

Calculation of Start Emissions in Air Quality Impact Assessment

General

For petrol vehicle, including: PC, MC, LGV3/4, PV4 & MC, all the start emissions are instantly released at the time when the engine starts. For LPG vehicle, including: Taxi, PLB & PV5 and diesel vehicle with Selective Catalytic Reduction Device (SCR), the “adjusted” start emissions are released over a longer period (e.g., 150m for LPG vehicle and 700m for diesel vehicle with SCR) after the engine starts. For details, please refer to Table 1.

Table 1 Spread Distance of Adjusted Start Emission

Vehicle Class	Fuel Type	Spread Distance of Adjusted Start Emission, Ds, (m) *
Any (with SCR)	Diesel	700
TAXI	LPG	150
PLB	LPG	150
PV5	LPG	150
PC	Petrol	0
LGV3/4	Petrol	0
PV4	Petrol	0
MC	Petrol	0

Remark (*) – the spread distance should count starting from the location where the engine starts.

Adjustment for Start Emissions

For LPG and diesel vehicle (with SCR), with idling at the beginning of the trip, please deduct the idling emission and spread out the adjusted start emissions evenly over the distance provided.

The idling emission part will be assumed to emit right on the spot. In case when the idling at the start is longer than K mins (e.g., 1 mins for FB with SCR; and 0.5 min for Taxi), only K mins of the idling will be used to adjust the start emission.

Details of K for different classes are shown in Table 2.

Table 2 Maximum Duration for adjusting start emission, "K"

Vehicle Class	Fuel Type	Maximum Duration for adjusting start emission, "K", (minutes)
Any (with SCR)	Diesel	1
TAXI	LPG	0.5
PLB	LPG	1
PV5	LPG	1
PC	Petrol	0
LGV3/4	Petrol	0
PV4	Petrol	0
MC	Petrol	0

For details, please refer to the following equations:

(1) [idling emission] = [idling EF] x [Actual Idling Duration at Start]

(2) [idling emission for the purpose of start emission adjustment] = [idling rate] x minimum(K, [Actual Idling duration at start])

(3) [Adjusted Start Emission] = maximum(0, [Start Emission] - [idling emission for the purpose of start emission adjustment])

and geographically,

(4) [adjusted start emission] ==> spread over Ds

(5) [idling emission] ==> emitted right at the spot

Idling Emission

As regards idling emissions, if spread distance, Ds, is larger than zero and soak time (duration of engine off prior to engine ignition) is longer than or equal to 4 hours for petrol/LPG vehicles or 1 hour for diesel SCR vehicles,

(6) [idling EF] = [cold idling EF]

Table of Cold Idling Emission Factors, which are based on local measurement data, is in **Annex A**

otherwise,

(7) [idling EF] = warm/hot idling rate.

Currently there is no local measurement data for warm/hot idling rate. Project proponent is advised to use data adopted by recognized international organizations. The source of reference of the adopted warm/hot idling emission factors should be provided.

Please note that according to the operation procedures specified in EPD's Practice Note for Professional Persons, **Control of Air Pollution in Semi-Confined Public Transport Interchanges Control of Air Pollution, ProPECC PN 1/98**, the operator of PTI shall instruct all drivers using the PTI to switch off the vehicle engines while waiting to minimize idling emissions. Hence, idling activities within PTI should be very small, if any, under normal circumstances. For details, please refer to:

https://www.epd.gov.hk/epd/sites/default/files/epd/english/resources/pub/publications/files/pn98_1.pdf. For other type of parking sites, if idling activities are involved, please refer to the approach detailed in this note to estimate idling emissions and adjust start emissions accordingly.

As for running exhaust emission, it should be included in the "start-distance" of the above.

Cold Idling EF Averaging Among Technology Groups (Tech Groups)

Note also that the cold idling EF provided is by Tech Groups in **Annex A** while the start EFs in EMFAC-HK output (e.g. emfac mode) are trip-weighted-average (among Tech Groups), users are advised to calculate the trip-weighted-average among Tech Groups of the cold idling EF when applying the above methodology as an estimation.

