**Solutions to Assignment 5 on removal of particulates in air**

5-3 Table 5-4, Emission factor = 10A lb/ton coal burned = 10 (7%) = 70 lb/ton coal

Emissions = 70lb/2000 x 1lb coal/10,800 = 3.2 lb/106 BTU

Fed standard = 0.03 lb /106 BTU.

Therefore, required removal efficiency = [3.2 -0.03]/3.2 = 99.1 %

5-5 a) Table 5-4: EF = 9.3 S(%) + 3.07 lb/103 gal burned = 9.3 (0.2) + 3.07 = 4.93 lb/ 103 gal

Emissions = 4.93/103 x 1gal/140,000 BTU = 0.035 lb/ 106 BTU

Efficiency = (0.035 -0.03)/ 0.035 x 100 = 14.3% based on NSPS of 0.03 lb/ 106 BTU

5-23 a) N = Integral of 6,000,000 x (dp-1)dp between 1 and 49.

= dp2/2 –dp between 1 and 49.

When we substitute the ranges, this provides us with a total number, 6.91 x 109

b) m = Integral of mdp.ndp.ddp = Πρ/8 Int dp3 (6x106)ddp = 0.182 kg

c) The required area is found by dividing the integral of the surface area of the particles =

Π/m Int dp2n(dp)d/dp When you work this all out, you will get about 100-200 m2 per kg.

5-53 An analysis will show flow is turbulent, so use Efficiency = 1- exp {-VtL/hVg}

Solving for Vt = 37 cm/s; From Figure 5-8 and ρ 2g/cm3, the particle diameter is 82 μm

An analytical solution from the terminal velocity under laminar conditions renders 80 μm

* 1. Using Eq 5-98 or 5-97 a) K2 = 0.00304/(3x10-6)1.1 = 3614 cm H2O (m/s)-1 (kg/m2)-1

1. K2 = 2060; c) K2 = 961 and d) K2 = 448 (same units) (Not in assignment)
   1. a) For 99%, We = 1.5 cm/s or 0.015 s/m

Pt = exp (-A/Q x We) A/Q -ln Pt/We = -ln0.01/0.015 m/s = 307 s/m (or m2/m3/s)

1. For 99.5%, We = 0.018 m/s, A/Q -ln Pt/We = -ln0.05/0.018 m/s = 294 s/m
2. For 99.9%, We = 0.018 m/s, A/Q -ln Pt/We = -ln0.001/0.018 m/s = 384 s/m