Gas analysis implications of the IED (Industrial Emissions Directive) in the Oil Refining Industry

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Environmental Regulations – EU Perspective Background

- IPPC (Integrated Pollution Prevention and Control)
  - Started in 1996, revised in 2008
  - Objective: Prevent or minimize emissions to air land and water from major industrial plants
  - Status at revision
    - Uptake by 27 member states is inconsistent
    - Only 26,000 of 50,000 sites have permits
- WID (Waste Incineration Plant)
- LCPD (Large Combustion Plant Directive)
  - Started in 1988, revised in 2001

Environmental Regulations – EU Perspective Background

IED is a recast of seven existing Directives:

- Large Combustion Plant directive (LCPD)
- The Integrated Pollution Prevention and Control directive (IPPCD)
- The Waste Incineration directive (WID)
- the Solvent Emissions directive (SED)

and the three existing directives on

- Titanium dioxide on disposal (78/176/EEC),
- monitoring and surveillance (82/883/EEC) and
- programs for the reduction of pollution (92/112/EEC).

Timescale for Implementation

- **6th Jan 2011** IED into force

- **6th Jan 2013** All member states fully transpose the IED. The Directive applies to all new installations from this date onwards.

- **6th Jan 2014** Applies to existing installations on permit renewal (every 5 years). All existing installations previously subject to IPPC, WI, SE and the TiO2 Directives must meet the requirements of the IED. LCP do not yet need to meet the new ELVs (Ch. III, Annex V).

- **6th July 2015** Applies to existing installations operating newly prescribed activities (e.g. waste installations, wood based panels, wood preservation) must meet the requirements of the IED.

- **1st Jan 2016** Existing LCP must meet the requirements set out in Chapter III and Annex V. Implementation in respect of large combustion plants already in existence before 6 January 2013.

Examples of industries explicitly mentioned in the IED
There are many more…

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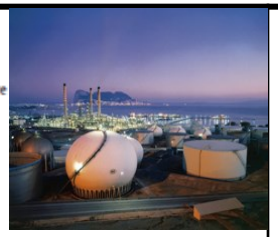


1. Energy industries

1.1. Combustion of fuels in installations with a total rated thermal input of 50 MW or more

1.2. Refining of mineral oil and gas

1.3. Production of coke

1.4. Gasification or liquefaction of:

(a) coal;

(b) other fuels in installations with a total rated thermal input of 20 MW or more.

2. Production and processing of metals

2.1. Metal ore (including sulphide ore) roasting or sintering

2.2. Production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2.5 tonnes per hour

2.3. Processing of ferrous metals:

(a) operation of hot-rolling mills with a capacity exceeding 20 tonnes of crude steel per hour;

(b) operation of smitheries with hammers the energy of which exceeds 50 kilojoule per hammer, where the calorific power used exceeds 20 MW;

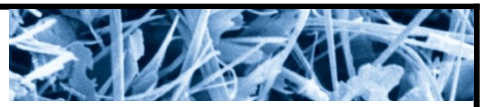
(c) application of protective fused metal coats with an input exceeding 2 tonnes of crude steel per hour.

2.4. Operation of ferrous metal foundries with a production capacity exceeding 20 tonnes per day

2.5. Processing of non-ferrous metals:

(a) production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes;

(b) melting, including the alloyage, of non-ferrous metals, including recovered products and operation of non-ferrous metal foundries, with a melting capacity exceeding 4 tonnes per day for lead and cadmium or 20 tonnes per day for all other metals.



3. Mineral industry

3.1. Production of cement, lime and magnesium oxide:

(a) production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or in other kilns with a production capacity exceeding 50 tonnes per day;

(b) production of lime in kilns with a production capacity exceeding 50 tonnes per day;

(c) production of magnesium oxide in kilns with a production capacity exceeding 50 tonnes per day.

3.2. Production of asbestos or the manufacture of asbestos-based products

3.3. Manufacture of glass including glass fibre with a melting capacity exceeding 20 tonnes per day

3.4. Melting mineral substances including the production of mineral fibres with a melting capacity exceeding 20 tonnes per day

3.5. Manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain with a production capacity exceeding 75 tonnes per day and/or with a kiln capacity exceeding 4 m^3 and with a setting density per kiln exceeding 300 kg/m^3

4. Chemical industry

For the purpose of this section, production within the meaning of the categories of activities contained in this section means the production on an industrial scale by chemical or biological processing of substances or groups of substances listed in points 4.1 to 4.6

4.1. Production of organic chemicals, such as:

(a) simple hydrocarbons (linear or cyclic, saturated or unsaturated, aliphatic or aromatic);

(b) oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters and mixtures of esters, acetates, ethers, peroxides and epoxy resins;

(c) sulphurous hydrocarbons;

(d) nitrogenous hydrocarbons such as amines, amides, nitrous compounds, nitro compounds or nitrate compounds, nitriles, cyanates, isocyanates;

(e) phosphorus-containing hydrocarbons;

(f) halogenic hydrocarbons;

(g) organometallic compounds;

(h) plastic materials (polymers, synthetic fibres and cellulose-based fibres);

(i) synthetic rubbers;

(j) dyes and pigments;

(k) surface-active agents and surfactants.

