2	7.090E-2	7.010E-2	6.430E-2	6.650E-2	5.230E-2
20 - 30°C:	25	7.200E-2	6.680E-2	6.900E-2	6.340E-2	6.280E-2	5.770E-2	5.900E-2	4.680E-2
30 - 40°C:	35	6.450E-2	5.930E-2	6.080E-2	5.500E-2	5.450E-2	5.020E-2	5.070E-2	4.050E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.871	4.487	4.615	4.193	4.151	3.823	3.875	3.088
-20 - -10°C:	-15	4.871	4.487	4.615	4.193	4.151	3.823	3.875	3.088
-10 - 0°C:	-5	4.871	4.487	4.615	4.193	4.151	3.823	3.875	3.088
0 - 10°C:	5	4.871	4.487	4.615	4.193	4.151	3.823	3.875	3.088
10 - 20°C:	15	4.871	4.487	4.615	4.193	4.151	3.823	3.875	3.088
20 - 30°C:	25	4.871	4.487	4.615	4.193	4.151	3.823	3.875	3.088
30 - 40°C:	35	4.871	4.487	4.615	4.193	4.151	3.823	3.875	3.088

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.640E-2	1.530E-2	1.590E-2	1.490E-2	1.470E-2	1.350E-2	1.390E-2	1.100E-2
-20 - -10°C:	-15	1.640E-2	1.530E-2	1.590E-2	1.490E-2	1.470E-2	1.350E-2	1.390E-2	1.100E-2
-10 - 0°C:	-5	1.640E-2	1.530E-2	1.590E-2	1.490E-2	1.470E-2	1.350E-2	1.390E-2	1.100E-2
0 - 10°C:	5	1.640E-2	1.530E-2	1.590E-2	1.490E-2	1.470E-2	1.350E-2	1.390E-2	1.100E-2
10 - 20°C:	15	1.640E-2	1.530E-2	1.590E-2	1.490E-2	1.470E-2	1.350E-2	1.390E-2	1.100E-2
20 - 30°C:	25	1.640E-2	1.530E-2	1.590E-2	1.490E-2	1.470E-2	1.350E-2	1.390E-2	1.100E-2
30 - 40°C:	35	1.640E-2	1.530E-2	1.590E-2	1.490E-2	1.470E-2	1.350E-2	1.390E-2	1.100E-2

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-2.700E-3	-2.500E-3	-2.600E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.200E-3	-1.800E-3
-20 - -10°C:	-15	-2.700E-3	-2.500E-3	-2.600E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.200E-3	-1.800E-3
-10 - 0°C:	-5	-2.700E-3	-2.500E-3	-2.600E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.200E-3	-1.800E-3
0 - 10°C:	5	-2.700E-3	-2.500E-3	-2.600E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.200E-3	-1.800E-3
10 - 20°C:	15	-2.700E-3	-2.500E-3	-2.600E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.200E-3	-1.800E-3
20 - 30°C:	25	-2.700E-3	-2.500E-3	-2.600E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.200E-3	-1.800E-3
30 - 40°C:	35	-2.700E-3	-2.500E-3	-2.600E-3	-2.400E-3	-2.400E-3	-2.200E-3	-2.200E-3	-1.800E-3

Annex 25: Cold excess unit emission according to average speed and ambient temperature for Euro 0 gasoline cars without catalyst according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.407	6.038	5.800	5.513	5.436	5.030	4.842	4.331
-20 - -10°C:	-15	4.404	4.918	4.724	4.490	4.428	4.097	3.944	3.527
-10 - 0°C:	-5	3.401	3.798	3.648	3.468	3.420	3.164	3.046	2.724
0 - 10°C:	5	2.398	2.678	2.572	2.445	2.411	2.231	2.148	1.921
10 - 20°C:	15	1.395	1.558	1.497	1.423	1.403	1.298	1.250	1.117
20 - 30°C:	25	3.922E-1	4.380E-1	4.207E-1	3.999E-1	3.943E-1	3.649E-1	3.513E-1	3.141E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	7.753	8.811	8.590	8.363	8.310	7.712	7.417	6.590
-20 - -10°C:	-15	6.478	7.360	7.171	6.972	6.924	6.425	6.178	5.491
-10 - 0°C:	-5	5.177	5.878	5.724	5.558	5.517	5.119	4.920	4.375
0 - 10°C:	5	3.846	4.366	4.248	4.119	4.087	3.791	3.644	3.241
10 - 20°C:	15	2.483	2.817	2.739	2.652	2.630	2.440	2.344	2.086
20 - 30°C:	25	1.091	1.237	1.202	1.162	1.152	1.068	1.026	9.136E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	8.216E-1	9.249E-1	8.937E-1	8.567E-1	8.470E-1	7.846E-1	7.544E-1	6.732E-1
-20 - -10°C:	-15	6.676E-1	7.504E-1	7.242E-1	6.929E-1	6.847E-1	6.341E-1	6.098E-1	5.444E-1
-10 - 0°C:	-5	5.090E-1	5.712E-1	5.506E-1	5.259E-1	5.193E-1	4.808E-1	4.624E-1	4.131E-1
0 - 10°C:	5	3.458E-1	3.873E-1	3.729E-1	3.554E-1	3.507E-1	3.246E-1	3.123E-1	2.791E-1
10 - 20°C:	15	1.777E-1	1.986E-1	1.909E-1	1.816E-1	1.791E-1	1.657E-1	1.595E-1	1.426E-1
20 - 30°C:	25	4.500E-3	5.000E-3	4.800E-3	4.600E-3	4.500E-3	4.200E-3	4.000E-3	3.600E-3
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.800E-3	3.200E-3	3.100E-3	3.000E-3	3.000E-3	2.800E-3	2.600E-3	2.400E-3
-20 - -10°C:	-15	2.800E-3	3.200E-3	3.100E-3	3.000E-3	3.000E-3	2.800E-3	2.600E-3	2.400E-3
-10 - 0°C:	-5	2.800E-3	3.200E-3	3.100E-3	3.000E-3	3.000E-3	2.800E-3	2.600E-3	2.400E-3
0 - 10°C:	5	2.800E-3	3.200E-3	3.100E-3	3.000E-3	3.000E-3	2.800E-3	2.600E-3	2.400E-3
10 - 20°C:	15	2.800E-3	3.200E-3	3.100E-3	3.000E-3	3.000E-3	2.800E-3	2.600E-3	2.400E-3
20 - 30°C:	25	2.800E-3	3.200E-3	3.100E-3	3.000E-3	3.000E-3	2.800E-3	2.600E-3	2.400E-3
30 - 40°C:	35	2.800E-3	3.200E-3	3.100E-3	3.000E-3	3.000E-3	2.800E-3	2.600E-3	2.400E-3

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.086	6.113	5.832	5.645	5.529	4.941	4.855	4.454
-20 - -10°C:	-15	4.143	4.979	4.751	4.598	4.504	4.024	3.955	3.628
-10 - 0°C:	-5	3.199	3.845	3.669	3.551	3.478	3.108	3.054	2.802
0 - 10°C:	5	2.256	2.711	2.587	2.504	2.452	2.191	2.153	1.975
10 - 20°C:	15	1.312	1.577	1.505	1.457	1.427	1.275	1.253	1.149
20 - 30°C:	25	3.690E-1	4.434E-1	4.231E-1	4.095E-1	4.011E-1	3.584E-1	3.522E-1	3.231E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	7.362	9.010	8.709	8.623	8.493	7.645	7.493	6.796
-20 - -10°C:	-15	6.148	7.521	7.266	7.185	7.074	6.365	6.239	5.661
-10 - 0°C:	-5	4.910	6.003	5.796	5.725	5.634	5.067	4.967	4.509
0 - 10°C:	5	3.646	4.456	4.300	4.241	4.172	3.750	3.677	3.339
10 - 20°C:	15	2.352	2.873	2.771	2.729	2.684	2.412	2.365	2.149
20 - 30°C:	25	1.033	1.260	1.215	1.195	1.175	1.055	1.035	9.407E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	7.752E-1	9.391E-1	9.007E-1	8.790E-1	8.625E-1	7.727E-1	7.585E-1	6.927E-1
-20 - -10°C:	-15	6.293E-1	7.614E-1	7.295E-1	7.106E-1	6.970E-1	6.241E-1	6.127E-1	5.600E-1
-10 - 0°C:	-5	4.795E-1	5.792E-1	5.543E-1	5.390E-1	5.284E-1	4.729E-1	4.644E-1	4.249E-1
0 - 10°C:	5	3.255E-1	3.925E-1	3.752E-1	3.641E-1	3.568E-1	3.191E-1	3.134E-1	2.871E-1
10 - 20°C:	15	1.672E-1	2.011E-1	1.920E-1	1.860E-1	1.822E-1	1.628E-1	1.600E-1	1.467E-1
20 - 30°C:	25	4.200E-3	5.100E-3	4.800E-3	4.700E-3	4.600E-3	4.100E-3	4.000E-3	3.700E-3
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.700E-3	3.300E-3	3.100E-3	3.100E-3	3.000E-3	2.700E-3	2.700E-3	2.400E-3
-20 - -10°C:	-15	2.700E-3	3.300E-3	3.100E-3	3.100E-3	3.000E-3	2.700E-3	2.700E-3	2.400E-3
-10 - 0°C:	-5	2.700E-3	3.300E-3	3.100E-3	3.100E-3	3.000E-3	2.700E-3	2.700E-3	2.400E-3
0 - 10°C:	5	2.700E-3	3.300E-3	3.100E-3	3.100E-3	3.000E-3	2.700E-3	2.700E-3	2.400E-3
10 - 20°C:	15	2.700E-3	3.300E-3	3.100E-3	3.100E-3	3.000E-3	2.700E-3	2.700E-3	2.400E-3
20 - 30°C:	25	2.700E-3	3.300E-3	3.100E-3	3.100E-3	3.000E-3	2.700E-3	2.700E-3	2.400E-3
30 - 40°C:	35	2.700E-3	3.300E-3	3.100E-3	3.100E-3	3.000E-3	2.700E-3	2.700E-3	2.400E-3

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.199	6.062	5.733	5.393	5.381	5.320	4.654	4.017
-20 - -10°C:	-15	4.234	4.938	4.670	4.393	4.383	4.333	3.790	3.272
-10 - 0°C:	-5	3.270	3.813	3.606	3.392	3.385	3.346	2.927	2.527
0 - 10°C:	5	2.306	2.689	2.543	2.392	2.387	2.359	2.064	1.782
10 - 20°C:	15	1.341	1.564	1.479	1.392	1.389	1.373	1.201	1.037
20 - 30°C:	25	3.771E-1	4.397E-1	4.159E-1	3.912E-1	3.904E-1	3.859E-1	3.376E-1	2.914E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	7.553	8.902	8.546	8.133	8.266	8.200	7.060	6.152
-20 - -10°C:	-15	6.310	7.436	7.135	6.785	6.889	6.833	5.885	5.128
-10 - 0°C:	-5	5.041	5.939	5.695	5.412	5.490	5.444	4.692	4.086
0 - 10°C:	5	3.744	4.410	4.227	4.014	4.067	4.032	3.477	3.027
10 - 20°C:	15	2.416	2.845	2.725	2.586	2.617	2.595	2.238	1.948
20 - 30°C:	25	1.061	1.249	1.195	1.133	1.146	1.136	9.805E-1	8.530E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	7.943E-1	9.309E-1	8.858E-1	8.366E-1	8.403E-1	8.319E-1	7.227E-1	6.263E-1
-20 - -10°C:	-15	6.447E-1	7.549E-1	7.175E-1	6.770E-1	6.791E-1	6.720E-1	5.846E-1	5.063E-1
-10 - 0°C:	-5	4.911E-1	5.744E-1	5.452E-1	5.140E-1	5.148E-1	5.093E-1	4.437E-1	3.839E-1
0 - 10°C:	5	3.331E-1	3.893E-1	3.690E-1	3.475E-1	3.475E-1	3.437E-1	2.999E-1	2.592E-1
10 - 20°C:	15	1.709E-1	1.995E-1	1.888E-1	1.776E-1	1.774E-1	1.754E-1	1.533E-1	1.324E-1
20 - 30°C:	25	4.300E-3	5.000E-3	4.700E-3	4.500E-3	4.400E-3	4.400E-3	3.900E-3	3.300E-3
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.800E-3	3.200E-3	3.100E-3	2.900E-3	3.000E-3	2.900E-3	2.500E-3	2.200E-3
-20 - -10°C:	-15	2.800E-3	3.200E-3	3.100E-3	2.900E-3	3.000E-3	2.900E-3	2.500E-3	2.200E-3
-10 - 0°C:	-5	2.800E-3	3.200E-3	3.100E-3	2.900E-3	3.000E-3	2.900E-3	2.500E-3	2.200E-3
0 - 10°C:	5	2.800E-3	3.200E-3	3.100E-3	2.900E-3	3.000E-3	2.900E-3	2.500E-3	2.200E-3
10 - 20°C:	15	2.800E-3	3.200E-3	3.100E-3	2.900E-3	3.000E-3	2.900E-3	2.500E-3	2.200E-3
20 - 30°C:	25	2.800E-3	3.200E-3	3.100E-3	2.900E-3	3.000E-3	2.900E-3	2.500E-3	2.200E-3
30 - 40°C:	35	2.800E-3	3.200E-3	3.100E-3	2.900E-3	3.000E-3	2.900E-3	2.500E-3	2.200E-3

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.573	6.006	6.147	5.541	5.484	5.056	5.106	4.075
-20 - -10°C:	-15	5.354	4.892	5.007	4.513	4.467	4.118	4.159	3.319
-10 - 0°C:	-5	4.135	3.778	3.867	3.485	3.450	3.180	3.212	2.564
0 - 10°C:	5	2.915	2.664	2.726	2.457	2.432	2.242	2.265	1.808
10 - 20°C:	15	1.696	1.550	1.586	1.430	1.415	1.305	1.318	1.052
20 - 30°C:	25	4.768E-1	4.357E-1	4.459E-1	4.019E-1	3.978E-1	3.668E-1	3.704E-1	2.956E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	9.141	8.549	8.918	8.364	8.258	7.579	7.868	6.174
-20 - -10°C:	-15	7.650	7.149	7.452	6.973	6.886	6.321	6.549	5.146
-10 - 0°C:	-5	6.122	5.718	5.954	5.558	5.490	5.041	5.212	4.101
0 - 10°C:	5	4.556	4.252	4.423	4.120	4.070	3.738	3.857	3.039
10 - 20°C:	15	2.947	2.748	2.856	2.653	2.622	2.409	2.480	1.957
20 - 30°C:	25	1.297	1.209	1.255	1.163	1.149	1.056	1.085	8.573E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	9.888E-1	9.129E-1	9.411E-1	8.596E-1	8.505E-1	7.828E-1	7.969E-1	6.333E-1
-20 - -10°C:	-15	8.052E-1	7.420E-1	7.638E-1	6.955E-1	6.883E-1	6.337E-1	6.438E-1	5.123E-1
-10 - 0°C:	-5	6.154E-1	5.659E-1	5.816E-1	5.280E-1	5.226E-1	4.813E-1	4.880E-1	3.887E-1
0 - 10°C:	5	4.190E-1	3.844E-1	3.944E-1	3.570E-1	3.533E-1	3.256E-1	3.295E-1	2.627E-1
10 - 20°C:	15	2.158E-1	1.975E-1	2.022E-1	1.825E-1	1.806E-1	1.665E-1	1.682E-1	1.343E-1
20 - 30°C:	25	5.500E-3	5.000E-3	5.100E-3	4.600E-3	4.500E-3	4.200E-3	4.200E-3	3.400E-3
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.400E-3	3.200E-3	3.300E-3	3.000E-3	3.000E-3	2.700E-3	2.800E-3	2.200E-3
-20 - -10°C:	-15	3.400E-3	3.200E-3	3.300E-3	3.000E-3	3.000E-3	2.700E-3	2.800E-3	2.200E-3
-10 - 0°C:	-5	3.400E-3	3.200E-3	3.300E-3	3.000E-3	3.000E-3	2.700E-3	2.800E-3	2.200E-3
0 - 10°C:	5	3.400E-3	3.200E-3	3.300E-3	3.000E-3	3.000E-3	2.700E-3	2.800E-3	2.200E-3
10 - 20°C:	15	3.400E-3	3.200E-3	3.300E-3	3.000E-3	3.000E-3	2.700E-3	2.800E-3	2.200E-3
20 - 30°C:	25	3.400E-3	3.200E-3	3.300E-3	3.000E-3	3.000E-3	2.700E-3	2.800E-3	2.200E-3
30 - 40°C:	35	3.400E-3	3.200E-3	3.300E-3	3.000E-3	3.000E-3	2.700E-3	2.800E-3	2.200E-3

Annex 26: Cold excess unit emission according to average speed and ambient temperature for Euro 1 diesel cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.057E-1	1.202E-1	1.174E-1	1.149E-1	1.144E-1	1.062E-1	1.023E-1	9.080E-2
-20 - -10°C:	-15	9.200E-2	1.046E-1	1.022E-1	1.000E-1	9.960E-2	9.250E-2	8.910E-2	7.900E-2
-10 - 0°C:	-5	7.830E-2	8.910E-2	8.700E-2	8.510E-2	8.480E-2	7.870E-2	7.580E-2	6.730E-2
0 - 10°C:	5	6.460E-2	7.350E-2	7.180E-2	7.020E-2	6.990E-2	6.500E-2	6.260E-2	5.550E-2
10 - 20°C:	15	5.090E-2	5.790E-2	5.660E-2	5.540E-2	5.510E-2	5.120E-2	4.930E-2	4.370E-2
20 - 30°C:	25	3.720E-2	4.230E-2	4.140E-2	4.050E-2	4.030E-2	3.740E-2	3.610E-2	3.200E-2
30 - 40°C:	35	2.350E-2	2.680E-2	2.620E-2	2.560E-2	2.550E-2	2.370E-2	2.280E-2	2.020E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.409	3.853	3.735	3.601	3.566	3.306	3.178	2.832
-20 - -10°C:	-15	3.409	3.853	3.735	3.601	3.566	3.306	3.178	2.832
-10 - 0°C:	-5	3.409	3.853	3.735	3.601	3.566	3.306	3.178	2.832
0 - 10°C:	5	3.409	3.853	3.735	3.601	3.566	3.306	3.178	2.832
10 - 20°C:	15	3.409	3.853	3.735	3.601	3.566	3.306	3.178	2.832
20 - 30°C:	25	3.409	3.853	3.735	3.601	3.566	3.306	3.178	2.832
30 - 40°C:	35	3.409	3.853	3.735	3.601	3.566	3.306	3.178	2.832

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	9.000E-3	1.030E-2	1.000E-2	9.700E-3	9.700E-3	9.000E-3	8.600E-3	7.700E-3
-20 - -10°C:	-15	8.200E-3	9.300E-3	9.100E-3	8.800E-3	8.800E-3	8.100E-3	7.800E-3	7.000E-3
-10 - 0°C:	-5	7.300E-3	8.300E-3	8.100E-3	7.900E-3	7.900E-3	7.300E-3	7.000E-3	6.200E-3
0 - 10°C:	5	6.500E-3	7.400E-3	7.200E-3	7.000E-3	7.000E-3	6.500E-3	6.200E-3	5.500E-3
10 - 20°C:	15	5.700E-3	6.400E-3	6.300E-3	6.100E-3	6.100E-3	5.600E-3	5.400E-3	4.800E-3
20 - 30°C:	25	4.800E-3	5.500E-3	5.300E-3	5.200E-3	5.200E-3	4.800E-3	4.600E-3	4.100E-3
30 - 40°C:	35	4.000E-3	4.500E-3	4.400E-3	4.300E-3	4.300E-3	4.000E-3	3.800E-3	3.400E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.530E-2	1.710E-2	1.640E-2	1.550E-2	1.530E-2	1.410E-2	1.360E-2	1.220E-2
-20 - -10°C:	-15	1.530E-2	1.710E-2	1.640E-2	1.550E-2	1.530E-2	1.410E-2	1.360E-2	1.220E-2
-10 - 0°C:	-5	1.530E-2	1.710E-2	1.640E-2	1.550E-2	1.530E-2	1.410E-2	1.360E-2	1.220E-2
0 - 10°C:	5	1.530E-2	1.710E-2	1.640E-2	1.550E-2	1.530E-2	1.410E-2	1.360E-2	1.220E-2
10 - 20°C:	15	1.530E-2	1.710E-2	1.640E-2	1.550E-2	1.530E-2	1.410E-2	1.360E-2	1.220E-2
20 - 30°C:	25	1.530E-2	1.710E-2	1.640E-2	1.550E-2	1.530E-2	1.410E-2	1.360E-2	1.220E-2
30 - 40°C:	35	1.530E-2	1.710E-2	1.640E-2	1.550E-2	1.530E-2	1.410E-2	1.360E-2	1.220E-2

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.007E-1	1.232E-1	1.194E-1	1.188E-1	1.172E-1	1.057E-1	1.036E-1	9.380E-2
-20 - -10°C:	-15	8.760E-2	1.073E-1	1.039E-1	1.034E-1	1.020E-1	9.200E-2	9.020E-2	8.170E-2
-10 - 0°C:	-5	7.460E-2	9.130E-2	8.840E-2	8.800E-2	8.680E-2	7.830E-2	7.680E-2	6.950E-2
0 - 10°C:	5	6.150E-2	7.530E-2	7.300E-2	7.260E-2	7.170E-2	6.460E-2	6.330E-2	5.740E-2
10 - 20°C:	15	4.850E-2	5.940E-2	5.750E-2	5.720E-2	5.650E-2	5.100E-2	4.990E-2	4.520E-2
20 - 30°C:	25	3.550E-2	4.340E-2	4.210E-2	4.180E-2	4.130E-2	3.730E-2	3.650E-2	3.310E-2
30 - 40°C:	35	2.240E-2	2.740E-2	2.660E-2	2.650E-2	2.610E-2	2.360E-2	2.310E-2	2.090E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.224	3.921	3.772	3.701	3.636	3.263	3.201	2.916
-20 - -10°C:	-15	3.224	3.921	3.772	3.701	3.636	3.263	3.201	2.916
-10 - 0°C:	-5	3.224	3.921	3.772	3.701	3.636	3.263	3.201	2.916
0 - 10°C:	5	3.224	3.921	3.772	3.701	3.636	3.263	3.201	2.916
10 - 20°C:	15	3.224	3.921	3.772	3.701	3.636	3.263	3.201	2.916
20 - 30°C:	25	3.224	3.921	3.772	3.701	3.636	3.263	3.201	2.916
30 - 40°C:	35	3.224	3.921	3.772	3.701	3.636	3.263	3.201	2.916

