Idling Emission Factors within Proposed Project

Background

While the latest EMFAC-HK model would generate a set of accurate prediction of the travelling vehicle emission factors, it was not dedicated to the calculation of idling emissions from vehicles, which account for most of the emissions from the Depot. Other more appropriate approach to estimating the idling emissions from the Depot was therefore sought.

Appendix of the *"Road Tunnels: Vehicle Emissions and Air Demand for Ventilation"* published by the Permanent International Association of Road Congresses (PIARC) in November 2004 presents the emission factors for different Euro engine types under different traveling speeds and gradients, including idling mode (i.e. v= 0). Emission factors presented in the document was adopted for deriving the idling emission factors for the proposed Project.

Methodology

In determining the composite idling emission factors in the assessment year, it takes account of the technology fraction of different engine types. Although the existing vehicles will most likely be replaced with vehicles complying with the standards for environmental friendly (EF) petrol cars or Euro V standard or above for commercial vehicles in prevailing policy, no implementation schedule is determined at this stage of this EIA study. In this connection, it was assumed that all the vehicles within the proposed Project to be EURO II on conservative side.

As the vehicle repair/ testing works involving idling emission would be come-and-go basis, maximum engine on-time per each vehicle is assumed to be maximal **15 minutes** for conservative approach. Same assumptions were depolyed for washing activity of RCVs by using automatic vehicle washing machine. The number of vehicles under repair/ testing/ washing is assumed to be max. **20** at each time as it is limited by the number of repair/ testing/ washing bays. Although the repair/ testing period for a single vehicle may last for about 2 to 3 hours, **15-minute** idling emissions were assumed in each hour of the period for each vehicle throughout all working hours every day as conservative approach.

During water refilling of street washing vehicles and manual washing of RCVs, engine needs not to be turned on and therefore no engine on-time was assumed.

Annexes A to C presents the detailed calculations of emission rates and locations of the sources assumed. The floors that potentially emit idling emissions include Level 1, Level 3M and Level 5 where FEHD Depot, HKPF PVP&EC and EMSD Depot locate.

On average, such engine running would be repeated at an interval of two to three hours during the 10 hours of major maintenance works (i.e. 08:00 - 18:00). The operation schedule is therefore assumed to 100% from 08:00 to 18:00 every day, as shown in **Annex D.**

Table 1
Vehicle Inventory

	Vehicle Type								
	General Purpose Vehicle					Special Purpose Vehicle			
	Private Car	Motor Cycle	Light Bus/ Large Van	Medium Van	Light Truck	Refuse Collection Vehicle	Street Washing Vehicle	Grab Lorry	Total
Daily In-bound Traffic	23	23	71	32	15	16	4	2	186
Daily Out-bound Traffic	26	25	66	29	15	12	5	1	179
Total	49	48	137	61	30	28	9	3	365
%	13.4%	13.2%	37.5%	16.7%	8.2%	7.7%	2.5%	0.8%	

Equation 1
Emission Rate by Heavy Goods Vehicle

$$Q = q_{ex} \times f_m \times f_h + q_{ne}$$

where

Q = emission for NOx or particulate matter (g/hr veh)

qex = basic emission factor, depending on average speed and road gradient for a heavy duty vehicle with a total mass of 10 tonnes (m2/hr veh)

qne = emission factor for non-exhaust particulate matter

fm = mass factor

fh = altitude factor

Table 2
Idling NOx Idling Emission

Activity	Tier [Note 1]	q_{ex} [Note 2]	f_m [Note 3]	f_h [Note 4]	q_{ne} [Note 5]	Emission Rate (g/hr)	Operation Time (s)	Corrected NOx Emission Rate (g/hr) per Vehicle	Corrected NOx (g/s) Emission Rate per Vehicle	Max. No. of Vehicles	Corrected NOx (g/s)
Vehicle Washing at FEHD Depot	Euro II	40.8	2.5	1	0	102	900	25.5	0.00708	1	0.0070833
Vehicle Repair/ Testing at HKPF PVP&EC	Euro II	40.8	2.5	1	0	102	900	25.5	0.00708	5	0.0354167
Vehicle Repair/ Testing at EMSD Depot	Euro II	40.8	2.5	1	0	102	900	25.5	0.00708	14	0.0991667
										20	0.1416667

