Industrial Emission Directive (IED) - What composting and biogas plants may expect from the new Best Available Technique Reference document (BREF) for biological treatment of waste

Florian Amlinger
Industrial Emissions Directive 2010/75/EU (IED)

Key instrument for minimising consumption and the emissions of industrial activities in Europe

General framework:
- **prevent** and, if not feasible, reduce pollution
- high level of **protection for the environment as a whole**
- **permit** based on **Best Available Techniques (BAT)**

BAT are determined by a Technical Working Group steered by the JRC (EIPPCB) and documented in **BREFs**

‘BAT conclusions’ are secondary legislation
Environmental scope of the IED

- Emissions to water
- Waste prevention and recovery
- Energy & water use
- Emissions to air
- Prevention and control of accidents
- Noise
- Heat
- Odour
- Vibration
The ‘Sevilla process’

**Industry**

**Environmental NGOs**

**EU Member States** + EFTA and Accession Countries

**European Commission/EIPPCB**

**TWG** kick-off meeting

Draft 1 (D1)

Draft 2 (D2) *

Final TWG meeting

Final draft

* D2 optional

Total duration:
- 24 – 29 months (without D2)
- 29 – 39 months (with D2)

- Forum opinion on BREF
- Adoption of BAT conclusions through the IED Art. 75 Committee
Which type of facilities are affected by the new IED?

- **Annex I of the IED includes:**
  - Biological treatment (recovery)
    - Composting ➔ 75
    - Biogas Plants ➔ 100 tonnes/day
  - Biological treatment (disposal)
    - MBT ➔ 50
    - Biogas Plants ➔ 100 tonnes/day

**Definition .... daily capacity:**

*The maximum capacity to which the installation is limited technically or legally.*

**UK:** Tonnes of composting piles on composting site / days of processing

**AT:** ... the daily average ➔ e.g.:

$$75 \times 365 = 27,375 \text{ t/year}$$
TWG subgroups

- Subgroup to **support the development of the questionnaire**
  - Subgroup on **biological treatment** *(December 2013 – December 2015)*
  - Subgroup on **mechanical treatment**
  - Subgroup on **physico-chemical treatment**
Proposed techniques / processes

→ Categories

**BIOLOGICAL TREATMENT**

**Source separated biowaste & sewage sludge**

- **1** Composting
  - **1a** Indoor Composting
  - **1b** Outdoor Composting
  - **1c** Optional: in combination with outdoor maturation

- **2** Wet Digestion
- **3a/b** Dry Digestion
  - Without post composting of digestate
  - With post composting of digestate

- **4a/b** Application on land according to national and European legislation
- **5** Incineration with energy recovery

**Mixed waste → MBT**

- **Composting**
- **Bio-Drying of sewage sludge**

- **4a** Aerobic rotting indoor/ encapsulated alone or combined with outdoor maturation
- **6 - AD** (if used)

**Purpose**

- **1** Composting
- **2** Wet Digestion
- **3a/b** Dry Digestion
- **4a/b** Application on land according to national and European legislation
- **5** Incineration with energy recovery

**AD**

- **4a** Aerobic rotting indoor/ encapsulated alone or combined with outdoor maturation
- **6 - AD** (if used)

**Bio-Drying of sewage sludge**

- **4a** Application on land according to national legislation
- **5** Landfilling complying with national stability criteria
- **6 - AD** (if used)

**Bio-Drying**

- **4a** Landfilling complying with national criteria

**Composting**

- **4a** Application on land according to national legislation
- **5** Landfilling etc. complying with national criteria
Techniques / Processes described

- Plant design
- Waste (pre) acceptance procedures
- Storage & handling of incoming waste
- Preparation of wastes for composting process
- Process monitoring & control
- Emissions to water
- Emissions to air
  - Odour – Bioaerosols & Dust – Ammonia
  - Measures of waste gas treatment
- Energy efficiency measures
- Measures to reduce raw materials consumption
- Product preparation

Additional in Chapter 4:

Achieved environmental benefits – Cross-media effects – Operational data – Applicability – Economics - Driving force for implementation – Example plants – Reference literature
Outdoor & Indoor Composting

- **OUTDOOR Composting** means composting techniques including reception, intermediate storage, pre-treatment, intensive rotting and maturation in an open, roofed or unroofed area, where gaseous emissions produced due to the biological decomposition process may be captured and purified by means of end of pipe abatement techniques only in case if negative aerations is installed during intensive rotting or maturation phase.