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	8.600E-3	1.050E-2	1.010E-2	1.000E-2	9.900E-3	8.900E-3	8.700E-3	7.900E-3
-20 - -10°C:	-15	7.800E-3	9.500E-3	9.200E-3	9.100E-3	9.000E-3	8.100E-3	7.900E-3	7.200E-3
-10 - 0°C:	-5	7.000E-3	8.500E-3	8.200E-3	8.200E-3	8.100E-3	7.300E-3	7.100E-3	6.400E-3
0 - 10°C:	5	6.200E-3	7.600E-3	7.300E-3	7.200E-3	7.100E-3	6.400E-3	6.300E-3	5.700E-3
10 - 20°C:	15	5.400E-3	6.600E-3	6.400E-3	6.300E-3	6.200E-3	5.600E-3	5.500E-3	5.000E-3
20 - 30°C:	25	4.600E-3	5.600E-3	5.400E-3	5.400E-3	5.300E-3	4.800E-3	4.700E-3	4.200E-3
30 - 40°C:	35	3.800E-3	4.600E-3	4.500E-3	4.400E-3	4.400E-3	3.900E-3	3.800E-3	3.500E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.440E-2	1.720E-2	1.640E-2	1.590E-2	1.550E-2	1.390E-2	1.360E-2	1.250E-2
-20 - -10°C:	-15	1.440E-2	1.720E-2	1.640E-2	1.590E-2	1.550E-2	1.390E-2	1.360E-2	1.250E-2
-10 - 0°C:	-5	1.440E-2	1.720E-2	1.640E-2	1.590E-2	1.550E-2	1.390E-2	1.360E-2	1.250E-2
0 - 10°C:	5	1.440E-2	1.720E-2	1.640E-2	1.590E-2	1.550E-2	1.390E-2	1.360E-2	1.250E-2
10 - 20°C:	15	1.440E-2	1.720E-2	1.640E-2	1.590E-2	1.550E-2	1.390E-2	1.360E-2	1.250E-2
20 - 30°C:	25	1.440E-2	1.720E-2	1.640E-2	1.590E-2	1.550E-2	1.390E-2	1.360E-2	1.250E-2
30 - 40°C:	35	1.440E-2	1.720E-2	1.640E-2	1.590E-2	1.550E-2	1.390E-2	1.360E-2	1.250E-2

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.029E-1	1.213E-1	1.166E-1	1.113E-1	1.135E-1	1.127E-1	9.690E-2	8.450E-2
-20 - -10°C:	-15	8.960E-2	1.056E-1	1.015E-1	9.690E-2	9.880E-2	9.810E-2	8.440E-2	7.360E-2
-10 - 0°C:	-5	7.630E-2	8.990E-2	8.640E-2	8.240E-2	8.410E-2	8.350E-2	7.180E-2	6.260E-2
0 - 10°C:	5	6.290E-2	7.420E-2	7.130E-2	6.800E-2	6.940E-2	6.890E-2	5.930E-2	5.170E-2
10 - 20°C:	15	4.960E-2	5.850E-2	5.620E-2	5.360E-2	5.470E-2	5.430E-2	4.670E-2	4.070E-2
20 - 30°C:	25	3.630E-2	4.270E-2	4.110E-2	3.920E-2	4.000E-2	3.970E-2	3.410E-2	2.980E-2
30 - 40°C:	35	2.290E-2	2.700E-2	2.600E-2	2.480E-2	2.530E-2	2.510E-2	2.160E-2	1.880E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.306	3.883	3.707	3.511	3.542	3.509	3.037	2.638
-20 - -10°C:	-15	3.306	3.883	3.707	3.511	3.542	3.509	3.037	2.638
-10 - 0°C:	-5	3.306	3.883	3.707	3.511	3.542	3.509	3.037	2.638
0 - 10°C:	5	3.306	3.883	3.707	3.511	3.542	3.509	3.037	2.638
10 - 20°C:	15	3.306	3.883	3.707	3.511	3.542	3.509	3.037	2.638
20 - 30°C:	25	3.306	3.883	3.707	3.511	3.542	3.509	3.037	2.638
30 - 40°C:	35	3.306	3.883	3.707	3.511	3.542	3.509	3.037	2.638

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	8.800E-3	1.030E-2	9.900E-3	9.500E-3	9.600E-3	9.500E-3	8.200E-3	7.200E-3
-20 - -10°C:	-15	8.000E-3	9.400E-3	9.000E-3	8.600E-3	8.700E-3	8.600E-3	7.400E-3	6.500E-3
-10 - 0°C:	-5	7.100E-3	8.400E-3	8.100E-3	7.700E-3	7.800E-3	7.800E-3	6.700E-3	5.800E-3
0 - 10°C:	5	6.300E-3	7.500E-3	7.100E-3	6.800E-3	6.900E-3	6.900E-3	5.900E-3	5.200E-3
10 - 20°C:	15	5.500E-3	6.500E-3	6.200E-3	5.900E-3	6.000E-3	6.000E-3	5.200E-3	4.500E-3
20 - 30°C:	25	4.700E-3	5.500E-3	5.300E-3	5.000E-3	5.100E-3	5.100E-3	4.400E-3	3.800E-3
30 - 40°C:	35	3.900E-3	4.600E-3	4.400E-3	4.200E-3	4.200E-3	4.200E-3	3.600E-3	3.200E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.470E-2	1.710E-2	1.620E-2	1.520E-2	1.510E-2	1.490E-2	1.310E-2	1.130E-2
-20 - -10°C:	-15	1.470E-2	1.710E-2	1.620E-2	1.520E-2	1.510E-2	1.490E-2	1.310E-2	1.130E-2
-10 - 0°C:	-5	1.470E-2	1.710E-2	1.620E-2	1.520E-2	1.510E-2	1.490E-2	1.310E-2	1.130E-2
0 - 10°C:	5	1.470E-2	1.710E-2	1.620E-2	1.520E-2	1.510E-2	1.490E-2	1.310E-2	1.130E-2
10 - 20°C:	15	1.470E-2	1.710E-2	1.620E-2	1.520E-2	1.510E-2	1.490E-2	1.310E-2	1.130E-2
20 - 30°C:	25	1.470E-2	1.710E-2	1.620E-2	1.520E-2	1.510E-2	1.490E-2	1.310E-2	1.130E-2
30 - 40°C:	35	1.470E-2	1.710E-2	1.620E-2	1.520E-2	1.510E-2	1.490E-2	1.310E-2	1.130E-2

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.239E-1	1.161E-1	1.215E-1	1.149E-1	1.134E-1	1.040E-1	1.088E-1	8.500E-2
-20 - -10°C:	-15	1.078E-1	1.011E-1	1.058E-1	1.000E-1	9.870E-2	9.050E-2	9.470E-2	7.400E-2
-10 - 0°C:	-5	9.180E-2	8.600E-2	9.010E-2	8.510E-2	8.400E-2	7.710E-2	8.060E-2	6.300E-2
0 - 10°C:	5	7.570E-2	7.100E-2	7.430E-2	7.030E-2	6.930E-2	6.360E-2	6.650E-2	5.200E-2
10 - 20°C:	15	5.970E-2	5.590E-2	5.860E-2	5.540E-2	5.460E-2	5.010E-2	5.240E-2	4.100E-2
20 - 30°C:	25	4.360E-2	4.090E-2	4.280E-2	4.050E-2	3.990E-2	3.660E-2	3.830E-2	2.990E-2
30 - 40°C:	35	2.760E-2	2.590E-2	2.710E-2	2.560E-2	2.530E-2	2.320E-2	2.420E-2	1.890E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.074	3.781	3.914	3.609	3.568	3.281	3.362	2.661
-20 - -10°C:	-15	4.074	3.781	3.914	3.609	3.568	3.281	3.362	2.661
-10 - 0°C:	-5	4.074	3.781	3.914	3.609	3.568	3.281	3.362	2.661
0 - 10°C:	5	4.074	3.781	3.914	3.609	3.568	3.281	3.362	2.661
10 - 20°C:	15	4.074	3.781	3.914	3.609	3.568	3.281	3.362	2.661
20 - 30°C:	25	4.074	3.781	3.914	3.609	3.568	3.281	3.362	2.661
30 - 40°C:	35	4.074	3.781	3.914	3.609	3.568	3.281	3.362	2.661

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.060E-2	9.900E-3	1.040E-2	9.700E-3	9.600E-3	8.800E-3	9.200E-3	7.200E-3
-20 - -10°C:	-15	9.600E-3	9.000E-3	9.400E-3	8.800E-3	8.700E-3	8.000E-3	8.300E-3	6.500E-3
-10 - 0°C:	-5	8.700E-3	8.100E-3	8.400E-3	7.900E-3	7.800E-3	7.200E-3	7.500E-3	5.900E-3
0 - 10°C:	5	7.700E-3	7.200E-3	7.500E-3	7.000E-3	6.900E-3	6.400E-3	6.600E-3	5.200E-3
10 - 20°C:	15	6.700E-3	6.200E-3	6.500E-3	6.100E-3	6.000E-3	5.500E-3	5.800E-3	4.500E-3
20 - 30°C:	25	5.700E-3	5.300E-3	5.500E-3	5.200E-3	5.100E-3	4.700E-3	4.900E-3	3.800E-3
30 - 40°C:	35	4.700E-3	4.400E-3	4.600E-3	4.300E-3	4.200E-3	3.900E-3	4.000E-3	3.200E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.860E-2	1.700E-2	1.740E-2	1.560E-2	1.550E-2	1.430E-2	1.430E-2	1.150E-2
-20 - -10°C:	-15	1.860E-2	1.700E-2	1.740E-2	1.560E-2	1.550E-2	1.430E-2	1.430E-2	1.150E-2
-10 - 0°C:	-5	1.860E-2	1.700E-2	1.740E-2	1.560E-2	1.550E-2	1.430E-2	1.430E-2	1.150E-2
0 - 10°C:	5	1.860E-2	1.700E-2	1.740E-2	1.560E-2	1.550E-2	1.430E-2	1.430E-2	1.150E-2
10 - 20°C:	15	1.860E-2	1.700E-2	1.740E-2	1.560E-2	1.550E-2	1.430E-2	1.430E-2	1.150E-2
20 - 30°C:	25	1.860E-2	1.700E-2	1.740E-2	1.560E-2	1.550E-2	1.430E-2	1.430E-2	1.150E-2
30 - 40°C:	35	1.860E-2	1.700E-2	1.740E-2	1.560E-2	1.550E-2	1.430E-2	1.430E-2	1.150E-2

Annex 27: Cold excess unit emission according to average speed and ambient temperature for Euro 1 gasoline cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.986	2.238	2.163	2.076	2.053	1.902	1.828	1.631
-20 - -10°C:	-15	1.639	1.846	1.785	1.712	1.693	1.569	1.508	1.346
-10 - 0°C:	-5	1.291	1.454	1.406	1.349	1.334	1.236	1.188	1.060
0 - 10°C:	5	9.434E-1	1.063	1.028	9.860E-1	9.750E-1	9.033E-1	8.685E-1	7.748E-1
10 - 20°C:	15	5.959E-1	6.713E-1	6.490E-1	6.227E-1	6.158E-1	5.706E-1	5.485E-1	4.894E-1
20 - 30°C:	25	2.483E-1	2.797E-1	2.705E-1	2.595E-1	2.566E-1	2.378E-1	2.286E-1	2.039E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.059	5.731	5.567	5.381	5.333	4.946	4.753	4.232
-20 - -10°C:	-15	4.158	4.711	4.576	4.423	4.384	4.065	3.907	3.479
-10 - 0°C:	-5	3.258	3.690	3.585	3.465	3.434	3.185	3.060	2.725
0 - 10°C:	5	2.357	2.670	2.594	2.507	2.485	2.304	2.214	1.972
10 - 20°C:	15	1.456	1.650	1.602	1.549	1.535	1.424	1.368	1.218
20 - 30°C:	25	5.556E-1	6.294E-1	6.113E-1	5.909E-1	5.857E-1	5.431E-1	5.220E-1	4.648E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.562E-1	1.742E-1	1.672E-1	1.587E-1	1.564E-1	1.447E-1	1.394E-1	1.247E-1
-20 - -10°C:	-15	1.562E-1	1.742E-1	1.672E-1	1.587E-1	1.564E-1	1.447E-1	1.394E-1	1.247E-1
-10 - 0°C:	-5	1.562E-1	1.742E-1	1.672E-1	1.587E-1	1.564E-1	1.447E-1	1.394E-1	1.247E-1
0 - 10°C:	5	1.562E-1	1.742E-1	1.672E-1	1.587E-1	1.564E-1	1.447E-1	1.394E-1	1.247E-1
10 - 20°C:	15	1.562E-1	1.742E-1	1.672E-1	1.587E-1	1.564E-1	1.447E-1	1.394E-1	1.247E-1
20 - 30°C:	25	1.562E-1	1.742E-1	1.672E-1	1.587E-1	1.564E-1	1.447E-1	1.394E-1	1.247E-1
30 - 40°C:	35	1.562E-1	1.742E-1	1.672E-1	1.587E-1	1.564E-1	1.447E-1	1.394E-1	1.247E-1

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.360E-2	3.740E-2	3.580E-2	3.390E-2	3.340E-2	3.090E-2	2.980E-2	2.660E-2
-20 - -10°C:	-15	3.360E-2	3.740E-2	3.580E-2	3.390E-2	3.340E-2	3.090E-2	2.980E-2	2.660E-2
-10 - 0°C:	-5	3.360E-2	3.740E-2	3.580E-2	3.390E-2	3.340E-2	3.090E-2	2.980E-2	2.660E-2
0 - 10°C:	5	3.360E-2	3.740E-2	3.580E-2	3.390E-2	3.340E-2	3.090E-2	2.980E-2	2.660E-2
10 - 20°C:	15	3.360E-2	3.740E-2	3.580E-2	3.390E-2	3.340E-2	3.090E-2	2.980E-2	2.660E-2
20 - 30°C:	25	3.360E-2	3.740E-2	3.580E-2	3.390E-2	3.340E-2	3.090E-2	2.980E-2	2.660E-2
30 - 40°C:	35	3.360E-2	3.740E-2	3.580E-2	3.390E-2	3.340E-2	3.090E-2	2.980E-2	2.660E-2

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.874	2.273	2.181	2.130	2.091	1.873	1.839	1.678
-20 - -10°C:	-15	1.546	1.875	1.799	1.757	1.725	1.546	1.517	1.385
-10 - 0°C:	-5	1.218	1.477	1.418	1.385	1.359	1.218	1.195	1.091
0 - 10°C:	5	8.904E-1	1.080	1.036	1.012	9.930E-1	8.899E-1	8.734E-1	7.972E-1
10 - 20°C:	15	5.624E-1	6.819E-1	6.543E-1	6.391E-1	6.272E-1	5.620E-1	5.516E-1	5.035E-1
20 - 30°C:	25	2.343E-1	2.842E-1	2.727E-1	2.663E-1	2.614E-1	2.342E-1	2.299E-1	2.098E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.789	5.841	5.627	5.535	5.441	4.886	4.792	4.358
-20 - -10°C:	-15	3.936	4.801	4.626	4.549	4.472	4.016	3.938	3.582
-10 - 0°C:	-5	3.084	3.761	3.624	3.564	3.503	3.146	3.085	2.806
0 - 10°C:	5	2.231	2.721	2.622	2.579	2.535	2.276	2.232	2.030
10 - 20°C:	15	1.379	1.681	1.620	1.593	1.566	1.406	1.379	1.255
20 - 30°C:	25	5.259E-1	6.415E-1	6.180E-1	6.078E-1	5.975E-1	5.366E-1	5.262E-1	4.786E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.469E-1	1.763E-1	1.681E-1	1.625E-1	1.591E-1	1.421E-1	1.397E-1	1.282E-1
-20 - -10°C:	-15	1.469E-1	1.763E-1	1.681E-1	1.625E-1	1.591E-1	1.421E-1	1.397E-1	1.282E-1
-10 - 0°C:	-5	1.469E-1	1.763E-1	1.681E-1	1.625E-1	1.591E-1	1.421E-1	1.397E-1	1.282E-1
0 - 10°C:	5	1.469E-1	1.763E-1	1.681E-1	1.625E-1	1.591E-1	1.421E-1	1.397E-1	1.282E-1
10 - 20°C:	15	1.469E-1	1.763E-1	1.681E-1	1.625E-1	1.591E-1	1.421E-1	1.397E-1	1.282E-1
20 - 30°C:	25	1.469E-1	1.763E-1	1.681E-1	1.625E-1	1.591E-1	1.421E-1	1.397E-1	1.282E-1
30 - 40°C:	35	1.469E-1	1.763E-1	1.681E-1	1.625E-1	1.591E-1	1.421E-1	1.397E-1	1.282E-1

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.160E-2	3.780E-2	3.600E-2	3.470E-2	3.400E-2	3.030E-2	2.980E-2	2.740E-2
-20 - -10°C:	-15	3.160E-2	3.780E-2	3.600E-2	3.470E-2	3.400E-2	3.030E-2	2.980E-2	2.740E-2
-10 - 0°C:	-5	3.160E-2	3.780E-2	3.600E-2	3.470E-2	3.400E-2	3.030E-2	2.980E-2	2.740E-2
0 - 10°C:	5	3.160E-2	3.780E-2	3.600E-2	3.470E-2	3.400E-2	3.030E-2	2.980E-2	2.740E-2
10 - 20°C:	15	3.160E-2	3.780E-2	3.600E-2	3.470E-2	3.400E-2	3.030E-2	2.980E-2	2.740E-2
20 - 30°C:	25	3.160E-2	3.780E-2	3.600E-2	3.470E-2	3.400E-2	3.030E-2	2.980E-2	2.740E-2
30 - 40°C:	35	3.160E-2	3.780E-2	3.600E-2	3.470E-2	3.400E-2	3.030E-2	2.980E-2	2.740E-2

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.921	2.253	2.145	2.027	2.037	2.017	1.751	1.518
-20 - -10°C:	-15	1.585	1.859	1.770	1.672	1.681	1.664	1.445	1.253
-10 - 0°C:	-5	1.249	1.464	1.394	1.317	1.324	1.311	1.138	9.868E-1
0 - 10°C:	5	9.127E-1	1.070	1.019	9.627E-1	9.677E-1	9.581E-1	8.317E-1	7.212E-1
10 - 20°C:	15	5.764E-1	6.759E-1	6.435E-1	6.081E-1	6.112E-1	6.051E-1	5.253E-1	4.555E-1
20 - 30°C:	25	2.402E-1	2.817E-1	2.682E-1	2.534E-1	2.547E-1	2.522E-1	2.189E-1	1.898E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.916	5.784	5.534	5.247	5.304	5.257	4.541	3.949
-20 - -10°C:	-15	4.041	4.754	4.549	4.313	4.360	4.321	3.732	3.246
-10 - 0°C:	-5	3.166	3.725	3.564	3.379	3.415	3.385	2.924	2.543
0 - 10°C:	5	2.291	2.695	2.578	2.445	2.471	2.449	2.115	1.840
10 - 20°C:	15	1.415	1.665	1.593	1.510	1.527	1.513	1.307	1.137
20 - 30°C:	25	5.399E-1	6.352E-1	6.078E-1	5.762E-1	5.825E-1	5.773E-1	4.987E-1	4.337E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.500E-1	1.748E-1	1.651E-1	1.553E-1	1.548E-1	1.530E-1	1.340E-1	1.156E-1
-20 - -10°C:	-15	1.500E-1	1.748E-1	1.651E-1	1.553E-1	1.548E-1	1.530E-1	1.340E-1	1.156E-1
-10 - 0°C:	-5	1.500E-1	1.748E-1	1.651E-1	1.553E-1	1.548E-1	1.530E-1	1.340E-1	1.156E-1
0 - 10°C:	5	1.500E-1	1.748E-1	1.651E-1	1.553E-1	1.548E-1	1.530E-1	1.340E-1	1.156E-1
10 - 20°C:	15	1.500E-1	1.748E-1	1.651E-1	1.553E-1	1.548E-1	1.530E-1	1.340E-1	1.156E-1
20 - 30°C:	25	1.500E-1	1.748E-1	1.651E-1	1.553E-1	1.548E-1	1.530E-1	1.340E-1	1.156E-1
30 - 40°C:	35	1.500E-1	1.748E-1	1.651E-1	1.553E-1	1.548E-1	1.530E-1	1.340E-1	1.156E-1

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.220E-2	3.750E-2	3.530E-2	3.320E-2	3.300E-2	3.260E-2	2.860E-2	2.470E-2
-20 - -10°C:	-15	3.220E-2	3.750E-2	3.530E-2	3.320E-2	3.300E-2	3.260E-2	2.860E-2	2.470E-2
-10 - 0°C:	-5	3.220E-2	3.750E-2	3.530E-2	3.320E-2	3.300E-2	3.260E-2	2.860E-2	2.470E-2
0 - 10°C:	5	3.220E-2	3.750E-2	3.530E-2	3.320E-2	3.300E-2	3.260E-2	2.860E-2	2.470E-2
10 - 20°C:	15	3.220E-2	3.750E-2	3.530E-2	3.320E-2	3.300E-2	3.260E-2	2.860E-2	2.470E-2
20 - 30°C:	25	3.220E-2	3.750E-2	3.530E-2	3.320E-2	3.300E-2	3.260E-2	2.860E-2	2.470E-2
30 - 40°C:	35	3.220E-2	3.750E-2	3.530E-2	3.320E-2	3.300E-2	3.260E-2	2.860E-2	2.470E-2

