Overcoming technical hurdles on the journey towards a workable PPC Permit

‘‘Caring for the environment and creating safer workplaces’’

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Ray Pullen

- Technical and Quality Manager
- 23 years experience in the chemical industry
- 7 years in stack testing
- 3 years Technical Officer for the STA

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Permit anomalies

- Oxygen Reference Correction Values
- Moisture Correction
- NO_2 Monitoring
- Class A & Class B VOCs

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Oxygen Reference Correction Values (ORCV)

- Required to enable comparison between emission levels from same process in different locations.
- Level set is based on process characteristics.
- Values cover virtually whole range of oxygen concentrations.

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Permits

Standard reference conditions frequently referred to by footnote at foot of table listing ELVs

- Footnote reference is in generic form, as follows:
  - *Unless otherwise stated, any reference in this Permit to concentrations of substances in emissions into air means:*
  - *In relation to gases from combustion process, the concentration in dry air at a temperature of 273K, at a pressure of 101.3kPa and with an **oxygen content of 3%** dry for **liquid and gaseous fuels**, **6%** dry for **solid fuels**; and/or*
  - *In relation to gases from non-combustion sources, the concentration at a temperature of 273K and at a pressure of 101.3kPa with no correction for water vapour content"*
- Not related to details of process

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Oxygen Reference Correction Values

O_2%	Process Description
3	Gas & Oil fired Combustion Processes
5	Land fill gas engines
6	Solid Fuel Combustion Processes
8	Continuous Furnaces (Lead, Glass, Glass Frit and Enamel etc) (PG 3 /4)
10	Cement Kilns
11	Incineration & Metal Decontamination Processes (PG1/12, PG2/9)
13	Pot Furnaces (PG3/4)
15	Gas Turbines / Compression Ignition Engines
17	Vegetable Drying Processes (PG6/27)
18	Heavy Clay Goods – Kiln Emissions; China & Ball Clay Processes (PG3/2, PG 3/7)

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Oxygen Reference Correction Values

<u>Unspecified</u> - 'O2 (& Moisture) References should be that which corresponds to the normal operating conditions in the process concerned':

- Furnaces for the extraction of non-ferrous metal from scrap. (PG2/1)
- Hot Dip Galvanising (PG2/2)
- Electrical, Crucible and Reverberating Furnaces (PG2/3)
- Iron, steel and Non-ferrous Metal Foundry Processes (PG2/4)
- Hot & Cold Blast Cupolas & Rotary Furnaces (PG2/5)
- Aluminium & Alloys Processing (PG2/6)
- Polymerisation of Preformulated Resins or Gel-coats (PG4/2)

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Oxygen Reference Correction Values

Permit Assumption:

Natural Gas Fired Process = 3% ORCV (derived from gas fuelled steam generating boilers which operate ~3%O_2)

Practical Experience:

Natural Gas Fired Process = 3 - 19% O_2 concentrations in stack (depending upon process)

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Calculation Example

- Combustion process: Natural Gas Fired
- ORCV = 3% (Gaseous fuel)
- Measured concentration of NOx = 50mg/m^3
- ELV = 100mg/m^3
- **BUT** Measured O_2 = 13.5%

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Correction Factor

$$\frac{21 - 3}{21 - 13.5}$$

$$= 2.4$$

$$\times 50 = 120 mg/m^3$$

– Exceeds ELV

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Case Study One
Biogas Flare stack

Problem: PPC Permit stipulates a 3% ORCV but configuration/design of installation leads to a measured oxygen level around 13.5%. Hence oxygen correction leads to emission concentrations above ELV.

What we did: We collected data from stack over long periods to establish mean operating oxygen level.

Solution: Took up case on clients behalf with EA resulting in more appropriate ORCV being applied.

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Case Study Two
Vaccine Production

Problem: Oxidiser used to destroy waste gases from egg-based culture medium is natural gas fired. Hence 3% ORCV applied in Permit resulting in compliance failure (above ELV) because of application of 3% ORCV.

What we did: We carried out extensive oxygen concentration monitoring and proved normal operating conditions produced a stack oxygen concentration of around 14%.

Solution: Took up case on clients behalf with EA resulting in more appropriate ORCV being applied to process.

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Case Study Three
Wire Treatment

Problem:

Operator heats baths of liquid into which coils of wire are dipped to apply various treatments.

The heating of the baths is via a natural gas flame – hence 3% ORCV applied to the process in the Permit.

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Case Study Three
Wire Treatment

What we did:

We carried out extensive oxygen monitoring and proved normal operating conditions produced a stack oxygen concentration of 9, 10, 15 or 17% depending upon whether the burner was in low or high fire mode and whether 1,2 or 3 burners were ignited. This results in corrected concentrations of combustion gases above ELV.

Solution:

Representations have been made to the Local EA Inspector, who is reviewing the process with the aim of applying a more appropriate ORCV.

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Moisture Correction

Problem:

- Permit wording frequently stipulates: *"without correction for moisture* content" or *"with no correction for water vapour content".*
- Such phrases are meaningless as they do not stipulate ***WHEN*** corrections should be made.

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Moisture Correction

- Examples:
  - Some NO_x analysers able to measure WET gas and others only DRY gas
  - VOC analysers based on FID measure WET gas

- **WHEN** should each of these examples be corrected for ‘moisture content’

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Moisture Correction

What we did:

- Brought this confusion to Environment Agency's attention. They acknowledged the problem.

Solution:

- EA sent out memo to National Permitting Team requesting that conditions should be changed to "reported as dry gas".

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NO_2 Monitoring

- **Problem**:
  - EA's preferred method for NO_x monitoring is chemiluminescence (BS EN 14792).
  - Generally ideal for combustion processes where NO/NO_2 ratio is around 95/5%.
  - However, some processes produce virtually **all NO_2**.
  - Some chemiluminescence based analysers have difficulty coping with high levels of NO_2 and **cannot be calibrated with NO_2 .**

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NO_2 Monitoring

- Such processes include:
  - Di-azo reactions in dyestuff manufacture.
  - Brightening of aluminium components in acid baths.

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NO_2 Monitoring

- **What we did**:
  - Application to EA to consider alternative monitoring techniques.
- **Solution**:
  - Footnote in Draft MID 14792 alerting reader to fact that other monitoring techniques may be required for such processes.

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Class A & B VOCs

Problem:

- Permit requested measuring Class A & Class B VOC compounds from same duct.

- Definitive list of Class A & Class B does not appear to exist.

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Class A & B VOCs

What we did:

- Brought this confusion to Environment Agency's attention. They acknowledged the problem.

Solution:

- Environment Agency's current strategy is to measure Total VOC by FID analyser and then separately speciate for any potentially highly toxic compounds.

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Summary

- Permits can contain unreasonable or ambiguous requirements which, if ignored, can result in non-compliance and/or unnecessary expense.

- Using consultants with wide ranging experience and expertise to present the case to the Environment Agency for application of appropriate amendments to the permit can prove beneficial.

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- MCERTS Stack Emission Monitoring
- Environmental Consultancy
- Solvent Management Plans
- Training
- Health & Safety Consultancy/Monitoring

Website: www.envirocare.org

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