Appendix 3.7 Detailed Calculations of Marine Emissions

Emission Inventory for Marine Emissions

	Source	Type	X	Y	Release Height	Initial lateral dimension	Initial vertical dimension	Stack Height	Exit Temperature	Exit Velocity	Stack Diameter	Emission Rate			Remarks
	ID		(m)	(m)	(m)	(m)	(m)	(m)	(K)	(m/s)	m	NOx (g/s)	RSP (g/s)	FSP (g/s) or (g/m^2/s)	
Tsuen Wan Pier - Park Island Ferry Service	PIM01	VOLUME	829033.2	825160.0	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	1. The calculation methodologies for the initial lateral dimension and initial vertical dimension of the volume sources refer to Table 3-2 of User's Guide for the AMS/EPA Regulatory Model (AERMOD). 2. The stack parameters for 'POINTHOR' source type refer to 'Passenger Vessel (High Speed Vessel)' adopted in Appendix 3.5 of the approved EIA Study on Lei Yue Mun waterfront Enhancement Project (EIA-258/2018).
	PIM02	VOLUME	829052.5	825165.4	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM03	VOLUME	829071.9	825170.8	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM04	VOLUME	829091.2	825176.2	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM05	VOLUME	829110.6	825181.6	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM06	VOLUME	829130.0	825187.0	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM07	VOLUME	829149.3	825192.4	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM08	VOLUME	829168.7	825197.8	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM09	VOLUME	829188.0	825203.3	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM10	VOLUME	829207.4	825208.7	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM11	VOLUME	829226.7	825214.1	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM12	VOLUME	829246.1	825219.5	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM13	VOLUME	829265.4	825224.9	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM14	VOLUME	829284.8	825230.3	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM15	VOLUME	829304.1	825235.7	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM16	VOLUME	829323.5	825241.1	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM17	VOLUME	829342.9	825246.5	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM18	VOLUME	829362.2	825251.9	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM19	VOLUME	829381.6	825257.3	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIM20	VOLUME	829400.9	825262.7	3.0	9.35	2.79	-	-	-	-	3.961E-02	5.078E-04	5.078E-04	
	PIH01	POINTHOR	829420.3	825268.1	-	-	-	6.200	773.000	8.000	0.700	3.396E-02	5.608E-04	5.608E-04	
Cargo Vessels	CVM01	POINT	829457.6	824188.9	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	1. The stack parameters refer to 'Chinese Trading Vessels' adopted in Appendix 3.5 of the approved EIA Study on Lei Yue Mun waterfront Enhancement Project (EIA-258/2018). 2. The emission rates for NOx, RSP and FSP are calcuated based on the number of vessels between 8:00 am - 12:00pm and 1:00pm - 6:00 pm.
	CVM02	POINT	829450.3	824236.8	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM03	POINT	829443.1	824284.8	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM04	POINT	829435.8	824332.7	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM05	POINT	829428.6	824380.7	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM06	POINT	829421.3	824428.6	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM07	POINT	829414.0	824476.6	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM08	POINT	829406.8	824524.5	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM09	POINT	829399.5	824572.5	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM10	POINT	829392.3	824620.4	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM11	POINT	829385.0	824668.4	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM12	POINT	829377.7	824716.3	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM13	POINT	829370.5	824764.3	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM14	POINT	829362.8	824812.1	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM15	POINT	829335.3	824852.1	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM16	POINT	829307.9	824892.1	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM17	POINT	829280.5	824932.0	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM18	POINT	829253.0	824972.0	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM19	POINT	829225.6	825012.0	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
	CVM20	POINT	829184.0	825034.9	-	-	-	11.000	555.000	25.000	0.800	4.606E-03	1.475E-04	1.428E-04	
Passenger Ferry	CFM01	POINT	829457.6	824188.9	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	1. The stack parameters refer to 'Launches and Ferries' adopted in Appendix 3.5 of the approved EIA Study on Lei Yue Mun waterfront Enhancement Project (EIA-258/2018). 2. The emission rates for NOx, RSP and FSP are calcuated based on the number of vessels between 8:00 am - 12:00pm and 1:00pm - 6:00 pm.
	CFM02	POINT	829450.3	824236.8	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM03	POINT	829443.1	824284.8	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM04	POINT	829435.8	824332.7	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM05	POINT	829428.6	824380.7	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM06	POINT	829421.3	824428.6	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM07	POINT	829414.0	824476.6	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM08	POINT	829406.8	824524.5	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM09	POINT	829399.5	824572.5	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM10	POINT	829392.3	824620.4	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM11	POINT	829385.0	824668.4	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM12	POINT	829377.7	824716.3	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM13	POINT	829370.5	824764.3	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM14	POINT	829362.8	824812.1	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM15	POINT	829335.3	824852.1	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM16	POINT	829307.9	824892.1	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM17	POINT	829280.5	824932.0	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM18	POINT	829253.0	824972.0	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM19	POINT	829225.6	825012.0	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	
	CFM20	POINT	829184.0	825034.9	-	-	-	8.000	555.000	8.000	0.800	1.779E-03	4.131E-05	3.798E-05	

