# Appendix 3.10
# Emission Inventory and Calculation on Chimneys

## Calculation of Boiler Emissions in North District Hospital

**North District Hospital Boiler (NDHC01-03)**

| | | | | | |
|---|---|---|---|---|---|
| Monthly Consumption | = | 5,863,104 | MJ | | **Note 1** |
| | = | 1,628,640 | kWh | | 1kWh = 3.6MJ |
| Consumption per Boiler | = | 542,880 | kWh | | 3 boilers |
| **Consumption Rate per Boiler** | = | 0.2027 | kWh/s | …(1) | **Note 2** |
| | = | 2,626.84 | MJ/hr | …(2) | |
| NOx Emission Factor | = | 220 | mg/kWh | | **Note 3** |
| | = | 0.22 | g/kWh | …(3) | |
| **NOx Emission Rate:** | = | **0.0892** | **g/s** | …(4)=(3)*(1) | **Note 4** |
| PM Emission Factor From Gas Combustion | = | 7.6 | $lb/10^6scf$ | | **Note 5** |
| | = | 121.60 | $kg/10^6m^3$ | …(5) | To convert from $lb/10^6scf$ to $kg/10^6m^3$, multiply by 16. |
| Heating Value of Natural Gas (Calorific Value) | = | 1020 | Btu/scf | | **Note 6** |
| | = | 38.00 | $MJ/m^3$ | …(6) | |
| **PM (TSP/RSP/FSP) Emission Rate** | = | 16809.72 | $kg/10^6hr$ | …(7)=(2)/(6)*(5) | **Note 4** |
| | = | **0.0047** | **g/s** | | 1kg=1000g; 1hour=3600seconds |

**Note:**

[1] 2019 monthly fuel consumption is provided by North District Hospital. Highest monthly fuel consumption is adopted as conservative approach.

[2] Assume 24 hours operation per day as a conservative approach .

[3] Reference from Section 3.5.1 of AEIAR142/2009 "Provision of a Poultry Slaughtering Centre in Sheung Shui".

[4] The emission rate is multiplied by 2 times as a conservative approach.

[5] The emission factor as PM(Total) on Table 1.4-2 of Chapter 1.4, USEPA AP42, Fifth Edition, Volume I is adopted as Towngas has similar combustion characteristics to natural gas.

[6] Reference from Town Gas Characteristics in Towngas Website. (https://www.towngas.com/en/About-Us/Hong-Kong-Gas-Business/Gas-Production)

**Emission Inventory on Chimneys**

| Building | Model ID | X | Y | Source | Operation | Base | Stack Height | Stack Diameter | Exit Temp. | Stack Velocity | Emission Rates | | | | Use on Phase | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | NOx | RSP/PM10 | FSP/PM2.5 | TSP | | | |
| (Name) | (#) | (HK1980) | (HK1980) | (Type) | (Hours) | (mPD) | (mAG) | (m) | (K) | (m/s) | (g/s) | (g/s) | (g/s) | (g/s) | Design/Base | Construction | |
| North District Hospital | NDHC01 | 830849.00 | 839680.00 | POINT | 24-Hour | 15.2 | 64.52 | 0.60 | 333 | 7 | 0.0892 | 0.0047 | 0.0047 | 0.0047 | ✓ | ✓ | [1],[3],[4] |
| | NDHC02 | 830850.00 | 839681.00 | POINT | 24-Hour | 15.2 | 64.52 | 0.60 | 333 | 7 | 0.0892 | 0.0047 | 0.0047 | 0.0047 | ✓ | ✓ | |
| | NDHC03 | 830851.00 | 839682.00 | POINT | 24-Hour | 15.2 | 64.52 | 0.60 | 333 | 7 | 0.0892 | 0.0047 | 0.0047 | 0.0047 | ✓ | ✓ | |
| North District Hospital Expansion | NDHE01 | 830778.00 | 839734.00 | POINT | 24-Hour | 12.0 | 64.52 | 0.60 | 333 | 7 | 0.0892 | 0.0047 | 0.0047 | 0.0047 | ✓ | | [2],[3],[4] |
| | NDHE02 | 830780.00 | 839732.00 | POINT | 24-Hour | 12.0 | 64.52 | 0.60 | 333 | 7 | 0.0892 | 0.0047 | 0.0047 | 0.0047 | ✓ | | |
| | NDHE03 | 830782.00 | 839730.00 | POINT | 24-Hour | 12.0 | 64.52 | 0.60 | 333 | 7 | 0.0892 | 0.0047 | 0.0047 | 0.0047 | ✓ | | |
| | | | | | | | | | Use on Design/Base Phase | | ✓ | ✓ | ✓ | | | | |
| | | | | | | | | | Use on Construction Phase | | | ✓ | ✓ | ✓ | | | |

**Note:**

[1] Information provided by North District Hospital.

[2] No information on North District Hospital Expansion, for conservative, assume the same as North District Hospital.

[3] For those chimneys where the operators did not provide any information, their exit velocities and temperatures are assumed to be 7m/s and 373K advised by EPD.

[4] For Hospital Boilers, for conservative approach, assume PM listed = TSP = RSP = FSP as no reference shall be made on Hong Kong situations.