Appendix 3.6 Calculation of Marine Emission Source

Distribution of Vessel Type within the assessment area

Abbreviation	Vessel Type	Daily Volume Entering Shelter	Entering Shetler Percentage (%)	Daily Volume Leaving Shelter	Leaving Shetler Percentage (%)	Total	Overall Percentage
CC/T	Chemical Carrier/Tanker	0	0%	0	0%	0	0%
CC/V	Conventional Cargo Vessel	3	1%	3	1%	6	1%
C/F	Cruise/Ferry	0	0%	0	0%	0	0%
DBC	Dry Bulk Carrier	0	0%	0	0%	0	0%
FV	Fishing/Fish processing Vessel	1	0%	1	0%	2	0%
FCCV	Fully Cellular Container Vessel (FCCV)	0	0%	0	0%	0	0%
GC	Gas Carrier/Tanker	0	0%	0	0%	0	0%
Barge	Lighter/Barge/Cargo Junk	3	1%	6	2%	9	2%
OT	Oil Tanker	0	0%	0	0%	0	0%
PV	Pleasure Vessel	1	0%	1	0%	2	0%
R	Roll On/Roll Off	12	5%	11	4%	23	4%
SCV	Semi-container Vessel	0	0%	0	0%	0	0%
Tug	Tug	44	17%	41	16%	85	16%
Other	Other Vessel	194	75%	197	76%	391	75%
Total		258	100%	260	100%	518	100%

Tuen Mun - Tung Chung - Sha Lo Wan - Tai O Ferry Schedule by Fortune Ferry Company

	Monday to Friday		Saturday				Sunday & Public Holiday			
	Arrival	Departure	Arrival	Arrival (On Demand)	Departure	Departure (On Demand)	Arrival	Arrival (On Demand)	Departure	Departure (On Demand)
07:00-08:00	1	1	1	0	1	0	1	0	1	0
08:00-09:00	1	1	1	0	1	0	0	0	1	1
09:00-10:00	0	1	0	0	1	2	0	0	1	1
10:00-11:00	1	1	1	0	1	1	1	0	1	1
11:00-12:00	0	1	0	0	1	2	0	0	0	1
12:00-13:00	0	0	0	0	0	0	1	0	1	1
13:00-14:00	0	0	0	0	0	0	0	0	0	1
14:00-15:00	1	0	1	0	0	0	1	0	0	0
15:00-16:00	0	1	0	2	1	0	0	2	1	0
16:00-17:00	1	0	1	1	0	0	1	1	0	1
17:00-18:00	0	1	0	1	1	0	0	1	1	0
18:00-19:00	1	0	1	2	0	0	1	4	0	0
19:00-20:00	1	1	1	2	1	0	1	2	1	0
Daily	7	8	7	8	8	5	7	10	8	7

Remark: On-demand schedule is subject to actual situation and passenger demand.

With reference to the Study on Marine Vessels Emission Inventory (MVEIS) by HKUST, the marine emission was estimated in activity-based approach. The emission factors were derived in units of works (gram per kilowatt-hour), dependent on fractional load of the equipment during different vessel activity modes. The calculation is summarized as below:

$$Emission = P \times FL \times T \times EF$$

where *P* is the installed power of equipment;
FL is fractional load of equipment in a specific mode;
T is operation time-in-mode; and
EF is fractional load emission factor of equipment

Appendix 3.6 Calculation of Marine Emission Source

Emission Rates for Local Vessels

Main Engine (ME) Emission

		MVEIS Assumption						ME Emission Factor (g/kWh)[8,9,10]				Low Load Adjustment Multiplier[11]				Effective Emission Factor (g/hr)			
Vessel Type	Speed (knots)	Vessel Type	Operation mode	ME Engine Type[1]	Fuel Type[2]	ME Power Rating (kW)[3,4,5]	ME Loading Factor[6,7]			PM10	PM2.5			PM10	PM2.5			PM10	PM2.5
Lighter/Barge/Cargo Junk	4.5	Lighter/Barge/Cargo Junk	Maneuvering	-	MGO	-	NA			-	-			NA	NA			NA	NA
Lighter/Barge/Cargo Junk	0	Lighter/Barge/Cargo Junk	Hotelling	-	MGO	-	NA			-	-			NA	NA			NA	NA
Fishing/Fish Processing Vessel	4.5	Fishing/Fish Processing Vessel	Maneuvering	MSD	MGO	420	0.095			0.31	0.29			1.48	1.48			18.3	17.1
Fishing/Fish Processing Vessel	0	Fishing/Fish Processing Vessel	Hotelling	MSD	MGO	420	0.000			0.31	0.29			1.00	1.00			0.0	0.0
Conventional Cargo Vessel	4.5	RTV(FCCV)	Maneuvering	DE	MGO	485	0.300			0.31	0.29			1.00	1.00			45.1	42.2
Conventional Cargo Vessel	0	RTV(FCCV)	Hotelling	DE	MGO	485	0.000			0.31	0.29			1.00	1.00			0.0	0.0
Roll On/Roll Off	4.5	Roll On/Roll Off	Maneuvering	SSD	MGO	7250	0.020			0.31	0.29			7.29	7.29			327.7	306.5
Roll On/Roll Off	0	Roll On/Roll Off	Hotelling	SSD	MGO	7250	0.000			0.31	0.29			1.00	1.00			0.0	0.0
Pleasure Vessel	4.5	Pleasure Vessel	Maneuvering	HSD	MGO	786	0.020			0.31	0.29			7.29	7.29			35.5	33.2
Pleasure Vessel	0	Pleasure Vessel	Hotelling	HSD	MGO	786	0.000			0.31	0.29			1.00	1.00			0.0	0.0
Tug	4.5	Tug	Maneuvering	HSD	MGO	2344	0.020			0.31	0.29			7.29	7.29			105.9	99.1
Tug	0	Tug	Hotelling	HSD	MGO	2344	0.000			0.31	0.29			1.00	1.00			0.0	0.0
Other Vessel	4.5	Other Vessel	Maneuvering	MSD	MGO	7832	0.037			0.31	0.29			4.33	4.33			389.0	363.9
Other Vessel	0	Other Vessel	Hotelling	MSD	MGO	7832	0.000			0.31	0.29			1.00	1.00			0.0	0.0
Launch & Ferry	4.5	Pleasure Vessel	Maneuvering	HSD	MGO	786	0.020			0.31	0.29			7.29	7.29			35.5	33.2
Launch & Ferry	0	Pleasure Vessel	Hotelling	HSD	MGO	786	0.000			0.31	0.29			1.00	1.00			0.0	0.0

