**Appendix 3 Copy of D1 Calculation**
**Enviroparks Hirwaun Ltd**
**October 2008**

**Calculate the Pollution Index for each Pollutant**

Pi = D/(Gd-Bc)*1000

N.B. Always ensure you scroll right across and add other pollutants as necessary.

Pi = pollution index (m3 s-1)
D = discharge rate (g/s)
Gd = guideline concentration (mg m-3) (if no Gd available, use 1/40th STEL or TWA, or 1/100th MEL - see EH40)
Bc = background concentration (mg m-3) (use local data where available, Table 2 in D1, or assume zero. Calculate and use Be if necessary (see below))

**Is stack considered to stand alone (all other stacks are > 5 stack diameters away)? If so:**

| **NO2** | | | **CO** | | | **SO2** | | | **Suspended Particulate Matter** | | | **HCl** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | 9.76 | g s-1 | D | 4.19 | g s-1 | D | 1.57 | g s-1 | D | 0.67 | g s-1 | D | 0.23 | g s-1 |
| Gd | 0.2 | mg m-3 | Gd | 57 | mg m-3 | Gd | 0.44 | mg m-3 | Gd | 0.3 | mg m-3 | Gd | 0.1 | mg m-3 |
| Bc | 0.01011 | mg m-3 | Bc | 0.12 | mg m-3 | Bc | 0.00279 | mg m-3 | Bc | 0.02248 | mg m-3 | Bc | 0.028 | mg m-3 |
| Pi = | 51398.18 | m3 s-1 | Pi = | 73.66385 | m3 s-1 | Pi = | 3590.952 | m3 s-1 | Pi = | 2414.24 | m3 s-1 | Pi = | 3194.444 | m3 s-1 |

**Major Poll 51398.18**

**Note; Main discharge pollutants incorporated, and Pi is calculated as the sum of all three releases**

**Calculate the Heat Release from the Stack**

Where release is predominantly combustion gases:

Q = V(1-(Tamb/Tdisch))/2.9

Q = heat release (MW)
V = total volume rate of discharge (m3 s-1)
Tamb and Tdisch = ambient and discharge temperatures (K)
Notes:
Ambient temperature can be assumed at 10 oC (283K)
**Discharge temperature should include sensible heat only (if the discharge contains water droplets, the temperature should be reduced by: 0.0023 x discharge of water droplets (g s-1) to give sensible heat)**

| | | |
|---|---|---|
| V | 33.75 | m3 s-1 |
| Tamb | 283 | K |
| Tdisch | 393 | K |
| Q = | 3.257436 | MW |

**Calculate Ub and Um: The uncorrected discharge height (U) is the smaller of the two.**

Calculate the uncorrected discharge stack height Ub:

Ub = 10a*Pib

Q = 3.257

Table to calc a, b, min & Ub

| | Q lookup | a calc | b calc | min calc |
|---|---|---|---|---|
| Q< or = 1 | -1000 | -1.20744 | 0.492564 | 2.44045 |
| Q>1 | 1 | -1.26293 | 0.507326 | 2.423562 |

| | | |
|---|---|---|
| a | -1.26293 | |
| b | 0.507326 | |
| min | 2.423562 | |
| Ub | 13.39856 | major pollutant used |

NOTE: minimum values apply:
Ub min = 1m and max = 200m
Heat release min = 0.03kW and max = 100 MW
Pi min = 50 and max = 100,000,000
AND: if Q ≤ 1 then minimum Ub is 1.95*Q0.19
AND: if Q < 1 then minimum Ub is 1.7+0.25*Q0.9

Appendix 5

Calculate the discharge momentum M:

Assuming the discharge is of combustion gases or mainly air with small quantities of contaminants, the following calculation may be used. Otherwise, consult D1.

M = (Tamb/Tdisch)*V*w

M = discharge momentum (m4 s-2)
Tamb and Tdisch = ambient and discharge temperatures (K)
V = total volume rate of discharge (m3 s-1)
w = discharge velocity (m s-1)

| | | |
|---|---|---|
| Tamb | 283 | K |
| Tdisch | 393 | K |
| V | 33.75 | m3 s-1 |
| w | 15 | m s-1 |
| M | 364.5515 | m4 s-1 |

Calculate the uncorrected discharge stack height Um:

| | | |
|---|---|---|
| M= | 364.5515 | |
| x = | -1.36824 | |
| y = | 4.301462 | |
| z = | -12.1389 | |
| | (Note major pollutant has been entered, change below if other required) | |
| (y*log10Pi+z) = | 8.125111 | |
| Therefore log10Um = | 1.482221 | |
| Therefore Um = | 30.35436 | |

NOTE: minimum values apply:
Um min = 1m and max = 200m
Discharge momentum min = 1 and max = 2.104
Pi min = 50 and max = 100,000,000
Minimum Um is 0.82M0.32
Minimum Um for any value of M is 1 m

Calculate the final discharge height (C), correcting for nearby buildings

| | | |
|---|---|---|
| Ub = | 13.39856 | m |
| Um = | 30.35436 | m |
| U = | 13.39856 | Uncorrected discharge stack height |
| A = | 2.265494 | If no value for Ub, or if Ub > Um, then A = 1 |
| H = | 15 | Building height (m) at the highest point of the roof (but ignoring any protrusions of less than 1 % of roof area) |
| B = | 20 | Building width (m) measured at right angles to a line joining the discharge stack and the nearest point |
| K = | 15 | |
| T = | 37.5 | Height of disturbed flow over building |
| Tm = | 37.5 | Maximum T when considering all relevant buildings. |
| Hm = | 15 | Maximum H when considering all relevant buildings. |
| -U/H = | -0.89324 | |
| -U/Hm = | -0.89324 | |
| C = | Final corrected discharge stack height (see calculations below) | |

All buildings within a range of 5Um should be considered.
5Um = 151.7718 m
Considering the tallest building, compare H with U:
If U is > 2.5 times the tallest building, there is no further calculation to make and C = U

If U is less than 2.5 times the height of the tallest building, calculate C:

Multiple or Tall Buildings:
Record H (height) and B (width) for each building within 5U
Evaluate K for each building within 5U
Calculate T for each building within 5U
Find Tm and Hm
If U is greater than Tm, C = U and there is no further calculation

C = Hm(1-Hm/Tm)[U+(Tm-U)(1-A-U/Hm)] Therefore, C = 30.53455 m total stack height (Always round up to the nearest metre)