Emission Inventory for Gaseous Pollutant

Source	Source ID	Type	X	Y	Exit Temperature	Exit velocity	Internal diameter	Stack Height	Emission Rate	
									NOx	RSP
			(m)	(m)	(K)	(m/s)	(m)	(m)	(g/s)	(g/s)
ASB Bio-diesel [1]	E1	POINT	845667	816217	1088	0.54	0.96	12.50	1.470E-02	-
	E2	POINT	845738	816173	373	7	0.75	31.00	6.636E-01	3.318E-02
Hong Kong Aero Engine Service [2]	E4	POINT	846001	815731	325	16.4	15.9	40.00	1.407E+02	3.477E-01
TKO Industrial Estate [3]	E6	POINT	846080	816472	463	9	1.2	16.70	2.192E-01	1.096E-02
	E7	POINT	846066	816334	463	9	1.2	16.70	2.192E-01	1.096E-02
	E8	POINT	846035	816258	463	9	1.2	16.70	2.192E-01	1.096E-02
	E9	POINT	846025	816860	463	9	1.2	16.70	2.192E-01	1.096E-02
	E10	POINT	846147	816857	463	9	1.2	16.70	2.192E-01	1.096E-02
	E11	POINT	845975	816686	463	9	1.2	16.70	2.192E-01	1.096E-02
	E12	POINT	846064	816686	463	9	1.2	16.70	2.192E-01	1.096E-02
	E13	POINT	845981	816451	463	9	1.2	16.70	2.192E-01	1.096E-02
	E14	POINT	845582	815983	463	9	1.2	16.70	2.192E-01	1.096E-02
	E15	POINT	845714	815982	463	9	1.2	16.70	2.192E-01	1.096E-02
	E16	POINT	845942	816156	463	9	1.2	16.70	2.192E-01	1.096E-02
	E17	POINT	846394	816730	463	9	1.2	16.70	2.192E-01	1.096E-02
	E18	POINT	846416	816639	463	9	1.2	16.70	2.192E-01	1.096E-02
	E19	POINT	846444	816524	463	9	1.2	16.70	2.192E-01	1.096E-02
	E20	POINT	846087	815971	463	9	1.2	16.70	2.192E-01	1.096E-02
	E21	POINT	845911	815858	463	9	1.2	16.70	2.192E-01	1.096E-02
Television Broadcasts Limited [4]	EP1	POINT	846129	815433	463	9	0.2	5.00	1.739E-02	8.696E-04
	EP2	POINT	846129	815434	463	9	0.2	5.00	1.739E-02	8.696E-04
	EP3	POINT	846151	815482	463	9	0.3	25.57	4.090E-02	2.045E-03
	EP4	POINT	846151	815481	463	9	0.3	25.57	4.520E-02	2.260E-03
	EP5	POINT	846151	815483	463	9	0.3	25.57	4.520E-02	2.260E-03
	EP6	POINT	846150	815482	463	9	0.35	25.57	5.584E-02	2.792E-03
	EP7	POINT	846150	815483	463	9	0.35	25.57	6.616E-02	3.308E-03
	EP8	POINT	846144	815572	463	9	0.25	7.20	4.345E-02	2.173E-03
	EP9	POINT	846143	815572	463	9	0.25	7.20	4.345E-02	2.173E-03
Sai Tso Wan Landfill [5]	FS1	POINT	845946	817672	1323	0.24	2.8	18.30	4.388E-02	1.500E-03
TKO Landfill [5]	TO1	POINT	846449	816953	1123	0.13	1.9	19.00	1.806E-03	3.611E-04
	TO2	POINT	846440	816926	1123	0.061	2.75	20.00	1.941E-02	3.611E-04

Note:

[1] Detailed calculations of emission factors are given in "Emission factor for Biodiesel Plant in Tseung Kwan O Industrial Estate"

[2] Detailed calculations of emission factors are given in "Sensitivity Test on Pollutant Emissions from Hong Kong Aero Engine Service Ltd". The maximum emission rates are selected from the sensitivity test as a conservative assessment. Chimney information are referenced from the approved EIA Studies for "Development of a Biodiesel Plant at Tseung Kwan O Industrial Estate" (AEIAR-131/2009) and the information provided by the operator.

[3] Detailed calculations of emission factors are given in "Emission factor for Other Chimneys in Tseung Kwan O Industrial Estate". Chimney information are referenced from the approved EIA Studies for "Development of a Biodiesel Plant at Tseung Kwan O Industrial Estate" (AEIAR-131/2009) and "Fill Bank at Tseung Kwan O Area 137" (AEIAR-060/2002).

