

**Ordinance on Environmentally Compatible Storage  
of Waste from Human Settlements and  
on Biological Waste-Treatment Facilities\*)**

**of 20 February 2001**

In accordance with

- Article 12 (1) of the Closed Substance Cycle and Waste Management Act of 27 September 1994 (Federal Law Gazette I, p. 2705), last amended by Article 4 of the Act of 25 August 1998 (Federal Law Gazette I, p. 2455), and Article 7 (1) of the Federal Immission Control Act in the version promulgated on 14 May 1990 (Federal Law Gazette I, p. 880), last amended by Article 1 No. 3 of the Act of 9 October 1996 (Federal Law Gazette I, p. 1498), and after hearing the parties concerned,  
and
- Article 7a (1) 3<sup>rd</sup> and 4<sup>th</sup> sentences of the Federal Water Act, in the version promulgated on 12 November 1996 (Federal Law Gazette I, p. 1695),

the Federal Government does hereby promulgate the following:

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\*) The obligations resulting from Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations (OJ EC No. L 204 p. 37), amended by Directive 98/48/EG of the European Parliament and of the Council of 20 July 1998 (OJ EC No. L 217 p. 18), have been fulfilled.

**Article 1**  
**Ordinance on Environmentally Compatible Storage of**  
**Waste from Human Settlements**  
**(Abfallablagerungsverordnung – AbfAbIV)**

**Article 1 Scope of application**

(1) This Ordinance shall apply to

1. the storage of waste from human settlements, and of waste that can be managed like waste from human settlements, in landfills and
2. the treatment of waste from human settlements, and of waste that can be managed like waste from human settlements, for the purpose of compliance with landfill-allocation criteria.

(2) This Ordinance shall apply to

1. operators and owners of landfills (landfill operators),
2. operators of facilities for treatment of waste from human settlements and of waste within the meaning of Article 2 No. 2 and
3. owners of waste from human settlements and of waste within the meaning of Article 2 No. 2 for disposal.

(3) This Ordinance shall not apply to private households.

(4) The principles and basic obligations of closed-substance-cycle economies, pursuant to Articles 4 and 5 Closed Substance Cycle and Waste Management Act, shall not be affected.

**Article 2 Definitions of terms**

For the purposes of this Ordinance, the following definitions of terms shall apply:

1. Waste from human settlements:  
domestic waste and other waste that, due to its nature or composition, is similar to domestic waste.

2. Waste that can be managed like waste from human settlements:  
waste that, due to its nature or composition, may be managed together with waste from human settlements, or may be managed like such waste, especially sewage sludges from wastewater-treatment facilities for treatment of municipal wastewater or of wastewater with similarly low pollutant contamination, faeces, faecal sludge, residues from wastewater facilities, water-purification sludges, building waste and production-specific waste. This shall also include waste from treatment of waste from human settlements and of waste pursuant to the 1<sup>st</sup> sentence.
3. Waste with high thermal value:  
waste that, in mechanical or mechanical-biological treatment of waste from human settlements, and of waste within the meaning of Article 2 No. 2, is separated, has a considerably higher thermal value than waste subjected to treatment and can be used for energy recovery.
4. Mechanical-biological treatment:  
processing or conversion of waste from human settlements, and of waste within the meaning of Article 2 No. 2 with biologically degradable organic components, via a combination of mechanical and other physical processes (for example, cutting or crushing, sorting) with biological processes (rotting, fermentation).
5. Landfill:  
waste-management facility for the storage of waste above the earth's surface (above-ground landfill).
6. Landfill section:  
separately operated area of a landfill. Landfill sections may overlap only in embankment areas.
7. Old landfill:
  - a. landfill under construction or in operation, or a landfill section under construction or in operation, whose construction and operation were permitted on 1 June 1993 or which were permissible pursuant to Article 35 Closed Substance Cycle and Waste Management Act and
  - b. landfills for the permitting of which, as of 1 June 1993, a plan-approval procedure had been initiated and the relevant public notification had been provided.

8. Landfill class I:

landfill for waste that contains a very small organic component and that exhibits very low pollutant release in leaching testing.

9. Landfill class II:

landfill for waste, including mechanically and biologically treated waste, that has a larger organic component than waste that may be stored in Class I landfills, and in which the pollutant release in leaching testing is greater than that for landfill class I and, as compensation, is subject to stricter requirements for the landfill site and landfill sealing.

10. TA Siedlungsabfall:

The Third General Administrative Provision on the Waste Avoidance and Waste Management Act (TA Siedlungsabfall) of 14 May 1993 (Federal Gazette No. 99a).

### **Article 3 General requirements pertaining to storage**

(1) Waste from human settlements, and waste within the meaning of Article 2 No. 2, may be stored only in landfills or landfill sections that comply with the requirements for landfill class I or II. The requirements are defined in accordance with Number 10 of the TA Siedlungsabfall.

(2) Slightly polluted mineral waste may also be stored in landfills or landfill sections (landfills for building rubble and excavated soil) that do not fully comply with requirements for landfill class I specified in paragraph 1.

(3) Waste from human settlements, and waste within the meaning of Article 2 No. 2, with the exception of mechanically and biologically treated waste, may be stored only if it complies with the relevant allocation criteria of Annex 1 for landfill class I or II.

(4) Mixing of different wastes with each other, or with other materials, in order to achieve compliance with the allocation criteria of Annex 1 for the relevant landfill class, shall not be permitted. This shall not apply to allocation criterion Number 1 (strength).

(5) Waste that could impair the public interest if stored, due to its content of long-lived or bio-accumulable toxic substances, in keeping with its origin or nature, shall not, in general, be allocated to an above-ground landfill.

