

Appendix 3-3
Calculation of Daily and Annual RSP Emission Rates
of this Project

Northern Portion

Appendix 3-3A Summary Table of Calculated RSP Emissions Modeling Input Data of the Northern Portion of Project Site (Unmitigated Scenario)

For both the unmitigated scenario and mitigated scenarios, since there will be no construction activities during restricted hours, and on Sundays and general holidays, the calculated emission rates have been applied to day-time hours during general weekdays only (i.e. 0800 to 1800 hours). While from 1800 to 0800 hours during general workdays, and on Sunday and general holidays (whole day) are adopted for impact assessment of wind erosion on the site.

Cut and Cover (day-time only)

Project Site	Ref. ID	X coordiante	Y coordinate	Elevation, m	Release Height, m	Unmitigated *	
						Emission rate, g/m ² /s	Int. Vert. Dim.
Northern Portion	H-RECN-A1	823321.2	837466.0	4	0	5.09E-05	0
Northern Portion	H-RECN-A2	823340.2	837778.8	4	0	5.09E-05	0
Northern Portion	H-RECN-A3	823444.0	837690.9	4	0	5.09E-05	0

Wind Erosion

Project Site	Ref. ID	X coordiante	Y coordinate	Elevation, m	Release Height, m	Unmitigated (night-time only) *		Unmitigated (day-time only) *	
						Emission rate, g/m ² /s	Int. Vert. Dim.	Emission rate, g/m ² /s	Int. Vert. Dim.
Northern Portion	WR08	823321.2	837466.0	4	0	1.37E-06	0	1.37E-06	0
Northern Portion	WR09	823340.2	837778.8	4	0	1.37E-06	0	1.37E-06	0
Northern Portion	WR10	823444.0	837690.9	4	0	1.37E-06	0	1.37E-06	0

Travelling on Haul Road (unpaved) (day-time only)

Project Site	Road Segment ID	X coordiante	Y coordinate	Ground mPD level, m	X Length, m	Y Length, m	Emission Height, m	Angle, degree	Unmitigated *			Int. Vert. Dim.
									Calculated emission rate, g/m/s	Total emission, g/s	Emission rate, g/m ² /s	
									A	= (A*B)	= (A*B)/(B*C)	
Northern Portion	HR28	823514.5	837740.8	4	21	6	0.5	-124	3.22E-04	6.75E-03	5.36E-05	0
Northern Portion	HR29	823501.9	837759.6	4	21	6	0.5	-139	3.22E-04	6.75E-03	5.36E-05	0
Northern Portion	HR30	823453.7	837756.8	4	35	6	0.5	-23	3.22E-04	1.13E-02	5.36E-05	0
Northern Portion	HR31	823425.1	837736.6	4	35	6	0.5	-35	3.22E-04	1.13E-02	5.36E-05	0
Northern Portion	HR32	823404.2	837721.2	4	26	6	0.5	-38	3.22E-04	8.36E-03	5.36E-05	0
Northern Portion	HR33	823389.7	837709.7	4	19	6	0.5	-40	3.22E-04	6.11E-03	5.36E-05	0

Remark: * Please refer to Appendix 3-3C for the calculation of emission factors.

Appendix 3-3B Summary Table of Calculated RSP Emissions Modeling Input Data of the Northern Portion of Project Site (Mitigated Scenario)

For both the unmitigated scenario and mitigated scenarios, since there will be no construction activities during restricted hours, and on Sundays and general holidays, the calculated emission rates have been applied to day-time hours during general weekdays only (i.e. 0800 to 1800 hours). While from 1800 to 0800 hours during general workdays, and on Sunday and general holidays (whole day) are adopted for impact assessment of wind erosion on the site.

Cut and Cover (day-time only)

Project Site	Ref. ID	X coordinate	Y coordinate	Elevation, m	Release Height, m	Mitigated *	
						Emission rate, g/m ² /s	Int. Vert. Dim.
Northern Portion	H-RECN1	823342.56	837856.63	4	0	5.09E-06	0
Northern Portion	H-RECN2	823292.32	837815.82	4	0	5.09E-06	0
Northern Portion	H-RECN3	823292.32	837815.85	4	0	5.09E-06	0
Northern Portion	H-RECN4	823349.64	837778.66	4	0	5.09E-06	0
Northern Portion	H-RECN5	823428.04	837855.91	4	0	5.09E-06	0
Northern Portion	H-RECN6	823433.26	837855.99	4	0	5.09E-06	0
Northern Portion	H-RECN7	823427.74	837826.15	4	0	5.09E-06	0
Northern Portion	H-RECN8	823321.88	837771.19	4	0	5.09E-06	0
Northern Portion	H-RECN9	823321.5	837745.56	4	0	5.09E-06	0
Northern Portion	H-RECN10	823320.63	837711.48	4	0	5.09E-06	0
Northern Portion	H-RECN11	823380.66	837779.28	4	0	5.09E-06	0
Northern Portion	H-RECN12	823314.37	837677.17	4	0	5.09E-06	0
Northern Portion	H-RECN13	823307.98	837599.04	4	0	5.09E-06	0
Northern Portion	H-RECN14	823322.01	837467.54	4	0	5.09E-06	0
Northern Portion	H-RECN15	823360.6	837685.23	4	0	5.09E-06	0
Northern Portion	H-RECN16	823415.6	837661.49	4	0	5.09E-06	0
Northern Portion	H-RECN17	823463.26	837774.94	4	0	5.09E-06	0
Northern Portion	H-RECN18	823523.91	837760.45	4	0	5.09E-06	0
Northern Portion	H-RECN19	823519.4	837781.33	4	0	5.09E-06	0