Timetable for the transposition and implementation of BREFs – Some Examples

- Manufacture of Glass : March 2012
- Iron and Steel : March 2012
- Production of Cement, Lime and MgO2 : 04.2013
- Large Combustion Plants : First Draft 06.2013
- Waste Water and Gas Treatment : Final Draft 07.2014
- Production of Pulp, Paper and Board : 09.2014
- Non ferrous metals Industries : Final draft 10.2014
- Refining of Mineral Oil and Gas : 10.2014

- **Emissions limit values will be set based on „Best available technology“ for each industry, these are in BREF notes**
- **Most factories will already be operating within locally defined consent levels, these must be within the IED limits**
- **This legislation will standardise the maximum emission levels across the EU.**

Pollutants by Industry Segments

Customer Segments	Customer Applications	Products					
		O2, CO2	CO, CH4, NOx	SOx	VOC	NH3, HCl, CL2	Hg
Refining	Emissions profile biased towards hydrocarbons and VOC's	y	y	y	y		
Cement production	Extremely diverse emissions due to combustion of waste	y	y	y		y	y
Power generation gas	Emissions profile for very clean fossil fuel	y	y	y			
Power generation oil	Emissions profile for high sulfur fossil fuel	y	y	y			
Power generation coal	Emissions profile for high sulfur / high mercury fossil fuel	y	y	y			y
Glass melting	Generally „clean" emissions from natual gas combustion	y	y	y			
Waste incineration	Extremely diverse emissions due to combustion of waste	y	y	y		y	y

New IED and BREF Document for the Refining of Mineral Oil and Gas
NOx

- New (lower) Emissions Limit Values (ELV) will change (and increase) the requirements for environmental monitoring
- New emissions Limit Values will require investment in new pollution control unit operations which will require new process control instrumentation

Table 5.4: BAT- associated emission levels for NO_X emissions to air from the regenerator in the catalytic cracking process

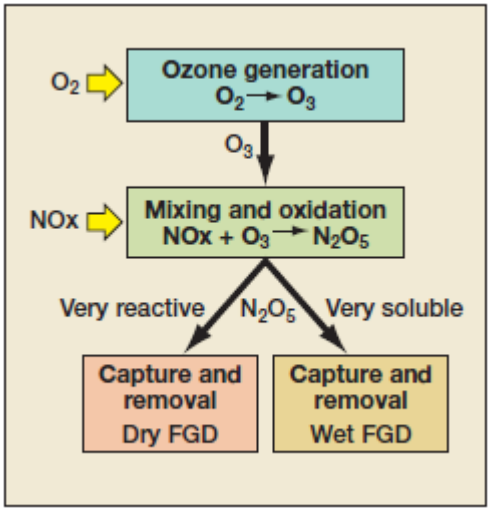
Parameter	Type of unit/combustion mode	BAT-AEL (monthly average) mg/Nm^3
NO_X, expressed as NO_2	New unit/all combustion mode	<30 – 100
	Existing unit/full combustion mode	<100 – 300 (1)
	Existing unit/partial combustion mode	100 – 400 (1)
(1) When antimony (Sb) injection is used for metal passivation, NO_X levels up to 700 mg/Nm^3 may occur. The lower end of the range can be achieved by using the SCR technique.		