Auxiliary Engine (AE) Emission

		MVEIS Assumption						AE Emission Factor (g/kWh)[8,9]				Effective Emission Factor (g/hr)			
Vessel Type	Speed (knots)	Vessel Type	Operation mode	Fuel Type[2]	AE Power Rating (kW)[12,13]	AE Loading Factor[14,15]				PM10	PM2.5			PM10	PM2.5
Lighter/Barge/Cargo Junk	4.5	Lighter/Barge/Cargo Junk	Maneuvering	MGO	551	0.135				0.32	0.29			23.8	21.6
Lighter/Barge/Cargo Junk	0	Lighter/Barge/Cargo Junk	Hotelling (Unloading)	MGO	551	0.655				0.32	0.29			115.5	104.7
Fishing/Fish Processing Vessel	4.5	Fishing/Fish Processing Vessel	Maneuvering	MGO	93	0.450				0.32	0.29			13.4	12.2
Fishing/Fish Processing Vessel	0	Fishing/Fish Processing Vessel	Hotelling (Unloading)	MGO	93	0.223				0.32	0.29			6.7	6.0
Conventional Cargo Vessel	4.5	RTV(FCCV)	Maneuvering	MGO	74	0.430				0.32	0.29			10.2	9.2
Conventional Cargo Vessel	0	RTV(FCCV)	Hotelling (Unloading)	MGO	74	0.430				0.32	0.29			10.2	9.2
Roll On/Roll Off	4.5	Roll On/Roll Off	Maneuvering	MGO	1878	0.450				0.32	0.29			270.4	245.0
Roll On/Roll Off	0	Roll On/Roll Off	Hotelling (Unloading)	MGO	1878	0.260				0.32	0.29			156.2	141.6
Pleasure Vessel	4.5	Pleasure Vessel	Maneuvering	MGO	60	0.320				0.32	0.29			6.1	5.6
Pleasure Vessel	0	Pleasure Vessel	Hotelling (Shut Down)	MGO	60	0.000				0.32	0.29			0.0	0.0
Tug	4.5	Tug	Maneuvering	MGO	520	0.450				0.32	0.29			74.9	67.9
Tug	0	Tug	Hotelling (Shut Down)	MGO	520	0.000				0.32	0.29			0.0	0.0
Other Vessel	4.5	Other Vessel	Maneuvering	MGO	1739	0.450				0.32	0.29			250.4	226.9
Other Vessel	0	Other Vessel	Hotelling (Shut Down)	MGO	1739	0.000				0.32	0.29			0.0	0.0
Launch & Ferry	4.5	Pleasure Vessel	Maneuvering	MGO	60	0.320				0.32	0.29			6.1	5.6
Launch & Ferry	0	Pleasure Vessel	Hotelling (Unloading)	MGO	60	0.320				0.32	0.29			6.1	5.6

Auxiliary Boiler (AB) Emission

		MVEIS Assumption						AB Emission Factor (g/kWh)[13,14]				Effective Emission Factor (g/hr)			
Vessel Type	Speed (knots)	MVEIS Vessel Type	Operation mode	Fuel Type[3]	AB Power Rating (kW)[16]	AB Loading Factor[17]				PM10	PM2.5	SO2	NOX	PM10	PM2.5
Roll On/Roll Off	4.5	Roll On/Roll Off	Maneuvering	MGO	87	0.00				0.19	0.14	0.0	0.0	0.0	0.0
Roll On/Roll Off	0	Roll On/Roll Off	Hotelling	MGO	87	0.00				0.19	0.14	0.0	0.0	0.0	0.0
Other Vessel	4.5	Other Vessel	Maneuvering	MGO	57	0.00				0.19	0.14	0.0	0.0	0.0	0.0
Other Vessel	0	Other Vessel	Hotelling	MGO	57	0.00				0.19	0.14	0.0	0.0	0.0	0.0

Remarks

(1) ME engine type is adopted as per Table 3-13. The engine type with the most number of calls for each type of vessels is adopted.
(2) Under the Air Pollution Control (Marine Light Diesel) Regulation, the sulphur content of the marine light diesel is 0.05%
(3) ME Power refers to Table 3-15, MVEIS
(4) Lighter/barge/cargo junk do not have main engine (S3.2.6, MVEIS)
(5) ME Power of RTV refers to Table 4-5, MVEIS. RTV(FCCV) with GRT 500-999 is most abundant according to Table 4-4, MVEIS.
(6) ME Loading factor refers to Table 3-18, MVEIS
(7) ME and AE loading factorss for RTV refer to Table 4-7, Table 4-8 and Table 4-10, MVEIS
(8) ME, AE and AB Emission factors refer to Table 3-27, Table 3-28, Table 3-29, MVEIS
(9) ME and AE Emission factors of RTV refer to Table 4-16, Table 4-17, MVEIS
(10) For Pleasure Vessel & Tug, no emission factor for HSD is available in the MVEIS. The ones for MSD are adopted instead.
(11) Low Load Adjustment Multiplier is adopted as per Table 3-30, MVEIS
(12) AE Power refers to Table 3-20, MVEIS
(13) AE Power refers to Table 4-6, MVEIS. RTV(FCCV) with GRT 500-999 is most abundant according to Table 4-4, MVEIS.
(14) AE Loading Factor refers to Table 3-21, MVEIS
(15) AE Loading factors of RTV refer to Table 4-9, MVEIS
(16) Auxiliary Boiler Energy Default refers to Table 3-23. MEVIS. There is no boiler for Fishing Vessel, Lighter/Barge/Cargo Junk, Pleasure Vessel, Tug and Launch & Ferry.
(17) Vessel burning MGO does not require AB. (S3.2.19, MVEIS)
(18) Hotelling mode refers to Table 3-25, MVEIS

Appendix 3.6 Calculation of Marine Emission Source

Marine Emission Rates for Ferries to/from Tuen Mun Ferry Terminal

Breakdown of Marine Emission Rates

Vessel Type	Speed (kn)[4]	Operation Mode	Distance (km)[1]	Time-in-mode (min)[2]	Daily Flow[3]	ME Emission (g/s)		AE Emission (g/s)		AB Emission (g/s)		Subtotal (g/s)	
						PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Launch & Ferry	4.5	Maneuvering	0.33	2.35	15	5.79E-03	5.42E-03	1.00E-03	9.08E-04	NA	NA	6.79E-03	6.32E-03
Launch & Ferry	0	Hotelling (Unloading)	NA	60.00	1	0.00E+00	0.00E+00	1.71E-03	1.55E-03	NA	NA	1.71E-03	1.55E-03

Remarks

(1) Distance refers to the distance of route considered in the assessment area

(2) Time-in-mode is estimated by the distance and vessel speed travelled in the corresponding mode. The hotelling time is assumed to be 60 minutes for the conservative approach

(3) Assume 1 ferry unloading at the pier when there is scheduled service.

