APPENDIX 9.1 - EMISSION FACTORS

Emission Factors Used In Dust Emission Calculations (USEPA, 1986 & subsequent updates):

Road Haulage (Unpaved)

$$E = \left(281.9 \times k \times \left(\frac{s}{12}\right)^{a} \times \left(\frac{W}{3}\right)^{b}\right) \times \left(\frac{365 - P}{365}\right) \ (g/veh\ km)$$

Where:
s = surface silt content (8.3%)
k = 4.9 (Total Dust), 1.8 (PM_{10}), 0.15 ($PM_{2.5}$)
W = mean vehicle weight (20 tonnes unladen, 32 tonnes laden)
a = 0.9 (PM_{10}/$PM_{2.5}$), 0.7 (Total Dust)
b = 0.45
P = 194 wet days

Road Haulage (Paved)

$$E = (k \times (sL)^{0.91} \times (W)^{1.02}) \times \left(\frac{1 - P}{4N}\right) \ (g/veh\ km)$$

Where:
sL = surface silt loading (0.2 g/m^2)
k = 24 (Total Dust), 4.6 (PM_{10}), 0.66 ($PM_{2.5}$)
W = mean vehicle weight (20 tonnes unladen, 32 tonnes laden)
P = 194 wet days
N = 365 days

Material Loading

$$E = \left(\frac{(k \times 0.0016) \times (\frac{U}{2.2})^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\right) \times \left(\frac{365 - P}{365}\right) (kg/Mg)$$

Where:
k = 0.74 (Total Dust), 0.35 (PM_{10}), 0.053 ($PM_{2.5}$)
M = moisture content (2.0%)
U = mean wind speed (5.2 m/s)
P = 194 wet days

Screening

$$= \left(\frac{T \times K}{H \times 3600 \times A}\right) \times \left(\frac{365 - P}{365}\right) \ (g/s/m^2)$$

Where:
T = Annual Tonnage of Material (200,000 T)
K = 12.5 (Total Dust), 4.3 (PM_{10}) , 0.28 ($PM_{2.5}$)
H = Annual Hours of Operation (2830 hours)
A = Area of activity
P = 194 Wet Days

Conveyor

$$= \left(\frac{T \times K}{H \times 3600 \times A}\right) \times \left(\frac{365 - P}{365}\right) \ (g/s/m^2)$$

Where:
T = Annual Tonnage of Material (200,000 T)

K = 1.5 (Total Dust), 0.55 (PM_{10}) , 0.14 ($PM_{2.5}$)
H = Annual Hours of Operation (2830 hours)
A = Area of activity
P = 194 Wet Days

Topsoil Removal

$$= \left(\frac{T \times K}{H \times 3600 \times A}\right) \times \left(\frac{365 - P}{365}\right) \ (g/s/m^2)$$

Where:
T = Annual Tonnage of Material (200,000 T)
K = 29 (Total Dust), 13.7 (PM_{10}) , 2.07 ($PM_{2.5}$)
H = Annual Hours of Operation (2830 hours)
A = Area of activity
P = 194 Wet Days

Wind Erosion of Stockpiles

The formulae for calculating wind erosion can be found in section 13.2.5 of AP42 titled "Industrial Wind Erosion". Information on monthly peak wind speeds and the number of gales per month is required in order to calculate the emission rates.

Categories	TSP Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Units
Topsoil Removal	2.05E-05	9.70E-06	1.47E-06	$g/s/m^2$
Bulldozing	1.80E-05	3.39E-06	4.74E-07	$g/s/m^2$
Screening 1	6.63E-05	2.28E-05	1.49E-06	$g/s/m^2$
Primary, Secondary & Tertiary Crushing 1 (uncontrolled)	1.43E-05	6.37E-06	1.17E-06	$g/s/m^2$
Material Loading	3.33E-03	1.58E-03	2.39E-04	$g/s/m^2$
Conveyor	7.96E-06	2.92E-06	7.43E-07	$g/s/m^2$
Paved Roads Off Site (g/s) per source every 5 m	1.50E-04	4.98E-06	7.14E-07	g/s
Unpaved Roads (g/s) per source every 5 m	8.67E-05	2.96E-05	2.47E-06	g/s

Table A9.1: Process Emission Rates for Air Quality Assessment