Addendum - Combustion in Boilers

This addendum coincides with the first reprint of the manual. It consists of a number of minor editorial changes. The most substantive changes relate to the use of direct measurement to estimate emissions (Section 3.1).

- **2.2.1 Emissions to Air**

Point Source Emissions

'These emissions are exhausted into a vent or stack…' changed to 'These emissions are exhausted into a vent (excluding roof vents) or stack…'

- **2.2.2 Emissions to Water**

Sentence added - 'However leakage and other emissions (including dust) from a tailings storage facility are reportable.

- **3.0 Emission Estimation Techniques**

Paragraph inserted at end of section:

The **usage**[a] of each of the substances listed as Category 1 and 1a under the NPI must be estimated to determine whether the 10 tonnes (or 25 tonnes for VOCs) reporting threshold is exceeded. If the threshold is exceeded, **emissions** of these Category 1 and 1a substances must be reported for all operations/processes relating to the facility, even if the actual emissions of the substances are very low or zero.

[a]Usage is defined as meaning the handling, manufacture, import, processing, coincidental production or other uses of the substances.

- **3.1.1 Sampling Data**

References to 'dry standard' changed to 'dry'.

- **Equation 3**

Paragraph preceding equation amended to read as follows:
'The information from some stack tests may be reported in grams of particulate per cubic metre of exhaust gas (wet)….'

Replaced 'Q_a = actual cubic metres of exhaust gas per second (m^3/s)' with
'Q_w = wet cubic metres of exhaust gas per second, m^3/ s)'
(1 – R/100) with (1-$moist_R$/100) where $moist_R$ = moisture content

- Use Equation 4 to calculate moisture content:

Equation 4

Moisture percentage = 100 % * weight of water vapour per specific volume of stack gas/total weight of the stack gas in that volume.

$$moist_R = \frac{100\ \% * \left(\frac{g_{moist}}{1000 * V_{m,STP}}\right)}{\left(\frac{g_{moist}}{1000 * V_{m,STP}}\right) + \rho_{STP}}$$

where

$moist_R$ = moisture content, %
g_{moist} = moisture collected, g
$V_{m,STP}$ = metered volume of sample at STP, m^3
ρ_{STP} = dry density of stack gas sample, kg/m^3 at STP
{if the density is not known a default value of 1.62 kg/m^3 may be used. This assumes a dry gas composition of 50% air, 50% CO_2}

- **Table 6** deleted Q_a and results for E_{PM}
- **Example 1**

Equation calculating E_{PM} changed to:

E_{PM} = C_{PM} * Q_d * 3.6 * [273 / (273 + T)]
= 0.072 * 8.48 * 3.6 * [273/423 K]
= 1.42 kg/hr

- Example 2 changed to:

Example 2 - Using CEMS Data

This example shows how SO_2 emissions can be calculated using Equation 5 based on the CEMS data for Time Period 1 shown in Table 7, and an exhaust gas temperature of 150°C (423 K).

$E_{SO2,1}$ = (C * MW * Q * 3 600) / [(22.4 * (T+273/273) * 10^6]
= (150.9 * 64 * 8.52 * 3 600) / [22.4 * (423/273) * 10^6]
= 296 217 907 / 34 707 692
= 8.53 kg/hr

For Time Period 2, also at 150°C

$E_{SO2,2}$ = 8.11 kg/hr

For Time Period 3, also at 150°C

$E_{SO2,3}$ = 7.23 kg/hr

Say representative operating conditions for the year are:

Period 1 = 1500 hr
Period 2 = 2000 hr
Period 3 = 1800 hr

Total emissions for the year are calculated by adding the results of the three Time Periods using Equation 6:

$E_{kpy,SO2}$ = $E_{SO2,1}$ * OpHrs + $E_{SO2,2}$ * OpHrs + $E_{SO2,3}$ * OpHrs
= (8.53 * 1500) + (8.11 * 2000) + (7.23 * 1800) kg
= 42021 kg/yr

Emissions, in terms of kg/tonne of oil consumed when operating in the same mode as Time Period 1, can be calculated using Equation 7

$E_{kpt,SO2}$ = E_{SO2} / A
= 8.53 / 290
= 2.94 * 10^{-2} kg SO_2 emitted per tonne of oil consumed.

When the boiler is operating as in Time Periods 2 or 3, similar calculations can be undertaken for emissions per tonne.

- **Equation 7** (Equation 8 in Version 1.01 of Manual)

'/100' inserted after 'pollutant concentration in fuel'

'Concentration of pollutant in fuel expressed as weight percent, %' added after equation.

- **Equation 8** (Equation 9 in Version 1.01 of Manual)

'*' inserted between '…OpHrs]' and 'EF_i'

- Equation in **Example 4** changed to:

$E_{kpy,i}$ = A * EF_i * [1 - (CE_i/100)]
$E_{kpy,Nox}$ = 600 t/yr * 16.5 kg/t * [1 - (80/100)]
= 9900 * 0.2
= 1980 kg/yr

- NB: There has been some general re-formatting of Tables, Equations, Figures and Examples. Equation numbers jump 1 place after Equation 4. Eg. Equation 4 in original (February 1999) version is Equation 5 in Version 1.01.