

## Appendix 3.2 - Detailed Calculations of Emissions from the IWMF

Oa:	Oxygen concentration of flue gas, dry gas
Os:	Standard oxygen concentration, dry gas
Ca, dry, Oa:	Actual flue gas concentration, dry gas, Oa
Ca, dry, Os:	Actual flue gas concentration, dry gas, Os
Ca, wet, Oa:	Actual flue gas concentration, wet gas, Oa
Cs:	Flue gas concentration at standard conditions
Va, dry:	Volume of flue gas at emission point, dry gas
Va, wet:	Volume of flue gas at emission point, wet gas
Vs:	Volume of flue gas under standard condition, dry gas
M:	Mass of pollutant in flue gas
%H2O:	% of moisture in flue gas
Pa:	Pressure of flue gas at emission point
Ps:	Standard pressure
Ta:	Temperature of flue gas at emission point
Ts:	Standard temperature

In accordance with Annex VI of EU Directive 200/76/EC,

$$Ca, \text{ dry, Oa} = Ca, \text{ dry, Os} \times (20.9 - Oa) / (20.9 - Os) \quad (\text{eqn. 1})$$

$$Ca, \text{ dry, Oa} = M / Va, \text{ dry} \quad (\text{eqn. 2})$$

$$= M / [Va, \text{ wet} \times (1 - \%H2O)] \quad (\text{eqn. 3})$$

$$Ca, \text{ wet, Oa} = M / Va, \text{ wet} \quad (\text{from eqn. 3})$$

$$= Ca, \text{ dry, Oa} \times (1 - \%H2O) \quad (\text{from eqn. 1})$$

$$= Ca, \text{ dry, Os} \times (1 - \%H2O) \times (20.9 - Oa) / (20.9 - Os) \quad (\text{eqn. 4})$$

$$Cs = M / Vs \quad (\text{eqn. 5})$$

By standard gas law,

$$Pa \times Va, \text{ dry} / Ta = Ps \times Vs / Ts$$

Since Pa = Ps,

$$\text{Therefore, } Va, \text{ dry} / Ta = Vs / Ts$$

From eqn. 2 and eqn. 5,

$$(M / Ca, \text{ dry, Oa}) / Ta = (M / Cs) / Ts$$

Therefore,

$$Ca, \text{ dry, Oa} = Cs \times Ts / Ta$$

From eqn. 4,

$$Ca, \text{ wet, Oa} = Cs \times (Ts / Ta) \times (1 - \%H2O) \times (20.9 - Oa) / (20.9 - Os)$$

For the IWMF, for any pollutant,

Oa= 6.1%

Os= 11%

%H2O= 20.4%

Ta= 413K

Ts= 273K

Therefore,

$$Ca, \text{ wet, Oa} = Cs \times (273 / 413K) \times (1 - 0.204) \times (20.9 - 6.1) / (20.9 - 11)$$

$$= 0.787 Cs$$

$$\text{The actual flow rate} = 1,050,200 \text{ m}^3/\text{hr}$$

Air Pollutant	BPM Emission Limits (mg m <sup>-3</sup> )		Emission Rate		
	Half-Hourly	Daily or as specified	Hourly (g/s)	Daily or as specified (g/s)	Annual Emission (Tonnes)
Particulates	30	10	6.88	2.29	217
SO <sub>2</sub>	200	50	45.89	11.47	1447
NO <sub>x</sub>	200	100	45.89	22.95	1447
Carbon Monoxide (CO)	100	50	22.95	11.47	724
Gaseous or vaporous organic substances	20	10	4.59	2.29	145
Hydrogen Chloride (HCl)	60	10	13.77	2.29	-
Hydrogen Fluoride (HF)	4	1	0.92	0.23	-
Total of 9 Heavy Metals	-	0.5	0.115	0.115	-
Mercury	-	0.05	1.15E-02	1.15E-02	-
Total Cadmium & Thallium	-	0.05	1.15E-02	1.15E-02	-
Dioxins & Furans	-	1.00E-07	2.29E-08	2.29E-08	-