Note 1	Euro II idling emission factor from heavy good vehicles for NOx was assumed as conservative approach.
Note 2	Basic idling emission factor, Tables II.3-46 to II.3-50, Appendix 2 of Road Tunnels: Vehicle Emission and Air Demand for Ventilation", PIARC, November 2004.
Note 3	Mass correction factor, Table II.3-51, Appendix 2 of "Road Tunnels: Vehicle Emission and Air Demand for Ventilation", PIARC, November 2004.
Note 4	Altitude factor, Tables II.3-59 Appendix 2 of "Road Tunnels: Vehicle Emission and Air Demand for Ventilation", PIARC, November 2004.
Note 5	Emission factor for non-exhaust particular matter, Tables III.3-2 of "Road Tunnels: Vehicle Emission and Air Demand for Ventilation", PIARC, November 2004.

Table 3

Idling PM Idling Emission

Activity	Tier [Note 1]	q_{ex} [Note 2]	f_m [Note 3]	f_h [Note 5]	q_{ne} [Note 6]	MIRA Correlation Factor (m^2/g) [Note4]	Emission Rate (g/hr)	Operation Time (s)	Corrected PM Emission Rate (g/hr) per Vehicle	Corrected PM (g/s) Emission Rate per Vehicle	Max. No. of Vehicles	Corrected PM (g/s) [Note 7]
Vehicle Washing at FEHD Depot	Euro II	8.4	2.3	1	0	4.7	4.11	900	1.028	0.000285	1	0.000285
Vehicle Repair/ Testing at HKPF PVP&EC	Euro II	8.4	2.3	1	0	4.7	4.11	900	1.028	0.000285	5	0.001427
Vehicle Repair/ Testing at EMSD Depot	Euro II	8.4	2.3	1	0	4.7	4.11	900	1.028	0.000285	14	0.003996
											20	0.005709

Note 1   Euro II idling emission factor from heavy good vehicles for NOx was assumed as conservative approach.

Note 2   Basic emission factor, Tables II.3-52 to II.3-56, Appendix 2 of "Road Tunnels: Vehicle Emission and Air Demand for Ventilation", PIARC, Nov
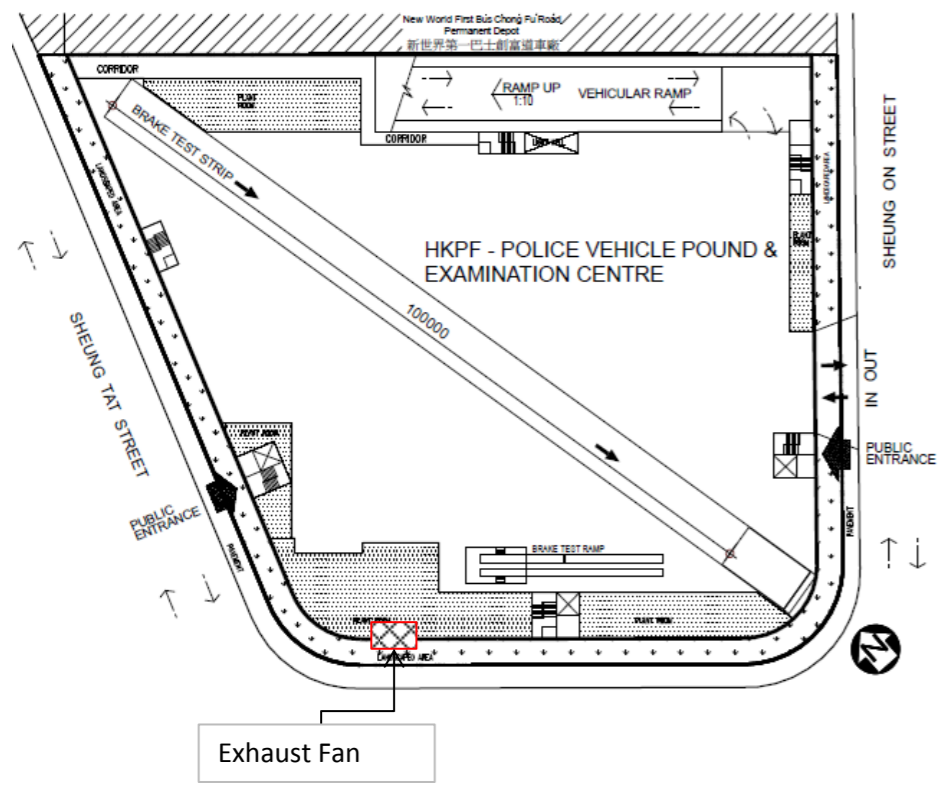
Note 3   Mass correction factor, Table II.3-57, Appendix 2 of "Road Tunnels: Vehicle Emission and Air Demand for Ventilation", PIARC, November 20

