

## 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<sub>10</sub>), 0.15 (PM<sub>2.5</sub>)

$W$  = mean vehicle weight (20 tonnes unladen, 32 tonnes laden)

$a$  = 0.9 (PM<sub>10</sub>/PM<sub>2.5</sub>), 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<sup>2</sup>)

$k$  = 24 (Total Dust), 4.6 (PM<sub>10</sub>), 0.66 (PM<sub>2.5</sub>)

$W$  = mean vehicle weight (20 tonnes unladen, 32 tonnes laden)

$P$  = 194 wet days

$N$  = 365 days

### **Material Loading**

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

Where:

$k$  = 0.74 (Total Dust), 0.35 (PM<sub>10</sub>), 0.053 (PM<sub>2.5</sub>)

$M$  = 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<sub>10</sub>), 0.28 (PM<sub>2.5</sub>)

$H$  = 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                                             | 6.63E-05            | 2.28E-05                  | 1.49E-06                   | $g/s/m^2$ |
| Primary, Secondary & Tertiary Crushing (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                   | $g/s/m^2$ |
| Blasting                                              | 2.66E-05            | 1.38E-05                  | 7.99E-07                   | $g/s/m^2$ |
| Paved Roads Off Site (g/s) per source every 5 m       | 7.48E-05            | 2.49E-06                  | 3.57E-07                   | $g/s$     |
| Unpaved Roads (g/s) per source every 5 m              | 4.34E-0             | 1.48E-05                  | 1.23E-06                   | $g/s$     |

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