(4) The vessel speed is the average speed of the corresponding operation mode with reference to Table 3-24, MVEIS

(5) Emission rate (g/s) = Effective Emission factor (g/hr) x Daily Flow x (Time-in-mode / 60) / 3600

Emission Rate for Marine Point Sources along the Route

Vessel Type	Operation Mode	Route ID	No. of Point Source	Emission Rate (g/s)	
				PM10	PM2.5
Launch & Ferry	Maneuvering	FR01 - FR06	6	1.132E-03	1.054E-03
Launch & Ferry	Hotelling (Unloading)	FP	1	1.707E-03	1.547E-03

Hourly Emission Profile

Hour	Maneuvering	Hotelling
0	0.00%	0.00%
1	0.00%	0.00%
2	0.00%	0.00%
3	0.00%	0.00%
4	0.00%	0.00%
5	0.00%	0.00%
6	0.00%	0.00%
7	13.33%	100.00%
8	13.33%	100.00%
9	6.67%	100.00%
10	13.33%	100.00%
11	6.67%	100.00%
12	0.00%	0.00%
13	0.00%	0.00%
14	6.67%	100.00%
15	6.67%	100.00%
16	6.67%	100.00%
17	6.67%	100.00%
18	6.67%	100.00%
19	13.33%	100.00%
20	0.00%	0.00%
21	0.00%	0.00%
22	0.00%	0.00%
23	0.00%	0.00%
Total	100.00%	-

Remark:

(1) Refer to Monday-to-Friday schedule of Tuen Mun - Tung Chung - Sha Lo Wan - Tai O Ferry Schedule by Fortune Ferry Company

(2) On-demand schedule varies according to actual situation, thus it is not considered as routine operation.

(3) Assume 1 ferry unloading at the pier when there is scheduled service.

Appendix 3.6 Calculation of Marine Emission Source

Marine Emission Rates for Fishing Vessels to/from Castle Peak Fish Market

Breakdown of Marine Emission Rates

Vessel Type	Speed (kn)[4]	Operation Mode	Distance (km)[1]	Time-in-mode (min)[2]	Daily Flow[3]	ME Emission (g/s)		AE Emission (g/s)		AB Emission (g/s)		Subtotal (g/s)	
						PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Fishing/Fish Processing Vessel	4.5	Maneuvering	0.50	3.57	2	6.05E-04	5.66E-04	4.44E-04	4.02E-04	NA	NA	1.05E-03	9.69E-04
Fishing/Fish Processing Vessel	0	Hotelling (Unloading)	NA	60.00	1	0.00E+00	0.00E+00	1.85E-03	1.67E-03	NA	NA	1.85E-03	1.67E-03

Remarks

(1) Distance refers to the distance of route considered in the assessment area

(2) Time-in-mode is estimated by the distance and vessel speed travelled in the corresponding mode. The hotelling time is assumed to be 60 minutes for the conservative approach

(3) According to the daily flow (round-trip), assume 1 fishing vessel per day hotelling at the fish market.

(4) The vessel speed is the average speed of the corresponding operation mode with reference to Table 3-24, MVEIS

(5) Emission rate (g/s) = Effective Emission factor (g/hr) x Daily Flow x (Time-in-mode / 60) / 3600

Emission Rate for Marine Point Sources along the Route

Vessel Type	Operation Mode	Route ID	No. of Point Source	Emission Rate (g/s)	
				PM10	PM2.5
Fishing/Fish Processing Vessel	Maneuvering	TS01 - TS09	9	1.166E-04	1.076E-04
Fishing/Fish Processing Vessel	Hotelling (Unloading)	FM	1	1.848E-03	1.675E-03

Hourly Emission Profile

Hour	Maneuvering	Hotelling
0	0.00%	0.00%
1	0.00%	0.00%
2	0.00%	0.00%
3	0.00%	0.00%
4	0.00%	0.00%
5	0.00%	0.00%
6	0.00%	0.00%
7	8.33%	8.33%
8	8.33%	8.33%
9	8.33%	8.33%
10	8.33%	8.33%
11	8.33%	8.33%
12	8.33%	8.33%
13	8.33%	8.33%
14	8.33%	8.33%
15	8.33%	8.33%
16	8.33%	8.33%
17	8.33%	8.33%
18	8.33%	8.33%
19	0.00%	0.00%
20	0.00%	0.00%
21	0.00%	0.00%
22	0.00%	0.00%
23	0.00%	0.00%
Total	100.00%	100.00%

Remark:

(1) Owing to unknown schedule, the hourly profile is assumed evenly throughout working hours.

Appendix 3.6 Calculation of Marine Emission Source

Marine Emission Rates for Vessels from/to Tuen Mun Public Cargo Working Area

Breakdown of Marine Emission Rates

						ME Emission (g/s)		AE Emission (g/s)		AB Emission (g/s)		Subtotal (g/s)	
Vessel Type	Speed (kn)[4]	Operation Mode	Distance (km)[1]	Time-in-mode (min)[2]	Daily Flow[3]	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Conventional Cargo Vessel	4.5	Maneuvering	1.08	7.78	6	9.75E-03	9.12E-03	2.20E-03	1.99E-03	NA	NA	1.20E-02	1.11E-02
Conventional Cargo Vessel	0	Hotelling (Unloading)	NA	60.00	2	0.00E+00	0.00E+00	5.66E-03	5.13E-03	NA	NA	5.66E-03	5.13E-03
Lighter/Barge/Cargo Junk	4.5	Maneuvering	1.08	7.78	9	0.00E+00	0.00E+00	7.72E-03	7.00E-03	NA	NA	7.72E-03	7.00E-03
Lighter/Barge/Cargo Junk	0	Hotelling (Unloading)	NA	60.00	2	0.00E+00	0.00E+00	6.42E-02	5.81E-02	NA	NA	6.42E-02	5.81E-02
Roll On/Roll Off	4.5	Maneuvering	1.08	7.78	23	2.72E-01	2.54E-01	2.24E-01	2.03E-01	0.00E+00	0.00E+00	4.96E-01	4.57E-01
Roll On/Roll Off	0	Hotelling (Unloading)	NA	60.00	3	0.00E+00	0.00E+00	1.30E-01	1.18E-01	0.00E+00	0.00E+00	1.30E-01	1.18E-01

Remarks

(1) Distance refers to the distance of route considered in the assessment area

(2) Time-in-mode is estimated by the distance and vessel speed travelled in the corresponding mode. The hotelling time is assumed to be 60 minutes for the conservative approach

(3) According to observation, assume 2 cargo vessels, 2 barges and 3 Roll On/Roll Off hotelling at all time during operation hours.