Start Emission Factor for Diesel Vehicle with SCR

For diesel vehicle with SCR, the above calculation will be a bit more complicated because not all vehicles have SCR and the start emission factor (EF) shown in the EMFAC-HK emfac mode output is a weighted average, which could be a lot smaller than the actual start EF of a SCR vehicle.

To spread the adjusted start emission correctly for these vehicles, please use the SCR-start-EF for the calculation and take only the fraction of SCR vehicles activities into account for start emission.

In order to allocate the amount of activity to diesel SCR vehicles and derive their EFs for different years, **Annex B** which contains information on the % SCR vehicles by technology groups is required. By using this information, one may obtain the % of SCR vehicles in each class for any assessment year (with help of EMFAC-HK's detail burden output, i.e. bdn file).

For example, the default EMFAC-HK (territory-wide average) result for the year 2024 is appended in **Annex C** for reference. The SCR % in each class can help allocating the right amount of activities. Also, to obtain the SCR-start EF for a class, one may divide the weighted average start EF for diesel vehicles of that class (i.e. "DSL" column of each class in emfac mode output) by the % of SCR among diesel vehicles. More specifically, for each class,

(8) [Number of trips of SCR vehicles] = [Number of trips of total non-electric Vehicles] x [% of SCR among total non-electric Vehicles]

(9) [Start EF of SCR Vehicles] = [Start EF of Diesel Vehicles] / [% of SCR Vehicles among Diesel Vehicles]

General remark: The above methodology and parameters are subject to review when more local data are available.

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Annex A Cold Idling Emission Factors

Cold[#] Idling Emission Factors

#Cold here means soak time greater than or equal to 4 hours for petrol/LPG vehicles or 1 hour for diesel SCR vehicles.

Class	Fuel Type	Pollutant	Emission Standard	Cold# Idling Emission Factor (g/s)
Taxi	LPG	NOx	Euro 2/3	0.0057
Taxi	LPG	NOx	Euro 4	0.0035
Taxi	LPG	NOx	Euro 5	0.0028
Taxi	LPG	NOx	Euro 6	0.0028
PLB	LPG	NOx	Euro III	0.0092
PLB	LPG	NOx	Euro IV	0.0039
PLB	LPG	NOx	Euro V	0.0039
PLB	LPG	NOx	Euro VI	0.0039
Taxi	LPG	THC	Euro 2/3	0.0187
Taxi	LPG	THC	Euro 4	0.0114
Taxi	LPG	THC	Euro 5	0.012
Taxi	LPG	THC	Euro 6	0.012
PLB	LPG	THC	Euro III	0.1073
PLB	LPG	THC	Euro IV	0.0752
PLB	LPG	THC	Euro V	0.0752
PLB	LPG	THC	Euro VI	0.0752
Taxi	LPG	CO	Euro 2/3	0.0187
Taxi	LPG	CO	Euro 4	0.0114
Taxi	LPG	CO	Euro 5	0.012
Taxi	LPG	CO	Euro 6	0.012
PLB	LPG	CO	Euro III	0.1073
PLB	LPG	CO	Euro IV	0.0752
PLB	LPG	CO	Euro V	0.0752
PLB	LPG	CO	Euro VI	0.0752
FBDD	Diesel	NOx	Euro II DPF & SCR	0.0737
FBDD	Diesel	NOx	Euro III DPF & SCR	0.0737
FBDD	Diesel	NOx	Euro IV	0.1535
FBDD	Diesel	NOx	Euro V	0.1535
FBDD	Diesel	NOx	Euro VI	0.0225
HGV9	Diesel	NOx	Euro IV - SCR	0.0144
HGV9	Diesel	NOx	Euro V - SCR	0.023
HGV9	Diesel	NOx	Euro VI	0.0037
HGV8	Diesel	NOx	Euro IV - SCR	0.0144
HGV8	Diesel	NOx	Euro V - SCR	0.023
HGV8	Diesel	NOx	Euro VI	0.0037
NFB9	Diesel	NOx	Euro IV - SCR	0.0573
NFB9	Diesel	NOx	Euro V - SCR	0.0474
NFB9	Diesel	NOx	Euro VI	0.0077
NFB8	Diesel	NOx	Euro IV - SCR	0.0573
NFB8	Diesel	NOx	Euro V - SCR	0.0474
NFB8	Diesel	NOx	Euro VI	0.0077
FBSD	Diesel	NOx	Euro IV	0.0573
FBSD	Diesel	NOx	Euro V	0.0474
FBSD	Diesel	NOx	Euro VI	0.0077