#### **Article 4 Requirements pertaining to storage of mechanically and biologically treated waste**

(1) Mechanically and biologically treated waste may be stored only if

1. the storage takes place in landfills or landfill sections that meet the requirements for landfill class II,
2. the waste fulfils the allocation criteria of Annex 2 for landfill class II,
3. the waste is not mixed in order to achieve compliance with the allocation criteria of Annex 2, and storage on top of already stored waste with a large biologically degradable component (for example, untreated domestic waste) would not lead to impairment of gas collection from such waste, and infiltration of water, for maintenance of biological decomposition processes in such waste, is technically possible or unnecessary, and there is no uncontrolled gas release, and
4. within the framework of mechanical-biological treatment, waste with high thermal value for recovery or thermal treatment, and other recoverable or pollutant-containing fractions, are separated.

In the cases of the 1<sup>st</sup> sentence no. 1, the requirements pursuant to Number 10 of the TA Siedlungsabfall are defined.

(2) In order to ensure proper storage of mechanically and biologically treated waste, the landfill operator shall

1. comply with the requirements of Annex 3 pertaining to landfilling of mechanically and biologically treated waste and
2. ensure that, after a landfill section has been filled, minor emissions of landfill gas that occur are oxidised before they are released into the atmosphere; on request, monitoring reports from the external control activity pursuant to Annex C No. 6 3<sup>rd</sup> sentence TA Siedlungsabfall, on remaining gas emissions, shall be submitted to the competent authority.

#### **Article 5 Obligations pertaining to checks and submission of proof**

(1) Upon every waste delivery, the landfill operator shall immediately carry out an acceptance check that shall include at least a visual inspection pursuant to the 2<sup>nd</sup> sentence and determination of the waste mass and waste type, including the waste key. In the visual inspection, the waste shall be

checked for appearance, consistency, colour and smell. In justified cases, the visual inspection may also take place when the waste is placed in the landfill.

(2) The landfill operator shall immediately carry out a control analysis pursuant to the 2<sup>nd</sup> sentence, if the visual inspection provides indications that requirements pertaining to the nature of the waste have not been complied with for the planned storage, or if there are discrepancies between the accompanying documents and the delivered waste. The extent of parameters for the control analysis shall be adjusted to the waste type and any waste peculiarities; samples shall be taken for storage and shall be kept available for at least one month. The control analyses shall be carried out pursuant to Annex 4.

(3) The landfill operator shall carry out random-sample control analyses of compliance with the relevant allocation criteria of Annex 1 or of Annex 2. Paragraph 2 2<sup>nd</sup> sentence 2<sup>nd</sup> half-sentence and 3<sup>rd</sup> sentence shall apply mutatis mutandis.

(4) The landfill operator shall inform the competent authority regarding any delivered waste for which storage is not permitted. Such waste shall be temporarily stored in an area permitted for such storage, until the authority has taken a decision on how the waste is to be managed.

(5) Results of the visual inspection, and of the control analyses pursuant to paragraphs 2 and 3, and data on further management of waste rejected because its storage is not permissible, shall be entered into the operating journal and submitted to the competent authority on request.

(6) The owner of waste delivered regularly from treatment plants, in large amounts, shall document to the landfill operator, for each amount (partial amounts count in full) of 2000 megagrams of delivered waste, and at least once per month, compliance with the following requirements:

1. For mechanically and biologically treated waste, compliance with the relevant allocation values of Annex 2 for the parameters "organic component of dry residue in original substance", determined as TOC (No. 2) or upper thermal value  $H_o$  (No. 6), TOC in eluate (No. 4.03) and "biological degradability of dry residue in original substance" determined as breathing activity  $AT_4$  (No. 5) or determined as gas-formation rate in the fermentation test  $GB_{21}$  (No. 5).

2. For treated waste not mentioned under Number 1, compliance with the relevant allocation values of Annex 1 for the parameters "organic component of dry residue in original substance" determined as ignition loss (No. 2.01) or as TOC (No. 2.02) and the eluate criteria pH value (No. 4.01), conductance (No. 4.02) and TOC (No. 4.03).

Such documentation shall be provided by submitting results of the relevant waste analyses. The waste analyses shall be carried out pursuant to Annex 4. Results of waste analyses shall be entered in the operating journal and submitted to the competent authority on request.

(7) Operators of landfills in which mechanically and biologically treated waste is stored shall keep records, for each working day, on compliance with requirements set forth in Annex 3 for landfilling of waste and landfill operation. The necessary analyses shall be carried out pursuant to Annex 4. The relevant records shall be entered into the operating journal and submitted to the competent authority on request.

#### **Article 6 Transitional provisions**

(1) Until 31 May 2001, excavated soil, building rubble and other mineral waste may be stored even if waste requirements pursuant to Annex 1 are not met. Such storage should take place in old landfills, even where such landfills do not meet the requirements of Article 3 (1), while meeting at least the requirements pursuant to Number 11 of the TA Siedlungsabfall, or should take place in separate sections of landfills of class I or II.

(2) Upon application of the landfill operator, the competent authority, under conditions pursuant to paragraph 3, may permit the following:

1. Domestic waste, commercial waste similar to domestic waste, sewage sludges and other waste with large organic components may be stored even if the waste requirements pursuant to Annex 1 or Annex 2 are not met. Such storage should take place in old landfills (landfills for domestic waste), even where such landfills do not meet the requirements of Article 3 (1), while meeting at least the requirements pursuant to Number 11 of the TA Siedlungsabfall, or should take place in separate sections of landfills of class II. Such permits shall be made to expire no later than 31 May 2005.