[4] Detailed calculations of emission factors are given in "Emission factor for Television Broadcasts Limited". Information on the exit temperature and velocity are referenced from the approved EIA Study for "Fill Bank at Tseung Kwan O Area 137" (AEIAR-060/2002)

[5] Referenced from the approved EIA Study for "Further Development of Tseung Kwan O Feasibility Study" (AEIAR-092/2005)

Emission factor for Biodiesel Plant in Tseung Kwan O Industrial Estate

Chimneys (Fuel Oil Combustion)

With reference to the Air Pollution Control (Fuel Restriction) Regulation

Emission Factors (Fuel Oil Combustion)

Emissoin Rate (g/L)	
NO_X	RSP
2.4	0.12

Chimneys (Biogas Combustion)

With reference to the approved EIA Study for "Development of a Biodiesel Plant at Tseung Kwan O Industrial Estate" (AEIAR-131/2009):

NOx Concentration Limit at the Exhaust = 37.6 mg/m^3

Given

Operation Hour =	24	hour per day	
Fuel Consumption =	895.8	kg/hour	[Referenced from the approved EIA Study for "Development of a Biodiesel Plant at Tseung Kwan O Industrial Estate" (AEIAR-131/2009)]
Fuel Density =	0.9	kg/L	
Total Exhaust from Biogas Combustion =	1407	m3/hour	

Source ID	Exit Temperature	Exit velocity	Internal diameter	Stack Height	Emissoin Rate (g/s)		Remark
	(K)	(m/s)	(m)	(m)	NO_X	RSP	
E1	1088	0.54	0.96	12.5	0.0147	-	Biogas Combustion
E2	373	7	0.75	31	0.6636	0.0332	Oil Combustion

Sensitivity Test on Pollutant Emissions from Hong Kong Aero Engine Service Ltd

NOx

Aircraft Model	Engine Model	NOx Emission from each Testing Cycle (60 minutest) [5]							
		Take-off mode for 5 minutes			Climb out mode for 55 minutes			Emission rate	
		Fuel Flow (kg/s)	EI (g/kg)	Emission (kg)	Fuel Flow (kg/s)	EI (g/kg)	Emission (kg)	(kg/hr)	(g/s)
Airbus A330-300 [1]	TRENT 772B-60	3.2	34.4	33.0	2.6	26.4	225.1	258	71.7
Airbus A340-600 [1]	TRENT 556-61	2.2	44.9	30.2	1.8	32.8	197.8	228	63.3
Airbus A380-800 [2]	TRENT900	3.1	52.0	48.5	2.5	40.4	329.6	378	105.0
	GP7200	3.1	52.0	48.5	2.5	40.4	329.4	378	105.0
Boeing 747-400 [3]	CF6-80C2B1F	2.4	24.9	18.1	2.0	19.7	129.0	147	40.9
	RB211-524H-T	2.8	31.2	26.3	2.2	23.2	169.9	196	54.5
	RB211-524G-T	2.6	28.4	22.3	2.1	21.8	149.6	172	47.8
Boeing 777-300 [1]	Trent 892	3.9	45.7	53.6	3.1	33.3	340.7	394	109.5
Boeing 777-300ER [4]	GE90-115B	4.7	50.3	70.8	3.7	36.0	435.8	507	140.7

RSP

Aircraft Model	Engine Model	RSP Emission from each Testing Cycle (60 minutest) [5]							
		Take-off mode for 5 minutes			Climb out mode for 55 minutes			Emission rate	
		Fuel Flow (kg/s)	EI (g/kg)	Emission (kg)	Fuel Flow (kg/s)	EI (g/kg)	Emission (kg)	(kg/hr)	(g/s)
Airbus A330-300 [1]	TRENT 772B-60	3.2	0.049	0.047	2.6	0.050	0.424	0.471	0.131
Airbus A340-600 [1]	TRENT 556-61	2.2	0.050	0.034	1.8	0.050	0.303	0.337	0.093
Airbus A380-800 [2]	TRENT900	3.1	0.057	0.053	2.5	0.063	0.511	0.564	0.157
	GP7200	3.1	0.057	0.053	2.5	0.063	0.511	0.564	0.157
Boeing 747-400 [3]	CF6-80C2B1F	2.4	0.076	0.055	2.0	0.065	0.425	0.480	0.133
	RB211-524H-T	2.8	0.140	0.118	2.2	0.155	1.134	1.252	0.348
	RB211-524G-T	2.6	0.142	0.111	2.1	0.157	1.078	1.189	0.330
Boeing 777-300 [1]	Trent 892	3.9	0.058	0.068	3.1	0.063	0.646	0.714	0.198
Boeing 777-300ER [4]	GE90-115B	4.7	0.062	0.087	3.7	0.054	0.656	0.743	0.206

Note:

[1] Engine model is referenced from Table B-2 in the Attachment B to Appendix 1 of ICAO Air Quality Manual.