Appendix 3.7 Detailed Calculations of Marine Emissions

	Source	Type	X	Y	Release Height	Initial lateral dimension	Initial vertical dimension	Stack Height	Exit Temperature	Exit Velocity	Stack Diameter	Emission Rate			Remarks
												NOx	RSP	FSP	
	ID		(m)	(m)	(m)	(m)	(m)	(m)	(K)	(m/s)	m	(g/s)	(g/s)	(g/s) or (g/m^2/s)	
Tanker	TKM01	POINT	829457.6	824188.9	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	1. The stack parameters refer to 'Bunker' adopted in Appendix 3.5 of the approved EIA Study on Lei Yue Mun waterfront Enhancement Project (EIA-258/2018). 2. The emission rates for NOx, RSP and FSP are calcuated based on the number of vessels between 8:00 am - 12:00pm and 1:00pm - 6:00 pm.
	TKM02	POINT	829450.3	824236.8	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM03	POINT	829443.1	824284.8	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM04	POINT	829435.8	824332.7	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM05	POINT	829428.6	824380.7	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM06	POINT	829421.3	824428.6	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM07	POINT	829414.0	824476.6	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM08	POINT	829406.8	824524.5	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM09	POINT	829399.5	824572.5	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM10	POINT	829392.3	824620.4	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM11	POINT	829385.0	824668.4	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM12	POINT	829377.7	824716.3	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM13	POINT	829370.5	824764.3	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM14	POINT	829362.8	824812.1	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM15	POINT	829335.3	824852.1	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM16	POINT	829307.9	824892.1	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM17	POINT	829280.5	824932.0	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM18	POINT	829253.0	824972.0	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM19	POINT	829225.6	825012.0	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
	TKM20	POINT	829184.0	825034.9	-	-	-	30.000	555.000	25.000	0.800	2.929E-02	1.510E-03	1.468E-03	
Tug	TGM01	POINTHOR	829457.6	824188.9	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	1. The stack parameters refer to 'Others' adopted in Appendix 3.5 of the approved EIA Study on Lei Yue Mun waterfront Enhancement Project (EIA-258/2018). 2. The emission rates for NOx, RSP and FSP are calcuated based on the number of vessels between 8:00 am - 12:00pm and 1:00pm - 6:00 pm.
	TGM02	POINTHOR	829450.3	824236.8	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM03	POINTHOR	829443.1	824284.8	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM04	POINTHOR	829435.8	824332.7	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM05	POINTHOR	829428.6	824380.7	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM06	POINTHOR	829421.3	824428.6	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM07	POINTHOR	829414.0	824476.6	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM08	POINTHOR	829406.8	824524.5	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM09	POINTHOR	829399.5	824572.5	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM10	POINTHOR	829392.3	824620.4	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM11	POINTHOR	829385.0	824668.4	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM12	POINTHOR	829377.7	824716.3	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM13	POINTHOR	829370.5	824764.3	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM14	POINTHOR	829362.8	824812.1	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM15	POINTHOR	829335.3	824852.1	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM16	POINTHOR	829307.9	824892.1	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM17	POINTHOR	829280.5	824932.0	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM18	POINTHOR	829253.0	824972.0	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM19	POINTHOR	829225.6	825012.0	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
	TGM20	POINTHOR	829184.0	825034.9	-	-	-	4.000	694.700	8.000	0.300	7.751E-02	4.125E-03	4.011E-03	
Pilot Vessels	PVM01	POINTHOR	829457.6	824188.9	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	1. The stack parameters refer to 'Others' adopted in Appendix 3.5 of the approved EIA Study on Lei Yue Mun waterfront Enhancement Project (EIA-258/2018). 2. The emission rates for NOx, RSP and FSP are calcuated based on the number of vessels between 8:00 am - 12:00pm and 1:00pm - 6:00 pm.
	PVM02	POINTHOR	829450.3	824236.8	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM03	POINTHOR	829443.1	824284.8	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM04	POINTHOR	829435.8	824332.7	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM05	POINTHOR	829428.6	824380.7	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM06	POINTHOR	829421.3	824428.6	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM07	POINTHOR	829414.0	824476.6	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM08	POINTHOR	829406.8	824524.5	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM09	POINTHOR	829399.5	824572.5	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM10	POINTHOR	829392.3	824620.4	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM11	POINTHOR	829385.0	824668.4	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM12	POINTHOR	829377.7	824716.3	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM13	POINTHOR	829370.5	824764.3	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM14	POINTHOR	829362.8	824812.1	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM15	POINTHOR	829335.3	824852.1	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM16	POINTHOR	829307.9	824892.1	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM17	POINTHOR	829280.5	824932.0	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM18	POINTHOR	829253.0	824972.0	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM19	POINTHOR	829225.6	825012.0	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	
	PVM20	POINTHOR	829184.0	825034.9	-	-	-	4.000	694.700	8.000	0.300	4.904E-03	1.564E-04	1.515E-04	

Appendix 3.7 Detailed Calculations of Marine Emissions

	Source	Type	X	Y	Release Height	Initial lateral dimension	Initial vertical dimension	Stack Height	Exit Temperature	Exit Velocity	Stack Diameter	Emission Rate			Remarks
												NOx	RSP	FSP	
	ID		(m)	(m)	(m)	(m)	(m)	(m)	(K)	(m/s)	m	(g/s)	(g/s)	(g/s) or (g/m^2/s)	
Fishing Vessels	FVM01	POINTHOR	829457.6	824188.9	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	1. The stack parameters refer to 'Fishing Vessel' adopted in Appendix 3.5 of the approved EIA Study on Lei Yue Mun waterfront Enhancement Project (EIA-258/2018). 2. The emission rates for NOx, RSP and FSP are calcuated based on the number of vessels between 8:00 am - 12:00pm and 1:00pm - 6:00 pm.
	FVM02	POINTHOR	829450.3	824236.8	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM03	POINTHOR	829443.1	824284.8	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM04	POINTHOR	829435.8	824332.7	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM05	POINTHOR	829428.6	824380.7	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM06	POINTHOR	829421.3	824428.6	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM07	POINTHOR	829414.0	824476.6	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM08	POINTHOR	829406.8	824524.5	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM09	POINTHOR	829399.5	824572.5	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM10	POINTHOR	829392.3	824620.4	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM11	POINTHOR	829385.0	824668.4	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM12	POINTHOR	829377.7	824716.3	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM13	POINTHOR	829370.5	824764.3	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM14	POINTHOR	829362.8	824812.1	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM15	POINTHOR	829335.3	824852.1	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM16	POINTHOR	829307.9	824892.1	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM17	POINTHOR	829280.5	824932.0	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM18	POINTHOR	829253.0	824972.0	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM19	POINTHOR	829225.6	825012.0	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	
	FVM20	POINTHOR	829184.0	825034.9	-	-	-	6.000	555.000	8.000	0.300	3.056E-03	7.127E-05	6.594E-05	