- **INDOOR Composting** means composting techniques including possibly reception, intermediate storage, pre-treatment, intensive rotting and maturation in an enclosed or encapsulated hall or vessel (‘reactor’), where the gaseous emissions produced due to the biological decomposition process are captured and purified by means of end of pipe abatement techniques.
- Receipt control
- Intermediate storage

- Compost storage

- Pre-treatment
- Conditioning
- Mixing

- Batch formation

- Intensive composting
- Maturation

- Refining the product
Plant design

→ dispersion modelling for impact prediction

Integrated approach looking at THE WHOLE PLANT and process steps

**Permit … Diffuse Emissions**

- Emmission / Impact Assessment & Prognosis
- Requirements on LOCATION & Process / Operation
- Failure Management

**Emmission / Impact Assessment & Prognosis**

- ODOUR
- DUST

**Requirements on LOCATION & Process / Operation**

- Process / Quality management > "Good Practice": Reduction / Minimisation Measures
- Documentation/ Information
- 3rd party inspection and certification

**Failure Management**

- Odour/Dust
- Improvement of Process Management & Control
- Measurements in order to evaluate success
- Apply monitoring
Documentation & Environmental quality management

● **Documentation – Waste tracking system: Input ➔ Output**
  - Pre-acceptance / Acceptance of waste
  - Type / Date / Quantity / Origin / Refusal / / Foreseen treatment / Location of storage ….

● **Environmental quality management systems**
  - EMS: ISO 14001 / EMAS / National Systems / Branch related EMS
  - Training and technical competence
    - Risk management / regulatory implications / Emission control / incidents & emergency management …
  - Documented operations and maintenance system
  - Accidents / incidents / non-conformance … management plan and documentation system
[PRE] Acceptance procedures

- Pre-acceptance procedure
  - Communication with waste owner
  - Waste type / Approval of compliance / Suitability for treatment
  - Quantities and delivery schedule

- Waste characterisation
  - Visual assessment or sampling/analysis

- Acceptance procedure
  - Visual inspection
  - Trained staff
  - Criteria for rejection
  - Controlled unloading ad dedicated site
  - Contingency plan
2.1.2 Waste acceptance at composting sites

- Visual inspection – compliance with permitted waste codes sorting of impurities – decision of acceptance / reject
Storage and handling of incoming waste

- Sufficient capacity
- Separated locations for odorous/putrescible and woody green waste
- Adapting material type, storage time and mixing to reduce odour emission potential
  - Limit size of stockpiles
  - Mix and/or cover with shredder material
- Complete emptying/cleaning/
- Impermeable surface & sealed drainage and leachate collection for putrescible/waste
- Minimise storage time (24 to 72 hrs)
- Prevention of wind drifting of light impurities
  - fences, walls, dams with hedges, fleece coverage
Pre-treatment and process control

- **Pre-treatment**
  - Screening/removal of impurities
  - **Composting**
    - Sufficient porosity of the initial mix for composting
    - Balancing the C:N ratio
    - Adjustment to proper moisture content
    - Adapting the feedstock blend according to the technique used.
    - Rapid compost batch formation

- **Process control plan – prevent uncontrolled emissions**
  - Temperature control and monitoring / Moisture assessment
  - Process management documentation and traceability
Odour management

- **All BIOLOGICAL TREATMENTS**
  - Minimise intermediate storage
    - odorous feedstock → 1 working day
    - fresh grass / leaves → 72 hours
  - Odour management plan // Complaints management

- **COMPOSTING general**
  - Adequate aeration and moisture adjustment during the initial active composting phase
  - Balanced C:N ratio
  - Consideration of weather conditions and wind direction
  - Draining off surface water from stored biowaste/compost
  - Dirty water collection and management

- **Outdoor COMPOSTING**
  - Measures against moisture surplus
  - Measures to improve structure
  - Windrow structure
  - Decomposition process management
INDOOR Composting – abatement techniques

