**Appendix 5B**

Calculation of Emission Rates

# Sample Calculation of Emission Rates

## Demolition/ Site Formation/ Slope Works

### *Material Handling*

| | | | |
|---|---|---|---|
| | TSP emission factor (kg/Mg) | k*0.0016*(U/2.2)^1.3 / (M/2)^1.4 | |
| | | | *from AP-42, 5th ed., S13.2.4* |
| | Particle size mutipler, k | 0.74 | *from AP-42, 5th ed., S13.2.4, particle size < 30 um* |
| | Material moisture content, M (%) | 24 | *SI data* |
| | Average wind speed, U (m/s) | 5.1 | *from EIA-Theme Park* |
| | No of working day per hour | 10 | *assumed* |
| | % mitigation | 50 | *water suppression* |
| | E(TSP) (g/Mg) | 0.05447 | *calculated* |

| *Demolition* | Handling Rate (m3/day) | 73 | *Engineer* |
|---|---|---|---|
| | **Emission (g/s)** | **2.1939E-04** | *Calculated* |

| *Slopework* | Handling Rate (m3/day) | 300 | *Engineer* |
|---|---|---|---|
| | **Emission (g/s)** | **9.0784E-04** | *Calculated* |

| *Excavation* | Handling Rate (m3/day) | 2000 | Engineer |
|---|---|---|---|
| | **Emission (g/s)** | **6.0523E-03** | Calculated |

### *Truck movements on haul road*

| | | | |
|---|---|---|---|
| | TSP emission factor (g/VMT) | 10 * ((s/12)^0.8) ((W/3)^0.5) / ((M/0.2)^0.4) * 281.9 * (S/15) | |
| | | | *from AP-42, 5th ed., S13.2.2* |
| | Surface material silt content, s (%) | 10 | *from EIA-Theme Park* |
| | Mean vehicle weight, W (tons) | 12.5 | *assumed* |
| | Surface material moisture content, M (%) | 10 | *from EIA-Theme Park* |
| | Speed (kph) | 10 | *from EIA-Theme Park* |
| | Speed, S (mph) | 6.2139 | *from AP-42, 5th ed., S13.2.2* |
| | Mitigation (%) | 85 | *paved road* |
| | E (g/VKT) | 64.6 | *calculated* |

| *Demolition* | No of truck (veh/hr) | 4 | *Engineer* |
|---|---|---|---|
| | **Emission (g/m/s)** | **7.1809E-05** | *Calculated* |

| *Slopeworks* | No of truck (veh/hr) | 8 | *Engineer* |
|---|---|---|---|
| | **Emission (g/m/s)** | **1.4362E-04** | *Calculated* |

| *Excavation* | No of trucks (veh/hr) | 14 | *Engineer* |
|---|---|---|---|
| | **Emission (g/m/s)** | **2.5133E-04** | *Calculated* |

### *Wet Drilling*

| | | | |
|---|---|---|---|
| | Emission Rate (g/Mg) | 8.40E-05 | AP42 Sec 11.19.2 |
| | Drilling Rate (m3/day) | 100 | Engineer |
| | Density (Mg/m3) | 2 | SI data |
| | No of working hour per day | 10 | assumed |
| | **Emission Rate (g/s)** | **4.6667E-07** | Calculated |

### *Wind Erosion*

| | | | |
|---|---|---|---|
| | TSP emission factor (Mg/hectare/yr) | 0.85 | *from AP-42, 5th ed., Table 11.9.4* |
| | % mitigation | 50 | |
| | **Emission Rate** | **1.3477E-06** | |

## Excavation at Contaminated Soils

### Dioxin

| | | | |
|---|---|---|---|
| | TSP emission factor (kg/Mg) | k*0.0016*(U/2.2)^1.3 / (M/2)^1.4 | |
| | | | *from AP-42, 5th ed., S13.2.4* |
| | Particle size mutipler, k | 0.74 | *from AP-42, 5th ed., S13.2.4, particle size < 30 um* |
| | Material moisture content, M (%) | 24 | *SI data* |
| | Average wind speed, U (m/s) | 5.1 | *from EIA-Theme Park* |
| | % mitigation | 50 | |
| | E(TSP) (g/Mg) | 0.05447 | *calculated* |
| | Dioxin level (pg/g) | 109383 | *SI data* |
| | E(dioxin) (ug/Mg) | 0.005958 | *calculated* |
| | Excavation Rate (Mg/hr) | 400 | *Engineer* |
| | **E(dioxin) (ug/s)** | **6.6201E-04** | *Calculated* |

### Cr6+

| | | | |
|---|---|---|---|
| | TSP emission factor (kg/Mg) | k*0.0016*(U/2.2)^1.3 / (M/2)^1.4 | |
| | | | *from AP-42, 5th ed., S13.2.4* |
| | Particle size mutipler, k | 0.74 | *from AP-42, 5th ed., S13.2.4, particle size < 30 um* |
| | Material moisture content, M (%) | 24 | *SI data* |
| | Average wind speed, U (m/s) | 5.1 | *from EIA-Theme Park* |
| | % mitigation | 50 | |
| | E(TSP) (g/Mg) | 0.05447 | *calculated* |
| | Cr6+level (ug/g) | 392 | *SI data* |
| | E(Cr6+) (ug/Mg) | 21.352355 | *calculated* |
| | Excavation Rate (Mg/hr) | 40 | *Engineer* |
| | **E(Cr6+) (ug/s)** | **0.237248** | *Calculated* |

