Best Available Techniques (BAT) for pollution prevention / reduction from coal-fired combustion plants in the context of the European Union Directive on industrial emissions (IED)

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BAT at coal-fired combustion plants in the context of the IED

- Directive on Industrial Emissions (IED) and the Integrated Pollution Prevention and Control (IPPC) Concept
- Current BATs
- Review of the Large Combustion Plants (LCP) Best Available Techniques Reference document (BREF)
IED amends a number of EU legislations concerning industrial emissions

Integrated Pollution Prevention and Control
Directive 2008/1/EC

Titanium dioxide industry

VOC emissions from solvents
Directive 1999/13/EC

Waste Incineration
Directive 2000/76/EC

Large Combustion Plants
Directive 2001/80/EC

European Pollutant Release and Transfer Register (E-PRTR)
Regulation 166/2006

Industrial Emissions
Directive 2010/75/EU
Large Combustion Plants (> 50 MW<sub>th</sub>) in the IED: Two aspects of a single regulation

- **IED Chapter II**: Best Available Techniques (BAT) approach (*BAT-associated emission levels*)

- **IED Chapter III**: New Emission limit values (ELVs) and special LCP provisions (Applicable to existing installations from 2016)
Large Combustion Plants (>50 MW$_{th}$) in the IED:
Two aspects of a single regulation

- **IED Chapter II**: Best Available Techniques (BAT) approach *(BAT-associated emission levels)* and Integrated Pollution Prevention and Control (IPPC) Concept

- **IED Chapter III**: Emission limit values (ELVs) and special LCP provisions
IPPC - operating scheme

Prevention and control of pollution arising from industrial installations

Industrial Emissions (integrated pollution prevention and control) Directive

Application of the best available techniques (BAT) described in BAT reference documents (BREFs)

BAT-based permit and emission limit values

1 legislation
35 BREFs
~ 50,000 installations
Definition of BAT

**Best**
Most effective in achieving a high general level of protection of the environment as a whole;

**Available**
Developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions;

**Techniques**
Both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned.
**Objective/ environmental benefit**

**BAT is to:**

Reduce VOC emissions to 10 – 50 mg/Nm³ as a daily average (by continuous monitoring of emissions) by using the following techniques individually or in combination:

<table>
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<th>Technique</th>
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<th>Applicability</th>
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<td>Waste gas incineration</td>
<td>Thermal incineration of organic pollutants with oxidation to CO₂, H₂O, etc.</td>
<td>The technique is generally applicable Not applicable to large waste gas volumes with low VOC concentrations (not economically viable)</td>
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<tr>
<td>Minimising the losses of solvent by ensuring a good sealing of the application system</td>
<td>Optimised design and maintenance of the application system</td>
<td>The technique is generally applicable</td>
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**Environmental performance associated with BAT (BAT-AEPLs or BAT-AELs)**

Technique(s) to satisfy the objective and meet the performance target
The ‘Sevilla process’

Industry

Env. NGOs

Draft 1 (D1)

Draft 2 (D2) *

Final TWG meeting

Member States + EFTA and Accession Countries

Commission/ EIPPCB

Comments

Draft 1 (D1)

Final draft

* D2- optional

Total duration:

• 24 - 29 months (without D2)
• 29 - 39 months (with D2)

BREF

• Forum opinion on BREF
• Adoption of BAT conclusions through the Committee

BAT conclusions

• Industry
• Member States
• Env. NGOs

Bulk of info. needed (incl. questionnaires)
## Milestones in the review process for the LCP BREF

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Current BATs for coal fired plants - Dust

including $PM_{10}$-$PM_{2.5}$-partly Hg

- Electrostatic precipitator: removal efficiency > 99.5 %
- Fabric Filter: removal efficiency > 99.95 %
- Co-benefice of FGD for equipped plants (mainly bigger pulverised coal boilers)
- Cyclone & mechanical collectors not BAT – Can be used for pre-cleaning

- Associated emissions (plants>300MW$_{th}$): from 5 to 20 mg/Nm$^3$ depending on the age of the plant and whether they are fitted or not with an FGD for SO$_x$ removal
Current BATs for coal fired plants – Heavy metals including Hg

Electrostatic precipitator with high dust removal efficiency below 130 °C

Combination of techniques:

- Bituminous coal: ESP (50%) + FGD (50%) + SCR (60%) to reach 90% Hg removal efficiency
- Coal of less quality (Sub-bituminous coal and lignite): 30-70% Hg removal efficiency
Current BATs for coal fired plants – $\text{SO}_2$ (1/2)