2. Waste from human settlements, and waste within the meaning of Article 2 No. 2, that fulfils the landfill-allocation criteria of landfill class I pursuant to Annex 1, may be stored in old landfills that do not meet the requirements of Article 3 (1), while meeting at least the requirements pursuant to Number 11 of the TA Siedlungsabfall. Relevant permits shall be made to expire no later than 15 July 2009.
3. Waste from human settlements, and waste within the meaning of Article 2 No. 2, the fulfils the landfill-allocation criteria of landfill class II, pursuant to Annex 1, or mechanically and biologically pre-treated waste that fulfils the landfill-allocation criteria of Annex 2, may be stored in old landfills (landfills for domestic waste), or in separate landfill sections, if the requirements of Article 3 (1) of landfill class II, except for Numbers 10.3.1 and 10.3.2 of the TA Siedlungsabfall, are met and the requirements pursuant to Number 11 of the TA Siedlungsabfall are met. Relevant permits shall be made to expire no later than 15 July 2009. In individual cases, the permit-expiration requirement may be waived if proof is provided that the protection aims pursuant to Numbers 10.3.1 and 10.3.2 of the TA Siedlungsabfall have been achieved through other equally effective technical protection measures and the public interest – seen in terms of the requirements of this Ordinance – is not impaired.

For the period until 31 May 2005, Number 1 shall apply mutatis mutandis to the technical requirements for landfills.

(3) The exceptions mentioned in paragraph 2 may be permitted only if the public interest is not impaired and if

1. in cases pertaining to Paragraph 2 No. 1, use of existing treatment capacities cannot be reasonably expected and
2. in cases pertaining to Paragraph 2 Nos. 2 and 3, use of landfills that meet the requirements in Article 3 (1) cannot be reasonably expected.

(4) An exemption from allocation of waste to landfills, permitted by the competent authority and issued prior to the entry into force of this Ordinance pursuant to Number 12.1 1<sup>st</sup> and 2<sup>nd</sup> sentence letter a of the TA Siedlungsabfall, shall apply to domestic waste, commercial waste similar to domestic waste, sewage sludges and other waste with large organic components, as a permit within the meaning of Paragraph 2 No. 1 pursuant to this Ordinance until no later than 1 June 2005.

## **Article 7 Administrative offences**

An administrative offence within the meaning of Article 61 (1) No. 5 of the Closed Substance Cycle and Waste Management Act shall be deemed to have been committed by anyone who, wilfully or negligently

1. in contravention of Article 3 (1) 1<sup>st</sup> sentence, paragraph 3 or 4 1<sup>st</sup> sentence or Article 4 (1) 1<sup>st</sup> sentence, stores or mixes waste,
2. in contravention of Article 4 (2) No. 1, does not comply with a listed requirement,
3. in contravention of Article 4 (2) No. 2 1<sup>st</sup> half-sentence, does not ensure that remaining emissions of landfill gas are oxidised before escaping into the atmosphere or
4. in contravention of Article 5 (1) 1<sup>st</sup> sentence or paragraph 2 1<sup>st</sup> sentence, does not carry out an acceptance check or control analysis, does not carry out an acceptance check or control analysis correctly, does not carry out an acceptance check or control analysis completely or does not carry out an acceptance check or control analysis on time.

Annexes:

Annex 1: Allocation criteria for landfills

Annex 2: Allocation criteria for landfills for mechanically and biologically pre-treated waste

Annex 3: Requirements pertaining to storage and landfill operation

Annex 4: Sampling and analysis procedures

## Annex 1

### Allocation criteria for landfills

In allocation of waste to landfills, the following allocation values shall be complied with:

No.	Parameter	Allocation values	
		Landfill class I	Landfill class II
<b>1</b>	<b>Strength<sup>1)</sup></b>		
1.01	Vane shear strength	≥ 25 kN/m <sup>2</sup>	≥ 25 kN/m <sup>2</sup>
1.02	Axial deformation	≤ 20%	≤ 20 %
1.03	Uniaxial compressive strength	≥ 50 kN/m <sup>2</sup>	≥ 50 kN/m <sup>2</sup>
<b>2</b>	<b>Organic component of dry residue in original substance<sup>2) 3)</sup></b>		
2.01	Determined as ignition loss	≤ 3 % by weight	≤ 5 % by weight <sup>4)</sup>
2.02	Determined as TOC	≤ 1 % by weight	≤ 3 % by weight
<b>3</b>	<b>Extractable lipophile substances in original substance</b>	≤ 0.4 % by weight	≤ 0.8 % by weight
<b>4</b>	<b>eluate criteria</b>		
4.01	pH value	5.5-13.0	5.5-13.0
4.02	Conductance	≤ 10000 µS/cm	≤ 50000 µS/cm
4.03	TOC	≤ 20 mg/l <sup>5)</sup>	≤ 100 mg/l
4.04	Phenols	≤ 0.2 mg/l	≤ 50 mg/l
4.05	Arsenic	≤ 0.2 mg/l	≤ 0.5 mg/l
4.06	Lead	≤ 0.2 mg/l	≤ 1 mg/l
4.07	Cadmium	≤ 0.05 mg/l	≤ 0.1 mg/l
4.08	Chromium-VI	≤ 0.05 mg/l	≤ 0.1 mg/l
4.09	Copper	≤ 1 mg/l	≤ 5 mg/l
4.10	Nickel	≤ 0.2 mg/l	≤ 1 mg/l
4.11	Mercury	≤ 0.005 mg/l	≤ 0.02 mg/l
4.12	Zinc	≤ 2 mg/l	≤ 5 mg/l
4.13	Fluoride	≤ 5 mg/l	≤ 25 mg/l
4.14	Ammonium-N	≤ 4 mg/l	≤ 200 mg/l
4.15	Cyanide, easily released	≤ 0.1 mg/l	≤ 0.5 mg/l
4.16	AOX	≤ 0.3 mg/l	≤ 1.5 mg/l
4.17	Water-soluble component (dry matter)	≤ 3 % by weight	≤ 6 % by weight

<sup>1)</sup> 1.02 may, together with 1.03, be applied in equivalence to 1.01. Strength must in each case be defined separately in accordance with the static requirements on landfill stability. Particularly in the case of cohesive, finely grained waste, it shall not be permissible to fall short of the values indicated for 1.02 in conjunction with 1.03.