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.388	2.206	2.276	2.082	2.060	1.896	1.931	1.534
-20 - -10°C:	-15	1.970	1.820	1.878	1.718	1.700	1.564	1.593	1.266
-10 - 0°C:	-5	1.552	1.434	1.480	1.353	1.339	1.232	1.255	9.972E-1
0 - 10°C:	5	1.134	1.048	1.081	9.890E-1	9.785E-1	9.005E-1	9.174E-1	7.287E-1
10 - 20°C:	15	7.163E-1	6.620E-1	6.829E-1	6.247E-1	6.180E-1	5.687E-1	5.794E-1	4.603E-1
20 - 30°C:	25	2.985E-1	2.759E-1	2.846E-1	2.603E-1	2.576E-1	2.370E-1	2.415E-1	1.918E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.019	5.603	5.815	5.386	5.324	4.892	5.027	3.972
-20 - -10°C:	-15	4.948	4.605	4.780	4.427	4.376	4.021	4.132	3.265
-10 - 0°C:	-5	3.876	3.608	3.744	3.468	3.428	3.150	3.237	2.558
0 - 10°C:	5	2.804	2.610	2.709	2.509	2.480	2.279	2.342	1.850
10 - 20°C:	15	1.733	1.613	1.674	1.550	1.533	1.408	1.447	1.143
20 - 30°C:	25	6.610E-1	6.153E-1	6.386E-1	5.915E-1	5.847E-1	5.373E-1	5.521E-1	4.362E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.901E-1	1.734E-1	1.773E-1	1.595E-1	1.579E-1	1.456E-1	1.470E-1	1.173E-1
-20 - -10°C:	-15	1.901E-1	1.734E-1	1.773E-1	1.595E-1	1.579E-1	1.456E-1	1.470E-1	1.173E-1
-10 - 0°C:	-5	1.901E-1	1.734E-1	1.773E-1	1.595E-1	1.579E-1	1.456E-1	1.470E-1	1.173E-1
0 - 10°C:	5	1.901E-1	1.734E-1	1.773E-1	1.595E-1	1.579E-1	1.456E-1	1.470E-1	1.173E-1
10 - 20°C:	15	1.901E-1	1.734E-1	1.773E-1	1.595E-1	1.579E-1	1.456E-1	1.470E-1	1.173E-1
20 - 30°C:	25	1.901E-1	1.734E-1	1.773E-1	1.595E-1	1.579E-1	1.456E-1	1.470E-1	1.173E-1
30 - 40°C:	35	1.901E-1	1.734E-1	1.773E-1	1.595E-1	1.579E-1	1.456E-1	1.470E-1	1.173E-1

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.100E-2	3.720E-2	3.800E-2	3.410E-2	3.370E-2	3.110E-2	3.140E-2	2.510E-2
-20 - -10°C:	-15	4.100E-2	3.720E-2	3.800E-2	3.410E-2	3.370E-2	3.110E-2	3.140E-2	2.510E-2
-10 - 0°C:	-5	4.100E-2	3.720E-2	3.800E-2	3.410E-2	3.370E-2	3.110E-2	3.140E-2	2.510E-2
0 - 10°C:	5	4.100E-2	3.720E-2	3.800E-2	3.410E-2	3.370E-2	3.110E-2	3.140E-2	2.510E-2
10 - 20°C:	15	4.100E-2	3.720E-2	3.800E-2	3.410E-2	3.370E-2	3.110E-2	3.140E-2	2.510E-2
20 - 30°C:	25	4.100E-2	3.720E-2	3.800E-2	3.410E-2	3.370E-2	3.110E-2	3.140E-2	2.510E-2
30 - 40°C:	35	4.100E-2	3.720E-2	3.800E-2	3.410E-2	3.370E-2	3.110E-2	3.140E-2	2.510E-2

Annex 28: Cold excess unit emission according to average speed and ambient temperature for Euro 2 diesel cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.928E-1	3.289E-1	3.172E-1	3.033E-1	2.997E-1	2.775E-1	2.669E-1	2.383E-1
-20 - -10°C:	-15	2.450E-1	2.749E-1	2.650E-1	2.531E-1	2.500E-1	2.315E-1	2.226E-1	1.989E-1
-10 - 0°C:	-5	1.964E-1	2.202E-1	2.121E-1	2.023E-1	1.998E-1	1.849E-1	1.779E-1	1.590E-1
0 - 10°C:	5	1.470E-1	1.646E-1	1.584E-1	1.510E-1	1.490E-1	1.379E-1	1.327E-1	1.186E-1
10 - 20°C:	15	9.670E-2	1.082E-1	1.040E-1	9.900E-2	9.770E-2	9.040E-2	8.700E-2	7.780E-2
20 - 30°C:	25	4.550E-2	5.090E-2	4.890E-2	4.650E-2	4.580E-2	4.240E-2	4.080E-2	3.650E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.332E+1	1.510E+1	1.469E+1	1.425E+1	1.414E+1	1.312E+1	1.262E+1	1.122E+1
-20 - -10°C:	-15	1.118E+1	1.266E+1	1.230E+1	1.192E+1	1.182E+1	1.096E+1	1.054E+1	9.382
-10 - 0°C:	-5	8.970	1.015E+1	9.861	9.534	9.452	8.766	8.428	7.503
0 - 10°C:	5	6.706	7.584	7.359	7.103	7.038	6.525	6.273	5.588
10 - 20°C:	15	4.377	4.946	4.794	4.620	4.575	4.241	4.076	3.633
20 - 30°C:	25	1.983	2.239	2.168	2.085	2.064	1.913	1.838	1.639
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.380E-2	7.210E-2	7.000E-2	6.760E-2	6.700E-2	6.210E-2	5.970E-2	5.320E-2
-20 - -10°C:	-15	5.110E-2	5.780E-2	5.610E-2	5.410E-2	5.360E-2	4.970E-2	4.780E-2	4.250E-2
-10 - 0°C:	-5	3.830E-2	4.330E-2	4.190E-2	4.040E-2	4.000E-2	3.710E-2	3.570E-2	3.180E-2
0 - 10°C:	5	2.530E-2	2.850E-2	2.770E-2	2.670E-2	2.640E-2	2.450E-2	2.350E-2	2.100E-2
10 - 20°C:	15	1.210E-2	1.370E-2	1.320E-2	1.270E-2	1.260E-2	1.170E-2	1.120E-2	1.000E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.650E-2	5.210E-2	5.010E-2	4.780E-2	4.720E-2	4.370E-2	4.200E-2	3.750E-2
-20 - -10°C:	-15	3.680E-2	4.110E-2	3.960E-2	3.770E-2	3.710E-2	3.440E-2	3.310E-2	2.960E-2
-10 - 0°C:	-5	2.680E-2	3.000E-2	2.880E-2	2.740E-2	2.700E-2	2.500E-2	2.400E-2	2.150E-2
0 - 10°C:	5	1.670E-2	1.860E-2	1.790E-2	1.700E-2	1.670E-2	1.550E-2	1.490E-2	1.330E-2
10 - 20°C:	15	6.300E-3	7.100E-3	6.800E-3	6.400E-3	6.300E-3	5.800E-3	5.600E-3	5.000E-3
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.760E-1	3.336E-1	3.195E-1	3.110E-1	3.050E-1	2.731E-1	2.681E-1	2.452E-1
-20 - -10°C:	-15	2.308E-1	2.788E-1	2.668E-1	2.595E-1	2.544E-1	2.277E-1	2.236E-1	2.046E-1
-10 - 0°C:	-5	1.850E-1	2.232E-1	2.135E-1	2.074E-1	2.033E-1	1.818E-1	1.786E-1	1.635E-1
0 - 10°C:	5	1.384E-1	1.668E-1	1.594E-1	1.547E-1	1.516E-1	1.355E-1	1.331E-1	1.220E-1
10 - 20°C:	15	9.100E-2	1.096E-1	1.046E-1	1.014E-1	9.930E-2	8.880E-2	8.730E-2	8.000E-2
20 - 30°C:	25	4.280E-2	5.150E-2	4.910E-2	4.760E-2	4.660E-2	4.160E-2	4.090E-2	3.750E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.263E+1	1.541E+1	1.487E+1	1.468E+1	1.444E+1	1.299E+1	1.274E+1	1.157E+1
-20 - -10°C:	-15	1.059E+1	1.291E+1	1.245E+1	1.227E+1	1.207E+1	1.085E+1	1.064E+1	9.669
-10 - 0°C:	-5	8.493	1.035E+1	9.970	9.809	9.645	8.664	8.497	7.730
0 - 10°C:	5	6.344	7.724	7.435	7.303	7.178	6.444	6.321	5.754
10 - 20°C:	15	4.138	5.033	4.840	4.747	4.663	4.184	4.105	3.740
20 - 30°C:	25	1.874	2.276	2.187	2.142	2.103	1.886	1.850	1.687
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.040E-2	7.350E-2	7.080E-2	6.950E-2	6.830E-2	6.140E-2	6.020E-2	5.480E-2
-20 - -10°C:	-15	4.840E-2	5.880E-2	5.660E-2	5.560E-2	5.460E-2	4.910E-2	4.810E-2	4.380E-2
-10 - 0°C:	-5	3.620E-2	4.400E-2	4.240E-2	4.160E-2	4.080E-2	3.660E-2	3.600E-2	3.270E-2
0 - 10°C:	5	2.390E-2	2.900E-2	2.790E-2	2.740E-2	2.690E-2	2.410E-2	2.370E-2	2.160E-2
10 - 20°C:	15	1.140E-2	1.390E-2	1.340E-2	1.310E-2	1.290E-2	1.150E-2	1.130E-2	1.030E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.380E-2	5.280E-2	5.050E-2	4.900E-2	4.800E-2	4.290E-2	4.220E-2	3.860E-2
-20 - -10°C:	-15	3.460E-2	4.170E-2	3.980E-2	3.860E-2	3.780E-2	3.380E-2	3.320E-2	3.040E-2
-10 - 0°C:	-5	2.520E-2	3.030E-2	2.890E-2	2.800E-2	2.740E-2	2.450E-2	2.410E-2	2.210E-2
0 - 10°C:	5	1.570E-2	1.880E-2	1.800E-2	1.740E-2	1.700E-2	1.520E-2	1.490E-2	1.370E-2
10 - 20°C:	15	6.000E-3	7.100E-3	6.800E-3	6.600E-3	6.400E-3	5.700E-3	5.600E-3	5.200E-3
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.826E-1	3.308E-1	3.142E-1	2.964E-1	2.971E-1	2.940E-1	2.559E-1	2.215E-1
-20 - -10°C:	-15	2.363E-1	2.764E-1	2.624E-1	2.474E-1	2.478E-1	2.451E-1	2.136E-1	1.848E-1
-10 - 0°C:	-5	1.893E-1	2.213E-1	2.099E-1	1.978E-1	1.979E-1	1.958E-1	1.707E-1	1.476E-1
0 - 10°C:	5	1.416E-1	1.654E-1	1.567E-1	1.476E-1	1.476E-1	1.460E-1	1.274E-1	1.101E-1
10 - 20°C:	15	9.310E-2	1.086E-1	1.029E-1	9.680E-2	9.670E-2	9.560E-2	8.350E-2	7.220E-2
20 - 30°C:	25	4.380E-2	5.110E-2	4.830E-2	4.540E-2	4.540E-2	4.480E-2	3.920E-2	3.390E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.295E+1	1.523E+1	1.459E+1	1.386E+1	1.405E+1	1.393E+1	1.202E+1	1.046E+1
-20 - -10°C:	-15	1.086E+1	1.277E+1	1.222E+1	1.160E+1	1.174E+1	1.164E+1	1.005E+1	8.744
-10 - 0°C:	-5	8.709	1.024E+1	9.792	9.287	9.390	9.306	8.043	6.993
0 - 10°C:	5	6.506	7.647	7.306	6.924	6.992	6.928	5.992	5.207
10 - 20°C:	15	4.244	4.985	4.759	4.506	4.544	4.502	3.897	3.385
20 - 30°C:	25	1.922	2.256	2.152	2.035	2.050	2.030	1.759	1.527
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.190E-2	7.270E-2	6.950E-2	6.590E-2	6.650E-2	6.590E-2	5.700E-2	4.960E-2
-20 - -10°C:	-15	4.960E-2	5.820E-2	5.560E-2	5.270E-2	5.320E-2	5.270E-2	4.560E-2	3.960E-2
-10 - 0°C:	-5	3.710E-2	4.360E-2	4.160E-2	3.940E-2	3.980E-2	3.940E-2	3.410E-2	2.960E-2
0 - 10°C:	5	2.450E-2	2.880E-2	2.750E-2	2.600E-2	2.620E-2	2.600E-2	2.250E-2	1.950E-2
10 - 20°C:	15	1.170E-2	1.380E-2	1.310E-2	1.240E-2	1.250E-2	1.240E-2	1.070E-2	9.300E-3
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.480E-2	5.240E-2	4.960E-2	4.670E-2	4.670E-2	4.620E-2	4.030E-2	3.490E-2
-20 - -10°C:	-15	3.540E-2	4.130E-2	3.910E-2	3.680E-2	3.680E-2	3.640E-2	3.180E-2	2.750E-2
-10 - 0°C:	-5	2.580E-2	3.010E-2	2.850E-2	2.680E-2	2.670E-2	2.640E-2	2.310E-2	1.990E-2
0 - 10°C:	5	1.600E-2	1.870E-2	1.760E-2	1.660E-2	1.650E-2	1.630E-2	1.430E-2	1.230E-2
10 - 20°C:	15	6.100E-3	7.100E-3	6.700E-3	6.300E-3	6.200E-3	6.200E-3	5.400E-3	4.700E-3
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.535E-1	3.254E-1	3.348E-1	3.045E-1	3.014E-1	2.775E-1	2.818E-1	2.243E-1
-20 - -10°C:	-15	2.962E-1	2.723E-1	2.799E-1	2.542E-1	2.516E-1	2.317E-1	2.350E-1	1.872E-1
-10 - 0°C:	-5	2.378E-1	2.183E-1	2.242E-1	2.032E-1	2.011E-1	1.853E-1	1.877E-1	1.496E-1
0 - 10°C:	5	1.782E-1	1.634E-1	1.676E-1	1.517E-1	1.501E-1	1.383E-1	1.400E-1	1.116E-1
10 - 20°C:	15	1.174E-1	1.075E-1	1.101E-1	9.950E-2	9.850E-2	9.070E-2	9.180E-2	7.320E-2
20 - 30°C:	25	5.530E-2	5.060E-2	5.180E-2	4.670E-2	4.620E-2	4.260E-2	4.300E-2	3.430E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.579E+1	1.472E+1	1.531E+1	1.427E+1	1.409E+1	1.294E+1	1.338E+1	1.053E+1
-20 - -10°C:	-15	1.328E+1	1.236E+1	1.284E+1	1.193E+1	1.179E+1	1.083E+1	1.117E+1	8.807
-10 - 0°C:	-5	1.068E+1	9.932	1.031E+1	9.550	9.440	8.674	8.923	7.045
0 - 10°C:	5	8.000	7.432	7.702	7.116	7.036	6.467	6.638	5.248
10 - 20°C:	15	5.233	4.855	5.026	4.630	4.578	4.210	4.311	3.413
20 - 30°C:	25	2.376	2.202	2.276	2.090	2.068	1.902	1.943	1.541
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	7.610E-2	7.070E-2	7.330E-2	6.770E-2	6.700E-2	6.160E-2	6.320E-2	5.000E-2
-20 - -10°C:	-15	6.100E-2	5.670E-2	5.870E-2	5.420E-2	5.360E-2	4.930E-2	5.050E-2	4.000E-2
-10 - 0°C:	-5	4.570E-2	4.240E-2	4.390E-2	4.050E-2	4.010E-2	3.680E-2	3.780E-2	2.990E-2
0 - 10°C:	5	3.020E-2	2.800E-2	2.900E-2	2.670E-2	2.640E-2	2.430E-2	2.490E-2	1.970E-2
10 - 20°C:	15	1.450E-2	1.340E-2	1.390E-2	1.280E-2	1.260E-2	1.160E-2	1.190E-2	9.400E-3
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.640E-2	5.170E-2	5.300E-2	4.800E-2	4.750E-2	4.380E-2	4.430E-2	3.530E-2
-20 - -10°C:	-15	4.460E-2	4.090E-2	4.190E-2	3.780E-2	3.740E-2	3.450E-2	3.490E-2	2.780E-2
-10 - 0°C:	-5	3.260E-2	2.980E-2	3.050E-2	2.750E-2	2.720E-2	2.510E-2	2.530E-2	2.020E-2
0 - 10°C:	5	2.030E-2	1.850E-2	1.900E-2	1.700E-2	1.690E-2	1.560E-2	1.570E-2	1.250E-2
10 - 20°C:	15	7.700E-3	7.000E-3	7.200E-3	6.400E-3	6.400E-3	5.900E-3	5.900E-3	4.700E-3
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

Annex 29: Cold excess unit emission according to average speed and ambient temperature for Euro 2 gasoline cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.605	1.776	1.697	1.603	1.578	1.458	1.408	1.261
-20 - -10°C:	-15	1.371	1.517	1.449	1.369	1.348	1.246	1.202	1.077
-10 - 0°C:	-5	1.137	1.258	1.202	1.135	1.117	1.032	9.966E-1	8.925E-1
0 - 10°C:	5	9.022E-1	9.982E-1	9.536E-1	9.007E-1	8.867E-1	8.193E-1	7.909E-1	7.083E-1
10 - 20°C:	15	6.676E-1	7.386E-1	7.055E-1	6.664E-1	6.560E-1	6.061E-1	5.852E-1	5.240E-1
20 - 30°C:	25	4.328E-1	4.788E-1	4.574E-1	4.320E-1	4.252E-1	3.929E-1	3.793E-1	3.397E-1
30 - 40°C:	35	1.979E-1	2.189E-1	2.091E-1	1.975E-1	1.944E-1	1.796E-1	1.734E-1	1.553E-1

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.969	4.524	4.439	4.386	4.384	4.076	3.936	3.481
-20 - -10°C:	-15	3.662	4.172	4.085	4.017	4.007	3.724	3.590	3.180
-10 - 0°C:	-5	3.328	3.787	3.699	3.618	3.602	3.345	3.221	2.857
0 - 10°C:	5	2.959	3.360	3.274	3.183	3.161	2.933	2.821	2.507
10 - 20°C:	15	2.545	2.882	2.798	2.702	2.677	2.482	2.385	2.124
20 - 30°C:	25	2.080	2.345	2.267	2.173	2.148	1.990	1.911	1.706
30 - 40°C:	35	1.562	1.747	1.679	1.594	1.572	1.454	1.399	1.252

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.768E-1	1.968E-1	1.887E-1	1.789E-1	1.763E-1	1.631E-1	1.571E-1	1.406E-1
-20 - -10°C:	-15	1.625E-1	1.807E-1	1.731E-1	1.640E-1	1.616E-1	1.494E-1	1.440E-1	1.289E-1
-10 - 0°C:	-5	1.480E-1	1.644E-1	1.574E-1	1.491E-1	1.468E-1	1.357E-1	1.309E-1	1.171E-1
0 - 10°C:	5	1.334E-1	1.480E-1	1.416E-1	1.340E-1	1.319E-1	1.220E-1	1.176E-1	1.053E-1
10 - 20°C:	15	1.186E-1	1.314E-1	1.256E-1	1.188E-1	1.170E-1	1.081E-1	1.043E-1	9.340E-2
20 - 30°C:	25	1.036E-1	1.147E-1	1.096E-1	1.035E-1	1.019E-1	9.410E-2	9.090E-2	8.140E-2
30 - 40°C:	35	8.850E-2	9.780E-2	9.330E-2	8.810E-2	8.670E-2	8.010E-2	7.740E-2	6.930E-2

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.870E-2	3.180E-2	3.040E-2	2.870E-2	2.820E-2	2.610E-2	2.520E-2	2.260E-2
-20 - -10°C:	-15	2.870E-2	3.180E-2	3.040E-2	2.870E-2	2.820E-2	2.610E-2	2.520E-2	2.260E-2
-10 - 0°C:	-5	2.870E-2	3.180E-2	3.040E-2	2.870E-2	2.820E-2	2.610E-2	2.520E-2	2.260E-2
0 - 10°C:	5	2.870E-2	3.180E-2	3.040E-2	2.870E-2	2.820E-2	2.610E-2	2.520E-2	2.260E-2
10 - 20°C:	15	2.870E-2	3.180E-2	3.040E-2	2.870E-2	2.820E-2	2.610E-2	2.520E-2	2.260E-2
20 - 30°C:	25	2.870E-2	3.180E-2	3.040E-2	2.870E-2	2.820E-2	2.610E-2	2.520E-2	2.260E-2
30 - 40°C:	35	2.870E-2	3.180E-2	3.040E-2	2.870E-2	2.820E-2	2.610E-2	2.520E-2	2.260E-2

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.508	1.796	1.706	1.640	1.605	1.432	1.408	1.297
-20 - -10°C:	-15	1.288	1.534	1.457	1.401	1.371	1.223	1.203	1.108
-10 - 0°C:	-5	1.068	1.272	1.208	1.161	1.136	1.013	9.970E-1	9.185E-1
0 - 10°C:	5	8.475E-1	1.009	9.583E-1	9.215E-1	9.018E-1	8.042E-1	7.912E-1	7.289E-1
10 - 20°C:	15	6.271E-1	7.467E-1	7.090E-1	6.817E-1	6.672E-1	5.950E-1	5.853E-1	5.393E-1
20 - 30°C:	25	4.066E-1	4.841E-1	4.596E-1	4.419E-1	4.325E-1	3.857E-1	3.794E-1	3.496E-1
30 - 40°C:	35	1.859E-1	2.213E-1	2.101E-1	2.020E-1	1.977E-1	1.763E-1	1.735E-1	1.598E-1

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.801	4.659	4.533	4.555	4.510	4.085	3.998	3.611
-20 - -10°C:	-15	3.497	4.287	4.162	4.162	4.114	3.718	3.641	3.292
-10 - 0°C:	-5	3.168	3.881	3.759	3.739	3.688	3.326	3.259	2.951
0 - 10°C:	5	2.808	3.434	3.317	3.280	3.229	2.906	2.848	2.585
10 - 20°C:	15	2.408	2.935	2.827	2.778	2.730	2.451	2.404	2.187
20 - 30°C:	25	1.962	2.380	2.284	2.228	2.186	1.958	1.921	1.754
30 - 40°C:	35	1.467	1.766	1.686	1.631	1.597	1.427	1.402	1.286