New IED and BREF Document for the Refining of Mineral Oil and Gas
NOx

Some of these new unit operations (eg SCR) also require chemical additives, eg NH3

Technique	Description	Applicability
i. Selective catalytic reduction (SCR)	See Section 5.20.2	To avoid potential fouling downstream, additional filtering might be required upstream of the SCR. For existing units, the applicability may be limited by space availability
ii. Selective non-catalytic reduction (SNCR)	See Section 5.20.2	For partial combustion FCCs with CO boilers, a sufficient residence time at the appropriate temperature is required. For full combustion FCCs without auxiliary boilers, additional fuel injection (e.g. hydrogen) may be required to match a lower temperature window
iii. Low temperature oxidation	See Section 5.20.2	Need for additional scrubbing capacity. Ozone generation and the associated risk management need to be properly addressed. The applicability may be limited by the need for additional waste water treatment and related cross-media effects (e.g. nitrate emissions) and by an insufficient supply of liquid oxygen (for ozone generation). The applicability of the technique may be limited by space availability

LoTOx



Ammonia for SCR De-NOx operation to clean up burner flue gases

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Table 5.2: **BAT-associated emission levels for ammonia (NH_3) emissions to air for a combustion or process unit where SCR or SNCR techniques are used**

Parameter	BAT-AEL (monthly average) mg/Nm^3
Ammonia expressed as NH_3	<5 – 15 (1) (2)

(1) The higher end of the range is associated with higher inlet NO_X concentrations, higher NO_X reduction rates and the ageing of the catalyst.
(2) The lower end of the range is associated with the use of the SCR technique.

New IED and BREF Document for the Refining of Mineral Oil and Gas
SOx

Despite technological advances, controlling sulphur remains a technical challenge for the petrochemical industry as the sulphur content of the world's dwindling crude oil resources is increasing. For refiners, throughput can be limited by the speed at which plants can desulphurise crude. Oxygen enrichment of the combustion air significantly increases sulphur handling capacity

Technique	Description	Applicability
i. Use of SO_X reducing catalysts additives	Use of a substance that transfers the sulphur associated with coke from the regenerator back to the reactor. See description in 5.20.3	Applicability may be restricted by regenerator conditions design. Requires appropriate hydrogen sulphide abatement capacity (e.g. SRU)
ii. Use of low sulphur feedstock (e.g. by feedstock selection or by hydrotreatment of the feed)	Feedstock selection favours low sulphur feedstocks among the possible sources to be processed at the unit. Hydrotreatment aims at reducing the sulphur, nitrogen and metal contents of the feed. See description in 5.20.3	Requires sufficient availability of low sulphur feedstocks, hydrogen production and hydrogen sulphide (H_2S) treatment capacity (e.g. amine and Claus units)

CEMS Calibration Gas Mixtures

- —Typical combustion by-product pollutant molecules
- —Generally binary mixtures, but multi-component combinations are also possible and can save time with fewer calibration events
- —ISO17025 accredited certification recommended for regulated and audited CEMS applications

EU IED Specialty Gases & Specialty Equipment Products

EU IED Specialty Gases & Specialty Equipment Products & applications

- New product requirements driven by rolling legislation change in Europe from 2014 through the next 10 years.
- CEMS and process control applications in various industrial segments with combustion-based high thermal load are explicitly covered by this new legislation, eg refining, waste incineration, power generation, glass melting, cement.
- Environmental emissions monitoring gas mixtures, high purity gases & related specialty equipment (often ISO 17025 accredited certification).
- Combustion process control gas mixtures (regular certification).
- De-NOx, De-SOx and other pollution mitigation unit operation process control gas mixtures (regular certification).

Specialty Gases & Specialty Equipment Environmental missions monitoring products

- Process control gas mixtures with % level and ppm level concentrations of typical combustion by-products or flue gas processing by-products, eg O2, CO2, CO, NO, SO2, NH3. Used for burner and pollution mitigation unit operation.
- High accuracy environmental calibration gas mixtures with ppb, ppm and low % level concentrations of typical combustion by-products, eg O2, CO2, CO, NO, SO2, NH3, Hg. These are often required with ISO17025 accreditation.
- High purity gases (Nitrogen or air) for instrument zero setting or FTIR purge
- Instrumentation fuel gases (Air, hydrogen) for FID detectors if hydrocarbon emissions are measured (eg VOC's).
- Calibration gas mixtures generally in 10l or 40l aluminium cylinders.
- Instrumentation gases and high purity gases generally in 50l steel cylinders.
- Some operations still use instrumentation mounted high in the stack and

DIRECTIVE 2010/75/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 24 November 2010
on industrial emissions (integrated pollution prevention and control)


DAkkS
Deutsche Akkreditierungsstelle GmbH
Akkreditierung

ANNEX II

AIR

List of polluting substances

1. Sulphur dioxide and other sulphur compounds
2. Oxides of nitrogen and other nitrogen compounds
3. Carbon monoxide
4. Volatile organic compounds
5. Metals and their compounds
6. Dust including fine particulate matter
7. Asbestos (suspended particulates, fibres)
8. Chlorine and its compounds
9. Fluorine and its compounds