(4) The vessel speed is the average speed of the corresponding operation mode with reference to Table 3-24, MVEIS

(5) Emission rate (g/s) = Effective Emission factor (g/hr) x Daily Flow x (Time-in-mode / 60) / 3600

Emission Rate for Marine Point Sources along the Route

				Emission Rate (g/s)	
Vessel Type	Operation Mode	Route ID	No. of Point Source	PM10	PM2.5
Conventional Cargo Vessel	Maneuvering	TS01 - TS22	22	5.433E-04	5.053E-04
Conventional Cargo Vessel	Hotelling (Unloading)	PP1	1	5.657E-03	5.127E-03
Lighter/Barge/Cargo Junk	Maneuvering	TS01 - TS22	22	3.509E-04	3.180E-04
Lighter/Barge/Cargo Junk	Hotelling (Unloading)	PP2	1	6.416E-02	5.815E-02
Roll On/Roll Off	Maneuvering	TS01 - TS22	22	2.253E-02	2.078E-02
Roll On/Roll Off	Hotelling (Unloading)	PP3	1	1.302E-01	1.180E-01

Hourly Emission Profile

Hour	Maneuvering	Hotelling
0	0.00%	0.00%
1	0.00%	0.00%
2	0.00%	0.00%
3	0.00%	0.00%
4	0.00%	0.00%
5	0.00%	0.00%
6	0.00%	0.00%
7	8.33%	100.00%
8	8.33%	100.00%
9	8.33%	100.00%
10	8.33%	100.00%
11	8.33%	100.00%
12	8.33%	100.00%
13	8.33%	100.00%
14	8.33%	100.00%
15	8.33%	100.00%
16	8.33%	100.00%
17	8.33%	100.00%
18	8.33%	100.00%
19	0.00%	0.00%
20	0.00%	0.00%
21	0.00%	0.00%
22	0.00%	0.00%
23	0.00%	0.00%
Total	100.00%	-

Remark:

(1) Owing to unknown schedule, the hourly profile is assumed evenly throughout working hours.

(2) According to observation, assume 2 cargo vessels, 2 barges and 3 Roll On/Roll Off hotelling at all time during operation hours.

Appendix 3.6 Calculation of Marine Emission Source

Marine Emission Rates for Vessels inside Tuen Mun Typhoon Shelter

Breakdown of Marine Emission Rates

						ME Emission (g/s)		AE Emission (g/s)		AB Emission (g/s)		Subtotal (g/s)	
Vessel Type	Speed (kn)[4]	Operation Mode	Distance (km)[1]	Time-in-mode (min)[2]	Daily Flow[3]	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Pleasure Vessel	4.5	Maneuvering	1.08	7.78	2	2.56E-03	2.39E-03	4.42E-04	4.01E-04	NA	NA	3.00E-03	2.79E-03
Pleasure Vessel	0	Hotelling (Shut Down)	NA	60.00	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00
Tug	4.5	Maneuvering	1.08	7.78	85	3.24E-01	3.03E-01	2.29E-01	2.08E-01	NA	NA	5.53E-01	5.11E-01
Tug	0	Hotelling (Shut Down)	NA	60.00	43	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00
Other Vessel	4.5	Maneuvering	0.88	6.34	391	4.46E+00	4.17E+00	2.87E+00	2.60E+00	0.00E+00	0.00E+00	7.33E+00	6.78E+00
Other Vessel	0	Hotelling (Shut Down)	NA	60.00	196	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Remarks

(1) Distance refers to the distance of route considered in the assessment area

(2) Time-in-mode is estimated by the distance and vessel speed travelled in the corresponding mode. The hotelling time is assumed to be 60 minutes for the conservative approach

(3) Accordingly to the daily flow (round-trip), assume all vessels hotelling.

(4) The vessel speed is the average speed of the corresponding operation mode with reference to Table 3-24, MVEIS

(5) Emission rate (g/s) = Effective Emission factor (g/hr) x Daily Flow x (Time-in-mode / 60) / 3600

Emission Rate for Marine Point Sources along the Route

				Emission Rate (g/s)	
Vessel Type	Operation Mode	Route ID	No. of Point Source	PM10	PM2.5
Pleasure Vessel	Maneuvering	TS01 - TS22	22	1.364E-04	1.270E-04
Pleasure Vessel	Hotelling (Shut down)	-	0	0.000E+00	0.000E+00
Tug	Maneuvering	TS01 - TS22	22	2.516E-02	2.323E-02
Tug	Hotelling (Shut down)	-	0	0.000E+00	0.000E+00
Other Vessel	Maneuvering	TS01 - TS09, TMR01 - TMR09	18	4.074E-01	3.764E-01
Other Vessel	Hotelling (Shut down)	-	0	0.000E+00	0.000E+00

Hourly Emission Profile

Hour	Maneuvering	Hotelling
0	0.00%	0.00%
1	0.00%	0.00%
2	0.00%	0.00%
3	0.00%	0.00%
4	0.00%	0.00%
5	0.00%	0.00%
6	0.00%	0.00%
7	8.33%	0.00%
8	8.33%	0.00%
9	8.33%	0.00%
10	8.33%	0.00%
11	8.33%	0.00%
12	8.33%	0.00%
13	8.33%	0.00%
14	8.33%	0.00%
15	8.33%	0.00%
16	8.33%	0.00%
17	8.33%	0.00%
18	8.33%	0.00%
19	0.00%	0.00%
20	0.00%	0.00%
21	0.00%	0.00%
22	0.00%	0.00%
23	0.00%	0.00%
Total	100.00%	-

Remark:

(1) Owing to unknown schedule, the hourly profile is assumed evenly throughout working hours.

(2) Assume engine shut down during hotelling, no emission is considered.

Appendix 3.6 Calculation of Marine Emission Source

Marine Emission Rates for Vessels from/to Project Barging Point

Breakdown of Marine Emission Rates

Vessel Type	Speed (kn)[4]	Operation Mode	Distance (km)[1]	Time-in-mode (min)[2]	Daily Flow[3]	ME Emission (g/s)		AE Emission (g/s)		AB Emission (g/s)		Subtotal (g/s)	
						PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Lighter/Barge/Cargo Junk	4.5	Maneuvering	0.28	1.98	2	0.00E+00	0.00E+00	4.36E-04	3.95E-04	NA	NA	4.36E-04	3.95E-04
Lighter/Barge/Cargo Junk	0	Hotelling (Unloading)	NA	60.00	1	0.00E+00	0.00E+00	3.21E-02	2.91E-02	NA	NA	3.21E-02	2.91E-02
Tug	4.5	Maneuvering	0.28	1.98	2	1.94E-03	1.82E-03	1.37E-03	1.24E-03	NA	NA	3.32E-03	3.06E-03

Remarks

(1) Distance refers to the distance of route considered in the assessment area

(2) Time-in-mode is estimated by the distance and vessel speed travelled in the corresponding mode. The hotelling time is assumed to be 60 minutes for the conservative approach

(3) According to the design, 1 barge + 1 tugboat arriving/departing in a day (with unknown schedule). The barge would stay at barging point for unloading during the operation hours (7am - 7pm).

