

Appendix 3.8 Detailed Calculation of Emissions from Marine Vessels

		IETS vessels (1)(2)	IWTS vessels (2)	OITF vessels (3)	North Lantau vessels	West Kowloon vessels	Additional vessels for STFs
Maneuvering speed (knots)		approximate 6	approximate 6	approximate 8	10	10	10
Idling period at WENT Landfill berth (please specify the time, e.g. 6:00am - 10:00a.m.)		19.5 hrs (21:30 - 17:00)	21 hrs (21:00 - 18:00)	3.5 hrs (11:00 - 14:30)	09:00am-10:00am	07:00-19:30	06:00-20:00
Number of trip per day		One vessel trip	One vessel trip	One vessel trip	Two vessels trip	One vessel trip	One vessel trip
Engine Power	Propulsion Engine (kW)	2 x 662kW	2 x 662kW	2 x 485kW	500kw x 2	1118.5kw x 2	1118.5kw x 2
	Auxiliary Engine (kW)	2 x 165kW	2 x 165kW	2 x 174kw	431kw, 95kw	125kw x 2	125kw x 2
Load Factor during Maneuvering (%)	Propulsion Engine	50%	50%	50%	80%	70%	70%
	Auxiliary Engine	NA	NA	NA	65%, 60%	80%	80%
Load Factor during Idling at WENT Landfill berth(%)	Propulsion Engine	75kWh	75kWh	NA	N/A	N/A	N/A
	Auxiliary Engine			20%	65%	N/A	N/A
Exhaust height of vent pipe above sea level (m)	Propulsion Engine	8	8	3.5	11	12	12
	Auxiliary Engine	8	8	3.5	11	11.5	11.5
Exhaust temperature of vent pipe (°C)	Propulsion Engine	255 -260	210 - 230	NA	426	600	600
	Auxiliary Engine	NA	NA	148 - 156	315	400	400
Exhaust diameter of vent pipe (m)	Propulsion Engine	0.3	0.3	0.2	0.2	0.25	0.25
	Auxiliary Engine	0.15	0.15	0.1	0.2	0.16	0.16

Notes:

(1) Average shore power measurement during berthing at IETS from 9 - 17 August 2008 as a reference :

Chai Wan vessel 73 Kwh
Nim Wan vessel 63.5 Kwh

(2) Exhaust temperature for IETS & IWTS was measured at WENT jetty on 19 August 2008 during the loading/unloading of containers when one propulsion engine is in operation :

IETS vessel - loading/unloading at WENT jetty from 08:00-14:30,

IWTS vessel - loading/unloading at WENT jetty from 14:30 - 17:30

One auxiliary engine operates for both vessels during the remaining period of berthing.

(3) For OITF vessel, two auxiliary engines operate during loading/unloading from 11:00-14:30

(4) The design and traveling/berthing mode of the additional vessel for STF was assumed the same as West Kowloon vessels. However, the maneuvering period will not be overlapped with other vessels.

According to Current Methodologies and Best Practices in Preparing Port Emission Inventories,

$$\text{Emission (g/hr)} = \text{Engine Power (kW)} \times \text{Loading Factor} \times \text{Emission Factor (g/kWh)}$$

	Emission Factor (g/kWh)	Adjusted Emission Factors using fuel with average 0.3% sulphur content (g/kWh)
NO _x	13.2	13.2
SO ₂	0.63	0.126
PM10	0.72	0.144

IETS & IWTS vessels

		Total emission/ferry (g/s)	Travel Distance (m)	Travel Time(min)	Total emission/ferry (g/s)
EF of NO _x /ferry	During Maneuvering	2.4273	1984	10.71	1.056E-02
	During Idling	0.2750			2.750E-01
EF of SO ₂ /ferry	During Maneuvering	0.0232	1984	10.71	1.008E-04
	During Idling	0.0026			2.625E-03
EF of RSP/ferry	During Maneuvering	0.0265	1984	10.71	1.152E-04
	During Idling	0.0030			3.000E-03

OITF vessels

		Total emission/ferry (g/s)	Travel Distance (m)	Travel Time(min)	Total emission/ferry (g/s)
EF of NO _x /ferry	During Maneuvering	1.7783	1984	8.03	5.804E-03
	During Idling	0.2552			2.552E-01
EF of SO ₂ /ferry	During Maneuvering	0.0170	1984	8.03	5.541E-05
	During Idling	0.0024			2.436E-03
EF of RSP/ferry	During Maneuvering	0.0194	1984	8.03	6.332E-05
	During Idling	0.0028			2.784E-03

North Lantau vessels

			Total emission/ferry (g/s)	Travel Distance (m)	Travel Time(min)	Total emission/ferry (g/s)
EF of NO _x /ferry	During Maneuvering	Propulsion Engine	2.9333	1984	6.42	7.660E-03
		Auxiliary Engine	1.2362			3.228E-03
	During Idling		1.2536			1.254E+00
EF of SO ₂ /ferry	During Maneuvering	Propulsion Engine	0.0280	1984	6.42	7.311E-05
		Auxiliary Engine	0.0118			3.081E-05
	During Idling		0.0120			
EF of RSP/ferry	During Maneuvering	Propulsion Engine	0.0320	1984	6.42	8.356E-05
		Auxiliary Engine	0.0135			3.521E-05
	During Idling		0.0137			

West Kowloon vessels

			Total emission/ferry (g/s)	Travel Distance (m)	Travel Time(min)	Total emission/ferry (g/s)
EF of NO _x /ferry	During Maneuvering	Propulsion Engine	5.7416	1984	6.42	1.499E-02
		Auxiliary Engine	0.7333			1.915E-03
	During Idling		0.0000			0.000E+00
EF of SO ₂ /ferry	During Maneuvering	Propulsion Engine	0.0548	1984	6.42	1.431E-04
		Auxiliary Engine	0.0070			1.828E-05
	During Idling		0.0000			0.000E+00
EF of RSP/ferry	During Maneuvering	Propulsion Engine	0.0626	1984	6.42	1.636E-04
		Auxiliary Engine	0.0080			2.089E-05
	During Idling		0.0000			0.000E+00

Additional vessels for STF

			Total emission/ferry (g/s)	Travel Distance (m)	Travel Time(min)	Total emission/ferry (g/s)
EF of NO _x /ferry	During Maneuvering	Propulsion Engine	5.7416	1984	6.42	1.499E-02
		Auxiliary Engine	0.7333			1.915E-03
	During Idling		0.0000			0.000E+00
EF of SO ₂ /ferry	During Maneuvering	Propulsion Engine	0.0548	1984	6.42	1.431E-04
		Auxiliary Engine	0.0070			1.828E-05
	During Idling		0.0000			0.000E+00
EF of RSP/ferry	During Maneuvering	Propulsion Engine	0.0626	1984	6.42	1.636E-04
		Auxiliary Engine	0.0080			2.089E-05
	During Idling		0.0000			0.000E+00

Notes:

- (1) The above vessels information are provided by EPD.
- (2) Refer to the information provided from the subject EPD officer of the Island East, Island West and Outlying Islands RTS, marine gas oil with average 0.3% sulphur is used as marine vessel fuel. Thus, emission factor for marine gas oil is adopted in the assessment.
- (3) OLM will be used for NO₂/NO_x conversion