Appendix 3.7 Detailed Calculations of Marine Emissions

Marine Emission approaching to / departing from Tsuen Wan Pier

Maneuvering (round trip)

Main Engine Power [1]		kW	2686
Main Engine Load Factor [2] [3]		-	0.7
Auxiliary Engine Power [4]		kW	326
Auxiliary Engine Load Factor [2] [5]		-	0.45
Distance Travelled per trip		nautical miles	0.217
Average Travelling Speed [6]		knots	4
		hr	0.0543
Emission Factors for Main Engine [10][11]	NOx	g/kWh	13.20
	PM10	g/kWh	0.17
Emission Factors for Auxiliary Engine [9][10]	NOx	g/kWh	10
	PM10	g/kWh	0.17
Emission Rates for Main Engine (round trip) [12]	NOx	g/s	7.480E-01
	PM10	g/s	9.426E-03
Emission Rates for Auxiliary Engine (round trip) [12]	NOx	g/s	4.421E-02
	PM10	g/s	7.302E-04
Total Emission Rates (round trip) [13]	NOx	g/s	7.922E-01
	PM10	g/s	1.016E-02
No. of Volume Sources		-	20
Emission Rate per Source	NOx	g/s	3.961E-02
	PM10	g/s	5.078E-04

Notes:

[1] There are two fleets for Park Island Ferry. The ferry model having higher Main Engine Power is adopted as a worst-case scenario: http://www.barcaferry.com/photo/photo_shipyards/marintekink/marintekink_cpv38_date.html
[2] Maneuvering mode was assumed as the ferry departed and approached pier and average speed of maneuvering mode was adopted based on Table 3-24 of MVEIS.
[3] The Main Engline Load Factor of Park Island Ferry is based on Table 4-8 of *MVEIS* .
[4] According to Paragraph 4.2.12, the auxiliary engine power of a Macau ferry ranges from 120-326 kW. As a worst-case scenario, 326 kW is adopted for AE power calculation.
[5] The Auxiliary Engine Load Factors of Park Island Ferry is based on Table 4-10 of *MVEIS*.
[6]The maneuvering speed is averaged for the speed for manoeuvring mode listed in Table 3-24 of MVEIS.
[7] Cruising Time = Length of Route ÷ Crusing Speed
[8] Reference made to Park Island ferry schedule: http://www.pitcl.com.hk/attachment/ferry/pdf/1488954768y5ntC.pdf
[9] The NOx emission rate for Auxiliary Engine was adopted based on Table 4-17 of *MVEIS*.
[10] According to the Air Pollution Control (Marine Light Diesel) Regulation, local vessel in Hong Kong should be using marine light diesel with sulphur content of 0.05%. Therefore, the PM10 emission factors for Main Engine and Auxiliary Engine were adjusted based on the formula stated in Paragraph 4.2.31 of *MVEIS* . The formula of PM10 Emission Factor is 0.23+ BSFC x 7 x 0.02247 x (Fuel Sulphur Fraction - 0.0024), where BSFC for Ferry is 213 and Fuel Sulphur Fraction is 0.0005.
[11] The NOx emission rate for Main Engine was adopted based on Table 4-17 of MVEIS.
[12] Emission Rate per round trip = Emission Factor x Engine Power x No. of Engine x Load Factor x Cruising Time ÷ 3600 x 2
[13] The $PM_{2.5}$ (FSP) emission rates for Park Island Ferry is assumed to be the same as PM_{10} (RSP).
[11] The main engine is IMO Tier 1 certified. According to Regulation 13 of MARPOL Annex VI, NOx emission limit of IMO Tier 1 engine having engine speed (n) 130-2000 is given by 45 x n^(-0.2).

Appendix 3.7 Detailed Calculations of Marine Emissions

Marine Emission berthing at Tsuen Wan Pier

Hotelling

Main Engine Power [1]		kW	2686
Main Engine Load Factor [2] [3]		-	0
Auxiliary Engine Power [4]		kW	326.0
Auxiliary Engine Load Factor [2] [5]		-	0.45
Hotelling Time [6]		hr	0.08
No. of Vessels [7]		per day	3
Emission Factors for Main Engine [9][10]	NOx	g/kWh	13.20
	PM10	g/kWh	0.17
Emission Factors for Auxiliary Engine [8][9]	NOx	g/kWh	10
	PM10	g/kWh	0.17
Emission Rates for Main Engine [11]	NOx	g/s	0.000E+00
	PM10	g/s	0.000E+00
Emission Rates for Auxiliary Engine [11]	NOx	g/s	3.396E-02
	PM10	g/s	5.608E-04
Total Emission Rates [12]	NOx	g/s	3.396E-02
	PM10	g/s	5.608E-04

Notes:

[1] There are two fleets for Park Island Ferry. The ferry model having higher Main Engine Power is adopted as a worst-case scenario: http://www.barcaferry.com/photo/photo_shipyards/marintekink/marintekink_cpv38_date.html
[2] Hotelling was assumed when berthing at the pier.
[3] Table 4-8 of *MVEIS*.
[4] According to Paragraph 4.2.12, the auxiliary engine power of a Macau ferry ranges from 120-326 kW. As a worst-case scenario, 326 kW is adopted for AE power calculation.
[5] Table 4-10 of *MVEIS*.
[6] Berthing time is based on observation.
[7] Reference made to Park Island ferry schedule: http://www.pitcl.com.hk/attachment/ferry/pdf/1488954768y5ntC.pdf
[8] Table 4-17 of *MVEIS*.
[9] According to the Air Pollution Control (Marine Light Diesel) Regulation, local vessel in Hong Kong should be using marine light diesel with sulphur content of 0.05%. Therefore, the emission factor of PM10 was adjusted based on the formula stated in Paragraph 4.2.31 of *MVEIS*.
[10] The NOx emission rate for Main Engine was adopted based on Table 4-17 of MVEIS.
[11] Emission Rate per trip = Emission Factor x Engine Power x No. of Engine x Load Factor x Hotelling Time ÷ 3600
[12] The $PM_{2.5}$ (FSP) emission rates for Park Island Ferry is assumed to be the same as PM_{10} (RSP).

Emission Factors for River-trade Vessels - 8:00am - 12:00pm & 1:00pm - 6:00pm

Main Engine (ME) Emission

	MD Vessel Type	No. of Vessels[1]	Average Speed (knot)[13]	Distance (nautical miles)	Time-in-mode (hr)[2]	MVEIS Assumption							ME Emission Factor (g/kWh)[10]			Sub-total (g/s)		
						MVEIS Vessel Type[3]	Operation Mode[4]	ME Engine Type[5]	Fuel Type[6]	ME Power Rating (kW)[7,8]	ME Loading Factor[9]	Brake Specific Fuel Consumption[10]	NOx	PM_{10}	$PM_{2.5}$	NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	1	4	0.54	0.14	Conventional Cargo Vesel (GRT >=1000)	Maneuvering	Diesel engine	MGO	654	0.300	213	10.00	0.30	0.29	7.36E-02	2.21E-03	2.13E-03
2	Passenger Ferry	2	4	0.54	0.14	Pleasure Vessel	Maneuvering	Diesel engine	MGO	786	0.020	203	13.20	0.31	0.29	1.56E-02	3.65E-04	3.42E-04
3	Tanker	2	4	0.54	0.14	Oil Tanker (GRT>=1000)	Maneuvering	Diesel engine	MGO	1565	0.300	213	13.20	0.72	0.70	4.65E-01	2.54E-02	2.46E-02
4	Tug	4	4	0.54	0.14	Tug (GRT >=1000)	Maneuvering	Diesel engine	MGO	2371	0.300	213	13.20	0.72	0.70	1.41E+00	7.68E-02	7.47E-02
5	Pilot Vessel	1	4	0.54	0.14	Other (GRT>=1000)	Maneuvering	Diesel engine	MGO	707	0.300	213	10.00	0.30	0.29	7.95E-02	2.39E-03	2.31E-03
6	Fishing Vessel	2	4	0.54	0.14	Fishing/ Fish Processing Vessel	Maneuvering	Diesel engine	MGO	420	0.095	203	13.20	0.31	0.29	3.95E-02	9.28E-04	8.68E-04

Auxiliary Engine (AE) Emission

	MD Vessel Type	No. of Vessels[1]	Average Speed (knot)[13]	Distance (nautical miles)	Time-in-mode (hr)[2]	MVEIS Assumption						AE Emission Factor (g/kWh)[10]			Sub-total (g/s)		
						MVEIS Vessel Type[3]	Operation Mode[4]	Fuel Type[6]	AE Power Rating (kW)[11]	AE Loading Factor[12]	Brake Specific Fuel Consumption[10]	NOx	PM_{10}	$PM_{2.5}$	NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	1	4	0.54	0.14	Conventional Cargo Vesel (GRT >=1000)	Maneuvering	MGO	115	0.430	213	10.00	0.40	0.39	1.85E-02	7.42E-04	7.23E-04
2	Passenger Ferry	2	4	0.54	0.14	Pleasure Vessel	Maneuvering	MGO	60	0.320	203	13.90	0.32	0.29	2.00E-02	4.61E-04	4.18E-04
3	Tanker	2	4	0.54	0.14	Oil Tanker (GRT>=1000)	Maneuvering	MGO	375	0.430	213	10.00	0.40	0.39	1.21E-01	4.84E-03	4.72E-03
4	Tug	4	4	0.54	0.14	Tug (GRT >=1000)	Maneuvering	MGO	220	0.430	213	10.00	0.40	0.39	1.42E-01	5.68E-03	5.53E-03
5	Pilot Vessel	1	4	0.54	0.14	Other (GRT>=1000)	Maneuvering	MGO	115	0.430	213	10.00	0.40	0.39	1.85E-02	7.42E-04	7.23E-04
6	Fishing Vessel	2	4	0.54	0.14	Fishing/ Fish Processing Vessel	Maneuvering	MGO	93	0.223	203	13.90	0.32	0.29	2.16E-02	4.98E-04	4.51E-04

Emission Rate for RTVs travelling within 500m study area

	MD Vessel Type	Operation Mode[4]	No. of Sources	Emission Rate (g/s)		
				NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	Maneuvering	20	4.61E-03	1.47E-04	1.43E-04
2	Passenger Ferry	Maneuvering	20	1.78E-03	4.13E-05	3.80E-05
3	Tanker	Maneuvering	20	2.93E-02	1.51E-03	1.47E-03
4	Tug	Maneuvering	20	7.75E-02	4.12E-03	4.01E-03
5	Pilot Vessel	Maneuvering	20	4.90E-03	1.56E-04	1.51E-04
6	Fishing Vessel	Maneuvering	20	3.06E-03	7.13E-05	6.59E-05

Remarks:

[1] The maximum number of vessels for different periods (i.e., 6:00 am - 8:00 am, 8:00 am - 12:00 pm, 12:00 pm - 1:00 pm, 1:00 pm - 6:00 pm, 6:00 pm -11:00 pm and 11:00 pm -6:00 am) was taken from the 24-hour real-time observation during 6 July to 8 July, 11 July, 15 July, 19 July and 12 Aug 2022.