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.662E-1	1.991E-1	1.897E-1	1.831E-1	1.793E-1	1.601E-1	1.574E-1	1.446E-1
-20 - -10°C:	-15	1.527E-1	1.828E-1	1.740E-1	1.679E-1	1.644E-1	1.467E-1	1.443E-1	1.326E-1
-10 - 0°C:	-5	1.391E-1	1.663E-1	1.582E-1	1.525E-1	1.493E-1	1.333E-1	1.310E-1	1.205E-1
0 - 10°C:	5	1.253E-1	1.497E-1	1.423E-1	1.371E-1	1.342E-1	1.197E-1	1.177E-1	1.083E-1
10 - 20°C:	15	1.114E-1	1.329E-1	1.263E-1	1.215E-1	1.189E-1	1.061E-1	1.044E-1	9.610E-2
20 - 30°C:	25	9.730E-2	1.159E-1	1.101E-1	1.059E-1	1.036E-1	9.240E-2	9.090E-2	8.380E-2
30 - 40°C:	35	8.310E-2	9.880E-2	9.380E-2	9.010E-2	8.820E-2	7.860E-2	7.740E-2	7.130E-2

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.690E-2	3.210E-2	3.050E-2	2.930E-2	2.870E-2	2.560E-2	2.520E-2	2.320E-2
-20 - -10°C:	-15	2.690E-2	3.210E-2	3.050E-2	2.930E-2	2.870E-2	2.560E-2	2.520E-2	2.320E-2
-10 - 0°C:	-5	2.690E-2	3.210E-2	3.050E-2	2.930E-2	2.870E-2	2.560E-2	2.520E-2	2.320E-2
0 - 10°C:	5	2.690E-2	3.210E-2	3.050E-2	2.930E-2	2.870E-2	2.560E-2	2.520E-2	2.320E-2
10 - 20°C:	15	2.690E-2	3.210E-2	3.050E-2	2.930E-2	2.870E-2	2.560E-2	2.520E-2	2.320E-2
20 - 30°C:	25	2.690E-2	3.210E-2	3.050E-2	2.930E-2	2.870E-2	2.560E-2	2.520E-2	2.320E-2
30 - 40°C:	35	2.690E-2	3.210E-2	3.050E-2	2.930E-2	2.870E-2	2.560E-2	2.520E-2	2.320E-2

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.534	1.779	1.673	1.570	1.559	1.539	1.355	1.165
-20 - -10°C:	-15	1.310	1.519	1.429	1.340	1.331	1.314	1.158	9.951E-1
-10 - 0°C:	-5	1.086	1.259	1.184	1.111	1.103	1.089	9.595E-1	8.249E-1
0 - 10°C:	5	8.620E-1	9.994E-1	9.399E-1	8.818E-1	8.756E-1	8.643E-1	7.615E-1	6.546E-1
10 - 20°C:	15	6.378E-1	7.394E-1	6.954E-1	6.524E-1	6.478E-1	6.394E-1	5.634E-1	4.843E-1
20 - 30°C:	25	4.135E-1	4.793E-1	4.508E-1	4.229E-1	4.199E-1	4.145E-1	3.652E-1	3.139E-1
30 - 40°C:	35	1.891E-1	2.191E-1	2.061E-1	1.933E-1	1.920E-1	1.895E-1	1.670E-1	1.435E-1

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.868	4.566	4.400	4.223	4.341	4.314	3.700	3.233
-20 - -10°C:	-15	3.570	4.211	4.054	3.880	3.974	3.946	3.389	2.958
-10 - 0°C:	-5	3.244	3.825	3.676	3.507	3.578	3.551	3.054	2.663
0 - 10°C:	5	2.881	3.394	3.255	3.096	3.143	3.118	2.686	2.340
10 - 20°C:	15	2.472	2.908	2.782	2.636	2.663	2.639	2.280	1.983
20 - 30°C:	25	2.012	2.361	2.249	2.123	2.132	2.111	1.832	1.589
30 - 40°C:	35	1.502	1.754	1.659	1.560	1.556	1.538	1.344	1.161

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.696E-1	1.974E-1	1.863E-1	1.751E-1	1.744E-1	1.723E-1	1.511E-1	1.302E-1
-20 - -10°C:	-15	1.558E-1	1.812E-1	1.709E-1	1.605E-1	1.598E-1	1.579E-1	1.386E-1	1.194E-1
-10 - 0°C:	-5	1.418E-1	1.648E-1	1.554E-1	1.459E-1	1.451E-1	1.433E-1	1.259E-1	1.084E-1
0 - 10°C:	5	1.277E-1	1.483E-1	1.397E-1	1.311E-1	1.304E-1	1.288E-1	1.132E-1	9.740E-2
10 - 20°C:	15	1.134E-1	1.316E-1	1.239E-1	1.163E-1	1.155E-1	1.141E-1	1.004E-1	8.640E-2
20 - 30°C:	25	9.900E-2	1.148E-1	1.080E-1	1.013E-1	1.006E-1	9.930E-2	8.750E-2	7.520E-2
30 - 40°C:	35	8.450E-2	9.790E-2	9.200E-2	8.630E-2	8.560E-2	8.450E-2	7.450E-2	6.400E-2

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.740E-2	3.180E-2	2.990E-2	2.810E-2	2.790E-2	2.750E-2	2.420E-2	2.080E-2
-20 - -10°C:	-15	2.740E-2	3.180E-2	2.990E-2	2.810E-2	2.790E-2	2.750E-2	2.420E-2	2.080E-2
-10 - 0°C:	-5	2.740E-2	3.180E-2	2.990E-2	2.810E-2	2.790E-2	2.750E-2	2.420E-2	2.080E-2
0 - 10°C:	5	2.740E-2	3.180E-2	2.990E-2	2.810E-2	2.790E-2	2.750E-2	2.420E-2	2.080E-2
10 - 20°C:	15	2.740E-2	3.180E-2	2.990E-2	2.810E-2	2.790E-2	2.750E-2	2.420E-2	2.080E-2
20 - 30°C:	25	2.740E-2	3.180E-2	2.990E-2	2.810E-2	2.790E-2	2.750E-2	2.420E-2	2.080E-2
30 - 40°C:	35	2.740E-2	3.180E-2	2.990E-2	2.810E-2	2.790E-2	2.750E-2	2.420E-2	2.080E-2

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.963	1.774	1.804	1.613	1.595	1.473	1.484	1.184
-20 - -10°C:	-15	1.676	1.515	1.541	1.377	1.362	1.258	1.267	1.011
-10 - 0°C:	-5	1.390	1.256	1.278	1.142	1.129	1.042	1.051	8.381E-1
0 - 10°C:	5	1.103	9.969E-1	1.014	9.061E-1	8.963E-1	8.273E-1	8.337E-1	6.651E-1
10 - 20°C:	15	8.165E-1	7.377E-1	7.501E-1	6.704E-1	6.631E-1	6.121E-1	6.168E-1	4.920E-1
20 - 30°C:	25	5.294E-1	4.782E-1	4.863E-1	4.346E-1	4.298E-1	3.968E-1	3.998E-1	3.190E-1
30 - 40°C:	35	2.421E-1	2.186E-1	2.223E-1	1.987E-1	1.965E-1	1.814E-1	1.828E-1	1.458E-1

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.594	4.327	4.561	4.382	4.317	3.956	4.203	3.254
-20 - -10°C:	-15	4.264	4.008	4.211	4.015	3.958	3.628	3.826	2.974
-10 - 0°C:	-5	3.902	3.657	3.828	3.618	3.570	3.274	3.424	2.675
0 - 10°C:	5	3.496	3.266	3.403	3.184	3.145	2.886	2.991	2.350
10 - 20°C:	15	3.032	2.821	2.926	2.705	2.674	2.458	2.522	1.994
20 - 30°C:	25	2.505	2.317	2.389	2.180	2.158	1.986	2.017	1.606
30 - 40°C:	35	1.902	1.742	1.784	1.604	1.589	1.465	1.475	1.181

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.154E-1	1.961E-1	2.003E-1	1.799E-1	1.780E-1	1.642E-1	1.656E-1	1.322E-1
-20 - -10°C:	-15	1.982E-1	1.801E-1	1.838E-1	1.650E-1	1.632E-1	1.506E-1	1.518E-1	1.212E-1
-10 - 0°C:	-5	1.807E-1	1.640E-1	1.672E-1	1.499E-1	1.483E-1	1.369E-1	1.380E-1	1.101E-1
0 - 10°C:	5	1.629E-1	1.477E-1	1.505E-1	1.347E-1	1.333E-1	1.230E-1	1.240E-1	9.900E-2
10 - 20°C:	15	1.449E-1	1.312E-1	1.335E-1	1.195E-1	1.182E-1	1.091E-1	1.099E-1	8.770E-2
20 - 30°C:	25	1.267E-1	1.145E-1	1.165E-1	1.041E-1	1.030E-1	9.510E-2	9.580E-2	7.640E-2
30 - 40°C:	35	1.083E-1	9.770E-2	9.930E-2	8.860E-2	8.770E-2	8.090E-2	8.160E-2	6.500E-2

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.510E-2	3.180E-2	3.230E-2	2.890E-2	2.860E-2	2.640E-2	2.650E-2	2.120E-2
-20 - -10°C:	-15	3.510E-2	3.180E-2	3.230E-2	2.890E-2	2.860E-2	2.640E-2	2.650E-2	2.120E-2
-10 - 0°C:	-5	3.510E-2	3.180E-2	3.230E-2	2.890E-2	2.860E-2	2.640E-2	2.650E-2	2.120E-2
0 - 10°C:	5	3.510E-2	3.180E-2	3.230E-2	2.890E-2	2.860E-2	2.640E-2	2.650E-2	2.120E-2
10 - 20°C:	15	3.510E-2	3.180E-2	3.230E-2	2.890E-2	2.860E-2	2.640E-2	2.650E-2	2.120E-2
20 - 30°C:	25	3.510E-2	3.180E-2	3.230E-2	2.890E-2	2.860E-2	2.640E-2	2.650E-2	2.120E-2
30 - 40°C:	35	3.510E-2	3.180E-2	3.230E-2	2.890E-2	2.860E-2	2.640E-2	2.650E-2	2.120E-2

Annex 30: Cold excess unit emission according to average speed and ambient temperature for Euro 3 diesel cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.480E-2	6.090E-2	5.830E-2	5.530E-2	5.440E-2	5.030E-2	4.850E-2	4.340E-2
-20 - -10°C:	-15	5.480E-2	6.090E-2	5.830E-2	5.530E-2	5.440E-2	5.030E-2	4.850E-2	4.340E-2
-10 - 0°C:	-5	5.480E-2	6.090E-2	5.830E-2	5.530E-2	5.440E-2	5.030E-2	4.850E-2	4.340E-2
0 - 10°C:	5	5.480E-2	6.090E-2	5.830E-2	5.530E-2	5.440E-2	5.030E-2	4.850E-2	4.340E-2
10 - 20°C:	15	5.480E-2	6.090E-2	5.830E-2	5.530E-2	5.440E-2	5.030E-2	4.850E-2	4.340E-2
20 - 30°C:	25	5.480E-2	6.090E-2	5.830E-2	5.530E-2	5.440E-2	5.030E-2	4.850E-2	4.340E-2
30 - 40°C:	35	5.480E-2	6.090E-2	5.830E-2	5.530E-2	5.440E-2	5.030E-2	4.850E-2	4.340E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
-20 - -10°C:	-15	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
-10 - 0°C:	-5	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
0 - 10°C:	5	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
10 - 20°C:	15	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
20 - 30°C:	25	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
30 - 40°C:	35	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.400E-3	2.600E-3	2.500E-3	2.400E-3	2.400E-3	2.200E-3	2.100E-3	1.900E-3
-20 - -10°C:	-15	2.400E-3	2.600E-3	2.500E-3	2.400E-3	2.400E-3	2.200E-3	2.100E-3	1.900E-3
-10 - 0°C:	-5	2.400E-3	2.600E-3	2.500E-3	2.400E-3	2.400E-3	2.200E-3	2.100E-3	1.900E-3
0 - 10°C:	5	2.400E-3	2.600E-3	2.500E-3	2.400E-3	2.400E-3	2.200E-3	2.100E-3	1.900E-3
10 - 20°C:	15	2.400E-3	2.600E-3	2.500E-3	2.400E-3	2.400E-3	2.200E-3	2.100E-3	1.900E-3
20 - 30°C:	25	2.400E-3	2.600E-3	2.500E-3	2.400E-3	2.400E-3	2.200E-3	2.100E-3	1.900E-3
30 - 40°C:	35	2.400E-3	2.600E-3	2.500E-3	2.400E-3	2.400E-3	2.200E-3	2.100E-3	1.900E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-1.100E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
-20 - -10°C:	-15	-1.100E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
-10 - 0°C:	-5	-1.100E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
0 - 10°C:	5	-1.100E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
10 - 20°C:	15	-1.100E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
20 - 30°C:	25	-1.100E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
30 - 40°C:	35	-1.100E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.150E-2	6.160E-2	5.860E-2	5.660E-2	5.540E-2	4.940E-2	4.860E-2	4.470E-2
-20 - -10°C:	-15	5.150E-2	6.160E-2	5.860E-2	5.660E-2	5.540E-2	4.940E-2	4.860E-2	4.470E-2
-10 - 0°C:	-5	5.150E-2	6.160E-2	5.860E-2	5.660E-2	5.540E-2	4.940E-2	4.860E-2	4.470E-2
0 - 10°C:	5	5.150E-2	6.160E-2	5.860E-2	5.660E-2	5.540E-2	4.940E-2	4.860E-2	4.470E-2
10 - 20°C:	15	5.150E-2	6.160E-2	5.860E-2	5.660E-2	5.540E-2	4.940E-2	4.860E-2	4.470E-2
20 - 30°C:	25	5.150E-2	6.160E-2	5.860E-2	5.660E-2	5.540E-2	4.940E-2	4.860E-2	4.470E-2
30 - 40°C:	35	5.150E-2	6.160E-2	5.860E-2	5.660E-2	5.540E-2	4.940E-2	4.860E-2	4.470E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
-20 - -10°C:	-15	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
-10 - 0°C:	-5	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
0 - 10°C:	5	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
10 - 20°C:	15	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
20 - 30°C:	25	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
30 - 40°C:	35	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.200E-3	2.700E-3	2.500E-3	2.500E-3	2.400E-3	2.100E-3	2.100E-3	1.900E-3
-20 - -10°C:	-15	2.200E-3	2.700E-3	2.500E-3	2.500E-3	2.400E-3	2.100E-3	2.100E-3	1.900E-3
-10 - 0°C:	-5	2.200E-3	2.700E-3	2.500E-3	2.500E-3	2.400E-3	2.100E-3	2.100E-3	1.900E-3
0 - 10°C:	5	2.200E-3	2.700E-3	2.500E-3	2.500E-3	2.400E-3	2.100E-3	2.100E-3	1.900E-3
10 - 20°C:	15	2.200E-3	2.700E-3	2.500E-3	2.500E-3	2.400E-3	2.100E-3	2.100E-3	1.900E-3
20 - 30°C:	25	2.200E-3	2.700E-3	2.500E-3	2.500E-3	2.400E-3	2.100E-3	2.100E-3	1.900E-3
30 - 40°C:	35	2.200E-3	2.700E-3	2.500E-3	2.500E-3	2.400E-3	2.100E-3	2.100E-3	1.900E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-1.000E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-1.000E-3
-20 - -10°C:	-15	-1.000E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-1.000E-3
-10 - 0°C:	-5	-1.000E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-1.000E-3
0 - 10°C:	5	-1.000E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-1.000E-3
10 - 20°C:	15	-1.000E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-1.000E-3
20 - 30°C:	25	-1.000E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-1.000E-3
30 - 40°C:	35	-1.000E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-1.000E-3

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.250E-2	6.110E-2	5.760E-2	5.410E-2	5.380E-2	5.320E-2	4.670E-2	4.020E-2
-20 - -10°C:	-15	5.250E-2	6.110E-2	5.760E-2	5.410E-2	5.380E-2	5.320E-2	4.670E-2	4.020E-2
-10 - 0°C:	-5	5.250E-2	6.110E-2	5.760E-2	5.410E-2	5.380E-2	5.320E-2	4.670E-2	4.020E-2
0 - 10°C:	5	5.250E-2	6.110E-2	5.760E-2	5.410E-2	5.380E-2	5.320E-2	4.670E-2	4.020E-2
10 - 20°C:	15	5.250E-2	6.110E-2	5.760E-2	5.410E-2	5.380E-2	5.320E-2	4.670E-2	4.020E-2
20 - 30°C:	25	5.250E-2	6.110E-2	5.760E-2	5.410E-2	5.380E-2	5.320E-2	4.670E-2	4.020E-2
30 - 40°C:	35	5.250E-2	6.110E-2	5.760E-2	5.410E-2	5.380E-2	5.320E-2	4.670E-2	4.020E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
-20 - -10°C:	-15	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
-10 - 0°C:	-5	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
0 - 10°C:	5	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
10 - 20°C:	15	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
20 - 30°C:	25	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
30 - 40°C:	35	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.300E-3	2.600E-3	2.500E-3	2.300E-3	2.300E-3	2.300E-3	2.000E-3	1.700E-3
-20 - -10°C:	-15	2.300E-3	2.600E-3	2.500E-3	2.300E-3	2.300E-3	2.300E-3	2.000E-3	1.700E-3
-10 - 0°C:	-5	2.300E-3	2.600E-3	2.500E-3	2.300E-3	2.300E-3	2.300E-3	2.000E-3	1.700E-3
0 - 10°C:	5	2.300E-3	2.600E-3	2.500E-3	2.300E-3	2.300E-3	2.300E-3	2.000E-3	1.700E-3
10 - 20°C:	15	2.300E-3	2.600E-3	2.500E-3	2.300E-3	2.300E-3	2.300E-3	2.000E-3	1.700E-3
20 - 30°C:	25	2.300E-3	2.600E-3	2.500E-3	2.300E-3	2.300E-3	2.300E-3	2.000E-3	1.700E-3
30 - 40°C:	35	2.300E-3	2.600E-3	2.500E-3	2.300E-3	2.300E-3	2.300E-3	2.000E-3	1.700E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-1.000E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
-20 - -10°C:	-15	-1.000E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
-10 - 0°C:	-5	-1.000E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
0 - 10°C:	5	-1.000E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
10 - 20°C:	15	-1.000E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
20 - 30°C:	25	-1.000E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4
30 - 40°C:	35	-1.000E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.200E-3	-1.100E-3	-1.000E-3	-9.000E-4

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.680E-2	6.070E-2	6.200E-2	5.560E-2	5.500E-2	5.070E-2	5.120E-2	4.080E-2
-20 - -10°C:	-15	6.680E-2	6.070E-2	6.200E-2	5.560E-2	5.500E-2	5.070E-2	5.120E-2	4.080E-2
-10 - 0°C:	-5	6.680E-2	6.070E-2	6.200E-2	5.560E-2	5.500E-2	5.070E-2	5.120E-2	4.080E-2
0 - 10°C:	5	6.680E-2	6.070E-2	6.200E-2	5.560E-2	5.500E-2	5.070E-2	5.120E-2	4.080E-2
10 - 20°C:	15	6.680E-2	6.070E-2	6.200E-2	5.560E-2	5.500E-2	5.070E-2	5.120E-2	4.080E-2
20 - 30°C:	25	6.680E-2	6.070E-2	6.200E-2	5.560E-2	5.500E-2	5.070E-2	5.120E-2	4.080E-2
30 - 40°C:	35	6.680E-2	6.070E-2	6.200E-2	5.560E-2	5.500E-2	5.070E-2	5.120E-2	4.080E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
-20 - -10°C:	-15	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
-10 - 0°C:	-5	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
0 - 10°C:	5	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
10 - 20°C:	15	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
20 - 30°C:	25	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
30 - 40°C:	35	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.900E-3	2.600E-3	2.700E-3	2.400E-3	2.400E-3	2.200E-3	2.200E-3	1.800E-3
-20 - -10°C:	-15	2.900E-3	2.600E-3	2.700E-3	2.400E-3	2.400E-3	2.200E-3	2.200E-3	1.800E-3
-10 - 0°C:	-5	2.900E-3	2.600E-3	2.700E-3	2.400E-3	2.400E-3	2.200E-3	2.200E-3	1.800E-3
0 - 10°C:	5	2.900E-3	2.600E-3	2.700E-3	2.400E-3	2.400E-3	2.200E-3	2.200E-3	1.800E-3
10 - 20°C:	15	2.900E-3	2.600E-3	2.700E-3	2.400E-3	2.400E-3	2.200E-3	2.200E-3	1.800E-3
20 - 30°C:	25	2.900E-3	2.600E-3	2.700E-3	2.400E-3	2.400E-3	2.200E-3	2.200E-3	1.800E-3
30 - 40°C:	35	2.900E-3	2.600E-3	2.700E-3	2.400E-3	2.400E-3	2.200E-3	2.200E-3	1.800E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-9.000E-4
-20 - -10°C:	-15	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-9.000E-4
-10 - 0°C:	-5	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-9.000E-4
0 - 10°C:	5	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-9.000E-4
10 - 20°C:	15	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-9.000E-4
20 - 30°C:	25	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-9.000E-4
30 - 40°C:	35	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.200E-3	-1.100E-3	-1.100E-3	-9.000E-4

Annex 31: Cold excess unit emission according to average speed and ambient temperature for Euro 3 gasoline cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.318	2.575	2.466	2.335	2.300	2.127	2.050	1.835
-20 - -10°C:	-15	1.871	2.077	1.987	1.880	1.852	1.712	1.651	1.478
-10 - 0°C:	-5	1.419	1.574	1.505	1.423	1.401	1.295	1.249	1.119
0 - 10°C:	5	9.629E-1	1.066	1.019	9.627E-1	9.478E-1	8.759E-1	8.453E-1	7.570E-1
10 - 20°C:	15	5.014E-1	5.545E-1	5.295E-1	5.000E-1	4.921E-1	4.547E-1	4.390E-1	3.932E-1
20 - 30°C:	25	3.490E-2	3.860E-2	3.680E-2	3.470E-2	3.420E-2	3.160E-2	3.050E-2	2.730E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.873	6.654	6.469	6.268	6.218	5.768	5.547	4.935
-20 - -10°C:	-15	5.110	5.784	5.616	5.428	5.381	4.990	4.798	4.272
-10 - 0°C:	-5	4.317	4.880	4.732	4.562	4.519	4.189	4.027	3.588
0 - 10°C:	5	3.491	3.940	3.815	3.669	3.631	3.365	3.234	2.884
10 - 20°C:	15	2.629	2.963	2.864	2.747	2.716	2.516	2.418	2.158
20 - 30°C:	25	1.732	1.947	1.879	1.797	1.775	1.644	1.581	1.412
30 - 40°C:	35	7.950E-1	8.916E-1	8.587E-1	8.188E-1	8.082E-1	7.481E-1	7.194E-1	6.430E-1