### Styrene

| | | | |
|---|---|---|---|
| | Excaation rate (m3/hr) | 20 | *Engineer* |
| | Density (Mg/m3) | 2 | *SI data* |
| | Excavation Rate (Mg/hr) | 40 | *Calculated* |
| | Contamination Level (mg/kg) | 6.3 | *SI data* |
| | **E(styrene) (g/s)** | **0.07** | *Calculated (all styrene vaporise)* |

# Sample Calculation of Emission Rates

## Pollutant Emission rates of Theremal Desorption Facility

### Dioxin

| | | |
|---|---|---|
| Emisison limit (ng/m3) | 0.1 | design limit |
| Flow rate (m3/s) | 1 | max flow rate |
| **Emission rate (ng/s)** | **0.1** | calculated |

### TOC

| | | |
|---|---|---|
| Emisison limit (mg/m3) | 20 | design limit |
| Flow rate (m3/s) | 1 | max flow rate |
| **Emission rate (mg/s)** | **20** | calculated |

### dibenz(a,h)anthracene

| | | |
|---|---|---|
| Concentration (ug/kg) | 657 | SI data |
| Treatment rate (Mg/hr) | 20 | design data |
| Efficiency (%) | 0.0001 | design data |
| **Emission rate (ug/s)** | **0.003650** | calculated |

### PCB

| | | |
|---|---|---|
| Concentration (ug/kg) | 33400 | SI data |
| Treatment rate (Mg/hr) | 20 | design data |
| Efficiency (%) | 0.0001 | design data |
| **Emission rate (ug/s)** | **0.185556** | calculated |

### Hexachlorobenzene

| | | |
|---|---|---|
| Concentration (ug/kg) | 1000 | SI data |
| Treatment rate (Mg/hr) | 20 | design data |
| Efficiency (%) | 0.0001 | design data |
| **Emission rate (ug/s)** | **0.005556** | calculated |

### Combustion products (Towngas)

| | | |
|---|---|---|
| Consumption Rate | 5.00E+07 | Btu/hr |
| | 49020 | scf/hr |
| SO2 Emission Rate:(lb/10^6scf) | 0.6 | Ap42 Sect 1.4 |
| **SO2 Emission Rate (g/s)** | **0.0037** | calculated |
| NOx emission rate (lb/10^6scf) | 100 | Ap42 Sect 1.4 |
| NOx emission rate (g/s) | 0.6176 | calculated |
| **NO2 emission rate (g/s)** | **0.1235** | Assume NO2/NOx is 20% |
| CO emission rate (lb/10^6scf) | 84 | Ap42 Sect 1.4 |
| **CO emission rate (g/s)** | **0.5188** | calculated |

## Emisison Rate for Solidification

| | | |
|---|---|---|
| TSP emission factor (kg/Mg) | $k*0.0016*(U/2.2)^{1.3} / (M/2)^{1.4}$ | |
| | | *from AP-42, 5th ed., S13.2.4* |
| Particle size mutipler, k | 0.74 | *from AP-42, 5th ed., S13.2.4, particle size < 30 um* |
| Material moisture content, M (%) | 24 | *SI data* |
| Average wind speed, U (m/s) | 5.1 | *from EIA-Theme Park* |
| % mitigation | 50 | |
| E(TSP) (g/Mg) | 0.05447 | *calculated* |
| Handling rate (Mg/hr) | 60 | *assumed* |
| **TSP Emission rate(mg/s)** | **0.90784** | *Calculated* |
| Cr6+ contamination level (mg/kg) | 392 | *SI Data* |
| **Cr6+ Emission Rate (ug/s)** | **0.35587** | *Calculated* |

## Emisison Rate for Biopiling

| | | |
|---|---|---|
| TOC Emisison limit (mg/m3) | 20 | design limit |
| Flow rate (m3/s) | 0.93 | max flow rate |
| **TOC Emission rate (mg/s)** | **18.6** | calculated |

## Material Handling

| | | |
|---|---|---|
| TSP emission factor (kg/Mg) | $k*0.0016*(U/2.2)^{1.3} / (M/2)^{1.4}$ | |
| | | *from AP-42, 5th ed., S13.2.4* |
| Particle size mutipler, k | 0.74 | *from AP-42, 5th ed., S13.2.4, particle size < 30 um* |
| Material moisture content, M (%) | 24 | *SI data* |
| Average wind speed, U (m/s) | 5.1 | *from EIA-Theme Park* |
| No of working day per hour | 10 | *assumed* |
| % mitigation | 50 | *water suppression* |
| E(TSP) (g/Mg) | 0.05447 | *calculated* |
| Handling Rate (m3/hour) | 84 | *Engineer* |
| **TSP Emission (g/s)** | **2.5419E-03** | *Calculated* |
| Cr6+ contamination level (mg/kg) | 392 | *SI Data* |
| **Cr6+ Emission Rate (ug/s)** | **0.99644** | *Calculated* |