Note 4   A conversion factor between particulate emission in g and turbidity is given by the MIRA-correlation factor 1g =4.7m2 (see page 25 of "Road Tunnels: Vehicle Emission and Air Demand for Ventilation").
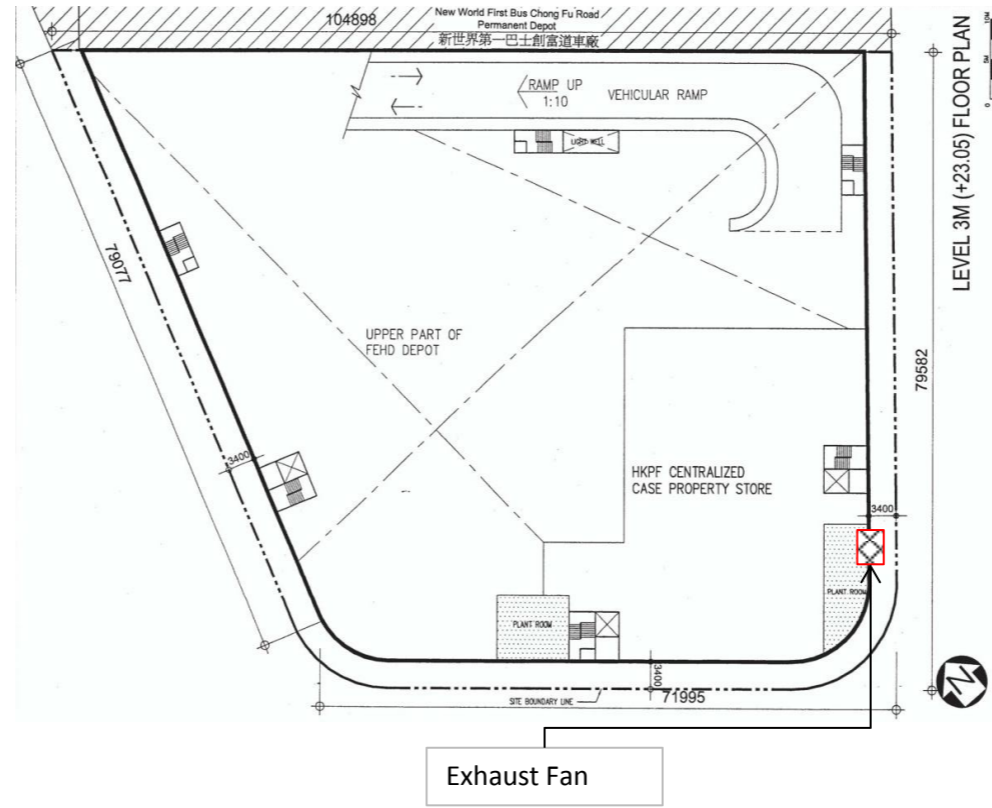
Note 5   Altitude factor, Tables II.3-59, Appendix 2 of "Road Tunnels: Vehicle Emission and Air Demand for Ventilation", PIARC, November 2004.