<sup>2)</sup> 2.01 may be applied in equivalence to 2.02.

<sup>3)</sup> Values slightly in excess of the ignition loss or solid-material TOC are permitted, for the following waste types, under the condition that such values in excess are not due to waste components that lead to considerable landfill-gas formation: contaminated excavated soil that is stored in a mono landfill; non-contaminated excavated soil; waste with a gypsum basis; fibre-reinforced cements; mineral building waste with slight amounts of extraneous components; old sand from foundries; broken-up road-construction material with an asphalt basis; waste of similar composition.

<sup>4)</sup> Does not apply to ash and dusts from coal-fired combustion systems not subject to licensing pursuant to Federal Immission Control Act (BImSchG).

<sup>5)</sup> Does not apply to waste with a gypsum basis that is stored in landfills of landfill class I.

**Annex 2**

**Allocation criteria for landfills for mechanically and biologically pre-treated waste**

In allocation of mechanically and biologically treated waste to landfills, the following allocation values shall be complied with:

<b>No.</b>	<b>Parameter</b>	<b>Allocation values</b>
<b>1</b>	<b>Strength <sup>1)</sup></b>	
1.01	Vane shear strength	≥ 25 kN/m <sup>2</sup>
1.02	Axial deformation	≤ 20 %
1.03	Uniaxial compressive strength	≥ 50 kN/m <sup>2</sup>
<b>2</b>	<b>Organic component of dry residue in original substance <sup>2)</sup></b>	
	Determined as TOC	≤ 18 % by weight
<b>3</b>	<b>Extractable lipophile substances in original substance</b>	≤ 0.8 % by weight
<b>4</b>	<b>Eluate criteria</b>	
4.01	pH value	5.5-13.0
4.02	Conductance	≤ 50000 μS/cm
4.03	TOC	≤ 250 mg/l
4.04	Phenols	≤ 50 mg/l
4.05	Arsenic	≤ 0.5 mg/l
4.06	Lead	≤ 1 mg/l
4.07	Cadmium	≤ 0.1 mg/l
4.08	Chromium-VI	≤ 0.1 mg/l
4.09	Copper	≤ 5 mg/l
4.10	Nickel	≤ 1 mg/l
4.11	Mercury	≤ 0.02 mg/l
4.12	Zinc	≤ 5 mg/l
4.13	Fluoride	≤ 25 mg/l
4.14	Ammonium-N	≤ 200 mg/l
4.15	Cyanide, easily released	≤ 0.5 mg/l
4.16	AOX	≤ 1.5 mg/l
4.17	Water-soluble component (dry matter)	≤ 6 % by weight
<b>5</b>	<b>Biological degradability of dry residue in original substance</b>	
	Determined as breathing activity (AT <sub>4</sub> )	≤ 5 mg /g <sup>3)</sup>
	or determined as gas-formation rate in the fermentation test (GB <sub>21</sub> )	≤ 20 l/kg <sup>4)</sup>
<b>6</b>	<b>Upper thermal value (H<sub>o</sub>) <sup>2)</sup></b>	≤ 6000 kJ/kg

<sup>1)</sup> 1.02 may, together with 1.03, be applied in equivalence to 1.01. Strength must in each case be defined separately in accordance with the static requirements on landfill stability. Particularly in the case of cohesive, finely grained waste, it shall not be permissible to fall short of the values indicated for 1.02 in conjunction with 1.03.

<sup>2)</sup> 2 may be applied in equivalence to 6.

<sup>3)</sup> mg O<sub>2</sub> with respect to dry weight

<sup>4)</sup> Standard litre of gas with respect to dry weight

### **Annex 3**

#### **Requirements pertaining to landfilling of mechanically and biologically treated waste**

In keeping with the structure and mechanical properties of mechanically and biologically treated waste that meets the requirements of Annex 2, in landfilling such waste the following supplementary requirements shall be complied with, in order to ensure that the relevant landfill behaves in an environmentally compatible way:

1. Reduction of the landfilling area to the smallest size possible in landfilling operation, covering areas not being filled with suitable materials and ensuring that surface water runs off in a planned, controlled manner.
2. During working days, the landfilling area shall be shaped into a slope of between 5 and 10%. In order to ensure that precipitation water runs off in a planned, controlled manner, the surface shall be smoothed and covered with materials impermeable to water.
3. In order to ensure that the body of the landfill is only slightly permeable, waste shall be landfilled via the thin-layer procedure and highly compressed. The maximum possible compressibility of the waste shall be achieved by optimising the waste's water content. To this end, in a test area the highest possible landfilling density (dry density) shall be determined as a function of water content (if at all possible, not over 35 % by weight) and applied compression energy. During landfill operations, every time that an amount totalling 5000 m<sup>3</sup> or 5000 Mg has been landfilled, proof shall be provided that at least 95% of the so-determined highest possible landfilling density has been achieved. If the waste composition changes significantly, the highest possible landfilling density shall be redetermined.