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.668E-1	5.229E-1	5.034E-1	4.800E-1	4.737E-1	4.385E-1	4.219E-1	3.770E-1
-20 - -10°C:	-15	3.738E-1	4.178E-1	4.016E-1	3.820E-1	3.768E-1	3.487E-1	3.356E-1	3.001E-1
-10 - 0°C:	-5	2.777E-1	3.096E-1	2.970E-1	2.820E-1	2.779E-1	2.571E-1	2.476E-1	2.215E-1
0 - 10°C:	5	1.784E-1	1.983E-1	1.899E-1	1.798E-1	1.772E-1	1.638E-1	1.579E-1	1.413E-1
10 - 20°C:	15	7.570E-2	8.380E-2	8.010E-2	7.570E-2	7.450E-2	6.890E-2	6.650E-2	5.950E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.450E-2	1.650E-2	1.610E-2	1.560E-2	1.550E-2	1.440E-2	1.380E-2	1.230E-2
-20 - -10°C:	-15	1.390E-2	1.590E-2	1.550E-2	1.500E-2	1.490E-2	1.380E-2	1.320E-2	1.180E-2
-10 - 0°C:	-5	1.330E-2	1.520E-2	1.480E-2	1.440E-2	1.420E-2	1.320E-2	1.270E-2	1.130E-2
0 - 10°C:	5	1.270E-2	1.450E-2	1.410E-2	1.370E-2	1.360E-2	1.260E-2	1.210E-2	1.080E-2
10 - 20°C:	15	1.220E-2	1.380E-2	1.350E-2	1.310E-2	1.300E-2	1.200E-2	1.150E-2	1.030E-2
20 - 30°C:	25	1.160E-2	1.320E-2	1.280E-2	1.250E-2	1.230E-2	1.150E-2	1.100E-2	9.800E-3
30 - 40°C:	35	1.100E-2	1.250E-2	1.220E-2	1.180E-2	1.170E-2	1.090E-2	1.040E-2	9.300E-3

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.178	2.605	2.479	2.390	2.339	2.088	2.053	1.888
-20 - -10°C:	-15	1.758	2.100	1.997	1.924	1.883	1.681	1.653	1.521
-10 - 0°C:	-5	1.334	1.591	1.512	1.456	1.425	1.271	1.250	1.151
0 - 10°C:	5	9.046E-1	1.078	1.024	9.849E-1	9.639E-1	8.597E-1	8.457E-1	7.790E-1
10 - 20°C:	15	4.710E-1	5.606E-1	5.321E-1	5.115E-1	5.005E-1	4.463E-1	4.391E-1	4.047E-1
20 - 30°C:	25	3.280E-2	3.900E-2	3.700E-2	3.550E-2	3.480E-2	3.100E-2	3.050E-2	2.810E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.565	6.788	6.546	6.453	6.349	5.707	5.596	5.087
-20 - -10°C:	-15	4.837	5.894	5.677	5.584	5.490	4.931	4.836	4.400
-10 - 0°C:	-5	4.082	4.967	4.778	4.689	4.607	4.134	4.056	3.694
0 - 10°C:	5	3.297	4.006	3.849	3.768	3.699	3.317	3.255	2.968
10 - 20°C:	15	2.481	3.009	2.887	2.818	2.765	2.478	2.432	2.220
20 - 30°C:	25	1.632	1.975	1.892	1.842	1.807	1.617	1.588	1.452
30 - 40°C:	35	7.485E-1	9.033E-1	8.639E-1	8.388E-1	8.220E-1	7.352E-1	7.221E-1	6.611E-1

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.396E-1	5.299E-1	5.066E-1	4.918E-1	4.820E-1	4.311E-1	4.234E-1	3.878E-1
-20 - -10°C:	-15	3.517E-1	4.231E-1	4.039E-1	3.913E-1	3.833E-1	3.426E-1	3.366E-1	3.087E-1
-10 - 0°C:	-5	2.611E-1	3.133E-1	2.986E-1	2.887E-1	2.827E-1	2.525E-1	2.482E-1	2.279E-1
0 - 10°C:	5	1.677E-1	2.005E-1	1.908E-1	1.840E-1	1.802E-1	1.608E-1	1.581E-1	1.454E-1
10 - 20°C:	15	7.110E-2	8.480E-2	8.050E-2	7.750E-2	7.580E-2	6.760E-2	6.650E-2	6.130E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.370E-2	1.690E-2	1.630E-2	1.610E-2	1.580E-2	1.420E-2	1.390E-2	1.260E-2
-20 - -10°C:	-15	1.320E-2	1.620E-2	1.560E-2	1.540E-2	1.520E-2	1.360E-2	1.330E-2	1.210E-2
-10 - 0°C:	-5	1.260E-2	1.550E-2	1.500E-2	1.480E-2	1.450E-2	1.300E-2	1.280E-2	1.160E-2
0 - 10°C:	5	1.210E-2	1.480E-2	1.430E-2	1.410E-2	1.390E-2	1.250E-2	1.220E-2	1.110E-2
10 - 20°C:	15	1.150E-2	1.410E-2	1.360E-2	1.350E-2	1.320E-2	1.190E-2	1.170E-2	1.060E-2
20 - 30°C:	25	1.100E-2	1.340E-2	1.300E-2	1.280E-2	1.260E-2	1.130E-2	1.110E-2	1.010E-2
30 - 40°C:	35	1.040E-2	1.280E-2	1.230E-2	1.220E-2	1.200E-2	1.070E-2	1.050E-2	9.600E-3

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.221	2.582	2.434	2.286	2.274	2.246	1.973	1.699
-20 - -10°C:	-15	1.792	2.081	1.961	1.841	1.830	1.808	1.589	1.368
-10 - 0°C:	-5	1.358	1.576	1.484	1.393	1.384	1.367	1.203	1.035
0 - 10°C:	5	9.205E-1	1.068	1.005	9.425E-1	9.361E-1	9.242E-1	8.138E-1	6.998E-1
10 - 20°C:	15	4.789E-1	5.550E-1	5.218E-1	4.895E-1	4.859E-1	4.796E-1	4.227E-1	3.633E-1
20 - 30°C:	25	3.330E-2	3.860E-2	3.630E-2	3.400E-2	3.370E-2	3.330E-2	2.940E-2	2.520E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.706	6.713	6.425	6.100	6.177	6.124	5.288	4.600
-20 - -10°C:	-15	4.961	5.833	5.577	5.289	5.346	5.298	4.580	3.981
-10 - 0°C:	-5	4.187	4.919	4.698	4.449	4.489	4.447	3.849	3.344
0 - 10°C:	5	3.382	3.971	3.787	3.581	3.606	3.572	3.095	2.687
10 - 20°C:	15	2.544	2.983	2.841	2.683	2.696	2.669	2.317	2.009
20 - 30°C:	25	1.673	1.960	1.863	1.757	1.762	1.743	1.516	1.313
30 - 40°C:	35	7.664E-1	8.962E-1	8.500E-1	8.007E-1	8.010E-1	7.923E-1	6.907E-1	5.974E-1

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.498E-1	5.255E-1	4.981E-1	4.692E-1	4.693E-1	4.642E-1	4.050E-1	3.501E-1
-20 - -10°C:	-15	3.596E-1	4.196E-1	3.970E-1	3.737E-1	3.731E-1	3.689E-1	3.224E-1	2.784E-1
-10 - 0°C:	-5	2.667E-1	3.106E-1	2.935E-1	2.759E-1	2.750E-1	2.718E-1	2.381E-1	2.053E-1
0 - 10°C:	5	1.710E-1	1.988E-1	1.874E-1	1.760E-1	1.751E-1	1.730E-1	1.519E-1	1.308E-1
10 - 20°C:	15	7.240E-2	8.400E-2	7.900E-2	7.410E-2	7.360E-2	7.270E-2	6.400E-2	5.500E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.410E-2	1.670E-2	1.600E-2	1.520E-2	1.540E-2	1.530E-2	1.320E-2	1.150E-2
-20 - -10°C:	-15	1.360E-2	1.600E-2	1.540E-2	1.460E-2	1.480E-2	1.470E-2	1.260E-2	1.100E-2
-10 - 0°C:	-5	1.300E-2	1.530E-2	1.470E-2	1.400E-2	1.420E-2	1.410E-2	1.210E-2	1.050E-2
0 - 10°C:	5	1.240E-2	1.470E-2	1.410E-2	1.340E-2	1.360E-2	1.350E-2	1.160E-2	1.010E-2
10 - 20°C:	15	1.180E-2	1.400E-2	1.340E-2	1.280E-2	1.290E-2	1.280E-2	1.100E-2	9.600E-3
20 - 30°C:	25	1.130E-2	1.330E-2	1.280E-2	1.210E-2	1.230E-2	1.220E-2	1.050E-2	9.200E-3
30 - 40°C:	35	1.070E-2	1.260E-2	1.210E-2	1.150E-2	1.170E-2	1.160E-2	1.000E-2	8.700E-3

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.829	2.569	2.619	2.348	2.324	2.144	2.161	1.726
-20 - -10°C:	-15	2.285	2.072	2.111	1.891	1.871	1.727	1.740	1.389
-10 - 0°C:	-5	1.734	1.571	1.599	1.431	1.416	1.307	1.317	1.051
0 - 10°C:	5	1.177	1.065	1.083	9.684E-1	9.580E-1	8.842E-1	8.910E-1	7.110E-1
10 - 20°C:	15	6.134E-1	5.539E-1	5.631E-1	5.030E-1	4.975E-1	4.592E-1	4.627E-1	3.691E-1
20 - 30°C:	25	4.280E-2	3.850E-2	3.910E-2	3.490E-2	3.460E-2	3.190E-2	3.210E-2	2.560E-2
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.972	6.494	6.750	6.276	6.202	5.697	5.877	4.632
-20 - -10°C:	-15	6.085	5.659	5.871	5.437	5.375	4.939	5.079	4.011
-10 - 0°C:	-5	5.157	4.787	4.957	4.571	4.520	4.156	4.259	3.371
0 - 10°C:	5	4.183	3.875	4.006	3.678	3.638	3.346	3.417	2.711
10 - 20°C:	15	3.162	2.922	3.014	2.755	2.726	2.509	2.553	2.030
20 - 30°C:	25	2.091	1.927	1.983	1.804	1.785	1.644	1.668	1.328
30 - 40°C:	35	9.632E-1	8.848E-1	9.084E-1	8.225E-1	8.143E-1	7.502E-1	7.589E-1	6.055E-1

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.656E-1	5.189E-1	5.325E-1	4.821E-1	4.772E-1	4.397E-1	4.452E-1	3.549E-1
-20 - -10°C:	-15	4.540E-1	4.153E-1	4.254E-1	3.839E-1	3.800E-1	3.503E-1	3.540E-1	2.824E-1
-10 - 0°C:	-5	3.381E-1	3.082E-1	3.151E-1	2.835E-1	2.806E-1	2.587E-1	2.611E-1	2.084E-1
0 - 10°C:	5	2.176E-1	1.977E-1	2.017E-1	1.809E-1	1.790E-1	1.651E-1	1.665E-1	1.329E-1
10 - 20°C:	15	9.260E-2	8.370E-2	8.520E-2	7.620E-2	7.540E-2	6.950E-2	7.010E-2	5.590E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.720E-2	1.610E-2	1.680E-2	1.560E-2	1.540E-2	1.420E-2	1.460E-2	1.150E-2
-20 - -10°C:	-15	1.650E-2	1.550E-2	1.610E-2	1.500E-2	1.480E-2	1.360E-2	1.400E-2	1.110E-2
-10 - 0°C:	-5	1.580E-2	1.480E-2	1.540E-2	1.430E-2	1.420E-2	1.300E-2	1.340E-2	1.060E-2
0 - 10°C:	5	1.510E-2	1.420E-2	1.470E-2	1.370E-2	1.360E-2	1.250E-2	1.280E-2	1.010E-2
10 - 20°C:	15	1.440E-2	1.350E-2	1.410E-2	1.310E-2	1.290E-2	1.190E-2	1.220E-2	9.700E-3
20 - 30°C:	25	1.370E-2	1.290E-2	1.340E-2	1.240E-2	1.230E-2	1.130E-2	1.160E-2	9.200E-3
30 - 40°C:	35	1.300E-2	1.220E-2	1.270E-2	1.180E-2	1.170E-2	1.070E-2	1.100E-2	8.700E-3

Annex 32: Cold excess unit emission according to average speed and ambient temperature for Euro 4 with no DISI gasoline cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.815	2.048	1.983	1.907	1.888	1.750	1.682	1.500
-20 - -10°C:	-15	1.464	1.650	1.596	1.532	1.515	1.404	1.350	1.204
-10 - 0°C:	-5	1.102	1.240	1.198	1.148	1.135	1.051	1.011	9.021E-1
0 - 10°C:	5	7.292E-1	8.191E-1	7.903E-1	7.557E-1	7.465E-1	6.913E-1	6.648E-1	5.937E-1
10 - 20°C:	15	3.442E-1	3.859E-1	3.718E-1	3.548E-1	3.503E-1	3.243E-1	3.119E-1	2.787E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.248	4.838	4.736	4.655	4.642	4.313	4.159	3.684
-20 - -10°C:	-15	3.709	4.218	4.118	4.022	4.002	3.716	3.577	3.175
-10 - 0°C:	-5	3.104	3.522	3.427	3.325	3.300	3.061	2.943	2.618
0 - 10°C:	5	2.419	2.735	2.651	2.551	2.525	2.341	2.249	2.005
10 - 20°C:	15	1.641	1.843	1.777	1.695	1.673	1.549	1.489	1.330
20 - 30°C:	25	7.509E-1	8.329E-1	7.964E-1	7.524E-1	7.407E-1	6.846E-1	6.602E-1	5.913E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.734E-1	3.059E-1	2.942E-1	2.800E-1	2.763E-1	2.557E-1	2.461E-1	2.200E-1
-20 - -10°C:	-15	2.184E-1	2.435E-1	2.337E-1	2.219E-1	2.187E-1	2.023E-1	1.949E-1	1.743E-1
-10 - 0°C:	-5	1.610E-1	1.789E-1	1.713E-1	1.621E-1	1.597E-1	1.477E-1	1.424E-1	1.274E-1
0 - 10°C:	5	1.012E-1	1.119E-1	1.068E-1	1.009E-1	9.930E-2	9.170E-2	8.860E-2	7.930E-2
10 - 20°C:	15	3.880E-2	4.260E-2	4.050E-2	3.820E-2	3.750E-2	3.470E-2	3.350E-2	3.010E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NO _x							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
-20 - -10°C:	-15	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
-10 - 0°C:	-5	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
0 - 10°C:	5	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
10 - 20°C:	15	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
20 - 30°C:	25	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
30 - 40°C:	35	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.715	2.082	2.001	1.959	1.924	1.726	1.693	1.544
-20 - -10°C:	-15	1.382	1.676	1.609	1.573	1.544	1.384	1.358	1.239
-10 - 0°C:	-5	1.040	1.259	1.207	1.178	1.156	1.035	1.016	9.282E-1
0 - 10°C:	5	6.873E-1	8.310E-1	7.958E-1	7.749E-1	7.599E-1	6.802E-1	6.679E-1	6.107E-1
10 - 20°C:	15	3.242E-1	3.912E-1	3.742E-1	3.636E-1	3.564E-1	3.189E-1	3.132E-1	2.866E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.055	4.970	4.824	4.822	4.764	4.305	4.216	3.813
-20 - -10°C:	-15	3.528	4.320	4.182	4.154	4.097	3.693	3.618	3.278
-10 - 0°C:	-5	2.943	3.595	3.469	3.424	3.369	3.029	2.970	2.698
0 - 10°C:	5	2.285	2.781	2.674	2.620	2.573	2.308	2.264	2.063
10 - 20°C:	15	1.545	1.867	1.787	1.736	1.701	1.522	1.494	1.368
20 - 30°C:	25	7.052E-1	8.419E-1	8.000E-1	7.696E-1	7.531E-1	6.717E-1	6.607E-1	6.082E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.573E-1	3.098E-1	2.959E-1	2.869E-1	2.811E-1	2.513E-1	2.469E-1	2.263E-1
-20 - -10°C:	-15	2.054E-1	2.465E-1	2.350E-1	2.272E-1	2.225E-1	1.987E-1	1.953E-1	1.793E-1
-10 - 0°C:	-5	1.513E-1	1.809E-1	1.721E-1	1.659E-1	1.624E-1	1.450E-1	1.425E-1	1.311E-1
0 - 10°C:	5	9.510E-2	1.131E-1	1.074E-1	1.032E-1	1.010E-1	9.000E-2	8.860E-2	8.160E-2
10 - 20°C:	15	3.640E-2	4.300E-2	4.070E-2	3.900E-2	3.820E-2	3.400E-2	3.350E-2	3.100E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
-20 - -10°C:	-15	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
-10 - 0°C:	-5	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
0 - 10°C:	5	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
10 - 20°C:	15	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
20 - 30°C:	25	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
30 - 40°C:	35	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.758	2.063	1.966	1.860	1.874	1.856	1.609	1.396
-20 - -10°C:	-15	1.417	1.661	1.582	1.495	1.504	1.489	1.292	1.121
-10 - 0°C:	-5	1.065	1.248	1.187	1.121	1.126	1.114	9.684E-1	8.392E-1
0 - 10°C:	5	7.039E-1	8.240E-1	7.827E-1	7.384E-1	7.403E-1	7.325E-1	6.375E-1	5.520E-1
10 - 20°C:	15	3.318E-1	3.880E-1	3.680E-1	3.468E-1	3.471E-1	3.434E-1	2.994E-1	2.589E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.140	4.884	4.700	4.496	4.604	4.571	3.926	3.427
-20 - -10°C:	-15	3.614	4.259	4.092	3.902	3.976	3.945	3.395	2.960
-10 - 0°C:	-5	3.020	3.556	3.408	3.237	3.281	3.254	2.806	2.443
0 - 10°C:	5	2.347	2.758	2.633	2.492	2.511	2.487	2.152	1.870
10 - 20°C:	15	1.582	1.852	1.759	1.657	1.658	1.641	1.428	1.236
20 - 30°C:	25	7.190E-1	8.346E-1	7.854E-1	7.368E-1	7.317E-1	7.225E-1	6.358E-1	5.469E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.632E-1	3.072E-1	2.909E-1	2.739E-1	2.736E-1	2.706E-1	2.363E-1	2.042E-1
-20 - -10°C:	-15	2.098E-1	2.444E-1	2.309E-1	2.171E-1	2.164E-1	2.139E-1	1.873E-1	1.616E-1
-10 - 0°C:	-5	1.543E-1	1.793E-1	1.690E-1	1.587E-1	1.579E-1	1.559E-1	1.370E-1	1.180E-1
0 - 10°C:	5	9.660E-2	1.120E-1	1.053E-1	9.870E-2	9.800E-2	9.670E-2	8.530E-2	7.330E-2
10 - 20°C:	15	3.680E-2	4.250E-2	3.990E-2	3.740E-2	3.700E-2	3.650E-2	3.230E-2	2.770E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NO _x							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
-20 - -10°C:	-15	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
-10 - 0°C:	-5	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
0 - 10°C:	5	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
10 - 20°C:	15	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
20 - 30°C:	25	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
30 - 40°C:	35	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.175	2.014	2.082	1.913	1.892	1.740	1.779	1.410
-20 - -10°C:	-15	1.759	1.626	1.678	1.537	1.520	1.399	1.427	1.132
-10 - 0°C:	-5	1.327	1.225	1.262	1.152	1.140	1.049	1.068	8.487E-1
0 - 10°C:	5	8.802E-1	8.105E-1	8.339E-1	7.586E-1	7.508E-1	6.913E-1	7.019E-1	5.587E-1
10 - 20°C:	15	4.165E-1	3.826E-1	3.929E-1	3.563E-1	3.527E-1	3.249E-1	3.291E-1	2.623E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.951	4.651	4.885	4.653	4.587	4.205	4.430	3.446
-20 - -10°C:	-15	4.355	4.079	4.265	4.023	3.971	3.642	3.802	2.973
-10 - 0°C:	-5	3.677	3.430	3.569	3.327	3.287	3.018	3.118	2.455
0 - 10°C:	5	2.896	2.687	2.780	2.556	2.528	2.325	2.375	1.884
10 - 20°C:	15	1.988	1.830	1.881	1.703	1.687	1.554	1.570	1.254
20 - 30°C:	25	9.186E-1	8.322E-1	8.472E-1	7.570E-1	7.492E-1	6.915E-1	6.956E-1	5.560E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.318E-1	3.038E-1	3.114E-1	2.814E-1	2.785E-1	2.567E-1	2.596E-1	2.070E-1
-20 - -10°C:	-15	2.658E-1	2.425E-1	2.479E-1	2.231E-1	2.208E-1	2.036E-1	2.055E-1	1.640E-1
-10 - 0°C:	-5	1.966E-1	1.784E-1	1.819E-1	1.631E-1	1.614E-1	1.489E-1	1.501E-1	1.198E-1
0 - 10°C:	5	1.238E-1	1.118E-1	1.136E-1	1.015E-1	1.004E-1	9.260E-2	9.340E-2	7.450E-2
10 - 20°C:	15	4.750E-2	4.260E-2	4.310E-2	3.840E-2	3.800E-2	3.510E-2	3.540E-2	2.810E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
-20 - -10°C:	-15	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
-10 - 0°C:	-5	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
0 - 10°C:	5	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
10 - 20°C:	15	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
20 - 30°C:	25	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
30 - 40°C:	35	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3