[2] Engine model is referenced from the manufacturer's website. (Airbus - http://www.airbus.com/aircraftfamilies/passengeraircraft/a380family/a380-800/specifications/)

[3] Engine model (CF-680C2B1F) is from Table B-2 in the Attachment B to Appendix 1 of ICAO Air Quality Manual, while engine models (RB211-524G-T & RB211-524H-T) are referenced from website of Hong Kong Aero Engine Services Limited (http://www.haesl.com/eng/engine_rb211-524.asp)

[4] Engine model is referenced from the manufacturer's website. (Boeing - http://www.boeing.com/commercial/777family/pf/pf_lrproduct.html)

[5] The test cycle (i.e. Take-off mode for 5 minutes and Climb-out mode for 55 minutes) is referenced from the approved EIA Study "Environmental Impact Assessment HAECO/HAESL Facilities at Tseung Kwan O" (EIA-147/BC). Fuel flow and Emission Index (EI) information are based on the EDMS v5.1.3 developed by the Federal Aviation Administration (FAA) and ICAO Air Quality Manual.

Emission factor for Other Chimneys in Tseung Kwan O Industrial Estate

Chimneys (Fuel Oil Combustion)

With reference to the Air Pollution Control (Fuel Restriction) Regulation

Emission Factors

Emissoin Rate (g/L)	
NO_X	RSP
2.4	0.12

Given

Operation Hour =	10	hour per day	
Max. Fuel Consumption Allowable =	52.6	m3/day	(Daily diesel consumption allocation avilable for
=	52600	L/day	
=	5260	L/hour	

Source ID	Exit Temperature	Exit velocity	Internal diameter	Stack Height	Emissoin Rate (g/s)	
	(K)	(m/s)	(m)	(m)	NO_X	RSP
E6	463	9	1.2	16.7	0.2192	0.0110
E7	463	9	1.2	16.7	0.2192	0.0110
E8	463	9	1.2	16.7	0.2192	0.0110
E9	463	9	1.2	16.7	0.2192	0.0110
E10	463	9	1.2	16.7	0.2192	0.0110
E11	463	9	1.2	16.7	0.2192	0.0110
E12	463	9	1.2	16.7	0.2192	0.0110
E13	463	9	1.2	16.7	0.2192	0.0110
E14	463	9	1.2	16.7	0.2192	0.0110
E15	463	9	1.2	16.7	0.2192	0.0110
E16	463	9	1.2	16.7	0.2192	0.0110
E17	463	9	1.2	16.7	0.2192	0.0110
E18	463	9	1.2	16.7	0.2192	0.0110
E19	463	9	1.2	16.7	0.2192	0.0110
E20	463	9	1.2	16.7	0.2192	0.0110
E21	463	9	1.2	16.7	0.2192	0.0110

Emission factor for Television Broadcasts Limited

Chimneys (Fuel Oil Combustion)

With reference to the Air Pollution Control (Fuel Restriction) Regulation

Emission Factors

Emissoin Rate (g/L)	
NO_X	RSP
2.4	0.12

Given

Operation Frequency = 15 minutes bi-weekly (assumed to be 15mins per hour as worst-case scenario)

Fuel Density = 0.85 kg/L

Source ID	Fuel Consumption Rate *	Fuel Consumed in 15 mins	Exit Temperature	Exit velocity	Internal diameter *	Stack Height *	Emissoin Rate (g/s)	
	(kg/hr)	(kg/hr)	(K)	(m/s)	(m)	(m)	NO_X	RSP
EP1	88.7	22.2	463	9	0.2	5	0.0174	0.0009
EP2	88.7	22.2	463	9	0.2	5	0.0174	0.0009
EP3	208.6	52.2	463	9	0.3	25.57	0.0409	0.0020
EP4	230.5	57.6	463	9	0.3	25.57	0.0452	0.0023
EP5	230.5	57.6	463	9	0.3	25.57	0.0452	0.0023
EP6	284.8	71.2	463	9	0.35	25.57	0.0558	0.0028
EP7	337.4	84.4	463	9	0.35	25.57	0.0662	0.0033
EP8	221.6	55.4	463	9	0.25	7.2	0.0435	0.0022
EP9	221.6	55.4	463	9	0.25	7.2	0.0435	0.0022

Note * : Details are provided by the operator.