## **Annex 4**

### **Specifications pertaining to analysis (sampling, sample preparation and analysis of treated waste), for Annexes 1 through 3**

#### **1 Sampling**

The samples necessary for conducting the tests shall be taken in accordance with Guideline PN 2/78 K of the Länder Study Group on Waste (LAGA), "Fundamental rules on the taking of samples from waste and landfilled materials" (last revision: 12/83)<sup>1)</sup>. This guideline shall be applied with the following supplements and modes of simplification:

##### **1.1 Homogeneity / heterogeneity**

The following allocation shall apply:

Waste whose homogeneity can be verified by visual inspection, such as dusts, reaction products from flue-gas purification systems, slags, mechanically and biologically treated waste, is normally homogeneous.

All other waste is heterogeneous.

##### **1.2 Number of samples, and sample amounts**

**1.2.1** In sampling, the number of individual samples to be taken shall be specified in keeping with the requirements of LAGA Guideline PN 2/78 K.

**1.2.2** Minimum sample quantity per individual sample, per waste producer and waste key, for Annex 1 and Annex 2:

Per individual sample, 1000 g or 1000 ml, unless the waste's lumpiness necessitates a larger sample quantity.

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1) To be supplanted by PN 98-1 (currently, in draft form, issued September 1999)

## **2 Determination of parameters**

Parameters shall be determined in accordance with the following procedures. Equivalent procedures, in keeping with the best available technology, shall be permitted. The user shall furnish relevant proof of such equivalency.

### **2.1 Strength (Annex 1 and 2, No. 1)**

#### **2.1.1 Vane shear strength (No. 1.01)**

DIN 4096 (issued May 1980)

#### **2.1.2 Axial deformation (No. 1.02)**

DIN 18136 (issued August 1996)

#### **2.1.3 Uniaxial compressive strength (No. 1.03)**

DIN 18136 (issued August 1996)

### **2.2 Organic component of dry residue in original substance (Annex 1 and 2, No. 2)**

#### **2.2.1 Ignition loss of dry residue in original substance (Annex 1 No. 2.01)**

DIN 38414-S3 (issued November 1985)

#### **2.2.2 Total organic carbon (TOC) of dry residue in original substance (Annex 1 No. 2.02, Annex 2 No. 2)**

Analytical-grade sample (< 0.2 mm). By determining the difference between total carbon content (reaction of sample in stream of oxygen at 900-1300°C) and inorganic carbon (expulsion by acidification and heating in stream of oxygen) or direct determination of total organic carbon after expulsion of inorganic carbon by means of acid treatment; detection of CO<sub>2</sub> formulation in accordance with DIN 38409-H3 (issued June 1983).<sup>1)</sup>

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1) To be supplanted by DIN EN 13137 (currently, in draft form, issued April 1998)

### **2.3 Extractable lipophile substances (Annex 1 and 2, No. 3)**

Extraction in accordance with LAGA Guideline KW/85, "Determination of the hydrocarbon content of waste" (last revision: March 1993), with subsequent gravimetric analysis pursuant to DIN 38409-H17 (issued May 1981).

Petroleum ether (boiling-point range 40-60 °C), or another suitable halogen-free solvent, shall be used instead of 1,1,2-trichloro- 1,2,2 trifluoroethane

### **2.4 Eluate preparation for parameter determination (Annex 1 and 2, No. 4)**

DIN 38414-S4 (issued October 1984) <sup>1)</sup>

The following supplements / deviations shall be observed:

- The original structure of the sample to be used should be extensively retained. Lumpy pieces must be crushed.
- A wide-neck glass bottle (10 cm diameter) must be used.
- Turn full circle through vertical axis once per minute.
- Centrifuge.
- Then filter once through membrane filter (pore size 0.45 µm); use compression filtration if necessary.

#### **2.4.1 pH value of eluate (No. 4.01)**

DIN 38404-C5 (issued January 1984)

#### **2.4.2 Conductance of eluate (No. 4.02)**

DIN EN 27888 (issued November 1993)

#### **2.4.3 Total organic carbon (TOC) in eluate (No. 4.03)**

DIN EN 1484 (issued August 1997)

#### **2.4.4 Phenols in eluate (No. 4.04)**

DIN 38409-H16-3 (issued June 1984)

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1) To be supplanted by DIN EN 12457-4 (currently, in draft form, issued February 2000)

**2.4.5 Arsenic in eluate (No. 4.05)**

DIN EN ISO 11969 (issued November 1996) or  
DIN EN ISO 11885 (issued April 1998)

**2.4.6 Lead in eluate (No. 4.06)**

DIN 38406-E2 (issued July 1998) or  
DIN EN ISO 11885 (issued April 1998)

**2.4.7 Cadmium in eluate (No. 4.07)**

DIN EN ISO 5961 (issued May 1998) or  
DIN EN ISO 11885 (issued April 1998)

**2.4.8 Chromium-VI in eluate (No. 4.08)**

DIN 38405-D24 (issued May 1987)

**2.4.9 Copper in eluate (No. 4.09)**

DIN 38406-E7 (issued September 1991) or  
DIN EN ISO 11885 (issued April 1998)

**2.4.10 Nickel in eluate (No. 4.10)**

DIN 38406-E11 (issued September 1991) or  
DIN 38406-E22 (issued March 1988)

**2.4.11 Mercury in eluate (No. 4.11)**

DIN EN 1483 (issued August 1997)

**2.4.12 Zinc in eluate (No. 4.12)**

DIN 38406-E8-1 (issued October 1980) or  
DIN EN ISO 11885 (issued April 1998)

**2.4.13 Fluoride in eluate (No. 4.13)**

DIN 38405-D4-1 (issued July 1985)

**2.4.14 Ammonium-N in eluate (No. 4.14)**

DIN 38406-E5-1 (issued October 1983) or  
DIN EN ISO 11732 (issued September 1997)

**2.4.15 Cyanide, easily released, in eluate (No. 4.15)**

DIN 38405-D14-2 (issued December 1988)

Where waste contains sulphide, analysis shall be carried out in accordance with DIN 38405-D13-2 (issued February 1981).