Wind Erosion

Project Site	Ref. ID	X coordinate	Y coordinate	Elevation, m	Release Height, m	Unmitigated (night-time only) *		Mitigated (day-time only) *	
						Emission rate, g/m ² /s	Int. Vert. Dim.	Emission rate, g/m ² /s	Int. Vert. Dim.
Northern Portion	W-RECN1	823342.56	837856.63	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN2	823292.32	837815.82	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN3	823292.32	837815.85	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN4	823349.64	837778.66	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN5	823428.04	837855.91	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN6	823433.26	837855.99	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN7	823427.74	837826.15	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN8	823321.88	837771.19	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN9	823321.5	837745.56	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN10	823320.63	837711.48	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN11	823380.66	837779.28	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN12	823314.37	837677.17	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN13	823307.98	837599.04	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN14	823322.01	837467.54	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN15	823360.6	837685.23	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN16	823415.6	837661.49	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN17	823463.26	837774.94	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN18	823523.91	837760.45	4	0	1.37E-06	0	1.37E-07	0
Northern Portion	W-RECN19	823519.4	837781.33	4	0	1.37E-06	0	1.37E-07	0

Inputs to the ISCST Model:

	Calculated Emission Rate *		Emission Rate Factor **
	Day-time (A)	Night-time (B)	
Workday	5.09E-06	1.37E-06	0.2692 =A/B
Sundays and Holidays	1.37E-07	1.37E-06	
	1.37E-06	1.37E-06	0.1000 =C/D
	1.37E-06	1.37E-06	

Remark: * Please refer to Appendix 3-3C for the calculation of emission factors.

** For general workdays, in order to simulate calculated emission rate due to wind erosion during nighttime period, the "Emission Rate Factor" is applied from 1800 to 0800 hours in the ISCST model. Similarly, for Sundays and Holidays, the calculated emission rate due to wind erosion during day-time period is simulated by adopting the "Emission Rate Factor" from 0800 to 1800 hours in the ISCST model.

Travelling on Haul Road (paved) (day-time only)

Project Site	Road Segment ID	X coordiante	Y coordinate	Ground mPD level, m	X Length, m	Y Length, m	Emission Height, m	Angle, degree	Mitigated *			Int. Vert. Dim.
									Calculated emission rate, g/m/s	Total emission, g/s	Emission rate, g/m ² /s	
					B	C			D	= (D*B)	=(D*B)/(B*C)	
Northern Portion	HR28	823514.5	837740.8	4	21	6	0.5	-124	3.22E-05	6.75E-04	5.36E-06	0
Northern Portion	HR29	823501.9	837759.6	4	21	6	0.5	-139	3.22E-05	6.75E-04	5.36E-06	0
Northern Portion	HR30	823453.7	837756.8	4	35	6	0.5	-23	3.22E-05	1.13E-03	5.36E-06	0
Northern Portion	HR31	823425.1	837736.6	4	35	6	0.5	-35	3.22E-05	1.13E-03	5.36E-06	0
Northern Portion	HR32	823404.2	837721.2	4	26	6	0.5	-38	3.22E-05	8.36E-04	5.36E-06	0
Northern Portion	HR33	823389.7	837709.7	4	19	6	0.5	-40	3.22E-05	6.11E-04	5.36E-06	0

Remark: * Please refer to Appendix 3-3C for the calculation of emission factors.

Appendix 3-3C Calculation of RSP Emission Rates of the Northern Portion of Project Site (Both Unmitigated and Mitigated Scenarios)