[2] The time-in-mode was obtained by dividing travelling distance by average maneuvering speed.

[3] Classification of vessel type was based on Table 4-1 of *MVEIS*.

[4] The Operation mode is referred to Table 3-24 of *MVEIS*.

[5] The Main engine type is referred to S4.2.6 of *MVEIS*.

[6] The fuel type is referred to S4.2.26 of *MVEIS*.

[7] For ME Power Rating of conventional cargo vessel, oil tanker and chemical Carrier, reference is made to Table 4-5 of *MVEIS*. For ME Power Rating of Fishing Vessel, reference is made to Table 3-15 of MVEIS.

[8] Passenger Ferry is assumed to be Pleasure Vessels, of which the ME Power Rating refers to Table 3-15 of *MVEIS*.

[9] For ME loading factor of Passager & Fishing Vessel, reference is made to Table 3-18 of *MVEIS*. For ME loading factor of Conventional Cargo Vessel, Oil Tanker, chemical carrier, Tug and Other, reference is made to Table 4-7 of MVEIS.

[10] For Conventional Cargo Vessel, Oil Tanker, Chemical Carrier, Tug and Other, emission factors and brake specific fuel consumption are referred to Table 4-16 of *MVEIS*. For Pleasure Vessel and Fishing Vessel, emission factors and brake specific fuel consumption are referred to Table 3-27 and Table 3-28.

[11] The Power rating of Auxiliary Engine is referred to Table 3-20, Table 4-6 of *MVEIS*.

[12] The Loading Factor of Auxiliary Engine is referred to Table 4-10 and Table 3-21 of *MVEIS*.

[13] The maneuvering speed is averaged for the speed for manoeuvring mode listed in Table 3-24 of MVEIS.

Emission Factors for River-trade Vessels - 6:00pm - 11:00pm

Main Engine (ME) Emission

	MD Vessel Type	No. of Vessels[1]	Average Speed (knot)[13]	Distance (nautical miles)	Time-in-mode (hr)[2]	MVEIS Assumption							ME Emission Factor (g/kWh)[10]			Sub-total (g/s)		
						MVEIS Vessel Type[3]	Operation Mode[4]	ME Engine Type[5]	Fuel Type[6]	ME Power Rating (kW)[7,8]	ME Loading Factor[9]	Brake Specific Fuel Consumption[10]	NOx	PM_{10}	$PM_{2.5}$	NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	2	4	0.54	0.14	Conventional Cargo Vesel (GRT >=1000)	Maneuvering	Diesel engine	MGO	654	0.300	213	10.00	0.30	0.29	1.47E-01	4.41E-03	4.27E-03
2	Passenger Ferry	1	4	0.54	0.14	Pleasure Vessel	Maneuvering	Diesel engine	MGO	786	0.020	203	13.20	0.31	0.29	7.78E-03	1.83E-04	1.71E-04
3	Tanker	2	4	0.54	0.14	Oil Tanker (GRT>=1000)	Maneuvering	Diesel engine	MGO	1565	0.300	213	13.20	0.72	0.70	4.65E-01	2.54E-02	2.46E-02
4	Tug	1	4	0.54	0.14	Tug (GRT >=1000)	Maneuvering	Diesel engine	MGO	2371	0.300	213	13.20	0.72	0.70	3.52E-01	1.92E-02	1.87E-02
5	Pilot Vessel	0	4	0.54	0.14	Other (GRT>=1000)	Maneuvering	Diesel engine	MGO	707	0.300	213	10.00	0.30	0.29	0.00E+00	0.00E+00	0.00E+00
6	Fishing Vessel	0	4	0.54	0.14	Fishing/ Fish Processing Vessel	Maneuvering	Diesel engine	MGO	420	0.095	203	13.20	0.31	0.29	0.00E+00	0.00E+00	0.00E+00

Auxiliary Engine (AE) Emission

	MD Vessel Type	No. of Vessels[1]	Average Speed (knot)[13]	Distance (nautical miles)	Time-in-mode (hr)[2]	MVEIS Assumption						AE Emission Factor (g/kWh)[10]			Sub-total (g/s)		
						MVEIS Vessel Type[3]	Operation Mode[4]	Fuel Type[6]	AE Power Rating (kW)[11]	AE Loading Factor[12]	Brake Specific Fuel Consumption[10]	NOx	PM_{10}	$PM_{2.5}$	NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	2	4	0.54	0.14	Conventional Cargo Vesel (GRT >=1000)	Maneuvering	MGO	115	0.430	213	10.00	0.40	0.39	3.71E-02	1.48E-03	1.45E-03
2	Passenger Ferry	1	4	0.54	0.14	Pleasure Vessel	Maneuvering	MGO	60	0.320	203	13.90	0.32	0.29	1.00E-02	2.30E-04	2.09E-04
3	Tanker	2	4	0.54	0.14	Oil Tanker (GRT>=1000)	Maneuvering	MGO	375	0.430	213	10.00	0.40	0.39	1.21E-01	4.84E-03	4.72E-03
4	Tug	1	4	0.54	0.14	Tug (GRT >=1000)	Maneuvering	MGO	220	0.430	213	10.00	0.40	0.39	3.55E-02	1.42E-03	1.38E-03
5	Pilot Vessel	0	4	0.54	0.14	Other (GRT>=1000)	Maneuvering	MGO	115	0.430	213	10.00	0.40	0.39	0.00E+00	0.00E+00	0.00E+00
6	Fishing Vessel	0	4	0.54	0.14	Fishing/ Fish Processing Vessel	Maneuvering	MGO	93	0.223	203	13.90	0.32	0.29	0.00E+00	0.00E+00	0.00E+00