**2.4.16 Adsorbable organically bound halogens (AOX) in eluate (No. 4.16)**

DIN EN 1485 (issued November 1996)

**2.4.17 Water-soluble component of dry residue in original substance  
determined through filtrate dry residue in eluate (No. 4.17)**

DIN 38409-H1-2 (issued January 1987)

**2.5 Biological degradability of dry residue in original substance  
breathing activity (AT<sub>4</sub>) (Annex 2 No. 5)**

Breathing activity determined over the course of 4 days, in laboratory testing

**2.5.1 Test apparatus:**

AT<sub>4</sub> shall be determined using a Sapromat, Respiromat or equivalent apparatus. All departures from the method listed below shall be documented.

**2.5.2 Temperature:**

20 ± 1°C in a temperature-controlled water bath or conditioned room.

**2.5.3 Sample storage:**

Sample preparation must be completed, and the test started, within 48 h following sampling. During this period temperatures over 4°C are permissible for no more than 24 h. If it is not possible to en-

sure compliance with this procedure, the sample shall be frozen, within 24 h after sampling, at – 18 to – 20 °C. Freezing of samples shall be documented in connection with evaluation. Thawing of samples must be gentle, and must last no longer than 24 h; during thawing, the temperature must not exceed 20°C.

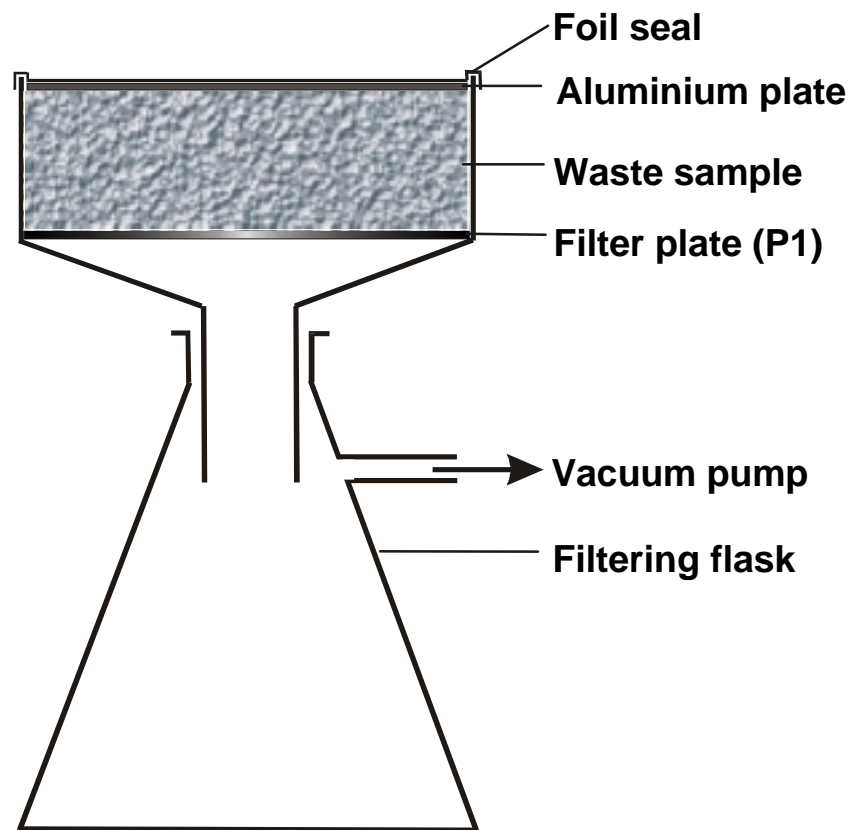
#### **2.5.4 Sample preparation:**

The original sample, in its entirety, must be wet-crushed to < 10 mm. If necessary, interfering substances (glass, stones and metals) may be discharged prior to crushing. Their weight components must be taken into account in evaluation of the test.

#### **2.5.5 Adjustment of the water content:**

Moisten 300 g of the prepared sample with 300 ml of tap water and place the wet mixture in the apparatus described in Figure 1. After covering and sealing, apply an underpressure of ca. 100,000 Pa (water-jet vacuum) and maintain for a period of 30 minutes. Determine the volume of the filtered-off water and subtract this from the added 300 ml of tap water. The amount of water determined in this manner is to be added to that part of the sample placed in the test apparatus.

If the water content of the sample to be used is larger than the determined water content, then transfer the sample, without further moistening, into the apparatus described in Figure 1, expose it for 30 minutes to the underpressure in the vacuum nutsch and then place it in the test apparatus.



Apparatus:

filtering flask, vacuum-proof, volume 1 to 2 litres, with rubber plug

filter nutsch, diameter 120 mm, filter plate (P1), volume 1 litre,

should have vertical side walls

aluminium plate, diameter the same as the inside diameter of the nutsch

vacuum pump and underpressure manometer

Figure 1: Apparatus for adjusting the water content

### 2.5.6 Sample amount:

A 40 g sample, adjusted to the water content determined as described above, is to be used.