(4) The vessel speed is the average speed of the corresponding operation mode with reference to Table 3-24, MVEIS

(5) Emission rate (g/s) = Effective Emission factor (g/hr) x Daily Flow x (Time-in-mode / 60) / 3600

Emission Rate for Marine Point Sources along the Route

Vessel Type	Operation Mode	Route ID	No. of Point Source	Emission Rate (g/s)	
				PM10	PM2.5
Lighter/Barge/Cargo Junk	Maneuvering	TS01 - TS05	5	8.727E-05	7.909E-05
Lighter/Barge/Cargo Junk	Hotelling (Unloading)	BP	1	3.208E-02	2.907E-02
Tug	Maneuvering	TS01 - TS05	5	6.632E-04	6.123E-04

Hourly Emission Profile

Hour	Maneuvering	Hotelling
0	0.00%	0.00%
1	0.00%	0.00%
2	0.00%	0.00%
3	0.00%	0.00%
4	0.00%	0.00%
5	0.00%	0.00%
6	0.00%	0.00%
7	8.33%	100.00%
8	8.33%	100.00%
9	8.33%	100.00%
10	8.33%	100.00%
11	8.33%	100.00%
12	8.33%	100.00%
13	8.33%	100.00%
14	8.33%	100.00%
15	8.33%	100.00%
16	8.33%	100.00%
17	8.33%	100.00%
18	8.33%	100.00%
19	0.00%	0.00%
20	0.00%	0.00%
21	0.00%	0.00%
22	0.00%	0.00%
23	0.00%	0.00%
Total	100.00%	-

Remark:

(1) Owing to unknown schedule, the hourly profile is assumed evenly throughout working hours.

(2) The barge would stay at barging point for unloading during the operation hours (7am - 7pm).

Appendix 3.6 Calculation of Marine Emission Source

Stack Parameters of Marine Vessel from Previous Studies

Vessel Type	Stack Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Diameter (m)	Remarks
Passenger Vessel (High Speed Vessel)	6.2	773	8	0.7	- Refer to EIA Study of Hong Kong International Airport in a Three-Runway System - Exit velocity is replaced by the one adopted in EIA Study of Organic Waste Treatment Facilities, Phase I.
Barge	11	588	8	0.2	- Refer to EIA study of Organic Waste Treatment Facilities, Phase I
Cruise	34.2	537	24.6	1.9	- Refer to EIA study of Kai Tak Development - Stack height ranges from 34.2m to 62m. Lowest height is adopted for conservative assumption.
Tugboat	4	694.7	8	0.3	- Refer to EIA study of Lei Yue Mun Waterfrond Enchancement Project
Generic Commerical Vessel	20	555	25	0.8	- Refer to Emissions Processing and Sensitivity Air Quality Modelling of Category 3 Commercial Marine Vessel Emissions , USEPA, US EPA 17th International Emission Inventory Conference, 2-5 June 2008, Portland, Oregon - Refer to Generating an Hour-By-Hour Model-Ready Marine Emission Inventory, RWDI Air Inc. and Environment Canada, US EPA 17th International Emission Inventory Conference, 2-5 June 2008, Portland, Oregon

Appendix 3.6 Calculation of Marine Emission Source

Stack Parameters of Marine Vessels adopted in the Assessment

Vessel Type	Stack Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Release Direction	Diameter (m)	Remarks
Barge (BR)	11	588	8	Vertical	0.2	- Parameters refer to the Barge.
Conventional Cargo Vessel (CV)	11	555	25	Vertical	0.8	- Chinese Trading Vessels in general. - Parameters refer to Generic Commerical Vessel. - Stack height by observation.
Roll On/ Roll Off (RR)	11	588	8	Vertical	0.2	- Parameters refer to the Barge.
Launches and Ferries (L&F)	8	555	8	Vertical	0.8	- Exit temperature refers to Generic Commerical Vessel. - Exit velocity refers to ones for small vessels (Passenger Vessel and Barge). - Stack height by observation.
Fishing Vessel (FV)	6	555	8	Horizontal	0.3	- Exit temperature refers to Generic Commerical Vessel. - Exit velocity refers to ones for small vessels (Passenger Vessel and Barge). - Stack height and stack diameter by observation.
Pleasure Vessel (PV)	0.5	773	8	Horizontal	0.3	- Exit temperature and exit velocity refer to Passenger Vessel (High Speed Vessel) for its high speed. - Generally equipped with wet exhaust system which injects seawater for cooling exhaust. Release height is close to the water surface. - Stack Diameter by obervation
Tugboat (TG)	4	694.7	8	Horizontal	0.3	- Parameters refer to the Tugboat.
Others (OV)	8	555	8	Vertical	0.8	- Fast launch, passenger launch are the typical vessels. - Parameters refers to Launches and Ferries