**Low sulphur fuel in combination with:**

**For pulverised coal-lignite boilers:**

- Wet scrubber (>100 MW$_{th}$) 85-98% removal efficiency / Co-benefit HCl-HF removal (98-99% removal efficiency) and Dust/Heavy Metal removal / Saleable gypsum by-product
- Spray dry scrubber 80-92% removal efficiency
- Dry sorbent injection (<250 MW$_{th}$) 70-90% removal efficiency
- Seawater scrubber
- Other techniques such as activated carbon+DESONOX process
- Natural desulphurisation with low quality lignites having low sulphur and high alkaline ash content (removal efficiency up to 90%)

**Associated emissions (>300 MW$_{th}$):** 20-150 mg/Nm$^3$ for new plants and 20-200 mg/Nm$^3$ for existing plants
Current BATs for coal fired plants – $\text{SO}_2$ (2/2)

- **Low sulphur fuel in combination with:**
  - **Fluidised bed boilers:**
    - Boiler limestone injection - Reaction S with Ca/Mg added to the bed – Fuels with S content 1-3%
      - For CFCB: removal efficiency 80-95%
      - For Fuels with S-content 4-6%: Boiler limestone injection + FGD
    - For BFCB: removal efficiency 55-65% - Not enough as BAT – Additional FGD needed

- **Associated emissions (>300MW\textsubscript{th}):** 100-200 mg/Nm\textsuperscript{3} for CFCB and PFCB / 20-150 mg/Nm\textsuperscript{3} for new BFCB and 20-200 mg/Nm\textsuperscript{3} for existing BFCB (fitted with FGD)
Current BATs for coal fired plants – NOx (1/2)

**Pulverised coal boilers:**
- Combination primary and secondary measures
- SCR: removal efficiency 80-95%
- Associated emissions (>300 MW<sub>th</sub>): **90-150** (90-200 for existing plants) mg/Nm<sup>3</sup>

**Pulverised lignite boilers:**
- Primary measures: Low NOx burners, Flue-Gas-Recirculation, Air Staging (OFA), etc.
- SCR may be applied additionally
- Associated emissions (>300 MW<sub>th</sub>): **50-200 mg/Nm<sup>3</sup>**

Retrofit to Low NOx burners / OFA can be limited due to boiler size – Application of modern swirl burners are BAT (equivalent flame length)

SNCR additional technique for small boilers with stable load & fuel quality
Current BATs for coal fired plants – NOx (2/2)

*Fluidised Bed boilers:*
- Air/Fuel staging
- Low combustion temperature (< 900°C)
- Associated emissions: (>300 MW<sub>th</sub>): 50-150 (50-200 for existing plants) mg/Nm³
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The LCP BREF review

**Scope:** Combustion in installations with total rated thermal input of 50 MW

**Fuels considered:**
- Primary solid fuels (coal, lignite, peat, oil shale)
- Biomass (grass, straw, vegetable waste, etc.)
- Primary liquid fuels (heavy and light fuel oils)
- Gaseous fuels (natural gas, liquefied gas, biogas, hydrogen and syngas)
- Industry-specific fuels (from Chemical, Iron and Steel, Pulp and Paper industries in so far as they are not yet covered by other BREFs)
- Waste (used in co-incineration process).
The LCP BREF review

Key environmental issues

Air emissions

- \( \text{NO}_x, \text{CO}, \text{SO}_2, \text{dust emissions} \) – \( \text{Not CO}_2 \) (Regulated through European Trading Scheme ETS)

- Other emissions e.g. heavy metals, dioxins and furans, VOCs, PAHs, HCl, Hf are assessed

Water emissions (mainly from FGD plants)

Residues – By-products

Energy Efficiency
Data collection – LCP BREF review
Crucial in the BAT approach under IED

The information on key environmental issues is obtained through a plant-specific questionnaire, including:

- emissions to air and water
- generation of solid by-product, residues and wastes
- efficient energy use
- techniques potentially candidates for BAT
- contextual information.

+500 questionnaires received - ~ 130 for coal or lignite fired plants

Other Information is derived from reports, scientific articles, technical information, case studies and environmental permits provided by the TWG (‘Bulk information’).

- 225 documents + several text revision proposals received
Structure of the revised LCP BREF

- **Preface**
- **Scope**
- 1. **General information**
- 2. **Common processes / techniques for energy generation**
- 3. **Common processes / techniques to prevent / reduce emissions and consumptions**
- 4. **Gasification / Liquefaction / Pyrolysis of fuels**
- 5. **Combustion of solid fuels**
- 6. **Combustion of liquid fuels**
- 7. **Combustion of gaseous fuels**
- 8. **Multi-fuel combustion and waste co-incineration**
- 9. **Emerging techniques**
- 10. **BAT conclusions for the sector**
- 11. **Concluding remarks**
- References
- Glossary
- Annexes

Applied processes and techniques (+examples)
Current consumption and emission levels
Candidate BAT
Thank you for your attention

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