### 2.5.7 Number of parallel batches:

Samples are to be tested in three parallel batches.

### **2.5.8 Test duration and evaluation:**

The evaluation period is 4 days, and it begins following the initial lag phase. The lag phase has ended when the mean oxygen consumption, expressed as a 3-hour mean, reaches 25% of the value that results as the 3-hour mean in the region of the largest increase in the oxygen consumption within the first 4 days.

The weight of the oxygen consumed during the lag phase is subtracted from the weight of the oxygen consumed throughout the entire test (lag phase + 4 days), and it must not be more than 10% of the overall value. If this condition is not fulfilled, determination may not be carried out. Measurements must be recorded on an hourly basis.

The analysis function and the 3-hour means are shown by entering the test duration (in hours) on the x-axis and the summed oxygen weights (in mg O<sub>2</sub> per g dry weight) on the y-axis.

### **2.5.9 Listing of the result:**

The result is listed with two significant places, in mg O<sub>2</sub> per g dry weight. Both the mean and the standard deviation are to be listed. If one of the values of the triple determination deviates from the mean by more than 20%, then this value is to be thrown out as an outlier. In such cases, the new mean is then calculated from the 2 remaining values.

## **2.6 Gas formation (GB<sub>21</sub>) (Annex 2 No. 5)**

Gas formation, determined over the course of 21 days, in laboratory testing

### **2.6.1 General instructions:**

The fermentation test is to be carried out on the basis of DIN 38414 Part 8 [DEV S8, German standardised procedures for testing of water, wastewater and sludge; sludge and sediments (Group S); determination of fermentation behaviour (S 8); Beuth Verlag GmbH; Berlin 1985] with modifications (s. No. 2.6.4 – 2.6.11). All deviations from the method described below are to be documented.

### **2.6.2 Set-up of apparatus for testing, and gas measurement:**

For these measurements, an apparatus like that shown in Figure 2 is to be used.

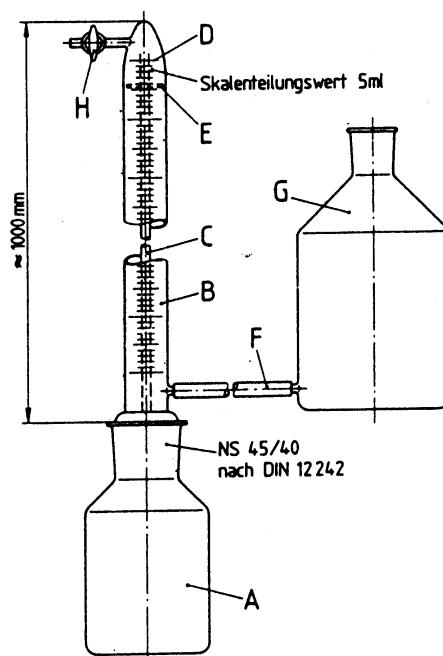
"It consists of an eudiometer tube (B) that has a volume of 300 to 400 ml and is graduated from the upper part down (scale-graduation intervals of 5 ml) and that is placed on the storage bottle (A) (which has a volume of about 500 ml) via a ground-glass connection. A connecting tube

(C), which enables the fermentation gas that has developed in the storage bottle to enter the measuring tube, passes through the bottom of the eudiometer tube. The connecting tube is held in position (E) by glass rods on four sides. The lower end of the eudiometer tube has a glass hose-coupling from which a sufficiently long hose connection (F) leads to a levelling bulb (G) made of glass or plastic (volume of at least 750 ml). The upper end of the eudiometer tube is fitted with a conical stopcock (H) for removal of gas samples and for adjusting the zero point (D)." [DIN 38414 Part 8, page 3]

"Sealing liquid: 30 ml sulphuric acid,  $\text{H}_2\text{SO}_4$  ( $\rho = 1.84 \text{ g/ml}$ ), are added to 1 l of distilled water; this mixture is warmed gently and 200 g of sodium sulphate(VI) decahydrate,  $\text{Na}_2\text{SO}_4 \cdot 10 \text{ H}_2\text{O}$ , are dissolved in it. The solution is then coloured red-orange by adding several drops of a methyl orange solution (0.1 g of methyl orange sodium salt, dissolved in 100 ml of distilled water). The sealing liquid is to be kept at room temperature. At low temperatures, sodium sulphate can crystallise out, and must then be brought back into solution via warming of the mixture." [DIN 38414 Part 8 – p. 3]

"The storage bottle (A) is ...filled with the listed..." amount of sample, inoculation sludge and water "...; the air in the bottle is displaced with nitrogen and the eudiometer tube (B) is applied. With the help of the levelling bulb (G), and the stopcock (H) of the eudiometer tube open, the level of the sealing liquid is set to the 0 mark. During this process, under no circumstances may sealing liquid ... flow over... into the connecting tube (C) and thus into ..." the sample space". The levelling bulb should still be filled about one-quarter full. Then, the stopcock (H) is closed. The storage bottle (A) with the ..." sample mixture "...is to be kept in the dark. The generated volume of gas is then read off whenever the sealing liquid is at the same level as the eudiometer tube and the levelling bulb, after the contents of the storage bottle (A) have been carefully swirled." [DIN 38414 Part 8, page 5]

"Upon every readout of the gas volume in the eudiometer tube, the temperature and the air pressure must be measured, to permit conversion of the gas volume to the standard state. The level of the sealing liquid is set to 0 after each readout, or after several readouts – depending on how much gas is generated – with the stopcock (H) open; in the process, air must not be sucked in through the stopcock (H)." [DIN 38414 Part 8, page 5]



