Appendix 4L

Emission of Kai Tak Cruise Terminal

Appendix 4L

CE 38/2008(HY)
Kai Tak Development - Trunk Road T2 and Infrastructure at South Apron
Investigation, Design and Construction
Emission of Kai Tak Cruise Terminal

Cruise Vessel	Event	Source ID	X-Coodinate	Y-Coordinate	Stack Height (m)	Stack Temp (K)	Stack Diameter (m)	Stack Exit Velocity (m/s)	NOx (g/s)	RSP (g/s)
Panamax	Hotelling	H1a	839974.7	818474.4	52	537	1.9	24.6	21.0698	2.1465
Panamax	Hotelling	H1	839974.7	818474.4	52	537	1.9	24.6	42.1395	4.2930
Panamax	Hotelling	H2a	839683.2	818756.5	52	537	1.9	24.6	21.0698	2.1465
Panamax	Hotelling	H2	839683.2	818756.5	52	537	1.9	24.6	42.1395	4.2930

Tug Boat	Event	Source ID	X-Coodinate	Y-Coordinate	Stack Height (m)	Stack Temp (K)	Stack Diameter (m)	Stack Exit Velocity (m/s)	NOx (g/s)	RSP (g/s)
Tug Boat_1		T1c	839917.8	818487.5	10	523	1	1.7	0.7177	0.0574
Tug Boat_2		T1d	839989.9	818418.2	10	523	1	1.7	0.7177	0.0574
Tug Boat_3		T2c	839626.3	818769.6	10	523	1	1.7	0.7177	0.0574
Tug Boat_4		T2d	839698.4	818700.2	10	523	1	1.7	0.7177	0.0574

Emission Factors for Cruise Terminal

Marine Emission from Cruise Ships

Emission Rate = Engine Power x Loading Factor x Emission Factor x Low Load Adjustment Factor

Type of Engine	Engine Power, kW [1]	Loading Factor [2]	Emission Factor, g/kWh [3]		Low Load Factor [4]	
		Hotelling	NOx	RSP	NOx	RSP
Propulsion Engine	88000	0	14.00	1.43	4.63	7.29
Auxiliary Engine	24464	0.416	14.70	1.44	N/A	N/A
Boiler	1000	1	2.10	0.80	N/A	N/A

Note:

[1] Engine Power for the Propulsion Engine - Referred to the approved KTD EIA Report (AEIAR-130/2009) - Appendix 6.4.
Engine Power for the Auxiliary Engine - According to Table 3-20 of the Study on Marine Vessels Emissions Inventory, February 2012:
Auxiliary Engine Power = 88000 x 0.278 = 24464 kW.
Engine Power for the Boiler - referred from Table 3-23 of the Study on Marine Vessels Emissions Inventory, February 2012 (assuming the passenger carrying capacity is more than 2600 for conservative approach).

[2] Loading Factor for the Propulsion Engine - Referred to Table 3-18 of the Study on Marine Vessels Emissions Inventory, February 2012.
Loading Factor for the Auxiliary Engine - referred to Table 3-21 of the Study on Marine Vessels Emissions Inventory, February 2012.
Loading Factor for the Boiler - Assumed 100% loading as a conservative approach.

[3] Emission Factor for the Propulsion Engine - Referred to Table 3-27 of the Study on Marine Vessels Emissions Inventory, February 2012 (assuming the engine type of Medium Speed Diesel Engine and use of Heavy Fuel Oil, according to KTD EIA).
Emission Factor for the Auxiliary Engine - Referred to Table 3-28 of the Study on Marine Vessels Emissions Inventory, February 2012 (assuming the use of Heavy Fuel Oil for conservative approach).
Emission Factor for the Boiler - Referred from Table 3-29 of the Study on Marine Vessels Emissions Inventory, February 2012 (assuming the use of Heavy Fuel Oil for conservative approach).

[4] Low Load Adjustment Factor - Referred to Table 3-30 of the Study on Marine Vessels Emissions Inventory, February 2012.

Emission Rate of Hotelling

Pollutant	Emission Rate (kg/hr)				Emission Rate for 60 mins [6]	Emission Rate for 30 mins [7]
	Propulsion Engine	Auxiliary Engine	Boiler	Total		
NOx	0.00	149.60	2.10	151.70	42.14	21.07
RSP	0.00	14.65	0.80	15.45	4.29	2.15

Note:

[6] Referred to the approved KTD EIA Report, it is assumed that the cruise vessel is not equipped with cold-ironing and hence hotelling emission is anticipated throughout the hotelling period.