Appendix 3.6 Calculation of Marine Emission Source

Marine Emission Sources Listing in AERMOD

Marine Route	Vessel Type	Route ID	Source ID	Type	Flow Direction	X	Y	Height (mAG)	Exit Temp. (K)	Exit velocity (m/s)	Stack Diameter (m)	RSP Emission Rate (g/s)	FSP Emission Rate (g/s)
Ferry Route	LF	FR01	FR01	POINT	Vertical	814514.76	825717.72	8	555	8	0.8	1.132E-03	1.054E-03
Ferry Route	LF	FR02	FR02	POINT	Vertical	814500.16	825669.90	8	555	8	0.8	1.132E-03	1.054E-03
Ferry Route	LF	FR03	FR03	POINT	Vertical	814486.14	825621.90	8	555	8	0.8	1.132E-03	1.054E-03
Ferry Route	LF	FR04	FR04	POINT	Vertical	814473.63	825573.49	8	555	8	0.8	1.132E-03	1.054E-03
Ferry Route	LF	FR05	FR05	POINT	Vertical	814459.65	825525.49	8	555	8	0.8	1.132E-03	1.054E-03
Ferry Route	LF	FR06	FR06	POINT	Vertical	814445.67	825477.48	8	555	8	0.8	1.132E-03	1.054E-03
Ferry Route	LF	FP	FP	POINT	Vertical	814528.90	825765.68	8	555	8	0.8	1.707E-03	1.547E-03
Route to/from Fish Market	FV	TS01	TS01FV	POINTHOR	Horizontal	815101.43	826077.33	6	555	8	0.3	1.166E-04	1.076E-04
Route to/from Fish Market	FV	TS02	TS02FV	POINTHOR	Horizontal	815078.88	826121.95	6	555	8	0.3	1.166E-04	1.076E-04
Route to/from Fish Market	FV	TS03	TS03FV	POINTHOR	Horizontal	815056.33	826166.58	6	555	8	0.3	1.166E-04	1.076E-04
Route to/from Fish Market	FV	TS04	TS04FV	POINTHOR	Horizontal	815033.78	826211.20	6	555	8	0.3	1.166E-04	1.076E-04
Route to/from Fish Market	FV	TS05	TS05FV	POINTHOR	Horizontal	815011.22	826255.83	6	555	8	0.3	1.166E-04	1.076E-04
Route to/from Fish Market	FV	TS06	TS06FV	POINTHOR	Horizontal	814988.67	826300.46	6	555	8	0.3	1.166E-04	1.076E-04
Route to/from Fish Market	FV	TS07	TS07FV	POINTHOR	Horizontal	814966.12	826345.08	6	555	8	0.3	1.166E-04	1.076E-04
Route to/from Fish Market	FV	TS08	TS08FV	POINTHOR	Horizontal	814943.57	826389.71	6	555	8	0.3	1.166E-04	1.076E-04
Route to/from Fish Market	FV	TS09	TS09FV	POINTHOR	Horizontal	814921.02	826434.33	6	555	8	0.3	1.166E-04	1.076E-04
Route to/from Fish Market	FV	FM	FM	POINTHOR	Horizontal	814860.01	826456.85	6	555	8	0.3	1.848E-03	1.675E-03
Route to/from Public Cargo Pier	CV	TS01	TS01CV	POINT	Vertical	815101.43	826077.33	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS02	TS02CV	POINT	Vertical	815078.88	826121.95	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS03	TS03CV	POINT	Vertical	815056.33	826166.58	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS04	TS04CV	POINT	Vertical	815033.78	826211.20	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS05	TS05CV	POINT	Vertical	815011.22	826255.83	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS06	TS06CV	POINT	Vertical	814988.67	826300.46	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS07	TS07CV	POINT	Vertical	814966.12	826345.08	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS08	TS08CV	POINT	Vertical	814943.57	826389.71	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS09	TS09CV	POINT	Vertical	814921.02	826434.33	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS10	TS10CV	POINT	Vertical	814934.35	826482.52	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS11	TS11CV	POINT	Vertical	814962.22	826524.03	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS12	TS12CV	POINT	Vertical	814990.66	826564.41	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS13	TS13CV	POINT	Vertical	815029.21	826596.95	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS14	TS14CV	POINT	Vertical	815070.15	826624.79	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS15	TS15CV	POINT	Vertical	815112.06	826652.06	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS16	TS16CV	POINT	Vertical	815157.37	826673.16	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS17	TS17CV	POINT	Vertical	815203.06	826694.45	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS18	TS18CV	POINT	Vertical	815248.48	826715.35	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS19	TS19CV	POINT	Vertical	815293.92	826736.20	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS20	TS20CV	POINT	Vertical	815339.37	826757.05	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS21	TS21CV	POINT	Vertical	815384.82	826777.89	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	TS22	TS22CV	POINT	Vertical	815430.26	826798.73	11	555	25	0.8	5.433E-04	5.053E-04
Route to/from Public Cargo Pier	CV	PP1	PP1	POINT	Vertical	815021.25	826652.53	11	555	25	0.8	5.657E-03	5.127E-03
Route to/from Public Cargo Pier	BR	TS01	TS01BR	POINT	Vertical	815101.43	826077.33	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS02	TS02BR	POINT	Vertical	815078.88	826121.95	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS03	TS03BR	POINT	Vertical	815056.33	826166.58	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS04	TS04BR	POINT	Vertical	815033.78	826211.20	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS05	TS05BR	POINT	Vertical	815011.22	826255.83	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS06	TS06BR	POINT	Vertical	814988.67	826300.46	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS07	TS07BR	POINT	Vertical	814966.12	826345.08	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS08	TS08BR	POINT	Vertical	814943.57	826389.71	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS09	TS09BR	POINT	Vertical	814921.02	826434.33	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS10	TS10BR	POINT	Vertical	814934.35	826482.52	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS11	TS11BR	POINT	Vertical	814962.22	826524.03	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS12	TS12BR	POINT	Vertical	814990.66	826564.41	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS13	TS13BR	POINT	Vertical	815029.21	826596.95	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS14	TS14BR	POINT	Vertical	815070.15	826624.79	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS15	TS15BR	POINT	Vertical	815112.06	826652.06	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS16	TS16BR	POINT	Vertical	815157.37	826673.16	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS17	TS17BR	POINT	Vertical	815203.06	826694.45	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS18	TS18BR	POINT	Vertical	815248.48	826715.35	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS19	TS19BR	POINT	Vertical	815293.92	826736.20	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS20	TS20BR	POINT	Vertical	815339.37	826757.05	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS21	TS21BR	POINT	Vertical	815384.82	826777.89	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	TS22	TS22BR	POINT	Vertical	815430.26	826798.73	11	588	8	0.2	3.509E-04	3.180E-04
Route to/from Public Cargo Pier	BR	PP2	PP2	POINT	Vertical	815157.49	826718.09	11	588	8	0.2	6.416E-02	5.815E-02
Route to/from Public Cargo Pier	RR	TS01	TS01RR	POINT	Vertical	815101.43	826077.33	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS02	TS02RR	POINT	Vertical	815078.88	826121.95	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS03	TS03RR	POINT	Vertical	815056.33	826166.58	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS04	TS04RR	POINT	Vertical	815033.78	826211.20	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS05	TS05RR	POINT	Vertical	815011.22	826255.83	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS06	TS06RR	POINT	Vertical	814988.67	826300.46	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS07	TS07RR	POINT	Vertical	814966.12	826345.08	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS08	TS08RR	POINT	Vertical	814943.57	826389.71	11	588	8	0.2	2.253E-02	2.078E-02