Type of Work	Type of Emission Source	Parameter	Value	Remark
Wind Erosion on Exposed Ground	(1) Wind Erosion (day-time)	TSP emission factor (Mg/hectare/year)	0.85	USEPA AP-42, S11.9, Table 11.9-4, 7/98 ed.
		Calculated RSP emission factor (Mg/hectare/year)	0.43	Converted from the above TSP emission factor based on a ratio of 0.51 for RSP/TSP. ®
		RSP Emission rate, g/m²/s (unmitigated)	1.37E-06	$=((0.43 \times 1000000)/10000m^2/(365 \times 24 \times 60 \times 60))$
		% of dust suppression [#]	90.0%	for watering 8 times per day [#]
		RSP Emission rate, g/m²/s (mitigated)	1.37E-07	
	(1) Wind Erosion (night-time)	TSP emission factor (Mg/hectare/year)	0.85	USEPA AP-42, S11.9, Table 11.9-4, 7/98 ed.
		Calculated RSP emission factor (Mg/hectare/year)	0.43	Converted from the above TSP emission factor based on a ratio of 0.51 for RSP/TSP. ®
		RSP Emission rate, g/m²/s (unmitigated)	1.37E-06	$=((0.43 \times 1000000)/10000m^2/(365 \times 24 \times 60 \times 60))$
Cut and Cover Activities	(2) Bulldozing & Surface Compacting (day-time only)	Eqn.: $E = (0.45 (s)^{1.5} / (M)^{1.4}) \times 0.75$		USEPA AP-42, S11.9, Table 11.9-2, 7/98 ed. (Based on the eqn. of particle size $\leq 15 \mu m$. According to Table 11.9-2, a scaling factor of 0.75 has been applied to the above eqn. in order to represent RSP emission factor) *
		Material moisture content (%), M	2.2	To represent the worst case scenario, the lowest moisture content within the range specified for overburden in the USEPA AP-42, S11.9, Table 11.9-3, 7/98 ed., is adopted
		Material silt content (%), s	15.1	To represent the worst case scenario, the highest silt content within the range specified for overburden in the USEPA AP-42, S11.9, Table 11.9-3, 7/98 ed., is adopted
		Calculated RSP Emission Factor (kg/hr), E	6.57E+00	
		Site Area (m ²), A	44500	Site area for the northern portion of Project Site
		Calculated RSP emission rate (unmitigated) (g/m²/s)	4.10E-05	$= (E \times 1000) / A / (60 \times 60)$
		% of dust suppression [#]	90.0%	for watering 8 times per day [#]
		Calculated RSP emission rate, g/m²/s (mitigated)	4.10E-06	
	(3) Removal/ unloading soil materials by excavators (day-time only)	TSP Emission Factor of excavator unloading topsoil (kg/Mg), E1	0.02	USEPA AP-42, S11.9, Table 11.9-4, 7/98 ed. (scraper unloading topsoil is adopted). *
		TSP Emission Factor of Topsoil removal by excavator (kg/Mg), E2	0.029	USEPA AP-42, S11.9, Table 11.9-4, 7/98 ed. (Topsoil removal by scraper is adopted). *
		Total TSP Emission by excavator (kg/Mg), E1+E2	4.90E-02	
		Calculated RSP Emission by excavator (kg/Mg), $E = (E1+E2) \times 0.51$	2.50E-02	Converted from the above TSP emission factor based on a ratio of 0.51 for RSP/TSP. ®
		Total quantity of materials involved (m ³), Q	46940	The total amount of excavated materials and imported fill materials for the Northern Portion from Engineer
		No. of months for site formation (Phase B to D), m	7.5	Duration of site formation works for the Project Site
		No. of working days per month, d	25	From Project Engineer
		No. of working hours per day, h	10	From Project Engineer (working hours = 0800 hr to 1800 hr)
		Average hourly output (m ³ /hr), O1	25.03	$= Q / (m \times d \times h)$
		Average hourly output (Mg/hr), O2	62.59	$= O1 \times 2.5 Mg/m^3$. Assuming the truck capacity of 6m ³ and 15 tons (i.e. soil density of 2.5 Mg/m ³).
Site Area (m ²), A	44500	Site area for the northern portion of Project Site		
Calculated emission rate (unmitigated) (g/m²/s)	9.76E-06	$= (O2 \times (E \times 1000) / A) / (60 \times 60)$		
% of dust suppression [#]	90.0%	for watering 8 times per day [#]		
Calculated emission rate (mitigated) (g/m²/s)	9.76E-07			

Type of Work	Type of Emission Source	Parameter	Value	Remark
	(4) Earth Handling/ Loading, Unloading, and stockpiling (day-time only)	Eqn.: $E = k \times (0.0016) \times ((U/2.2)^{1.3} / (M/2)^{1.4})$		USEPA AP-42, S13.2.4, 11/06 ed. *
		Particle size multiplier, k	0.35	particle size multiplier for particle size of 10 µm
		Mean wind speed (m/s), U	1.85	Based on year 2010 average wind speed recorded at Wetland Park Station of Hong Kong Observatory.
		Material moisture content (%), M	2.2	Pls. refer to Emission Source no. (2) above
		Calculated Emission Factor (kg/Mg), E	0.00039	$E = k \times (0.0016) \times ((U/2.2)^{1.3} / (M/2)^{1.4})$
		Total quantity of materials involved (m ³), Q	46940	The total amount of excavated materials and imported fill materials for the Northern Portion from Engineer
		No. of months for site formation, m	7.5	Duration of site formation works for the Project Site
		No. of working days per month, d	25	From Project Engineer
		No. of working hours per day, h	10	From Project Engineer (working hours = 0800 hr to 1800 hr)
		Average hourly output (m ³ /hr), O1	25.03	= Q/(m*d*h)
	Average hourly output (Mg/hr), O2	62.59	= O1 x 2.5Mg/m ³ . Assuming the truck capacity of 6m ³ and 15 tons (i.e. soil density of 2.5 Mg/m ³).	
	Site Area (m ²), A	44500	Site area for the northern portion of Project Site	
	Calculated emission rate (unmitigated) (g/m ² /s)	1.52E-07	= (O2 x (E x 1000)/ A)/(60*60)	
	% of dust suppression [#]	90.0%	for watering 8 times per day [#]	
	Calculated emission rate (mitigated) (g/m ² /s)	1.52E-08		
	Total Emission for "Cut and Cover" (= (2) + (3) + (4))	Unmitigated Total Emission rate, g/m ² /s, (day-time only)	5.09E-05	Calculated total unmitigated emission factor for "Cut and Cover".
		Mitigated Total Emission rate, g/m ² /s (day-time only)	5.09E-06	Calculated total mitigated emission factor for "Cut and Cover" ^{**} .