Class	Fuel Type	Pollutant	Emission Standard	Cold# Idling Emission Factor (g/s)
HGV7	Diesel	NOx	Euro V - SCR	0.0059
HGV7	Diesel	NOx	Euro V - DPF & SCR	0.0059
HGV7	Diesel	NOx	Euro VI	0.0059
NFB7	Diesel	NOx	Euro IV - SCR	0.0573
NFB7	Diesel	NOx	Euro VI	0.0077
LGV6	Diesel	NOx	Euro V - DPF & SCR	0.0028
LGV6	Diesel	NOx	Euro VI	0.001
NFB6	Diesel	NOx	Euro VI	0.001
PLB	Diesel	NOx	Euro VI	0.001
PV5	Diesel	NOx	Euro VI	0.001

Annex B Tech Groups Assumed to be equipped with Selective Catalytic Reduction (SCR) in EMFAC-HK V4.3

Vehicle Class	Fuel Type	Emission Standard	Tech Group Index	% of SCR in Tech Group
FBDD	Diesel	Euro II DPF & SCR Retrofitted	228	100%
FBDD	Diesel	Euro III DPF & SCR Retrofitted	229	100%
FBDD	Diesel	Euro IV	224	100%
FBDD	Diesel	Euro V	226	100%
FBDD	Diesel	Euro VI	215	100%
HGV9	Diesel	Euro IV - SCR	257	100%
HGV9	Diesel	Euro V - SCR	259	100%
HGV9	Diesel	Euro VI	255	100%
HGV8	Diesel	Euro IV - SCR	164	100%
HGV8	Diesel	Euro V - SCR	166	100%
HGV8	Diesel	Euro VI	162	100%
NFB9	Diesel	Euro IV - SCR	243	100%
NFB9	Diesel	Euro V - SCR	245	100%
NFB9	Diesel	Euro VI	241	100%
NFB8	Diesel	Euro IV - SCR	64	100%
NFB8	Diesel	Euro V - SCR	66	100%
NFB8	Diesel	Euro VI	62	100%
FBSD	Diesel	Euro V	116	56%
FBSD	Diesel	Euro VI	118	100%
HGV7	Diesel	Euro V - SCR	137	100%
HGV7	Diesel	Euro V - DPF & SCR	138	100%
HGV7	Diesel	Euro VI	135	100%
NFB7	Diesel	Euro IV - SCR	93	100%
NFB7	Diesel	Euro VI	105	100%
LGV6	Diesel	Euro V - DPF & SCR	139	100%
LGV6	Diesel	Euro VI	134	100%
NFB6	Diesel	Euro VI	104	100%
PLB	Diesel	Euro VI	194	100%
PV5	Diesel	Euro VI	204	100%

Remarks: 56% of SCR for Euro V FBSD will remain the same regardless of the assessment year

Annex C EMFAC-HK V4.3 Default (Territory-wide average) % of SCR vehicles by Vehicle Class in CY2024

Class	% of SCR among total non-electric Vehicles	% of SCR Vehicles among Diesel Vehicles
FBDD	99%	99%
FBSD	44%	44%
HGV7	52%	52%
HGV8	60%	60%
HGV9	50%	50%
LGV3	0%	0%
LGV4	0%	0%
LGV6	53%	53%
MC	0%	N.A.
NFB6	38%	38%
NFB7	45%	45%
NFB8	66%	66%
NFB9	67%	67%
PC	0%	0%
PLB	34%	66%
PV4	0%	0%
PV5	32%	41%
TAXI	0%	N.A.