Appendix 3.6 Calculation of Marine Emission Source

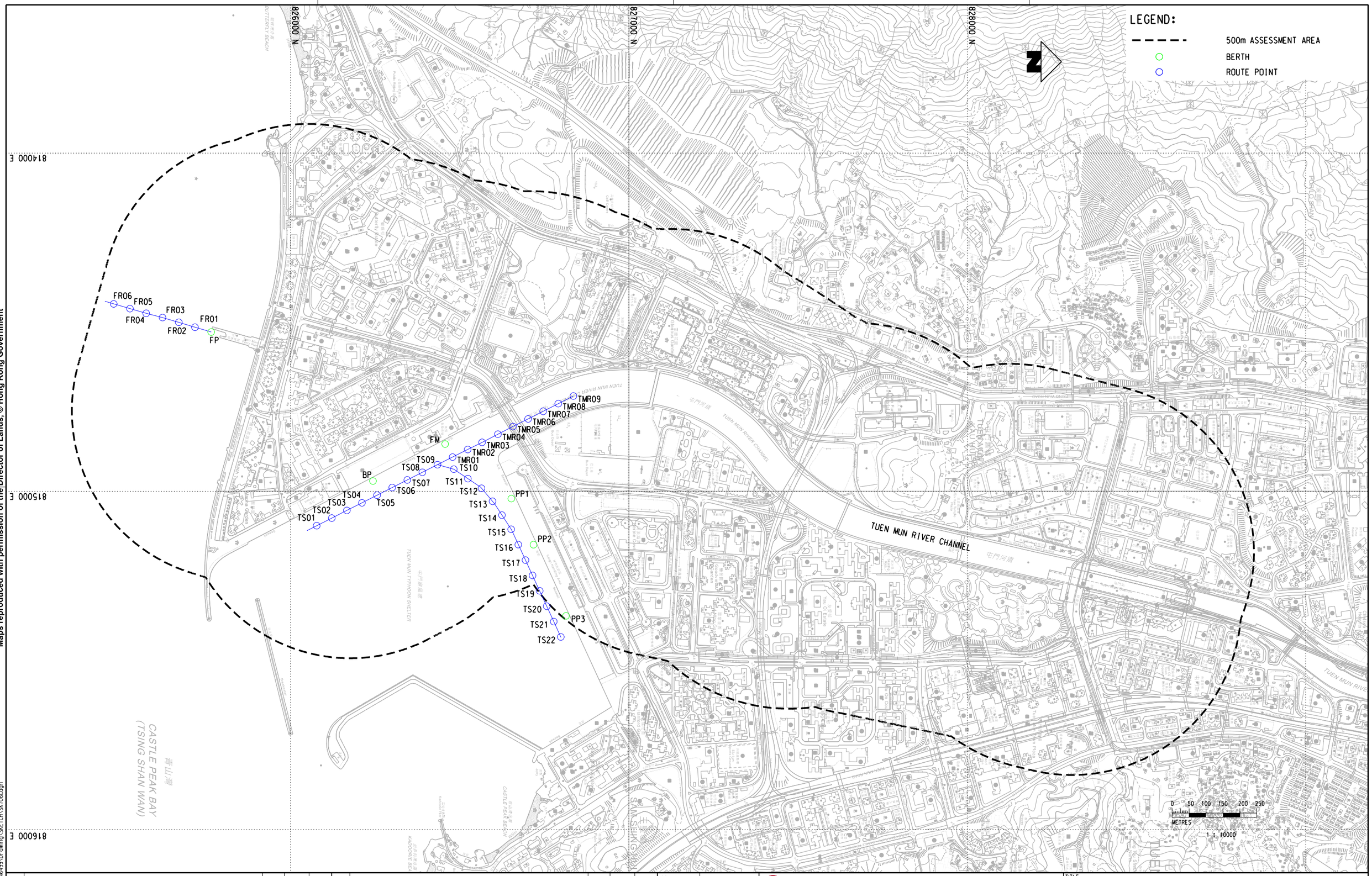
Marine Emission Sources Listing in AERMOD