Vehicle movement on Haul Road	(5) Paved Haul Road (day-time only)	Eqn.: $E = k \times (sL)^{0.91} \times (W)^{1.02}$		USEPA AP-42, S13.2.1, 11/06 ed.
		Particle size multiplier (g/VKT), k	0.62	USEPA AP-42, S13.2.1, 11/06 ed., Table 13.2.1-1 for PM-10.
		Road surface silt loading (g/m ²), sL	14	To represent the worst case scenario, the highest silt loading within the range of typical values specified for quarry operation in the USEPA AP-42, S13.2.1, 1/11 ed., Table 13.2.1-3, is adopted. **
		Mean vehicle weight (tons), W	16	The average weight of the empty truck and full load truck.
		Calculated Emission Factor (g/VKT), E1	115.76	$E = k \times (sL)^{0.91} \times (W)^{1.02}$
		Calculated emission factor (g/v-m), E2	0.116	= E1/1000
		Average no. of trucks (veh./hr), T	10	Estimated maximum no. of trucks per hour from Engineer
		Calculated emission rate (unmitigated), g/m/s	3.22E-04	= E2*(T/60*60)
		% of dust suppression [#]	90.0%	for watering 8 times per day [#]
		Calculated emission rate (mitigated), g/m/s	3.22E-05	

Remark:

Please refer to Appendix 3-9 for calculation of dust suppression efficiency. 90% dust suppression efficiency is adopted.

Due to the phased construction area, only limited space and construction plants will be available for construction in any one time. Thus, the construction activities under the "Cut and Cover" category that would contribute to dust emissions will unlikely to operate at the same time. In fact, only one of the above activities will operate in any one time. However, to be conservative, air quality impacts due to simultaneous construction of these activities has been taken into account in the assessment.

* The equation recommended for concerned particular construction activity as per Section 13.2.3 of USEPA AP-42 regarding heavy construction operation.

** The concerned construction activity of this Project during site formation stage will involve earth movement activities and transportation of excavated/ fill materials, etc. The nature of these activities is similar to that of quarry operation. Thus, the typical silt loading within the range of typical values from quarry site, as stipulated in USEPA AP-42, Table 13.2.1-3, S13.2.1, 11/06 ed., is adopted in the above equation. The reported highest silt loading value has been used in this exercise for worst case scenario. It is noted that similar assumption has also been adopted for paved construction haul road in the approved EIA report, Appendix F of the "EIA-032/1999 - East Rail Extension Hung Hom to Tsim Sha Tsui - Environmental Impact Assessment".

@ Please refer to Appendix 3-10 for the ratio of RSP/ TSP adopted.

Southern Portion

Appendix 3-3D Summary Table of Calculated RSP Emissions Modeling Input Data of the Southern Portion of Project Site (Unmitigated Scenario)

For both the unmitigated scenario and mitigated scenarios, since there will be no construction activities during restricted hours, and on Sundays and general holidays, the calculated emission rates have been applied to day-time hours during general weekdays only (i.e. 0800 to 1800 hours). While from 1800 to 0800 hours during general workdays, and on Sunday and general holidays (whole day) are adopted for impact assessment of wind erosion on the site.

Cut and Cover (day-time only)

Project Site	Ref. ID	X coordiante	Y coordinate	Elevation, m	Release Height, m	Unmitigated *	
						Emission rate, g/m ² /s	Int. Vert. Dim.
Southern Portion	H07	823269.3	837097.9	4	0	5.72E-05	0

Wind Erosion

Project Site	Ref. ID	X coordiante	Y coordinate	Elevation, m	Release Height, m	Unmitigated (night-time only) *		Unmitigated (day-time only) *
						Emission rate, g/m ² /s	Int. Vert. Dim.	Emission rate, g/m ² /s
Southern Portion	WR07	823269.3	837097.9	4	0	1.37E-06	0	1.37E-06

Travelling on Haul Road (unpaved) (day-time only)