- Exhaust air capture, collection and treatment with sufficiently dimensioned ventilation systems
- End of pipe treatment
  - **Biofilters** with requirements for biofilters management and optimisation
  - **Bio Scrubber**
  - **Chemical** scrubbers, including **wet** scrubbers, and **acid** scrubbers
  - **Activated carbons**
  - (Ozone treatment)
  - **Dust filters/separators**
- Emission abatement at the point of source
  - Encapsulation by means of **semipermeable membrane covers**
Water management

• ALL BIOLOGICAL TREATMENTS
  • Reuse and surface water segregation
  • Waste water management plan
  • Collection and treatment of dirty waters
  • Discharge and use of waste water
  • Separate collection and treatment of clean surface waters
  • Dimensioning of intermediate waste water tank(s)
  • Impermeable surface of processing areas
  • Draining off surface water from stored biowaste/compost
  • Quality management measures
  • Ensuring effective discharge of water
  • Use of clean water.

Direct and indirect discharge of waters:

➤ According to national regulations
Dust and Bioaerosols

- **ALL BIOLOGICAL TREATMENTS**
  - Dust mitigation measures
  - Machines and road cleaning
  - Physical barriers
  - Maintaining scrubbers and biofilters

- **COMPOSTING**
  - Effective overall management and maintaining adequate moisture content
  - Appropriate consideration of weather conditions and wind direction
  - Spatial orientation Windrows
Ammonia emissions

● COMPOSTING general
  ● Balancing C:N ratio of N-rich feedstock
  ● Optimise moisture of material according the water capacity during the composting stages
  ● Maintain an adequate pore structure Bulking/structural materials

● Indoor COMPOSTING
  ● Use of an acid scrubber to reduce ammonia in the exhaust air
Further aspects

- **Product preparation**
  - Adjust moisture before drum screening
  - Compost storage

- **Noise** → reference to national legislation

- **HAZOP - Hazard and Operability Study**
  - evaluate problems that may represent risks to equipment, or prevent efficient operation

- **Energy and resource management plans**
  - internal assessment of the energy and raw material consumption
In total 110 questionnaires.

**Questionnaire - Number of plants**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>IN/OUTdoor-C</th>
<th>OUTdoor-C</th>
<th>AD</th>
<th>AD + IN/OUTdoor-C</th>
<th>AD + IN/OUTdoor-</th>
<th>MBT-Indoor</th>
<th>MBT-Indoor</th>
<th>MBT-AD</th>
<th>MBT-AD + IN/OUTdoor</th>
<th>AD + IN/OUTdoor</th>
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<tbody>
<tr>
<td>Source separated bio-waste</td>
<td>14</td>
<td>14</td>
<td>25</td>
<td>16</td>
<td>9</td>
<td>6</td>
<td>13</td>
<td>7</td>
<td>1</td>
<td>4</td>
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<tr>
<td>Mixed municipal waste including bio-waste</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Organic Resources and Biological Treatment**
Questionnaire - Country profile
Daily treatment capacities

- Treatment of source separated bio-waste
- Treatment of mixed municipal waste including bio-waste

[Graph showing daily treatment capacities and various treatment methods]

Organic Resources and Biological Treatment
Example: Abatement via Biofiltering

- **50 plants** indicated that they use biofiltering as primary abatement technique for air emissions (possibly with wet scrubber / heat exchanger)
- **7 plants** did not give information on any monitoring of air emissions
- **4 plants** did provide emissions only via gas engine
- **8 plants** use additional air abatement technique at the site

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Volume</th>
<th>T</th>
<th>O2</th>
<th>Odour</th>
<th>NH₃</th>
<th>H₂S</th>
<th>TOC / TVOC</th>
<th>Dust</th>
<th>CH₄</th>
<th>N₂O*</th>
<th>NOₓ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m³/h</td>
<td>°C</td>
<td>Vol-%</td>
<td>OU/m³</td>
<td>mg/m³</td>
<td>mg/m³</td>
<td>mg/m³</td>
<td>mg/m³</td>
<td>mg/m³</td>
<td>mg/m³</td>
<td>mg/m³</td>
</tr>
<tr>
<td>MIN</td>
<td>1,945</td>
<td>7.0</td>
<td>20.1</td>
<td>30</td>
<td>0.0</td>
<td>0.00</td>
<td>0.40</td>
<td>0.00</td>
<td>5.09</td>
<td>2.00</td>
<td>2.97</td>
</tr>
<tr>
<td>MAX</td>
<td>585,000</td>
<td>41.9</td>
<td>20.9</td>
<td>12,967</td>
<td>265.0</td>
<td>1.03</td>
<td>21.00</td>
<td>9.35</td>
<td>895.00</td>
<td>46.00</td>
<td>14.33</td>
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<tr>
<td>AVERAGE</td>
<td>81,055</td>
<td>31.1</td>
<td>20.5</td>
<td>1,297</td>
<td>18.7</td>
<td>0.26</td>
<td>10.00</td>
<td>1.37</td>
<td>248.53</td>
<td>24.00</td>
<td>8.65</td>
</tr>
</tbody>
</table>