Emission Rate for RTVs travelling within 500m study area

	MD Vessel Type	Operation Mode[4]	No. of Sources	Emission Rate (g/s)		
				NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	Maneuvering	20	9.21E-03	2.95E-04	2.86E-04
2	Passenger Ferry	Maneuvering	20	8.89E-04	2.07E-05	1.90E-05
3	Tanker	Maneuvering	20	2.93E-02	1.51E-03	1.47E-03
4	Tug	Maneuvering	20	1.94E-02	1.03E-03	1.00E-03
5	Pilot Vessel	Maneuvering	20	0.00E+00	0.00E+00	0.00E+00
6	Fishing Vessel	Maneuvering	20	0.00E+00	0.00E+00	0.00E+00

Remarks:

[1] The maximum number of vessels for different periods (i.e., 6:00 am - 8:00 am, 8:00 am - 12:00 pm, 12:00 pm - 1:00 pm, 1:00 pm - 6:00 pm, 6:00 pm -11:00 pm and 11:00 pm -6:00 am) was taken from the 24-hour real-time observation during 6 July to 8 July, 11 July, 15 July, 19 July and 12 Aug 2022.

[2] The time-in-mode was obtained by dividing travelling distance by average maneuvering speed.

[3] Classification of vessel type was based on Table 4-1 of *MVEIS*.

[4] The Operation mode is referred to Table 3-24 of *MVEIS*.

[5] The Main engine type is referred to S4.2.6 of *MVEIS*.

[6] The fuel type is referred to S4.2.26 of *MVEIS*.

[7] For ME Power Rating of conventional cargo vessel, oil tanker and chemical Carrier, reference is made to Table 4-5 of *MVEIS*. For ME Power Rating of Fishing Vessel, reference is made to Table 3-15 of MVEIS.

[8] Passenger Ferry is assumed to be Pleasure Vessels, of which the ME Power Rating refers to Table 3-15 of *MVEIS*.

[9] For ME loading factor of Passager & Fishing Vessel, reference is made to Table 3-18 of *MVEIS*. For ME loading factor of Conventional Cargo Vessel, Oil Tanker, chemical carrier, Tug and Other, reference is made to Table 4-7 of MVEIS.

[10] For Conventional Cargo Vessel, Oil Tanker, Chemical Carrier, Tug and Other, emission factors and brake specific fuel consumption are referred to Table 4-16 of *MVEIS*. For Pleasure Vessel and Fishing Vessel, emission factors and brake specific fuel consumption are referred to Table 3-27 and Table 3-28.

[11] The Power rating of Auxiliary Engine is referred to Table 3-20, Table 4-6 of *MVEIS*.

[12] The Loading Factor of Auxiliary Engine is referred to Table 4-10 and Table 3-21 of *MVEIS*.

[13] The maneuvering speed is averaged for the speed for manoeuvring mode listed in Table 3-24 of MVEIS.

Emission Factors for River-trade Vessels - 11:00pm - 6:00am & 12:00pm - 1:00pm

Main Engine (ME) Emission

	MD Vessel Type	No. of Vessels[1]	Average Speed (knot)[13]	Distance (nautical miles)	Time-in-mode (hr)[2]	MVEIS Assumption							ME Emission Factor (g/kWh)[10]			Sub-total (g/s)		
						MVEIS Vessel Type[3]	Operation Mode[4]	ME Engine Type[5]	Fuel Type[6]	ME Power Rating (kW)[7,8]	ME Loading Factor[9]	Brake Specific Fuel Consumption[10]	NOx	PM_{10}	$PM_{2.5}$	NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	0	4	0.54	0.14	Conventional Cargo Vessel (GRT >=1000)	Maneuvering	Diesel engine	MGO	654	0.300	213	10.00	0.30	0.29	0.00E+00	0.00E+00	0.00E+00
2	Passenger Ferry	1	4	0.54	0.14	Pleasure Vessel	Maneuvering	Diesel engine	MGO	786	0.020	203	13.20	0.31	0.29	7.78E-03	1.83E-04	1.71E-04
3	Tanker	0	4	0.54	0.14	Oil Tanker (GRT>=1000)	Maneuvering	Diesel engine	MGO	1565	0.300	213	13.20	0.72	0.70	0.00E+00	0.00E+00	0.00E+00
4	Tug	1	4	0.54	0.14	Tug (GRT >=1000)	Maneuvering	Diesel engine	MGO	2371	0.300	213	13.20	0.72	0.70	3.52E-01	1.92E-02	1.87E-02
5	Pilot Vessel	0	4	0.54	0.14	Other (GRT>=1000)	Maneuvering	Diesel engine	MGO	707	0.300	213	10.00	0.30	0.29	0.00E+00	0.00E+00	0.00E+00
6	Fishing Vessel	0	4	0.54	0.14	Fishing/ Fish Processing Vessel	Maneuvering	Diesel engine	MGO	420	0.095	203	13.20	0.31	0.29	0.00E+00	0.00E+00	0.00E+00