Project Site	Road Segment ID	X coordiante	Y coordinate	Ground mPD level, m	X Length, m	Y Length, m	Emission Height, m	Angle, degree	Unmitigated *			Int. Vert. Dim.
									Calculated emission rate, g/m/s	Total emission, g/s	Emission rate, g/m ² /s	
					B	C						
							A	= (A*B)	= (A*B)/(B*C)			
Southern Portion	HR-RECs1	823300.4	837376.9	4	21	6	0.5	-12	3.22E-04	6.75E-03	5.36E-05	0
Southern Portion	HR-RECs2	823321.1	837347.0	4	35	6	0.5	-113	3.22E-04	1.13E-02	5.36E-05	0
Southern Portion	HR-RECs3	823323.2	837310.0	4	35	6	0.5	-90	3.22E-04	1.13E-02	5.36E-05	0
Southern Portion	HR-RECs4	823316.4	837279.6	4	32	6	0.5	-77	3.22E-04	1.03E-02	5.36E-05	0
Southern Portion	HR-RECs5	823281.5	837283.2	4	30	6	0.5	-4	3.22E-04	9.65E-03	5.36E-05	0
Southern Portion	HR-RECs6	823260.8	837248.3	4	46	6	0.5	-49	3.22E-04	1.48E-02	5.36E-05	0
Southern Portion	HR-RECs7	823231.8	837228.6	4	35	6	0.5	-35	3.22E-04	1.13E-02	5.36E-05	0
Southern Portion	HR-RECs8	823197.0	837230.4	4	35	6	0.5	3	3.22E-04	1.13E-02	5.36E-05	0
Southern Portion	HR-RECs9	823241.0	837195.7	4	35	6	0.5	-91	3.22E-04	1.13E-02	5.36E-05	0
Southern Portion	HR-RECs10	823244.0	837178.6	4	18	6	0.5	-99	3.22E-04	5.79E-03	5.36E-05	0

Remark: * Please refer to Appendix 3-F for the calculation of emission factors.

Appendix 3-3E Summary Table of Calculated RSP Emissions Modeling Input Data of the Southern Portion of Project Site (Mitigated Scenario)

For both the unmitigated scenario and mitigated scenarios, since there will be no construction activities during restricted hours, and on Sundays and general holidays, the calculated emission rates have been applied to day-time hours during general weekdays only (i.e. 0800 to 1800 hours). While from 1800 to 0800 hours during general workdays, and on Sunday and general holidays (whole day) are adopted for impact assessment of wind erosion on the site.

Cut and Cover (day-time only)

Project Site	Ref. ID	X coordiante	Y coordinate	Elevation,m	Release Height, m	Mitigated *	
						Emission rate, g/m ² /s	Int. Vert. Dim.
Southern Portion	H-RECs1	823084.84	837274.36	4	0	5.72E-06	0
Southern Portion	H-RECs2	823110.84	837320.42	4	0	5.72E-06	0
Southern Portion	H-RECs3	823117.43	837240.41	4	0	5.72E-06	0
Southern Portion	H-RECs4	823137.05	837284.65	4	0	5.72E-06	0
Southern Portion	H-RECs5	823173.92	837244.83	4	0	5.72E-06	0
Southern Portion	H-RECs6	823188.77	837263.77	4	0	5.72E-06	0
Southern Portion	H-RECs7	823188.77	837263.77	4	0	5.72E-06	0
Southern Portion	H-RECs8	823217.48	837119.99	4	0	5.72E-06	0
Southern Portion	H-RECs9	823234.8	837161.99	4	0	5.72E-06	0
Southern Portion	H-RECs10	823177.64	837162.61	4	0	5.72E-06	0
Southern Portion	H-RECs11	823148.43	837202.38	4	0	5.72E-06	0
Southern Portion	H-RECs12	823234.8	837161.99	4	0	5.72E-06	0
Southern Portion	H-RECs13	823234.99	837196.46	4	0	5.72E-06	0
Southern Portion	H-RECs14	823232.2	837235.01	4	0	5.72E-06	0
Southern Portion	H-RECs15	823286.27	837284.1	4	0	5.72E-06	0
Southern Portion	H-RECs16	823244.83	837290.54	4	0	5.72E-06	0
Southern Portion	H-RECs17	823223.34	837318.37	4	0	5.72E-06	0
Southern Portion	H-RECs18	823250.91	837406.24	4	0	5.72E-06	0
Southern Portion	H-RECs19	823284.27	837284.1	4	0	5.72E-06	0

Wind Erosion

Project Site	Ref. ID	X coordiante	Y coordinate	Elevation,m	Release Height, m	Unmitigated (night-time only) *		Mitigated (day-time only) *
						Emission rate, g/m ² /s	Int. Vert. Dim.	
Southern Portion	W-RECs1	823084.84	837274.36	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs2	823110.84	837320.42	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs3	823117.43	837240.41	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs4	823137.05	837284.65	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs5	823173.92	837244.83	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs6	823188.77	837263.77	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs7	823188.77	837263.77	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs8	823217.48	837119.99	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs9	823234.8	837161.99	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs10	823177.64	837162.61	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs11	823148.43	837202.38	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs12	823234.8	837161.99	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs13	823234.99	837196.46	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs14	823232.2	837235.01	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs15	823286.27	837284.1	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs16	823244.83	837290.54	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs17	823223.34	837318.37	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs18	823250.91	837406.24	4	0	1.37E-06	0	1.37E-07
Southern Portion	W-RECs19	823284.27	837284.1	4	0	1.37E-06	0	1.37E-07

Inputs to the ISCST Model:

	Calculated Emission Rate *		Emission Rate Factor **
	Day-time (A)	Night-time (B)	
Workday	5.72E-06	1.37E-06	=A/B
Sundays and Holidays	1.37E-07	1.37E-06	

Remark: * Please refer to Appendix 3-F for the calculation of emission factors.