[7] Referred to the approved KTD EIA Report, the hotelling period of 30 minutes during the berthing period is adopted.

Marine Emission from Tugboat (assuming all Rivertrade tugboat)

Emission Rate = Engine Power x Loading Factor x Emission Factor

Type of Engine	Engine Power, kW [1]	Loading Factor [2]	Emission Factor, g/kWh [3]	
		Maneuvering	NOx	RSP
Propulsion Engine	2371	0.30	13.20	0.72
Auxiliary Engine	220	0.43	10.00	0.40

Note:

[1] Engine Power fo the Propulsion Engine - Referred to Table 4-5 of the Study on Marine Vessels Emissions Inventory, February 2012.
Engine Power for the Auxiliary Engine - Referred to Table 4-6 of the Study on Marine Vessels Emssions Inventory, February 2012.

[2] Loading Factor for the Propulsion Engine - Referred to Table 4-7 of the Study on Marine Vessels Emissions Inventory, February 2012.
Loading Factor for the Auxiliary Engine - Referred to Table 4-10 of the Study on Marine Vessels Emissions Inventory, February 2012.

[3] Emission Factor for the Propulsion Engine & Auxiliary Engine - Referred to Table 4-16 of the Study on Marine Vessels Emissions Inventory, February 2012.

Emission Rate of Maneuvering

Pollutant	Emission Rate (kg/hr)			Emission Rate for 15 mins [4]
	Propulsion Engine	Auxiliary Engine	Total	
NOx	9.39	0.95	10.34	0.72
RSP	0.51	0.04	0.55	0.04

Note:

[4] Referred to the approved KTD EIA Report, the tugboat will assist to the cruise vessel during the 15 minutes maneuvering motion.

Marine Emission from Tugboat (assuming all OGV tugboat)

Emission Rate = Engine Power x Loading Factor x Emission Factor x Low Load Adjustment Factor

Type of Engine	Engine Power, kW [1]	Loading Factor [2]	Emission Factor, g/kWh [3]		Low Load Factor [4]	
		Maneuvering	NOx	RSP	NOx	RSP
Propulsion Engine	2344	0.02	14.00	1.43	4.63	7.29
Auxiliary Engine	520	0.45	14.70	1.44	N/A	N/A

Note:

[1] Engine Power for the Propulsion Engine - Referred to Table 3-15 of the Study on Marine Vessels Emissions Inventory, February 2012.
Engine Power for the Auxiliary Engine - According to Table 3-20 of the Study on Marine Vessels Emissions Inventory, February 2012:
Auxiliary Engine Power = 2344 x 0.222 = 520 kW.

[2] Loading Factor for the Propulsion Engine - Referred to Table 3-18 of the Study on Marine Vessels Emissions Inventory, February 2012.
Loading Factor for the Auxiliary Engine - referred to Table 3-21 of the Study on Marine Vessels Emissions Inventory, February 2012.
Loading Factor for the Boiler - Assumed 100% loading as a conservative approach.

[3] Emission Factor for the Propulsion Engine - Referred to Table 3-27 of the Study on Marine Vessels Emissions Inventory, February 2012 (assuming the engine type of Medium Speed Diesel Engine and use of Heavy Fuel Oil, according to KTD EIA).
Emission Factor for the Auxiliary Engine - Referred to Table 3-28 of the Study on Marine Vessels Emissions Inventory, February 2012 (assuming the use of Heavy Fuel Oil for conservative approach).

[4] Low Load Adjustment Factor - Referred to Table 3-30 of the Study on Marine Vessels Emissions Inventory, February 2012.

Emission Rate of Hotelling

Pollutant	Emission Rate (kg/hr)			Emission Rate for 15 mins [5]
	Propulsion Engine	Auxiliary Engine	Total	
NOx	3.04	3.44	6.48	0.45
RSP	0.49	0.34	0.83	0.06

Note:

[5] Referred to the approved KTD EIA Report, it is assumed that the cruise vessel is not equipped with cold-ironing and hence hotelling emission is anticipated throughout the hotelling period.