Auxiliary Engine (AE) Emission

	MD Vessel Type	No. of Vessels[1]	Average Speed (knot)[13]	Distance (nautical miles)	Time-in-mode (hr)[2]	MVEIS Assumption						AE Emission Factor (g/kWh)[10]			Sub-total (g/s)		
						MVEIS Vessel Type[3]	Operation Mode[4]	Fuel Type[6]	AE Power Rating (kW)[11]	AE Loading Factor[12]	Brake Specific Fuel Consumption[10]	NOx	PM_{10}	$PM_{2.5}$	NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	0	4	0.54	0.14	Conventional Cargo Vessel (GRT >=1000)	Maneuvering	MGO	115	0.430	213	10.00	0.40	0.39	0.00E+00	0.00E+00	0.00E+00
2	Passenger Ferry	1	4	0.54	0.14	Pleasure Vessel	Maneuvering	MGO	60	0.320	203	13.90	0.32	0.29	1.00E-02	2.30E-04	2.09E-04
3	Tanker	0	4	0.54	0.14	Oil Tanker (GRT>=1000)	Maneuvering	MGO	375	0.430	213	10.00	0.40	0.39	0.00E+00	0.00E+00	0.00E+00
4	Tug	1	4	0.54	0.14	Tug (GRT >=1000)	Maneuvering	MGO	220	0.430	213	10.00	0.40	0.39	3.55E-02	1.42E-03	1.38E-03
5	Pilot Vessel	0	4	0.54	0.14	Other (GRT>=1000)	Maneuvering	MGO	115	0.430	213	10.00	0.40	0.39	0.00E+00	0.00E+00	0.00E+00
6	Fishing Vessel	0	4	0.54	0.14	Fishing/ Fish Processing Vessel	Maneuvering	MGO	93	0.223	203	13.90	0.32	0.29	0.00E+00	0.00E+00	0.00E+00

Emission Rate for RTVs travelling within 500m study area

	MD Vessel Type	Operation Mode[4]	No. of Sources	Emission Rate (g/s)		
				NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	Maneuvering	20	0.00E+00	0.00E+00	0.00E+00
2	Passenger Ferry	Maneuvering	20	8.89E-04	2.07E-05	1.90E-05
3	Tanker	Maneuvering	20	0.00E+00	0.00E+00	0.00E+00
4	Tug	Maneuvering	20	1.94E-02	1.03E-03	1.00E-03
5	Pilot Vessel	Maneuvering	20	0.00E+00	0.00E+00	0.00E+00
6	Fishing Vessel	Maneuvering	20	0.00E+00	0.00E+00	0.00E+00

Remarks:

[1] The maximum number of vessels for different periods (i.e., 6:00 am - 8:00 am, 8:00 am - 12:00 pm, 12:00 pm - 1:00 pm, 1:00 pm - 6:00 pm, 6:00 pm -11:00 pm and 11:00 pm -6:00 am) was taken from the 24-hour real-time observation during 6 July to 8 July, 11 July, 15 July, 19 July and 12 Aug 2022.

[2] The time-in-mode was obtained by dividing travelling distance by average maneuvering speed.

[3] Classification of vessel type was based on Table 4-1 of *MVEIS*.

[4] The Operation mode is referred to Table 3-24 of *MVEIS*.

[5] The Main engine type is referred to S4.2.6 of *MVEIS*.

[6] The fuel type is referred to S4.2.26 of *MVEIS*.

[7] For ME Power Rating of conventional cargo vessel, oil tanker and chemical Carrier, reference is made to Table 4-5 of *MVEIS*. For ME Power Rating of Fishing Vessel, reference is made to Table 3-15 of MVEIS.

[8] Passenger Ferry is assumed to be Pleasure Vessels, of which the ME Power Rating refers to Table 3-15 of *MVEIS*.

[9] For ME loading factor of Passager & Fishing Vessel, reference is made to Table 3-18 of *MVEIS*. For ME loading factor of Conventional Cargo Vessel, Oil Tanker, chemical carrier, Tug and Other, reference is made to Table 4-7 of MVEIS.

[10] For Conventional Cargo Vessel, Oil Tanker, Chemical Carrier, Tug and Other, emission factors and brake specific fuel consumption are referred to Table 4-16 of *MVEIS*. For Pleasure Vessel and Fishing Vessel, emission factors and brake specific fuel consumption are referred to Table 3-27 and Table 3-28.

[11] The Power rating of Auxiliary Engine is referred to Table 3-20, Table 4-6 of *MVEIS*.

[12] The Loading Factor of Auxiliary Engine is referred to Table 4-10 and Table 3-21 of *MVEIS*.

[13] The maneuvering speed is averaged for the speed for manoeuvring mode listed in Table 3-24 of MVEIS.

Emission Factors for River-trade Vessels - 6:00am - 8:00am

Main Engine (ME) Emission

	MD Vessel Type	No. of Vessels[1]	Average Speed (knot)[13]	Distance (nautical miles)	Time-in-mode (hr)[2]	MVEIS Assumption							ME Emission Factor (g/kWh)[10]			Sub-total (g/s)		
						MVEIS Vessel Type[3]	Operation Mode[4]	ME Engine Type[5]	Fuel Type[6]	ME Power Rating (kW)[7,8]	ME Loading Factor[9]	Brake Specific Fuel Consumption[10]	NOx	PM_{10}	$PM_{2.5}$	NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	0	4	0.54	0.14	Conventional Cargo Vesel (GRT >=1000)	Maneuvering	Diesel engine	MGO	654	0.300	213	10.00	0.30	0.29	0.00E+00	0.00E+00	0.00E+00
2	Passenger Ferry	1	4	0.54	0.14	Pleasure Vessel	Maneuvering	Diesel engine	MGO	786	0.020	203	13.20	0.31	0.29	7.78E-03	1.83E-04	1.71E-04
3	Tanker	1	4	0.54	0.14	Oil Tanker (GRT>=1000)	Maneuvering	Diesel engine	MGO	1565	0.300	213	13.20	0.72	0.70	2.32E-01	1.27E-02	1.23E-02
4	Tug	3	4	0.54	0.14	Tug (GRT >=1000)	Maneuvering	Diesel engine	MGO	2371	0.300	213	13.20	0.72	0.70	1.06E+00	5.76E-02	5.60E-02
5	Pilot Vessel	1	4	0.54	0.14	Other (GRT>=1000)	Maneuvering	Diesel engine	MGO	707	0.300	213	10.00	0.30	0.29	7.95E-02	2.39E-03	2.31E-03
6	Fishing Vessel	0	4	0.54	0.14	Fishing/ Fish Processing Vessel	Maneuvering	Diesel engine	MGO	420	0.095	203	13.20	0.31	0.29	0.00E+00	0.00E+00	0.00E+00