** For general workdays, in order to simulate calculated emission rate due to wind erosion during nighttime period, the "Emission Rate Factor" is applied from 1800 to 0800 hours in the ISCST model. Similarly, for Sundays and Holidays, the calculated emission rate due to wind erosion during day-time period is simulated by adopting the "Emission Rate Factor" from 0800 to 1800 hours in the ISCST model.

Travelling on Haul Road (paved) (day-time only)

Project Site	Road Segment ID	X coordiante	Y coordinate	Ground mPD level, m	X Length, m	Y Length, m	Emission Height, m	Angle, degree	Mitigated *			Int. Vert. Dim.
									Calculated emission rate, g/m/s	Total emission, g/s	Emission rate, g/m ² /s	
					B	C			D	= (D*B)	=(D*B)/ (B*C)	
Southern Portion	HR-RECs1	823300.4	837376.9	4	21	6	0.5	-12	3.22E-05	6.75E-04	5.36E-06	0
Southern Portion	HR-RECs2	823321.1	837347.0	4	35	6	0.5	-113	3.22E-05	1.13E-03	5.36E-06	0
Southern Portion	HR-RECs3	823323.2	837310.0	4	35	6	0.5	-90	3.22E-05	1.13E-03	5.36E-06	0
Southern Portion	HR-RECs4	823316.4	837279.6	4	32	6	0.5	-77	3.22E-05	1.03E-03	5.36E-06	0
Southern Portion	HR-RECs5	823281.5	837283.2	4	30	6	0.5	-4	3.22E-05	9.65E-04	5.36E-06	0
Southern Portion	HR-RECs6	823260.8	837248.3	4	46	6	0.5	-49	3.22E-05	1.48E-03	5.36E-06	0
Southern Portion	HR-RECs7	823231.8	837228.6	4	35	6	0.5	-35	3.22E-05	1.13E-03	5.36E-06	0
Southern Portion	HR-RECs8	823197.0	837230.4	4	35	6	0.5	3	3.22E-05	1.13E-03	5.36E-06	0
Southern Portion	HR-RECs9	823241.0	837195.7	4	35	6	0.5	-91	3.22E-05	1.13E-03	5.36E-06	0
Southern Portion	HR-RECs10	823244.0	837178.6	4	18	6	0.5	-99	3.22E-05	5.79E-04	5.36E-06	0

Remark: * Please refer to Appendix 3-F for the calculation of emission factors.

Appendix 3-3F Calculation of RSP Emission Rates of the Southern Portion of Project Site (Both Unmitigated and Mitigated Scenarios)

Type of Work	Type of Emission Source	Parameter	Value	Remark
Wind Erosion on Exposed Ground	(1) Wind Erosion (day-time)	TSP emission factor (Mg/hectare/year)	0.85	USEPA AP-42, S11.9, Table 11.9-4, 7/98 ed.
		Calculated RSP emission factor (Mg/hectare/year)	0.43	Converted from the above TSP emission factor based on a ratio of 0.51 for RSP/TSP. ®
		RSP Emission rate, g/m²/s (unmitigated)	1.37E-06	=((0.43*1000000)/10000m ² /(365*24*60*60))
		% of dust suppression [#]	90.0%	for watering 8 times per day [#]
		RSP Emission rate, g/m²/s (mitigated)	1.37E-07	
	(1) Wind Erosion (night-time)	TSP emission factor (Mg/hectare/year)	0.85	USEPA AP-42, S11.9, Table 11.9-4, 7/98 ed.
		Calculated RSP emission factor (Mg/hectare/year)	0.43	Converted from the above TSP emission factor based on a ratio of 0.51 for RSP/TSP. ®
		RSP Emission rate, g/m²/s (unmitigated)	1.37E-06	=((0.43*1000000)/10000m ² /(365*24*60*60))
Cut and Cover Activities	(2) Bulldozing & Surface Compacting (day-time only)	Eqn.: $E = (0.45 (s)^{1.5} / (M)^{1.4}) \times 0.75$		USEPA AP-42, S11.9, Table 11.9-2, 7/98 ed. (Based on the eqn. of particle size <= 15 µm. According to Table 11.9-2, a scaling factor of 0.75 has been applied to the above eqn. in order to represent RSP emission factor) *
		Material moisture content (%), M	2.2	To represent the worst case scenario, the lowest moisture content within the range specified for overburden in the USEPA AP-42, S11.9, Table 11.9-3, 7/98 ed., is adopted
		Material silt content (%), s	15.1	To represent the worst case scenario, the highest silt content within the range specified for overburden in the USEPA AP-42, S11.9, Table 11.9-3, 7/98 ed., is adopted
		Calculated RSP Emission Factor (kg/hr), E	6.57E+00	
		Site Area (m ²), A	43000	Site area for the southern portion of Project Site
		Calculated RSP emission rate (unmitigated) (g/m²/s)	4.24E-05	= (E*1000)/A/(60*60)
		% of dust suppression [#]	90.0%	for watering 8 times per day [#]
		Calculated RSP emission rate, g/m²/s (mitigated)	4.24E-06	
	(3) Removal/ unloading soil materials by excavators (day-time only)	TSP Emission Factor of excavator unloading topsoil (kg/Mg), E1	0.02	USEPA AP-42, S11.9, Table 11.9-4, 7/98 ed. (scraper unloading topsoil is adopted). *
		TSP Emission Factor of Topsoil removal by excavator (kg/Mg), E2	0.029	USEPA AP-42, S11.9, Table 11.9-4, 7/98 ed. (Topsoil removal by scraper is adopted). *
		Total TSP Emission by excavator (kg/Mg), E1+E2	4.90E-02	
		Calculated RSP Emission by excavator (kg/Mg), E = (E1+E2) x0.51)	2.50E-02	Converted from the above TSP emission factor based on a ratio of 0.51 for RSP/TSP. ®
		Total quantity of materials involved (m ³), Q	67460	The total amount of excavated materials and imported fill materials for the Southern Portion from the Engineer
		No. of months for site formation (Phase B to D), m	7.5	Duration of site formation works for the Project Site
		No. of working days per month, d	25	From Project Engineer
		No. of working hours per day, h	10	From Project Engineer (working hours = 0800 hr to 1800 hr)
		Average hourly output (m ³ /hr), O1	35.98	= Q/(m*d*h)
		Average hourly output (Mg/hr), O2	89.95	= O1 x 2.5Mg/m ³ . Assuming the truck capacity of 6m3 and 15 tons (i.e. soil density of 2.5 Mg/m3).
		Site Area (m ²), A	43000	Site area for the southern portion of Project Site
		Calculated emission rate (unmitigated) (g/m²/s)	1.45E-05	= (O2 x (E x 1000) / A) / (60*60)
		% of dust suppression [#]	90.0%	for watering 8 times per day [#]
		Calculated emission rate (mitigated) (g/m²/s)	1.45E-06	