| No. of plants | 29 | 26 | 3 | 26 | 21 | 10 | 10 | 11 | 4 | 2 |
| No. of value entries | 142 | 131 | 33 | 105 | 229 | 68 | 62 | 60 | 15 | 4 |

Range limits CA

- - - 4,500 5-50 1.5-10 20-100 5-30 ---- ---- 150

Plants with limit

- - - 12 11 5 7 8 - - 1

* … One plant additionally indicated a limit of 100 g per ton input, set by the Competent Authority.

**Remark:** Bio-aerosols (Total Bacteria, Gram Negative Bacteria, Aspergillus Fumigatus and Mesophilic Bacteria) have been monitored only at five plants from two MS and the parameters CO, HCl, HF, Hg, HC and PCDD/PCDF have been monitored each at only one site. By that, these parameters were excluded from detailed illustration.
# Discussed Key Environmental Indicators & Associated Emission Levels/Limits

<table>
<thead>
<tr>
<th></th>
<th>Open (1c)</th>
<th>Closed (1a+1b)</th>
<th>AD* (2)</th>
<th>MBT aerobic (4a+4b)</th>
<th>MBT AD (5)</th>
<th>MBT aerobic+ AD (6a + 6b)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Odour</strong></td>
<td>L; in case of odour problems</td>
<td>✓ L</td>
<td>✓ L</td>
<td>✓ L</td>
<td>✓ L</td>
<td>✓ L</td>
</tr>
<tr>
<td><strong>NH₃</strong></td>
<td>---</td>
<td>✓ G/P</td>
<td>✓ G/P</td>
<td>✓ G/P</td>
<td>✓ G/P</td>
<td>✓ G/P</td>
</tr>
<tr>
<td><strong>Screening in case of odour problems:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dust</strong></td>
<td>✓ L</td>
<td>✓ L</td>
<td>✓ L</td>
<td>✓ L</td>
<td>✓ L</td>
<td>✓ L</td>
</tr>
<tr>
<td><strong>TOC or NMVOC</strong></td>
<td>---</td>
<td>✓ L/G/P</td>
<td>---</td>
<td>✓ L/P</td>
<td>---</td>
<td>✓ L/P</td>
</tr>
<tr>
<td><strong>H₂S</strong></td>
<td>---</td>
<td>✓ L/P</td>
<td>✓ L/P</td>
<td>✓ L/P</td>
<td>✓ L/P</td>
<td>✓ L/P</td>
</tr>
<tr>
<td><strong>Linked to detection (AD)</strong></td>
<td></td>
<td></td>
<td>✓ G</td>
<td>---</td>
<td>✓ G</td>
<td>✓ G</td>
</tr>
<tr>
<td><strong>CH₄</strong></td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>✓ G</td>
<td>---</td>
<td>✓ G</td>
</tr>
<tr>
<td><strong>In case of the use of RTO (check functioning of abatement technology)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓ G</td>
<td>---</td>
</tr>
<tr>
<td><strong>N₂O</strong></td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>✓ G</td>
<td>---</td>
<td>✓ G</td>
</tr>
</tbody>
</table>

L … local nuisance  G … global impact  P … process monitoring
Next steps

- **Draft 1**
  - Sept/Oct 2015

- **Consultation**
  - 8 weeks
  - Meeting with Subgroup Biological Treatment to discuss key issues of concern

- **Final meeting of TWG**
  - Mid to end 2016 (!)

- **New BREF/WT**
  - 2017
Ευχαριστώ πολύ

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