Annex 33: Cold excess unit emission according to average speed and ambient temperature for future Euro 4 diesel cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
-20 - -10°C:	-15	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
-10 - 0°C:	-5	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
0 - 10°C:	5	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
10 - 20°C:	15	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
20 - 30°C:	25	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
30 - 40°C:	35	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
-20 - -10°C:	-15	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
-10 - 0°C:	-5	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
0 - 10°C:	5	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
10 - 20°C:	15	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
20 - 30°C:	25	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
30 - 40°C:	35	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
-20 - -10°C:	-15	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
-10 - 0°C:	-5	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
0 - 10°C:	5	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
10 - 20°C:	15	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
20 - 30°C:	25	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
30 - 40°C:	35	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
-20 - -10°C:	-15	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
-10 - 0°C:	-5	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
0 - 10°C:	5	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
10 - 20°C:	15	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
20 - 30°C:	25	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
30 - 40°C:	35	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
-20 - -10°C:	-15	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
-10 - 0°C:	-5	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
0 - 10°C:	5	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
10 - 20°C:	15	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
20 - 30°C:	25	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
30 - 40°C:	35	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
-20 - -10°C:	-15	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
-10 - 0°C:	-5	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
0 - 10°C:	5	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
10 - 20°C:	15	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
20 - 30°C:	25	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
30 - 40°C:	35	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
-20 - -10°C:	-15	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
-10 - 0°C:	-5	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
0 - 10°C:	5	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
10 - 20°C:	15	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
20 - 30°C:	25	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
30 - 40°C:	35	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
-20 - -10°C:	-15	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
-10 - 0°C:	-5	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
0 - 10°C:	5	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
10 - 20°C:	15	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
20 - 30°C:	25	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
30 - 40°C:	35	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
-20 - -10°C:	-15	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
-10 - 0°C:	-5	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
0 - 10°C:	5	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
10 - 20°C:	15	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
20 - 30°C:	25	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
30 - 40°C:	35	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
-20 - -10°C:	-15	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
-10 - 0°C:	-5	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
0 - 10°C:	5	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
10 - 20°C:	15	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
20 - 30°C:	25	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
30 - 40°C:	35	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
-20 - -10°C:	-15	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
-10 - 0°C:	-5	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
0 - 10°C:	5	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
10 - 20°C:	15	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
20 - 30°C:	25	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
30 - 40°C:	35	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
-20 - -10°C:	-15	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
-10 - 0°C:	-5	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
0 - 10°C:	5	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
10 - 20°C:	15	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
20 - 30°C:	25	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
30 - 40°C:	35	-6.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
-20 - -10°C:	-15	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
-10 - 0°C:	-5	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
0 - 10°C:	5	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
10 - 20°C:	15	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
20 - 30°C:	25	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
30 - 40°C:	35	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
-20 - -10°C:	-15	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
-10 - 0°C:	-5	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
0 - 10°C:	5	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
10 - 20°C:	15	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
20 - 30°C:	25	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
30 - 40°C:	35	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
-20 - -10°C:	-15	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
-10 - 0°C:	-5	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
0 - 10°C:	5	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
10 - 20°C:	15	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
20 - 30°C:	25	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
30 - 40°C:	35	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-8.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
-20 - -10°C:	-15	-8.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
-10 - 0°C:	-5	-8.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
0 - 10°C:	5	-8.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
10 - 20°C:	15	-8.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
20 - 30°C:	25	-8.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4
30 - 40°C:	35	-8.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-7.000E-4	-6.000E-4	-6.000E-4	-5.000E-4

Annex 34: Cold excess unit emission according to average speed and ambient temperature for future Euro 4 with DISI gasoline cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.815	2.048	1.983	1.907	1.888	1.750	1.682	1.500
-20 - -10°C:	-15	1.464	1.650	1.596	1.532	1.515	1.404	1.350	1.204
-10 - 0°C:	-5	1.102	1.240	1.198	1.148	1.135	1.051	1.011	9.021E-1
0 - 10°C:	5	7.292E-1	8.191E-1	7.903E-1	7.557E-1	7.465E-1	6.913E-1	6.648E-1	5.937E-1
10 - 20°C:	15	3.442E-1	3.859E-1	3.718E-1	3.548E-1	3.503E-1	3.243E-1	3.119E-1	2.787E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.957	4.503	4.401	4.309	4.291	3.985	3.839	3.404
-20 - -10°C:	-15	3.442	3.910	3.811	3.710	3.686	3.421	3.291	2.924
-10 - 0°C:	-5	2.868	3.250	3.158	3.053	3.027	2.807	2.698	2.402
0 - 10°C:	5	2.223	2.508	2.427	2.330	2.304	2.135	2.051	1.830
10 - 20°C:	15	1.500	1.681	1.618	1.540	1.519	1.406	1.352	1.209
20 - 30°C:	25	6.824E-1	7.551E-1	7.210E-1	6.803E-1	6.695E-1	6.186E-1	5.970E-1	5.348E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.734E-1	3.059E-1	2.942E-1	2.800E-1	2.763E-1	2.557E-1	2.461E-1	2.200E-1
-20 - -10°C:	-15	2.184E-1	2.435E-1	2.337E-1	2.219E-1	2.187E-1	2.023E-1	1.949E-1	1.743E-1
-10 - 0°C:	-5	1.610E-1	1.789E-1	1.713E-1	1.621E-1	1.597E-1	1.477E-1	1.424E-1	1.274E-1
0 - 10°C:	5	1.012E-1	1.119E-1	1.068E-1	1.009E-1	9.930E-2	9.170E-2	8.860E-2	7.930E-2
10 - 20°C:	15	3.880E-2	4.260E-2	4.050E-2	3.820E-2	3.750E-2	3.470E-2	3.350E-2	3.010E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NO _x							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
-20 - -10°C:	-15	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
-10 - 0°C:	-5	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
0 - 10°C:	5	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
10 - 20°C:	15	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
20 - 30°C:	25	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
30 - 40°C:	35	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.715	2.082	2.001	1.959	1.924	1.726	1.693	1.544
-20 - -10°C:	-15	1.382	1.676	1.609	1.573	1.544	1.384	1.358	1.239
-10 - 0°C:	-5	1.040	1.259	1.207	1.178	1.156	1.035	1.016	9.282E-1
0 - 10°C:	5	6.873E-1	8.310E-1	7.958E-1	7.749E-1	7.599E-1	6.802E-1	6.679E-1	6.107E-1
10 - 20°C:	15	3.242E-1	3.912E-1	3.742E-1	3.636E-1	3.564E-1	3.189E-1	3.132E-1	2.866E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.769	4.617	4.474	4.455	4.397	3.967	3.886	3.518
-20 - -10°C:	-15	3.269	3.998	3.864	3.826	3.768	3.392	3.325	3.016
-10 - 0°C:	-5	2.716	3.313	3.192	3.141	3.088	2.773	2.720	2.473
0 - 10°C:	5	2.097	2.547	2.446	2.390	2.345	2.102	2.063	1.882
10 - 20°C:	15	1.411	1.702	1.626	1.576	1.544	1.380	1.356	1.242
20 - 30°C:	25	6.408E-1	7.632E-1	7.244E-1	6.958E-1	6.808E-1	6.070E-1	5.972E-1	5.503E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.573E-1	3.098E-1	2.959E-1	2.869E-1	2.811E-1	2.513E-1	2.469E-1	2.263E-1
-20 - -10°C:	-15	2.054E-1	2.465E-1	2.350E-1	2.272E-1	2.225E-1	1.987E-1	1.953E-1	1.793E-1
-10 - 0°C:	-5	1.513E-1	1.809E-1	1.721E-1	1.659E-1	1.624E-1	1.450E-1	1.425E-1	1.311E-1
0 - 10°C:	5	9.510E-2	1.131E-1	1.074E-1	1.032E-1	1.010E-1	9.000E-2	8.860E-2	8.160E-2
10 - 20°C:	15	3.640E-2	4.300E-2	4.070E-2	3.900E-2	3.820E-2	3.400E-2	3.350E-2	3.100E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
-20 - -10°C:	-15	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
-10 - 0°C:	-5	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
0 - 10°C:	5	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
10 - 20°C:	15	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
20 - 30°C:	25	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
30 - 40°C:	35	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.758	2.063	1.966	1.860	1.874	1.856	1.609	1.396
-20 - -10°C:	-15	1.417	1.661	1.582	1.495	1.504	1.489	1.292	1.121
-10 - 0°C:	-5	1.065	1.248	1.187	1.121	1.126	1.114	9.684E-1	8.392E-1
0 - 10°C:	5	7.039E-1	8.240E-1	7.827E-1	7.384E-1	7.403E-1	7.325E-1	6.375E-1	5.520E-1
10 - 20°C:	15	3.318E-1	3.880E-1	3.680E-1	3.468E-1	3.471E-1	3.434E-1	2.994E-1	2.589E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.856	4.547	4.371	4.173	4.260	4.228	3.636	3.171
-20 - -10°C:	-15	3.351	3.949	3.789	3.606	3.665	3.635	3.131	2.728
-10 - 0°C:	-5	2.788	3.280	3.139	2.977	3.010	2.984	2.577	2.241
0 - 10°C:	5	2.153	2.528	2.410	2.277	2.289	2.267	1.965	1.705
10 - 20°C:	15	1.445	1.689	1.600	1.506	1.504	1.488	1.298	1.122
20 - 30°C:	25	6.525E-1	7.563E-1	7.107E-1	6.664E-1	6.611E-1	6.525E-1	5.753E-1	4.943E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.632E-1	3.072E-1	2.909E-1	2.739E-1	2.736E-1	2.706E-1	2.363E-1	2.042E-1
-20 - -10°C:	-15	2.098E-1	2.444E-1	2.309E-1	2.171E-1	2.164E-1	2.139E-1	1.873E-1	1.616E-1
-10 - 0°C:	-5	1.543E-1	1.793E-1	1.690E-1	1.587E-1	1.579E-1	1.559E-1	1.370E-1	1.180E-1
0 - 10°C:	5	9.660E-2	1.120E-1	1.053E-1	9.870E-2	9.800E-2	9.670E-2	8.530E-2	7.330E-2
10 - 20°C:	15	3.680E-2	4.250E-2	3.990E-2	3.740E-2	3.700E-2	3.650E-2	3.230E-2	2.770E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NO _x							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
-20 - -10°C:	-15	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
-10 - 0°C:	-5	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
0 - 10°C:	5	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
10 - 20°C:	15	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
20 - 30°C:	25	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
30 - 40°C:	35	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.175	2.014	2.082	1.913	1.892	1.740	1.779	1.410
-20 - -10°C:	-15	1.759	1.626	1.678	1.537	1.520	1.399	1.427	1.132
-10 - 0°C:	-5	1.327	1.225	1.262	1.152	1.140	1.049	1.068	8.487E-1
0 - 10°C:	5	8.802E-1	8.105E-1	8.339E-1	7.586E-1	7.508E-1	6.913E-1	7.019E-1	5.587E-1
10 - 20°C:	15	4.165E-1	3.826E-1	3.929E-1	3.563E-1	3.527E-1	3.249E-1	3.291E-1	2.623E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.633	4.345	4.551	4.309	4.250	3.898	4.083	3.187
-20 - -10°C:	-15	4.061	3.796	3.959	3.711	3.665	3.363	3.492	2.740
-10 - 0°C:	-5	3.411	3.176	3.297	3.056	3.021	2.776	2.854	2.254
0 - 10°C:	5	2.671	2.473	2.553	2.336	2.312	2.127	2.165	1.721
10 - 20°C:	15	1.823	1.673	1.716	1.548	1.534	1.414	1.426	1.140
20 - 30°C:	25	8.355E-1	7.547E-1	7.672E-1	6.844E-1	6.772E-1	6.252E-1	6.289E-1	5.024E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.318E-1	3.038E-1	3.114E-1	2.814E-1	2.785E-1	2.567E-1	2.596E-1	2.070E-1
-20 - -10°C:	-15	2.658E-1	2.425E-1	2.479E-1	2.231E-1	2.208E-1	2.036E-1	2.055E-1	1.640E-1
-10 - 0°C:	-5	1.966E-1	1.784E-1	1.819E-1	1.631E-1	1.614E-1	1.489E-1	1.501E-1	1.198E-1
0 - 10°C:	5	1.238E-1	1.118E-1	1.136E-1	1.015E-1	1.004E-1	9.260E-2	9.340E-2	7.450E-2
10 - 20°C:	15	4.750E-2	4.260E-2	4.310E-2	3.840E-2	3.800E-2	3.510E-2	3.540E-2	2.810E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
-20 - -10°C:	-15	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
-10 - 0°C:	-5	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
0 - 10°C:	5	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
10 - 20°C:	15	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
20 - 30°C:	25	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
30 - 40°C:	35	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3

Annex 35: Cold excess unit emission according to average speed and ambient temperature for future Euro 5 diesel cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
-20 - -10°C:	-15	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
-10 - 0°C:	-5	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
0 - 10°C:	5	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
10 - 20°C:	15	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
20 - 30°C:	25	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2
30 - 40°C:	35	4.380E-2	4.840E-2	4.630E-2	4.370E-2	4.300E-2	3.970E-2	3.840E-2	3.440E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
-20 - -10°C:	-15	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
-10 - 0°C:	-5	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
0 - 10°C:	5	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
10 - 20°C:	15	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
20 - 30°C:	25	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891
30 - 40°C:	35	3.411	3.871	3.771	3.667	3.643	3.381	3.253	2.891

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
-20 - -10°C:	-15	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
-10 - 0°C:	-5	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
0 - 10°C:	5	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
10 - 20°C:	15	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
20 - 30°C:	25	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
30 - 40°C:	35	2.000E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
-20 - -10°C:	-15	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
-10 - 0°C:	-5	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
0 - 10°C:	5	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
10 - 20°C:	15	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
20 - 30°C:	25	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
30 - 40°C:	35	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
-20 - -10°C:	-15	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
-10 - 0°C:	-5	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
0 - 10°C:	5	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
10 - 20°C:	15	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
20 - 30°C:	25	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2
30 - 40°C:	35	4.110E-2	4.900E-2	4.650E-2	4.470E-2	4.370E-2	3.900E-2	3.840E-2	3.540E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
-20 - -10°C:	-15	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
-10 - 0°C:	-5	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
0 - 10°C:	5	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
10 - 20°C:	15	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
20 - 30°C:	25	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983
30 - 40°C:	35	3.238	3.956	3.822	3.782	3.724	3.353	3.286	2.983

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
-20 - -10°C:	-15	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
-10 - 0°C:	-5	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
0 - 10°C:	5	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
10 - 20°C:	15	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
20 - 30°C:	25	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3
30 - 40°C:	35	1.900E-3	2.300E-3	2.100E-3	2.100E-3	2.000E-3	1.800E-3	1.800E-3	1.600E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-4.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
-20 - -10°C:	-15	-4.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
-10 - 0°C:	-5	-4.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
0 - 10°C:	5	-4.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
10 - 20°C:	15	-4.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
20 - 30°C:	25	-4.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
30 - 40°C:	35	-4.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
-20 - -10°C:	-15	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
-10 - 0°C:	-5	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
0 - 10°C:	5	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
10 - 20°C:	15	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
20 - 30°C:	25	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2
30 - 40°C:	35	4.180E-2	4.850E-2	4.560E-2	4.280E-2	4.250E-2	4.190E-2	3.690E-2	3.180E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
-20 - -10°C:	-15	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
-10 - 0°C:	-5	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
0 - 10°C:	5	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
10 - 20°C:	15	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
20 - 30°C:	25	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694
30 - 40°C:	35	3.318	3.907	3.745	3.563	3.619	3.589	3.094	2.694

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
-20 - -10°C:	-15	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
-10 - 0°C:	-5	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
0 - 10°C:	5	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
10 - 20°C:	15	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
20 - 30°C:	25	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3
30 - 40°C:	35	1.900E-3	2.200E-3	2.100E-3	2.000E-3	2.000E-3	1.900E-3	1.700E-3	1.500E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4
-20 - -10°C:	-15	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4
-10 - 0°C:	-5	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4
0 - 10°C:	5	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4
10 - 20°C:	15	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4
20 - 30°C:	25	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4
30 - 40°C:	35	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
-20 - -10°C:	-15	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
-10 - 0°C:	-5	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
0 - 10°C:	5	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
10 - 20°C:	15	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
20 - 30°C:	25	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2
30 - 40°C:	35	5.360E-2	4.840E-2	4.920E-2	4.400E-2	4.350E-2	4.010E-2	4.040E-2	3.230E-2

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
-20 - -10°C:	-15	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
-10 - 0°C:	-5	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
0 - 10°C:	5	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
10 - 20°C:	15	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
20 - 30°C:	25	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711
30 - 40°C:	35	4.029	3.763	3.922	3.670	3.625	3.328	3.452	2.711

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
-20 - -10°C:	-15	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
-10 - 0°C:	-5	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
0 - 10°C:	5	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
10 - 20°C:	15	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
20 - 30°C:	25	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3
30 - 40°C:	35	2.500E-3	2.200E-3	2.300E-3	2.000E-3	2.000E-3	1.900E-3	1.900E-3	1.500E-3

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	-6.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
-20 - -10°C:	-15	-6.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
-10 - 0°C:	-5	-6.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
0 - 10°C:	5	-6.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
10 - 20°C:	15	-6.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
20 - 30°C:	25	-6.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4
30 - 40°C:	35	-6.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-5.000E-4	-4.000E-4	-4.000E-4	-4.000E-4

Annex 36: Cold excess unit emission according to average speed and ambient temperature for future Euro 5 with no DISI gasoline cars according to the season

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.815	2.048	1.983	1.907	1.888	1.750	1.682	1.500
-20 - -10°C:	-15	1.464	1.650	1.596	1.532	1.515	1.404	1.350	1.204
-10 - 0°C:	-5	1.102	1.240	1.198	1.148	1.135	1.051	1.011	9.021E-1
0 - 10°C:	5	7.292E-1	8.191E-1	7.903E-1	7.557E-1	7.465E-1	6.913E-1	6.648E-1	5.937E-1
10 - 20°C:	15	3.442E-1	3.859E-1	3.718E-1	3.548E-1	3.503E-1	3.243E-1	3.119E-1	2.787E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.957	4.503	4.401	4.309	4.291	3.985	3.839	3.404
-20 - -10°C:	-15	3.442	3.910	3.811	3.710	3.686	3.421	3.291	2.924
-10 - 0°C:	-5	2.868	3.250	3.158	3.053	3.027	2.807	2.698	2.402
0 - 10°C:	5	2.223	2.508	2.427	2.330	2.304	2.135	2.051	1.830
10 - 20°C:	15	1.500	1.681	1.618	1.540	1.519	1.406	1.352	1.209
20 - 30°C:	25	6.824E-1	7.551E-1	7.210E-1	6.803E-1	6.695E-1	6.186E-1	5.970E-1	5.348E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.734E-1	3.059E-1	2.942E-1	2.800E-1	2.763E-1	2.557E-1	2.461E-1	2.200E-1
-20 - -10°C:	-15	2.184E-1	2.435E-1	2.337E-1	2.219E-1	2.187E-1	2.023E-1	1.949E-1	1.743E-1
-10 - 0°C:	-5	1.610E-1	1.789E-1	1.713E-1	1.621E-1	1.597E-1	1.477E-1	1.424E-1	1.274E-1
0 - 10°C:	5	1.012E-1	1.119E-1	1.068E-1	1.009E-1	9.930E-2	9.170E-2	8.860E-2	7.930E-2
10 - 20°C:	15	3.880E-2	4.260E-2	4.050E-2	3.820E-2	3.750E-2	3.470E-2	3.350E-2	3.010E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NO _x							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
-20 - -10°C:	-15	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
-10 - 0°C:	-5	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
0 - 10°C:	5	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
10 - 20°C:	15	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
20 - 30°C:	25	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
30 - 40°C:	35	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.715	2.082	2.001	1.959	1.924	1.726	1.693	1.544
-20 - -10°C:	-15	1.382	1.676	1.609	1.573	1.544	1.384	1.358	1.239
-10 - 0°C:	-5	1.040	1.259	1.207	1.178	1.156	1.035	1.016	9.282E-1
0 - 10°C:	5	6.873E-1	8.310E-1	7.958E-1	7.749E-1	7.599E-1	6.802E-1	6.679E-1	6.107E-1
10 - 20°C:	15	3.242E-1	3.912E-1	3.742E-1	3.636E-1	3.564E-1	3.189E-1	3.132E-1	2.866E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.769	4.617	4.474	4.455	4.397	3.967	3.886	3.518
-20 - -10°C:	-15	3.269	3.998	3.864	3.826	3.768	3.392	3.325	3.016
-10 - 0°C:	-5	2.716	3.313	3.192	3.141	3.088	2.773	2.720	2.473
0 - 10°C:	5	2.097	2.547	2.446	2.390	2.345	2.102	2.063	1.882
10 - 20°C:	15	1.411	1.702	1.626	1.576	1.544	1.380	1.356	1.242
20 - 30°C:	25	6.408E-1	7.632E-1	7.244E-1	6.958E-1	6.808E-1	6.070E-1	5.972E-1	5.503E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.573E-1	3.098E-1	2.959E-1	2.869E-1	2.811E-1	2.513E-1	2.469E-1	2.263E-1
-20 - -10°C:	-15	2.054E-1	2.465E-1	2.350E-1	2.272E-1	2.225E-1	1.987E-1	1.953E-1	1.793E-1
-10 - 0°C:	-5	1.513E-1	1.809E-1	1.721E-1	1.659E-1	1.624E-1	1.450E-1	1.425E-1	1.311E-1
0 - 10°C:	5	9.510E-2	1.131E-1	1.074E-1	1.032E-1	1.010E-1	9.000E-2	8.860E-2	8.160E-2
10 - 20°C:	15	3.640E-2	4.300E-2	4.070E-2	3.900E-2	3.820E-2	3.400E-2	3.350E-2	3.100E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
-20 - -10°C:	-15	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
-10 - 0°C:	-5	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
0 - 10°C:	5	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
10 - 20°C:	15	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
20 - 30°C:	25	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
30 - 40°C:	35	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.758	2.063	1.966	1.860	1.874	1.856	1.609	1.396
-20 - -10°C:	-15	1.417	1.661	1.582	1.495	1.504	1.489	1.292	1.121
-10 - 0°C:	-5	1.065	1.248	1.187	1.121	1.126	1.114	9.684E-1	8.392E-1
0 - 10°C:	5	7.039E-1	8.240E-1	7.827E-1	7.384E-1	7.403E-1	7.325E-1	6.375E-1	5.520E-1
10 - 20°C:	15	3.318E-1	3.880E-1	3.680E-1	3.468E-1	3.471E-1	3.434E-1	2.994E-1	2.589E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.856	4.547	4.371	4.173	4.260	4.228	3.636	3.171
-20 - -10°C:	-15	3.351	3.949	3.789	3.606	3.665	3.635	3.131	2.728
-10 - 0°C:	-5	2.788	3.280	3.139	2.977	3.010	2.984	2.577	2.241
0 - 10°C:	5	2.153	2.528	2.410	2.277	2.289	2.267	1.965	1.705
10 - 20°C:	15	1.445	1.689	1.600	1.506	1.504	1.488	1.298	1.122
20 - 30°C:	25	6.525E-1	7.563E-1	7.107E-1	6.664E-1	6.611E-1	6.525E-1	5.753E-1	4.943E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.632E-1	3.072E-1	2.909E-1	2.739E-1	2.736E-1	2.706E-1	2.363E-1	2.042E-1
-20 - -10°C:	-15	2.098E-1	2.444E-1	2.309E-1	2.171E-1	2.164E-1	2.139E-1	1.873E-1	1.616E-1
-10 - 0°C:	-5	1.543E-1	1.793E-1	1.690E-1	1.587E-1	1.579E-1	1.559E-1	1.370E-1	1.180E-1
0 - 10°C:	5	9.660E-2	1.120E-1	1.053E-1	9.870E-2	9.800E-2	9.670E-2	8.530E-2	7.330E-2
10 - 20°C:	15	3.680E-2	4.250E-2	3.990E-2	3.740E-2	3.700E-2	3.650E-2	3.230E-2	2.770E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NO _x							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
-20 - -10°C:	-15	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
-10 - 0°C:	-5	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
0 - 10°C:	5	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
10 - 20°C:	15	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
20 - 30°C:	25	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
30 - 40°C:	35	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.175	2.014	2.082	1.913	1.892	1.740	1.779	1.410
-20 - -10°C:	-15	1.759	1.626	1.678	1.537	1.520	1.399	1.427	1.132
-10 - 0°C:	-5	1.327	1.225	1.262	1.152	1.140	1.049	1.068	8.487E-1
0 - 10°C:	5	8.802E-1	8.105E-1	8.339E-1	7.586E-1	7.508E-1	6.913E-1	7.019E-1	5.587E-1
10 - 20°C:	15	4.165E-1	3.826E-1	3.929E-1	3.563E-1	3.527E-1	3.249E-1	3.291E-1	2.623E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.633	4.345	4.551	4.309	4.250	3.898	4.083	3.187
-20 - -10°C:	-15	4.061	3.796	3.959	3.711	3.665	3.363	3.492	2.740
-10 - 0°C:	-5	3.411	3.176	3.297	3.056	3.021	2.776	2.854	2.254
0 - 10°C:	5	2.671	2.473	2.553	2.336	2.312	2.127	2.165	1.721
10 - 20°C:	15	1.823	1.673	1.716	1.548	1.534	1.414	1.426	1.140
20 - 30°C:	25	8.355E-1	7.547E-1	7.672E-1	6.844E-1	6.772E-1	6.252E-1	6.289E-1	5.024E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.318E-1	3.038E-1	3.114E-1	2.814E-1	2.785E-1	2.567E-1	2.596E-1	2.070E-1
-20 - -10°C:	-15	2.658E-1	2.425E-1	2.479E-1	2.231E-1	2.208E-1	2.036E-1	2.055E-1	1.640E-1
-10 - 0°C:	-5	1.966E-1	1.784E-1	1.819E-1	1.631E-1	1.614E-1	1.489E-1	1.501E-1	1.198E-1
0 - 10°C:	5	1.238E-1	1.118E-1	1.136E-1	1.015E-1	1.004E-1	9.260E-2	9.340E-2	7.450E-2
10 - 20°C:	15	4.750E-2	4.260E-2	4.310E-2	3.840E-2	3.800E-2	3.510E-2	3.540E-2	2.810E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
-20 - -10°C:	-15	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
-10 - 0°C:	-5	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
0 - 10°C:	5	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
10 - 20°C:	15	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
20 - 30°C:	25	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
30 - 40°C:	35	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3