Type of Work	Type of Emission Source	Parameter		Remark	
	(4) Earth Handling/ Loading, Unloading, and stockpiling (day-time only)	Eqn.: $E = k \times (0.0016) \times ((U/2.2)^{1.3} / (M/2)^{1.4})$		USEPA AP-42, S13.2.4, 11/06 ed. *	
		Particle size multiplier, k	0.35	particle size multiplier for particle size of 10 µm	
		Mean wind speed (m/s), U	1.85	Based on year 2010 average wind speed recorded at Wetland Park Station of Hong Kong Observatory.	
		Material moisture content (%), M	2.2	Pls. refer to Emission Source no. (2) above	
		Calculated Emission Factor (kg/Mg), E	0.00039	$E = k \times (0.0016) \times ((U/2.2)^{1.3} / (M/2)^{1.4})$	
		Total quantity of materials involved (m ³), Q	67460	The total amount of excavated materials and imported fill materials for the Southern Portion from the Engineer	
		No. of months for site formation, m	7.5	Duration of site formation works for the Project Site	
		No. of working days per month, d	25	From Project Engineer	
		No. of working hours per day, h	10	From Project Engineer (working hours = 0800 hr to 1800 hr)	
		Average hourly output (m ³ /hr), O1	35.98	= Q/(m*d*h)	
		Average hourly output (Mg/hr), O2	89.95	= O1 x 2.5Mg/m ³ . Assuming the truck capacity of 6m3 and 15 tons (i.e. soil density of 2.5 Mg/m3).	
		Site Area (m ²), A	43000	Site area for the southern portion of Project Site	
		Calculated emission rate (unmitigated) (g/m ² /s)	2.27E-07	= (O2 x (E x 1000)/ A)/(60*60)	
		% of dust suppression [#]	90.0%	for watering 8 times per day [#]	
	Calculated emission rate (mitigated) (g/m ² /s)	2.27E-08			
	Total Emission for "Cut and Cover" (= (2) + (3) + (4))	Unmitigated Total Emission rate, g/m ² /s, (day-time only)	5.72E-05	Calculated total unmitigated emission factor for "Cut and Cover".	
		Mitigated Total Emission rate, g/m ² /s (day-time only)	5.72E-06	Calculated total mitigated emission factor for "Cut and Cover" ^{##} .	
	Vehicle movement on Haul Road	(5) Paved Haul Road (day-time only)	Eqn.: $E = k \times (sL)^{0.91} \times (W)^{1.02}$		USEPA AP-42, S13.2.1, 11/06 ed.
			Particle size multiplier (g/VKT), k	0.62	USEPA AP-42, S13.2.1, 11/06 ed., Table 13.2.1-1 for PM-10.
			Road surface silt loading (g/m ²), sL	14	To represent the worst case scenario, the highest silt loading within the range of typical values specified for quarry operation in the USEPA AP-42, S13.2.1, 1/11 ed., Table 13.2.1-3, is adopted. **
Mean vehicle weight (tons), W			16	The average weight of the empty truck and full load truck.	
Calculated Emission Factor (g/VKT), E1			115.76	$E = k \times (sL)^{0.91} \times (W)^{1.02}$	
Calculated emission factor (g/v-m), E2			0.116	= E1/1000	
Average no. of trucks (veh./hr), T			10	Estimated maximum no. of trucks per hour from Engineer	
Calculated emission rate (unmitigated), g/m/s			3.22E-04	= E2*(T/60*60)	
% of dust suppression [#]			90.0%	for watering 8 times per day [#]	
Calculated emission rate (mitigated), g/m/s			3.22E-05		

Remark:

Please refer to Appendix 3-9 for calculation of dust suppression efficiency. 90% dust suppression efficiency is adopted.