Auxiliary Engine (AE) Emission

	MD Vessel Type	No. of Vessels[1]	Average Speed (knot)[13]	Distance (nautical miles)	Time-in-mode (hr)[2]	MVEIS Assumption						AE Emission Factor (g/kWh)[10]			Sub-total (g/s)		
						MVEIS Vessel Type[3]	Operation Mode[4]	Fuel Type[6]	AE Power Rating (kW)[11]	AE Loading Factor[12]	Brake Specific Fuel Consumption[10]	NOx	PM_{10}	$PM_{2.5}$	NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	0	4	0.54	0.14	Conventional Cargo Vesel (GRT >=1000)	Maneuvering	MGO	115	0.430	213	10.00	0.40	0.39	0.00E+00	0.00E+00	0.00E+00
2	Passenger Ferry	1	4	0.54	0.14	Pleasure Vessel	Maneuvering	MGO	60	0.320	203	13.90	0.32	0.29	1.00E-02	2.30E-04	2.09E-04
3	Tanker	1	4	0.54	0.14	Oil Tanker (GRT>=1000)	Maneuvering	MGO	375	0.430	213	10.00	0.40	0.39	6.05E-02	2.42E-03	2.36E-03
4	Tug	3	4	0.54	0.14	Tug (GRT >=1000)	Maneuvering	MGO	220	0.430	213	10.00	0.40	0.39	1.06E-01	4.26E-03	4.15E-03
5	Pilot Vessel	1	4	0.54	0.14	Other (GRT>=1000)	Maneuvering	MGO	115	0.430	213	10.00	0.40	0.39	1.85E-02	7.42E-04	7.23E-04
6	Fishing Vessel	0	4	0.54	0.14	Fishing/ Fish Processing Vessel	Maneuvering	MGO	93	0.223	203	13.90	0.32	0.29	0.00E+00	0.00E+00	0.00E+00

Emission Rate for RTVs travelling within 500m study area

	MD Vessel Type	Operation Mode[4]	No. of Sources	Emission Rate (g/s)		
				NOx	PM_{10}	$PM_{2.5}$
1	Cargo Vessel	Maneuvering	20	0.00E+00	0.00E+00	0.00E+00
2	Passenger Ferry	Maneuvering	20	8.89E-04	2.07E-05	1.90E-05
3	Tanker	Maneuvering	20	1.46E-02	7.55E-04	7.34E-04
4	Tug	Maneuvering	20	5.81E-02	3.09E-03	3.01E-03
5	Pilot Vessel	Maneuvering	20	4.90E-03	1.56E-04	1.51E-04
6	Fishing Vessel	Maneuvering	20	0.00E+00	0.00E+00	0.00E+00

Remarks:

[1] The maximum number of vessels for different periods (i.e., 6:00 am - 8:00 am, 8:00 am - 12:00 pm, 12:00 pm - 1:00 pm, 1:00 pm - 6:00 pm, 6:00 pm -11:00 pm and 11:00 pm -6:00 am) was taken from the 24-hour real-time observation during 6 July to 8 July, 11 July, 15 July, 19 July and 12 Aug 2022.

[2] The time-in-mode was obtained by dividing travelling distance by average maneuvering speed.

[3] Classification of vessel type was based on Table 4-1 of *MVEIS*.

[4] The Operation mode is referred to Table 3-24 of *MVEIS*.

[5] The Main engine type is referred to S4.2.6 of *MVEIS*.

[6] The fuel type is referred to S4.2.26 of *MVEIS*.

[7] For ME Power Rating of conventional cargo vessel, oil tanker and chemical Carrier, reference is made to Table 4-5 of *MVEIS*. For ME Power Rating of Fishing Vessel, reference is made to Table 3-15 of MVEIS.

[8] Passenger Ferry is assumed to be Pleasure Vessels, of which the ME Power Rating refers to Table 3-15 of *MVEIS*.

[9] For ME loading factor of Passager & Fishing Vessel, reference is made to Table 3-18 of *MVEIS*. For ME loading factor of Conventional Cargo Vessel, Oil Tanker, chemical carrier, Tug and Other, reference is made to Table 4-7 of MVEIS.

[10] For Conventional Cargo Vessel, Oil Tanker, Chemical Carrier, Tug and Other, emission factors and brake specific fuel consumption are referred to Table 4-16 of *MVEIS*. For Pleasure Vessel and Fishing Vessel, emission factors and brake specific fuel consumption are referred to Table 3-27 and Table 3-28.

[11] The Power rating of Auxiliary Engine is referred to Table 3-20, Table 4-6 of *MVEIS*.

[12] The Loading Factor of Auxiliary Engine is referred to Table 4-10 and Table 3-21 of *MVEIS*.

[13] The maneuvering speed is averaged for the speed for manoeuvring mode listed in Table 3-24 of MVEIS.