Note 6   Emission factor for non-exhaust particular matter, Tables III.3-2 of "Road Tunnels: Vehicle Emission and Air Demand for Ventilation", PIARC, November 2004.
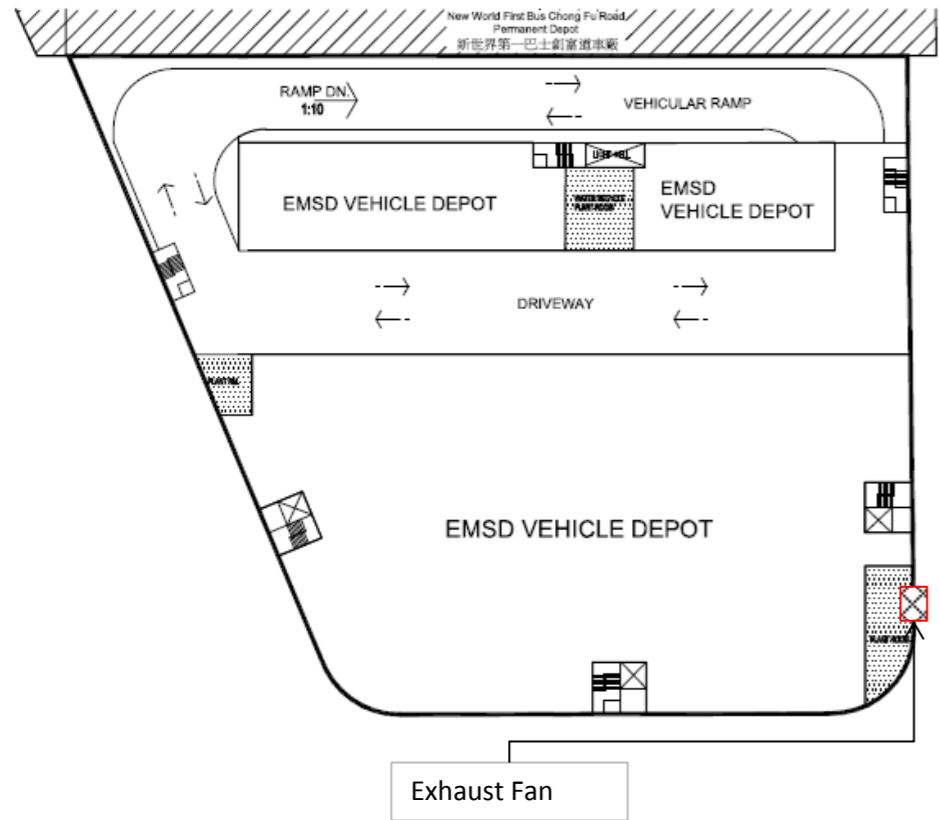
Level 1

Exhaust Fan

Level 3M

LEVEL 3M (+23.05) FLOOR PLAN

HKPF CENTRALIZED CASE PROPERTY STORE

UPPER PART OF FEHD DEPOT

Exhaust Fan

Level 5

EMSD VEHICLE DEPOT

EMSD VEHICLE DEPOT

DRIVEWAY

EMSD VEHICLE DEPOT

Exhaust Fan

Hour	NOx Operation Factor	RSP/ FSP Operation Factor
0:00	0	0
1:00	0	0
2:00	0	0
3:00	0	0
4:00	0	0
5:00	0	0
6:00	0	0
7:00	0	0
8:00	1	1
9:00	1	1
10:00	1	1
11:00	1	1
12:00	1	1
13:00	1	1
14:00	1	1
15:00	1	1
16:00	1	1
17:00	1	1
18:00	0	0
19:00	0	0
20:00	0	0
21:00	0	0
22:00	0	0
23:00	0	0