Annex 37: Cold excess unit emission according to average speed and ambient temperature for future Euro 5 with DISI gasoline cars according to the season

Cold excess unit emission in g/km, average speed in km/h, ambient temperature in °C.

season: year

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.815	2.048	1.983	1.907	1.888	1.750	1.682	1.500
-20 - -10°C:	-15	1.464	1.650	1.596	1.532	1.515	1.404	1.350	1.204
-10 - 0°C:	-5	1.102	1.240	1.198	1.148	1.135	1.051	1.011	9.021E-1
0 - 10°C:	5	7.292E-1	8.191E-1	7.903E-1	7.557E-1	7.465E-1	6.913E-1	6.648E-1	5.937E-1
10 - 20°C:	15	3.442E-1	3.859E-1	3.718E-1	3.548E-1	3.503E-1	3.243E-1	3.119E-1	2.787E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.957	4.503	4.401	4.309	4.291	3.985	3.839	3.404
-20 - -10°C:	-15	3.442	3.910	3.811	3.710	3.686	3.421	3.291	2.924
-10 - 0°C:	-5	2.868	3.250	3.158	3.053	3.027	2.807	2.698	2.402
0 - 10°C:	5	2.223	2.508	2.427	2.330	2.304	2.135	2.051	1.830
10 - 20°C:	15	1.500	1.681	1.618	1.540	1.519	1.406	1.352	1.209
20 - 30°C:	25	6.824E-1	7.551E-1	7.210E-1	6.803E-1	6.695E-1	6.186E-1	5.970E-1	5.348E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.734E-1	3.059E-1	2.942E-1	2.800E-1	2.763E-1	2.557E-1	2.461E-1	2.200E-1
-20 - -10°C:	-15	2.184E-1	2.435E-1	2.337E-1	2.219E-1	2.187E-1	2.023E-1	1.949E-1	1.743E-1
-10 - 0°C:	-5	1.610E-1	1.789E-1	1.713E-1	1.621E-1	1.597E-1	1.477E-1	1.424E-1	1.274E-1
0 - 10°C:	5	1.012E-1	1.119E-1	1.068E-1	1.009E-1	9.930E-2	9.170E-2	8.860E-2	7.930E-2
10 - 20°C:	15	3.880E-2	4.260E-2	4.050E-2	3.820E-2	3.750E-2	3.470E-2	3.350E-2	3.010E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
-20 - -10°C:	-15	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
-10 - 0°C:	-5	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
0 - 10°C:	5	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
10 - 20°C:	15	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
20 - 30°C:	25	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3
30 - 40°C:	35	5.900E-3	6.700E-3	6.600E-3	6.400E-3	6.400E-3	5.900E-3	5.700E-3	5.100E-3

season: winter

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.715	2.082	2.001	1.959	1.924	1.726	1.693	1.544
-20 - -10°C:	-15	1.382	1.676	1.609	1.573	1.544	1.384	1.358	1.239
-10 - 0°C:	-5	1.040	1.259	1.207	1.178	1.156	1.035	1.016	9.282E-1
0 - 10°C:	5	6.873E-1	8.310E-1	7.958E-1	7.749E-1	7.599E-1	6.802E-1	6.679E-1	6.107E-1
10 - 20°C:	15	3.242E-1	3.912E-1	3.742E-1	3.636E-1	3.564E-1	3.189E-1	3.132E-1	2.866E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.769	4.617	4.474	4.455	4.397	3.967	3.886	3.518
-20 - -10°C:	-15	3.269	3.998	3.864	3.826	3.768	3.392	3.325	3.016
-10 - 0°C:	-5	2.716	3.313	3.192	3.141	3.088	2.773	2.720	2.473
0 - 10°C:	5	2.097	2.547	2.446	2.390	2.345	2.102	2.063	1.882
10 - 20°C:	15	1.411	1.702	1.626	1.576	1.544	1.380	1.356	1.242
20 - 30°C:	25	6.408E-1	7.632E-1	7.244E-1	6.958E-1	6.808E-1	6.070E-1	5.972E-1	5.503E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.573E-1	3.098E-1	2.959E-1	2.869E-1	2.811E-1	2.513E-1	2.469E-1	2.263E-1
-20 - -10°C:	-15	2.054E-1	2.465E-1	2.350E-1	2.272E-1	2.225E-1	1.987E-1	1.953E-1	1.793E-1
-10 - 0°C:	-5	1.513E-1	1.809E-1	1.721E-1	1.659E-1	1.624E-1	1.450E-1	1.425E-1	1.311E-1
0 - 10°C:	5	9.510E-2	1.131E-1	1.074E-1	1.032E-1	1.010E-1	9.000E-2	8.860E-2	8.160E-2
10 - 20°C:	15	3.640E-2	4.300E-2	4.070E-2	3.900E-2	3.820E-2	3.400E-2	3.350E-2	3.100E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NO _x							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
-20 - -10°C:	-15	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
-10 - 0°C:	-5	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
0 - 10°C:	5	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
10 - 20°C:	15	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
20 - 30°C:	25	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3
30 - 40°C:	35	5.600E-3	6.900E-3	6.700E-3	6.600E-3	6.500E-3	5.900E-3	5.800E-3	5.200E-3

season: summer

Hour: day

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	1.758	2.063	1.966	1.860	1.874	1.856	1.609	1.396
-20 - -10°C:	-15	1.417	1.661	1.582	1.495	1.504	1.489	1.292	1.121
-10 - 0°C:	-5	1.065	1.248	1.187	1.121	1.126	1.114	9.684E-1	8.392E-1
0 - 10°C:	5	7.039E-1	8.240E-1	7.827E-1	7.384E-1	7.403E-1	7.325E-1	6.375E-1	5.520E-1
10 - 20°C:	15	3.318E-1	3.880E-1	3.680E-1	3.468E-1	3.471E-1	3.434E-1	2.994E-1	2.589E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.856	4.547	4.371	4.173	4.260	4.228	3.636	3.171
-20 - -10°C:	-15	3.351	3.949	3.789	3.606	3.665	3.635	3.131	2.728
-10 - 0°C:	-5	2.788	3.280	3.139	2.977	3.010	2.984	2.577	2.241
0 - 10°C:	5	2.153	2.528	2.410	2.277	2.289	2.267	1.965	1.705
10 - 20°C:	15	1.445	1.689	1.600	1.506	1.504	1.488	1.298	1.122
20 - 30°C:	25	6.525E-1	7.563E-1	7.107E-1	6.664E-1	6.611E-1	6.525E-1	5.753E-1	4.943E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.632E-1	3.072E-1	2.909E-1	2.739E-1	2.736E-1	2.706E-1	2.363E-1	2.042E-1
-20 - -10°C:	-15	2.098E-1	2.444E-1	2.309E-1	2.171E-1	2.164E-1	2.139E-1	1.873E-1	1.616E-1
-10 - 0°C:	-5	1.543E-1	1.793E-1	1.690E-1	1.587E-1	1.579E-1	1.559E-1	1.370E-1	1.180E-1
0 - 10°C:	5	9.660E-2	1.120E-1	1.053E-1	9.870E-2	9.800E-2	9.670E-2	8.530E-2	7.330E-2
10 - 20°C:	15	3.680E-2	4.250E-2	3.990E-2	3.740E-2	3.700E-2	3.650E-2	3.230E-2	2.770E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
-20 - -10°C:	-15	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
-10 - 0°C:	-5	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
0 - 10°C:	5	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
10 - 20°C:	15	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
20 - 30°C:	25	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3
30 - 40°C:	35	5.700E-3	6.800E-3	6.600E-3	6.300E-3	6.400E-3	6.300E-3	5.400E-3	4.700E-3

season: *intermediate*

Hour: *day*

pollutant:		CO							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	2.175	2.014	2.082	1.913	1.892	1.740	1.779	1.410
-20 - -10°C:	-15	1.759	1.626	1.678	1.537	1.520	1.399	1.427	1.132
-10 - 0°C:	-5	1.327	1.225	1.262	1.152	1.140	1.049	1.068	8.487E-1
0 - 10°C:	5	8.802E-1	8.105E-1	8.339E-1	7.586E-1	7.508E-1	6.913E-1	7.019E-1	5.587E-1
10 - 20°C:	15	4.165E-1	3.826E-1	3.929E-1	3.563E-1	3.527E-1	3.249E-1	3.291E-1	2.623E-1
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		CO ₂							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	4.633	4.345	4.551	4.309	4.250	3.898	4.083	3.187
-20 - -10°C:	-15	4.061	3.796	3.959	3.711	3.665	3.363	3.492	2.740
-10 - 0°C:	-5	3.411	3.176	3.297	3.056	3.021	2.776	2.854	2.254
0 - 10°C:	5	2.671	2.473	2.553	2.336	2.312	2.127	2.165	1.721
10 - 20°C:	15	1.823	1.673	1.716	1.548	1.534	1.414	1.426	1.140
20 - 30°C:	25	8.355E-1	7.547E-1	7.672E-1	6.844E-1	6.772E-1	6.252E-1	6.289E-1	5.024E-1
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		HC							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	3.318E-1	3.038E-1	3.114E-1	2.814E-1	2.785E-1	2.567E-1	2.596E-1	2.070E-1
-20 - -10°C:	-15	2.658E-1	2.425E-1	2.479E-1	2.231E-1	2.208E-1	2.036E-1	2.055E-1	1.640E-1
-10 - 0°C:	-5	1.966E-1	1.784E-1	1.819E-1	1.631E-1	1.614E-1	1.489E-1	1.501E-1	1.198E-1
0 - 10°C:	5	1.238E-1	1.118E-1	1.136E-1	1.015E-1	1.004E-1	9.260E-2	9.340E-2	7.450E-2
10 - 20°C:	15	4.750E-2	4.260E-2	4.310E-2	3.840E-2	3.800E-2	3.510E-2	3.540E-2	2.810E-2
20 - 30°C:	25	0	0	0	0	0	0	0	0
30 - 40°C:	35	0	0	0	0	0	0	0	0

pollutant:		NOx							
speed range:		0 - 10	10 - 20	20 - 30	30 - 40	40- 50	50- 60	60- 70	70-200
average speed:		5	15	25	35	45	55	65	75
-30 - -20°C:	-25	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
-20 - -10°C:	-15	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
-10 - 0°C:	-5	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
0 - 10°C:	5	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
10 - 20°C:	15	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
20 - 30°C:	25	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3
30 - 40°C:	35	6.800E-3	6.400E-3	6.700E-3	6.400E-3	6.300E-3	5.800E-3	6.000E-3	4.700E-3

Annex 38: Comparative influence of some parameters on PAH aggregated excess unit emission (model 3)

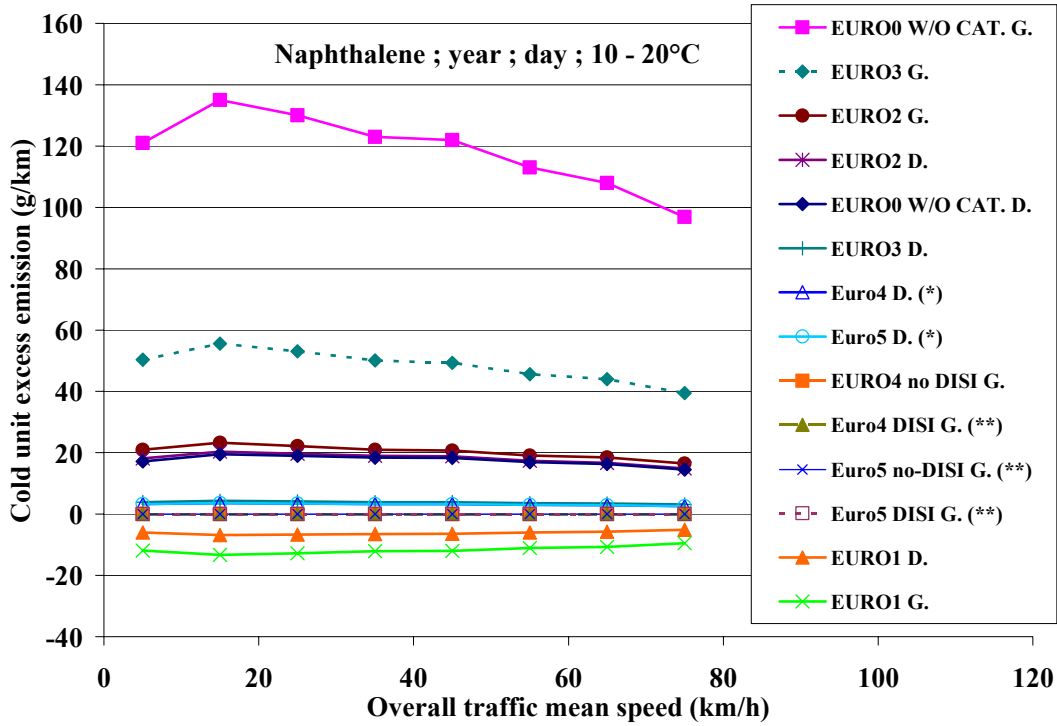


Figure 19: PAH Naphthalene cold unit excess emission according to average speed and vehicle technology (ambient temperature: 10-20°C, season: year, hour: whole day) (µg/km).
 * Computed from Euro 3 Diesel. ** Computed from Euro 4 no DISI Gasoline.

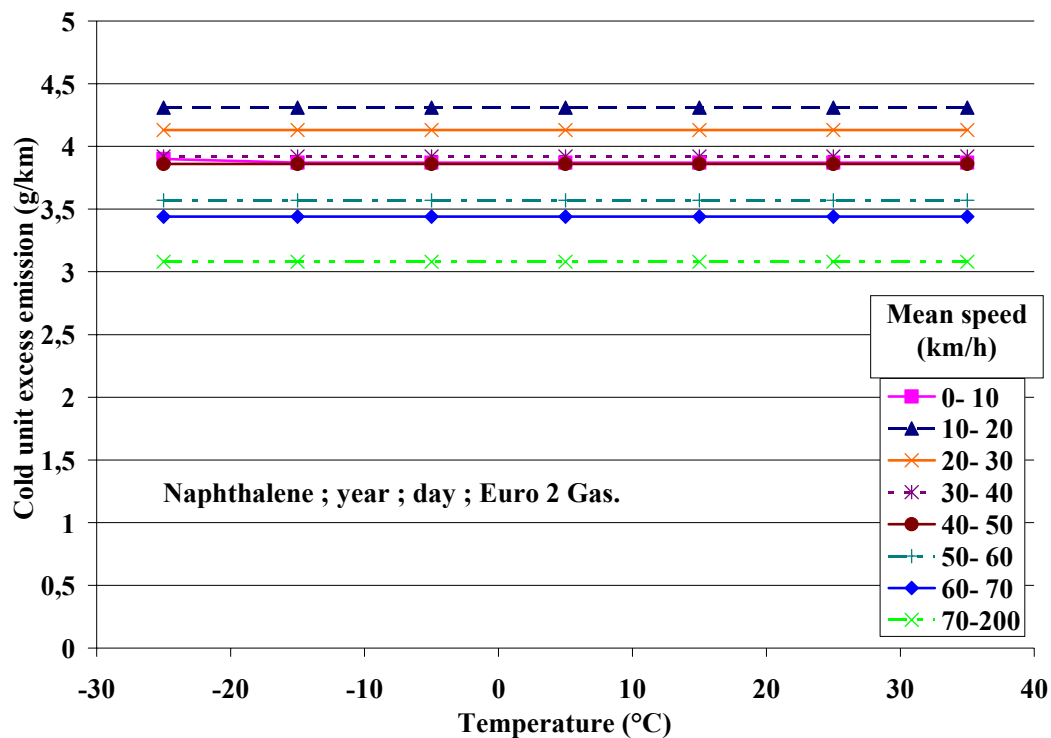


Figure 20: PAH Naphthalene cold unit excess emission according to ambient temperature and average speed for Euro 2 gasoline cars (season: year, hour: whole day) ($\mu\text{g}/\text{km}$).

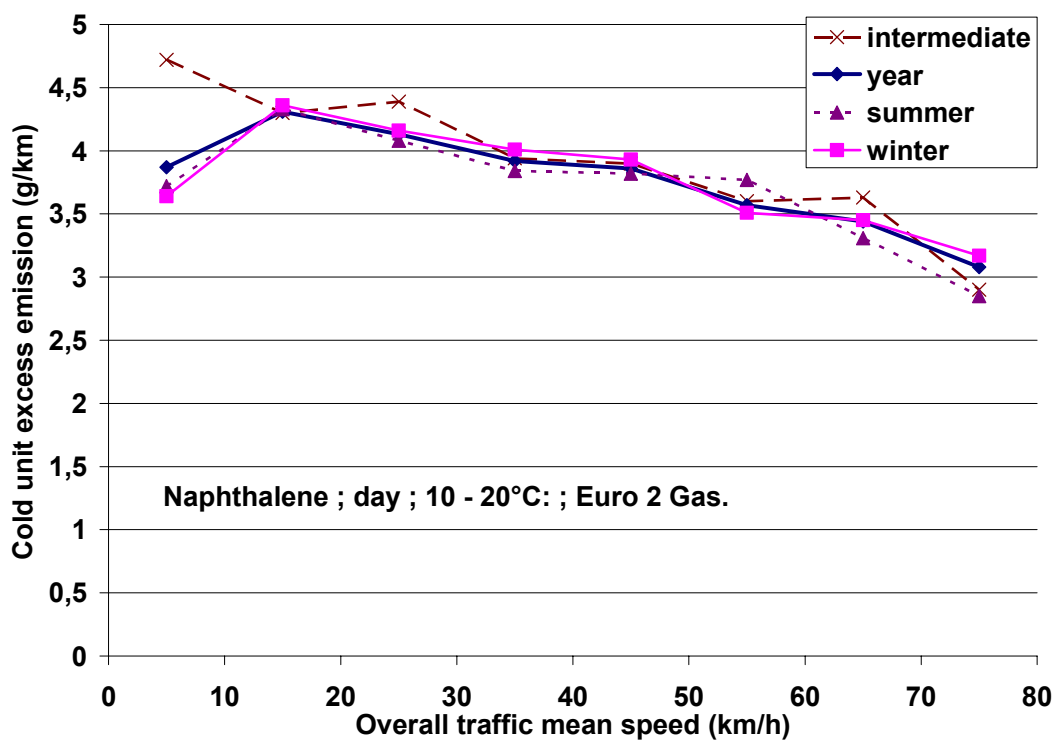


Figure 21: PAH Naphthalene cold unit excess emission according to season and average speed (ambient temperature: 10-20°C, gasoline Euro 2) ($\mu\text{g}/\text{km}$).