Due to the phased construction area, only limited space and construction plants will be available for construction in any one time. Thus, the construction activities under the "Cut and Cover" category that would contribute to dust emissions will unlikely to operate at the same time. In fact, only one of the above activities will operate in any one time. However, to be conservative, air quality impacts due to simultaneous construction of these activities has been taken into account in the assessment.

* The equation recommended for concerned particular construction activity as per Section 13.2.3 of USEPA AP-42 regarding heavy construction operation.

** The concerned construction activity of this Project during site formation stage will involve earth movement activities and transportation of excavated/ fill materials, etc. The nature of these activities is similar to that of quarry operation. Thus, the typical silt loading within the range of typical values from quarry site, as stipulated in USEPA AP-42, Table 13.2.1-3, S13.2.1, 11/06 ed., is adopted in the above equation. The reported highest silt loading value has been used in this exercise for worst case scenario. It is noted that similar assumption has also been adopted for paved construction haul road in the approved EIA report, Appendix F of the "EIA-032/1999 - East Rail Extension Hung Hom to Tsim Sha Tsui - Environmental Impact Assessment".

@ Please refer to Appendix 3-10 for the ratio of RSP/ TSP adopted.

Typical Values of Moisture Content and Silt Content as Stipulated in the USEPA AP-42, S11.9, Table 11.9-3, 7/98 ed.

Table 11.9-3 (Metric And English Units). TYPICAL VALUES FOR CORRECTION FACTORS APPLICABLE TO THE PREDICTIVE EMISSION FACTOR EQUATIONS^a

Source	Correction Factor	Number Of Test Samples	Range	Geometric Mean	Units
Blasting	Area blasted	17	100 - 6,800	1,590	m ²
	Area blasted	17	1100 - 73,000	17,000	ft ²
Coal loading	Moisture	7	6.6 - 38	17.8	%
Bulldozers	Coal	Moisture	4.0 - 22.0	10.4	%
		Silt	6.0 - 11.3	8.6	%
Overburden	Moisture	8	2.2 - 16.8	7.9	%
	Silt	8	3.8 - 15.1	6.9	%
Dragline	Drop distance	19	1.5 - 30	8.6	m
	Drop distance	19	5 - 100	28.1	ft
Scraper	Moisture	7	0.2 - 16.3	3.2	%
	Silt	10	7.2 - 25.2	16.4	%
	Weight	15	33 - 64	48.8	Mg
Grader	Weight	15	36 - 70	53.8	ton
	Speed	7	8.0 - 19.0	11.4	kph
Haul truck	Speed		5.0 - 11.8	7.1	mph
	Silt content	61	1.2 - 19.2	4.3	%
	Moisture	60	0.3 - 20.1	2.4	%
	Weight	61	20.9 - 260	110	mg
	Weight	61	23.0 - 290	120	ton

^a Reference 1,6.

Typical Value of Silt Loading for Quarry Operation as Stipulated in the USEPA AP-42, S13.2.1, 1/11 ed., Table 13.2.1-3.

Table 13.2.1-3 (Metric And English Units). TYPICAL SILT CONTENT AND LOADING VALUES FOR PAVED ROADS AT INDUSTRIAL FACILITIES^a

Industry	No. of Sites	No. Of Samples	Silt Content (%)		No. of Travel Lanes	Total Loading x 10 ⁻³			Silt Loading (g/m ²)	
			Range	Mean		Range	Mean	Units ^b	Range	Mean
Copper smelting	1	3	15.4-21.7	19.0	2	12.9 - 19.5	15.9	kg/km	188-400	292
Iron and steel production	9	48	1.1-35.7	12.5	2	45.8 - 69.2	55.4	lb/mi	0.09-79	9.7
Asphalt batching	1	3	2.6 - 4.6	3.3	1	0.006 - 4.77	0.495	kg/km	76-193	120
Concrete batching	1	3	5.2 - 6.0	5.5	2	0.020 -16.9	1.75	lb/mi	11-12	12
Sand and gravel processing	1	3	6.4 - 7.9	7.1	1	1.4 - 1.8	1.7	kg/km	53-95	70
Municipal solid waste landfill	2	7	-	-	2	5.0 - 6.4	5.9	lb/mi	1.1-32.0	7.4
Quarry	1	6	-	-	2	2.8 - 5.5	3.8	kg/km	2.4-14	8.2
Corn wet mills	3	15	-	-	2	9.9 - 19.4	13.3	lb/mi	0.05 - 2.9	1.1

^a References 1-2,5-6,11-13. Values represent samples collected from *industrial* roads. Public road silt loading values are presented in Table-13.2.1-2. Dashes indicate information not available. ^b Multiply entries by 1000 to obtain stated units; kilograms per kilometer (kg/km) and pounds per mile (lb/mi).