Marine Route	Vessel Type	Route ID	Source ID	Type	Flow Direction	X	Y	Height (mAG)	Exit Temp. (K)	Exit velocity (m/s)	Stack Diameter (m)	RSP Emission Rate (g/s)	FSP Emission Rate (g/s)
Route to/from Public Cargo Pier	RR	TS09	TS09RR	POINT	Vertical	814921.02	826434.33	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS10	TS10RR	POINT	Vertical	814934.35	826482.52	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS11	TS11RR	POINT	Vertical	814962.22	826524.03	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS12	TS12RR	POINT	Vertical	814990.66	826564.41	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS13	TS13RR	POINT	Vertical	815029.21	826596.95	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS14	TS14RR	POINT	Vertical	815070.15	826624.79	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS15	TS15RR	POINT	Vertical	815112.06	826652.06	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS16	TS16RR	POINT	Vertical	815157.37	826673.16	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS17	TS17RR	POINT	Vertical	815203.06	826694.45	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS18	TS18RR	POINT	Vertical	815248.48	826715.35	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS19	TS19RR	POINT	Vertical	815293.92	826736.20	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS20	TS20RR	POINT	Vertical	815339.37	826757.05	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS21	TS21RR	POINT	Vertical	815384.82	826777.89	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	TS22	TS22RR	POINT	Vertical	815430.26	826798.73	11	588	8	0.2	2.253E-02	2.078E-02
Route to/from Public Cargo Pier	RR	PP3	PP3	POINT	Vertical	815368.05	826814.12	11	588	8	0.2	1.302E-01	1.180E-01
Route to/from Typhoon Shelter	PV	TS01	TS01PV	POINTHOR	Horizontal	815101.43	826077.33	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS02	TS02PV	POINTHOR	Horizontal	815078.88	826121.95	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS03	TS03PV	POINTHOR	Horizontal	815056.33	826166.58	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS04	TS04PV	POINTHOR	Horizontal	815033.78	826211.20	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS05	TS05PV	POINTHOR	Horizontal	815011.22	826255.83	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS06	TS06PV	POINTHOR	Horizontal	814988.67	826300.46	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS07	TS07PV	POINTHOR	Horizontal	814966.12	826345.08	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS08	TS08PV	POINTHOR	Horizontal	814943.57	826389.71	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS09	TS09PV	POINTHOR	Horizontal	814921.02	826434.33	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS10	TS10PV	POINTHOR	Horizontal	814934.35	826482.52	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS11	TS11PV	POINTHOR	Horizontal	814962.22	826524.03	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS12	TS12PV	POINTHOR	Horizontal	814990.66	826564.41	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS13	TS13PV	POINTHOR	Horizontal	815029.21	826596.95	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS14	TS14PV	POINTHOR	Horizontal	815070.15	826624.79	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS15	TS15PV	POINTHOR	Horizontal	815112.06	826652.06	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS16	TS16PV	POINTHOR	Horizontal	815157.37	826673.16	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS17	TS17PV	POINTHOR	Horizontal	815203.06	826694.45	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS18	TS18PV	POINTHOR	Horizontal	815248.48	826715.35	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS19	TS19PV	POINTHOR	Horizontal	815293.92	826736.20	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS20	TS20PV	POINTHOR	Horizontal	815339.37	826757.05	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS21	TS21PV	POINTHOR	Horizontal	815384.82	826777.89	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	PV	TS22	TS22PV	POINTHOR	Horizontal	815430.26	826798.73	0.5	773	8	0.3	1.364E-04	1.270E-04
Route to/from Typhoon Shelter	TG	TS01	TS01TG	POINTHOR	Horizontal	815101.43	826077.33	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS02	TS02TG	POINTHOR	Horizontal	815078.88	826121.95	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS03	TS03TG	POINTHOR	Horizontal	815056.33	826166.58	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS04	TS04TG	POINTHOR	Horizontal	815033.78	826211.20	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS05	TS05TG	POINTHOR	Horizontal	815011.22	826255.83	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS06	TS06TG	POINTHOR	Horizontal	814988.67	826300.46	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS07	TS07TG	POINTHOR	Horizontal	814966.12	826345.08	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS08	TS08TG	POINTHOR	Horizontal	814943.57	826389.71	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS09	TS09TG	POINTHOR	Horizontal	814921.02	826434.33	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS10	TS10TG	POINTHOR	Horizontal	814934.35	826482.52	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS11	TS11TG	POINTHOR	Horizontal	814962.22	826524.03	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS12	TS12TG	POINTHOR	Horizontal	814990.66	826564.41	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS13	TS13TG	POINTHOR	Horizontal	815029.21	826596.95	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS14	TS14TG	POINTHOR	Horizontal	815070.15	826624.79	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS15	TS15TG	POINTHOR	Horizontal	815112.06	826652.06	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS16	TS16TG	POINTHOR	Horizontal	815157.37	826673.16	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS17	TS17TG	POINTHOR	Horizontal	815203.06	826694.45	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS18	TS18TG	POINTHOR	Horizontal	815248.48	826715.35	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS19	TS19TG	POINTHOR	Horizontal	815293.92	826736.20	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS20	TS20TG	POINTHOR	Horizontal	815339.37	826757.05	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS21	TS21TG	POINTHOR	Horizontal	815384.82	826777.89	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	TG	TS22	TS22TG	POINTHOR	Horizontal	815430.26	826798.73	4	694.7	8	0.3	2.516E-02	2.323E-02
Route to/from Typhoon Shelter	OV	TS01	TS01OV	POINT	Vertical	815101.43	826077.33	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TS02	TS02OV	POINT	Vertical	815078.88	826121.95	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TS03	TS03OV	POINT	Vertical	815056.33	826166.58	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TS04	TS04OV	POINT	Vertical	815033.78	826211.20	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TS05	TS05OV	POINT	Vertical	815011.22	826255.83	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TS06	TS06OV	POINT	Vertical	814988.67	826300.46	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TS07	TS07OV	POINT	Vertical	814966.12	826345.08	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TS08	TS08OV	POINT	Vertical	814943.57	826389.71	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TS09	TS09OV	POINT	Vertical	814921.02	826434.33	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TMR01	TMR01OV	POINT	Vertical	814898.47	826478.96	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TMR02	TMR02OV	POINT	Vertical	814876.06	826523.66	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TMR03	TMR03OV	POINT	Vertical	814855.01	826566.02	8	555	8	0.8	4.074E-01	3.764E-01

Appendix 3.6 Calculation of Marine Emission Source

Marine Emission Sources Listing in AERMOD

Marine Route	Vessel Type	Route ID	Source ID	Type	Flow Direction	X	Y	Height (mAG)	Exit Temp. (K)	Exit velocity (m/s)	Stack Diameter (m)	RSP Emission Rate (g/s)	FSP Emission Rate (g/s)
Route to/from Typhoon Shelter	OV	TMR04	TMR04OV	POINT	Vertical	814830.81	826612.83	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TMR05	TMR05OV	POINT	Vertical	814808.26	826657.46	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TMR06	TMR06OV	POINT	Vertical	814785.71	826702.08	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TMR07	TMR07OV	POINT	Vertical	814763.16	826746.71	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TMR08	TMR08OV	POINT	Vertical	814740.61	826791.33	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Typhoon Shelter	OV	TMR09	TMR09OV	POINT	Vertical	814718.05	826835.96	8	555	8	0.8	4.074E-01	3.764E-01
Route to/from Project Barging Point	BR	TS01	TS01PBR	POINT	Vertical	815101.43	826077.33	11	588	8	0.2	8.727E-05	7.909E-05
Route to/from Project Barging Point	BR	TS02	TS02PBR	POINT	Vertical	815078.88	826121.95	11	588	8	0.2	8.727E-05	7.909E-05
Route to/from Project Barging Point	BR	TS03	TS03PBR	POINT	Vertical	815056.33	826166.58	11	588	8	0.2	8.727E-05	7.909E-05
Route to/from Project Barging Point	BR	TS04	TS04PBR	POINT	Vertical	815033.78	826211.20	11	588	8	0.2	8.727E-05	7.909E-05
Route to/from Project Barging Point	BR	TS05	TS05PBR	POINT	Vertical	815011.22	826255.83	11	588	8	0.2	8.727E-05	7.909E-05
Route to/from Project Barging Point	BR	BP	BP	POINT	Vertical	814969.28	826243.60	11	588	8	0.2	3.208E-02	2.907E-02
Route to/from Project Barging Point	TG	TS01	TS01PTG	POINTHOR	Horizontal	815101.43	826077.33	4	694.7	8	0.3	6.632E-04	6.123E-04
Route to/from Project Barging Point	TG	TS02	TS02PTG	POINTHOR	Horizontal	815078.88	826121.95	4	694.7	8	0.3	6.632E-04	6.123E-04
Route to/from Project Barging Point	TG	TS03	TS03PTG	POINTHOR	Horizontal	815056.33	826166.58	4	694.7	8	0.3	6.632E-04	6.123E-04
Route to/from Project Barging Point	TG	TS04	TS04PTG	POINTHOR	Horizontal	815033.78	826211.20	4	694.7	8	0.3	6.632E-04	6.123E-04
Route to/from Project Barging Point	TG	TS05	TS05PTG	POINTHOR	Horizontal	815011.22	826255.83	4	694.7	8	0.3	6.632E-04	6.123E-04



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REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN	
DESIGNED	
CHECKED	
APPROVED	
DATE	

MTR

TUEN MUN SOUTH EXTENSION

ORIGINATOR

AECOM

CADD REF. SK7061.dgn

TITLE

C1502
TUEN MUN SOUTH EXTENSION
LOCATION OF MARINE EMISSION SOURCES

SCALE 1 : 10000 (A3)

FIGURE NO. SK7061

REV. –