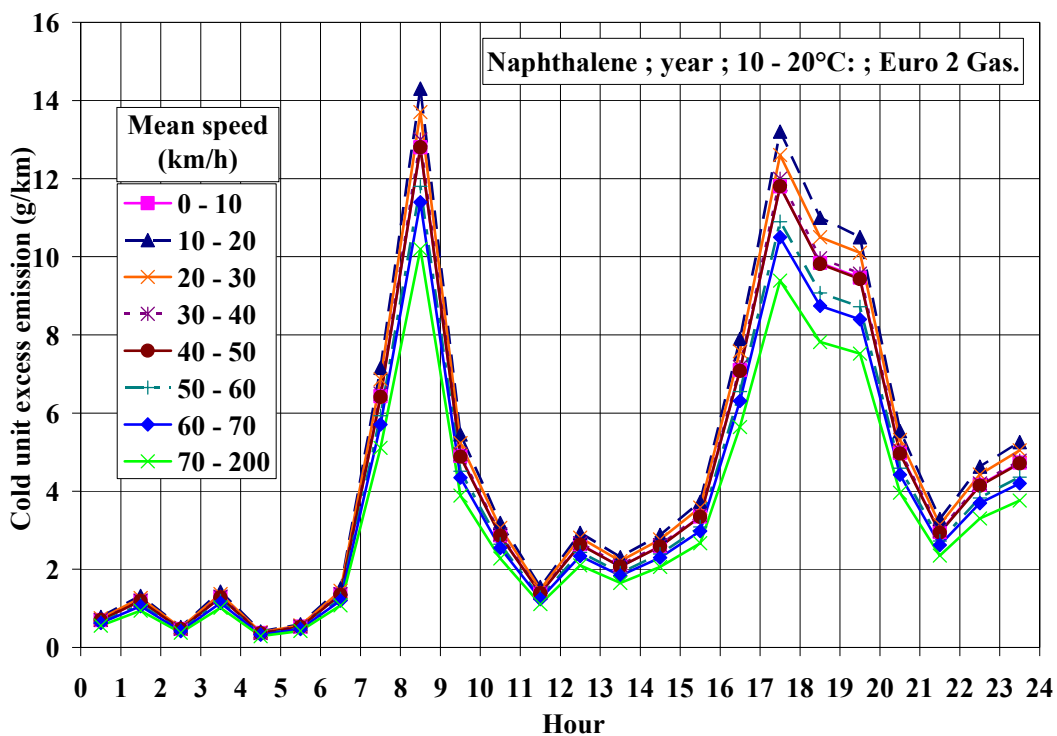


Figure 22: PAH Naphthalene cold unit excess emission according to hour and average speed (ambient temperature: 10-20°C, gasoline Euro 2) ($\mu\text{g}/\text{km}$)

Annex 39: Comparative influence of some parameters on VOC aggregated excess unit emission (model 3)

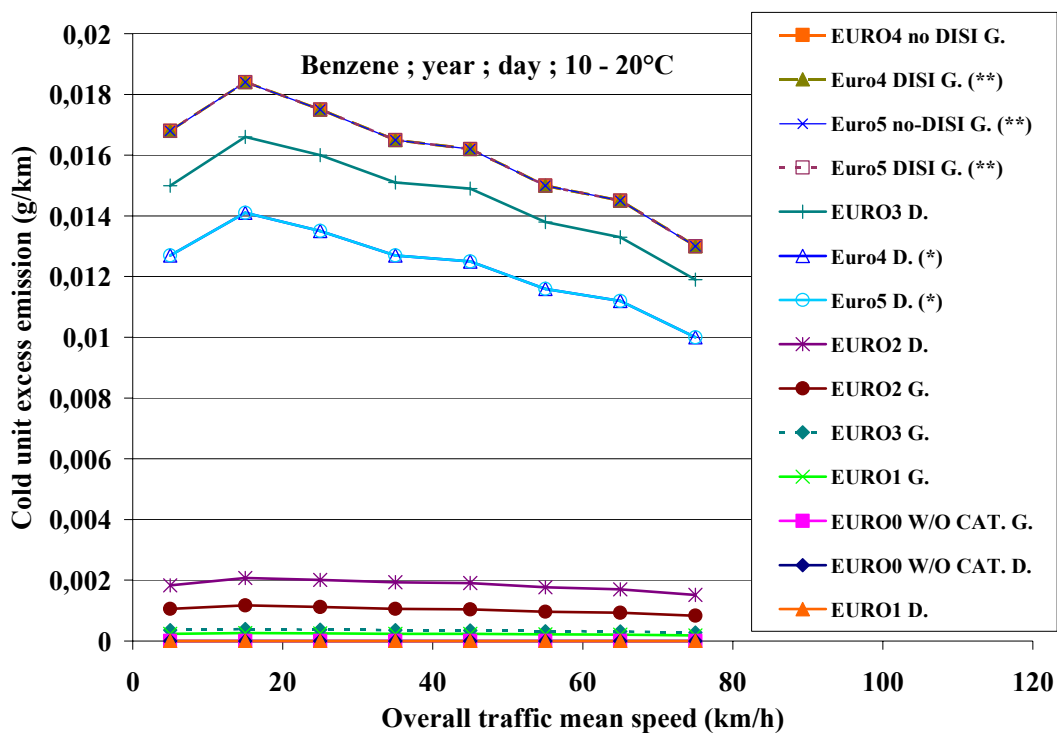


Figure 23: VOC Benzene cold unit excess emission according to average speed and vehicle technology (ambient temperature: 10-20°C, season: year, hour: whole day) (g/km).

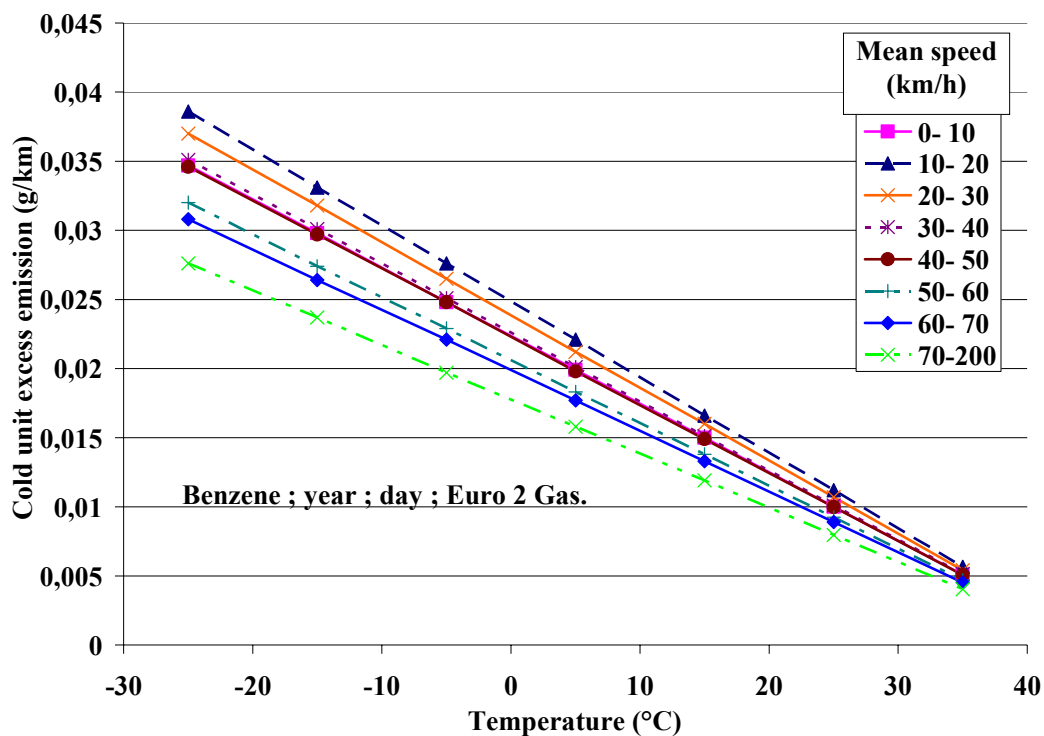


Figure 24: VOC Benzene cold unit excess emission according to ambient temperature and average speed for Euro 2 gasoline cars (season: year, hour: whole day) (g/km).

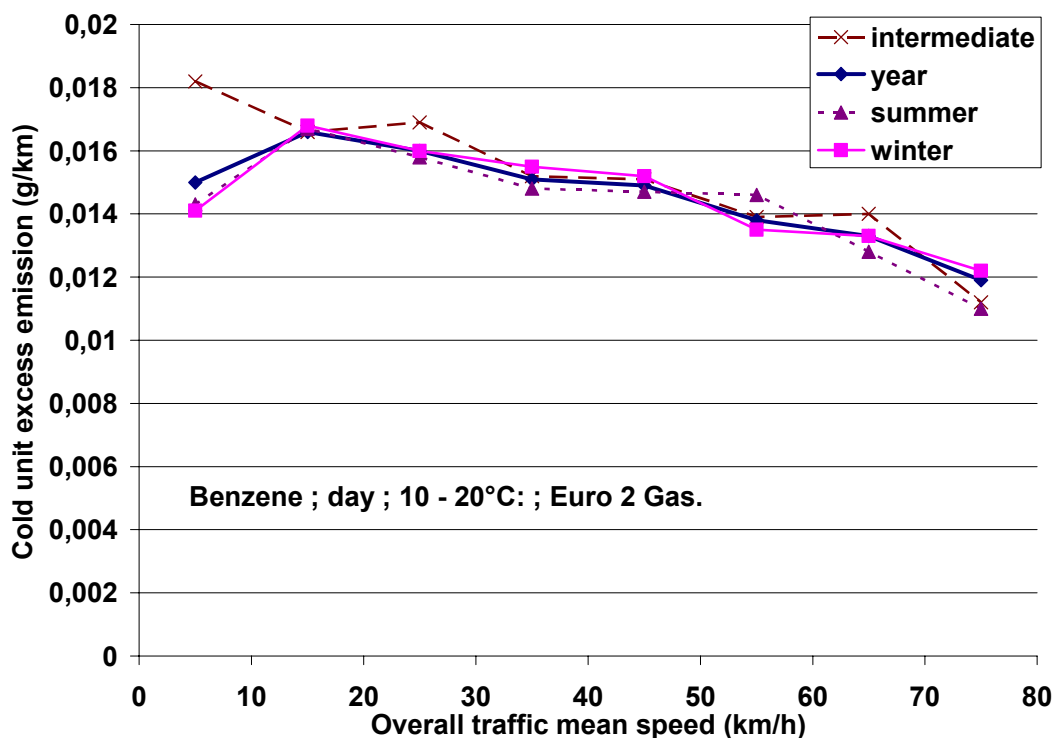


Figure 25: VOC Benzene cold unit excess emission according to season and average speed (ambient temperature: 10-20°C, gasoline Euro 2) (g/km).

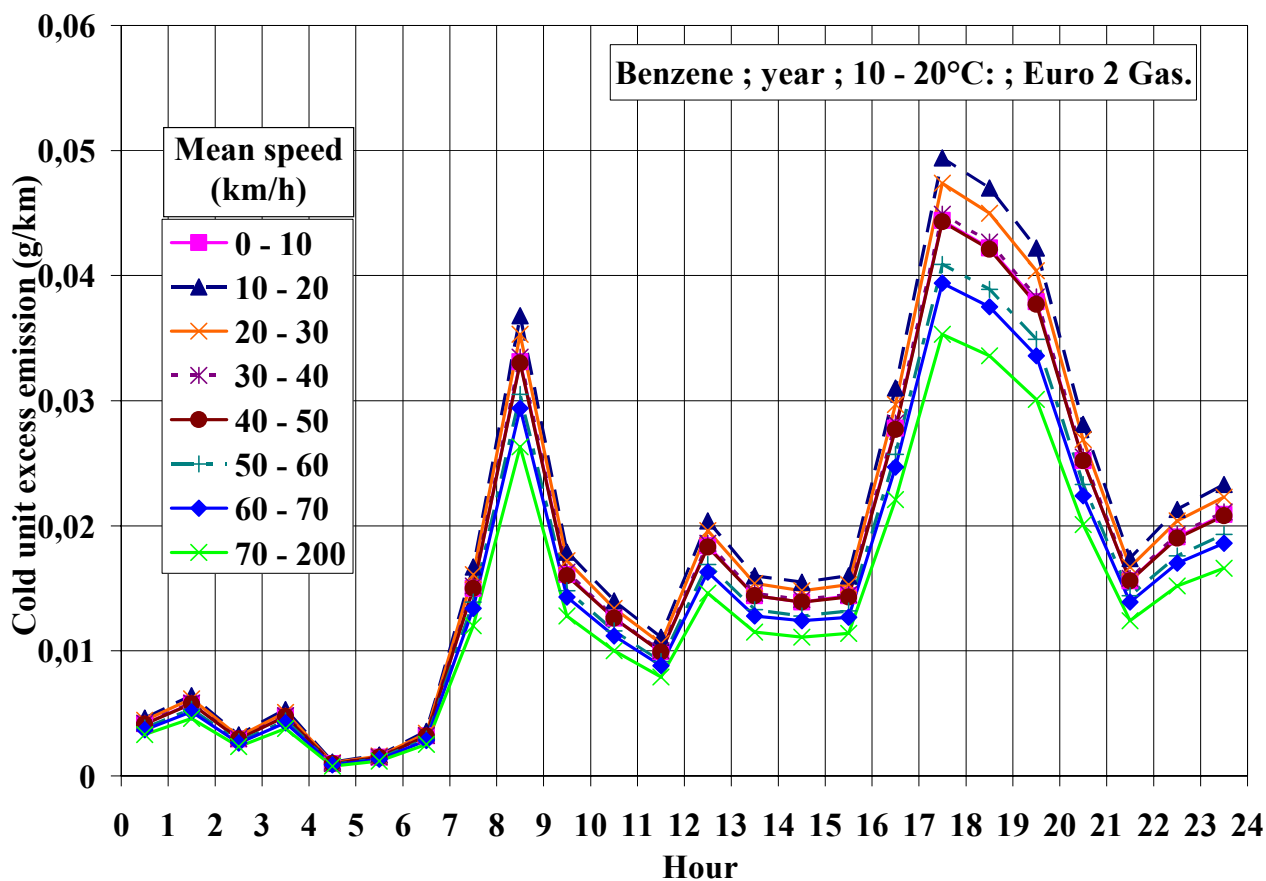


Figure 26: VOC Benzene cold unit excess emission according to hour and average speed (ambient temperature: 10-20°C, gasoline Euro 2) (g/km)

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7. References

- André M. (1989): Experimental study on the actual uses of the cars (EUREV). SAE International Congress and Exposition, Detroit, Michigan, SAE Paper 890874.
- André M. (1998): Construction de cycles de conduite représentatifs pour la mesure des émissions de polluants des véhicules (*Building-up of representative driving cycles for vehicle pollutant emission measurements*). Thèse, INSA Lyon, INRETS, Bron, France, 278 p.
- André M. (2004a): Real-world driving cycles for measuring cars pollutant emissions - Part A : The Artemis European driving cycles. INRETS report, Bron, France, n°LTE 0411, 97 p.
- André M. (2004b): The ARTEMIS European driving cycles for measuring car pollutant emissions. *Sci. Total Environ.*, n°334-335, p. 73-84.
- André M., R. Joumard, A.J. Hickman & D. Hassel (1994): Actual car use and operating conditions as emission parameters: derived urban driving cycles. *Sci. Total Environ.*, vol. 146/147, Elsevier Science, pp. 225-233.
- André M., U. Hammarström & I. Reynaud (1999): Driving statistics for the assessment of air pollutant emissions from road transport. INRETS report, LTE9906, Bron, France, 191 p., and <http://www.inrets.fr/infos/cost319/index.html>.
- Duboudin C. & C. Crozat (2002): Analyse de la méthodologie COPERT III (*Analysis of the Copert III methodology*). SCM report, Paris, 152 p.
- Eggleston H.S., D. Gaudioso, N. Gorissen, R. Joumard, R.C. Rijkeboer, Z. Samaras Z. & K.H. Zierock (1993): CORINAIR working group on emission factors for calculating 1990 emissions from road traffic - volume 1: Methodology and emission factors. CEC report, Luxembourg, 116 p.
- E.P.A. (1976): Environment Protection Agency, Federal Register AP 42, USA.
- GVF (1992): Dienst für Gesamtverkehrsfragen, Verkehrsverhalten in der Schweiz 1989. Mikrozensus 1989, GVF-Bericht 6/91, Bern, Switzerland.
- Hammarström U. (2002): Betydelsen av korta motoravstängningar och körtid för avgasemissioner från bensindrivna bilar med och utan katalysator. VTI meddelande 931, Sweden.
- Hassel D. & F.J. Weber (1996): Personal communication, TÜV Rheinland, Köln, Germany.
- Hassel D., P. Jost, F.-J. Weber, F. Dursbeck, K.-S. Sonnborn & D. Plettau (1993): Abgas-Emissionsfaktoren von Pkw in der Bundesrepublik Deutschland. TÜV Rheinland Gruppe report, n° UBA-FB 91-042, Köln, Germany, 250 p.
- Hausberger S. (1997): Globale Modellbildung für Emissions- und Verbrauchsszenarien im Verkehrssektor (Global Modelling of Scenarios Concerning Emission and Fuel Consumption in the Transport Sector); Dissertation am Institut für Verbrennungskraftmaschinen und Thermodynamik der TU-Graz; Graz,
- Hickman J., D. Hassel, R. Joumard, Z. Samaras & S. Sorenson (1999): MEET - Methodology for calculating transport emissions and energy consumption. European Commission, DG VII, ISBN 92-828-6785-4, Luxembourg, 362 p., and <http://www.inrets.fr/infos/cost319/index.html>.

-
- Joumard R. (ed.) (1999): COST 319 - Estimation of pollutant emissions from transport: Scientific state-of-the-art and network of European scientists. European Commission, DG Transport, n°EUR 18902, ISBN 92-828-6797-8, Luxembourg, 174 p., and <http://www.inrets.fr/infos/cost319/index.html>.
- Joumard R. & É. Sérié (1999): Modelling of cold start emissions for passenger cars. INRETS report, LTE 9931, Bron, France, 86 p.
- Joumard R., M. André, R. Vidon, P. Tassel & C. Pruvost (1999): Influence du cycle de conduite sur les émissions unitaires de polluants des voitures particulières. Rapport INRETS, n° LTE 9902, Bron, France, 122 p.
- Joumard R., L. Paturel, R. Vidon, J.P. Guittou, A.I. Saber & E. Combet (1990): Emissions unitaires de polluants des véhicules légers. INRETS report, n° 116, Bron, France, 120 p.
- Joumard R., P. Jost & J. Hickman (1995a): Influence of instantaneous speed and acceleration on hot passenger car emissions and fuel consumption. SAE International Congress and Exposition, Detroit, Michigan, SAE Paper 950928.
- Joumard R., R. Vidon, L. Paturel, C. Pruvost, P. Tassel, G. De Soete & A. Saber (1995b): Changes in pollutant emissions from passenger cars under cold start conditions. INRETS report, n° 197 bis, Bron, France, 75 p.
- Keller M., R. Evéquo, J. Heldstab & H. Kessler (1995): Émissions polluantes du trafic routier de 1950 à 2010. Cahier de l'environnement, n° 255, OFEFP, Berne, Switzerland, 430 p.
- Kyriakis N. A. & M. André (1998): Cold start of passenger cars. 4th int. scientific symp. *Transport and air pollution*, Avignon, France, 9-13 June 1997, and Int. J. Vehicle Design, vol. 20, Nos 1-4 (Special Issue), p. 137-146.
- Laguna J. P. & M.A. Robledo (1996): Report on emissions and fuel consumption in passenger cars at different starting conditions. INTA report, n° 96-00I244431-0036, Madrid, Spain, 20 p.
- Lenner M. (1994): Pollutant emissions from passenger cars. Influence of cold start, temperature and ambient humidity. VTI report, n° 400A, Linköping, Sweden, 42 p.
- Ntziachristos L. & Z. Samaras (2000): Copert III, Computer Program to Calculate Emissions from Road Transport. European Environment Agency, Copenhagen.
- Rijkeboer R. C. & H. Havenith (1996): Emissions during cold start and warm-up from passenger cars at low ambient temperatures. 17th International Vienna Engine Symposium, April 1996, VDI Verlag, Fortschritt-Berichte VDI, Reihe 12, n° 267.
- Sabate S. (1996): Methodology for calculating and redefining cold and hot start emissions, CARB report.
- Samaras Z., R. Coffey, N. Kyriakis, G. Koufodimos, F.J. Weber, D. Hassel & R. Joumard (1998): Emission factors for future road vehicles. LAT report, n°9829, Thessaloniki, Greece, 108 p., and <http://www.inrets.fr/infos/cost319/index.html>.
- Samaras Z., N. Kyriakis, M. Giannouli, E. Turlou & L. Ntziachristos (2001): Modeling of cold start emissions: Comparative assessment of existing methodologies. LAT report, Thessaloniki, Greece, 52 p.
- Schweizer Th., Ch. Rytz, N. Heeb & P. Mattrel (1997): Nachführung der Emissionsgrundlagen Strassenverkehr - Teilprojekt Emissionsfaktoren - Arbeiten 1996. EMPA Bericht-Nr. 161'150.
- Shayler P. J., N.J. Darnton & T. Ma (1996): The prediction of fuel consumption and emissions during engine warm-up. IMechE Int. Seminar on 'Application of powertrain and fuel technologies to meet emission standards', 24-26th June 1996, London, Paper C517-009.

-
- TNO (1993): Project in use compliance air pollution by cars in use. TNO Annual Report 1992-1993, TNO, The Netherlands, 85 p.
- Weilenmann M.F. (2001): Cold Start and cold ambient Emissions of Euro II cars. Proceedings 10th Int. Symp. Transport and Air Pollution, Boulder, USA.