- A Standflasche mit Schlammprobe, Inhalt 500 ml, z. B. Standflasche DIN 12 039 – W 500
- B Eudiometerrohr, Inhalt 300 bis 400 ml, Durchmesser 30 bis 35 mm, Skalenteilungswert 5 ml
- C Verbindungsrohr, Durchmesser etwa 6 mm
- D Nullmarke
- E Haltestifte bzw. Abstandhalter oder Lochverbindung zwischen Mantel des Eudiometerrohres und Verbindungsrohr
- F Schlauchverbindung
- G Niveaugefäß, Inhalt min. 750 ml, z. B. Stutzenflasche DIN 12 037 – K 1
- H Einweg-Kegelhahn, z. B. Küken DIN 12 541 – EM 3

Figure 2: Test apparatus for determination of the fermentation behaviour of sludges [DIN 38414 Part 8, page 6] [A: Storage bottle with sludge sample, volume of 500 ml – for example, DIN 12 039 – W 500 storage bottle; B: eudiometer tube, volume of 300 to 400 ml, diameter of 30 to 35 mm, scale graduation 5 ml; C: connecting tube, diameter of about 6 mm; D: zero mark; E: retaining pins or separators or hole connection between the cover of the eudiometer tube and the connecting tube; F: hose connection; G: levelling bulb, volume of at least 750 ml – for example, DIN 12 037 – K 1 aspirator; H: one-way conical stopcock – for example, DIN 12 541 – EM 3 plug]

### 2.6.3 Temperature

35 ± 1°C in the temperature-controlled water bath or conditioned room [pursuant to DIN 38414 Part 8].

#### **2.6.4 Sample storage:**

Sample preparation must be completed, and the test started, within 48 h following sampling. During this period temperatures over 4°C are permissible for no more than 24 h. If it is not possible to ensure compliance with this procedure, the sample shall be frozen, within 24 h after sampling, at – 18 to – 20 °C. Freezing of samples shall be documented in connection with evaluation. Thawing of samples must be gentle, and must last no longer than 24 h; during thawing, the temperature must not exceed 35°C.

#### **2.6.5 Sample preparation:**

The original sample, in its entirety, must be wet-crushed to < 10 mm. If necessary, interfering substances (glass, stones and metals) may be discharged prior to crushing. Their weight components must be taken into account in evaluation of the test.

#### **2.6.6 Inoculation sludge**

"Digested sludge from a municipal wastewater-treatment facility that has not been subjected to any measurable retardation during fermentation, and that has been kept for about one month under the conditions described below, is suitable as inoculation sludge. The sludge must not contain any coarse components and should develop a minimum amount of gas. It is useful to keep a considerable volume (about 10 l) of the inoculation sludge, with about 5 % dry residue, under anaerobic conditions in the closed system at (35 ± 1) °C, in order to make it possible to carry out a large number of tests simultaneously. In such cases, it must be ensured that the surrounding temperature does not fluctuate widely (for example, by covering the apparatus with a hood, etc.). A small percentage by volume (about 0.1 %) of fermentable substances, in the form of raw sludge..."may be added" every two weeks to the inoculation sludge...during further storage... The raw sludge must be free of toxic substances and should not contain any coarse components. After every such addition, the mixture should be thoroughly mixed. This inoculation sludge may not be used for the test batch until 1 week after the last addition of raw sludge."

[DIN 38414 Part 8, page 4]

**2.6.7 Sample weight:**

50 g of the prepared sample are used in the test apparatus. 50 ml of inoculation sludge are added to the sample and then the batch is filled with tap water to a level of 300 ml.

**2.6.8 Reference batch:**

Micro-crystalline cellulose is used to control the gas formation of the inoculation sludge. For this purpose, 50 ml of inoculation sludge are added to 1 g of cellulose, and the batch is filled with tap water to a level of 300 ml. The reference batch may be stirred throughout the entire duration of the test.

In the reference batch, a value of at least 400 Nl/kg must be reached; if this is not accomplished, the results must be thrown out, and the test conditions and the inoculation sludge must be checked.

**2.6.9 pH value:**

The pH value of the test batch must be measured at the beginning and end of the test.

If the pH value falls below 6.8 or exceeds 8.2, the measurement may not be counted. If the pH value is too low or too high at the beginning of the test, and if the pH value is adjusted with an alkalisng agent (caustic soda solution or caustic potash solution), or with hydrochloric acid (in order to lower the pH value), then this must be noted when the result is reported.

**2.6.10 Number of parallel batches:**

Samples are to be tested in three parallel batches.

Inoculation sludge and cellulose are to be tested in two parallel batches.

**2.6.11 Test duration and evaluation:**

Volumes of generated gas are measured by analogy with DIN 38414 Part 8, No. 10:

For each batch, Table 1 provides the model for data collection and calculation. The following equation is to be used to calculate the standard volume of the gas formed in the various individual time frames:

$$V_0 = V \cdot \frac{(p_L - p_w) \cdot T_0}{p_0 \cdot T} \quad (1) \text{ [pursuant to DIN 38414 Part 8, p. 8]}$$

$V_0$  gas volume, in ml

$V$  volume of generated gas, in ml

$p_L$  air pressure at the time of readout, in mbar

$p_w$  vapour pressure of the water at the temperature of the surrounding room, in mbar

$T_0$  standard temperature,  $T_0 = 273 \text{ K}$

$p_0$  standard pressure,  $p_0 = 1013 \text{ mbar}$

$T$  temperature of the gas or of the surrounding room, in K

Table 1: Model for evaluation of tests [pursuant to DIN 38414 Part 8, p. 9]

1	2	3	4	5	6	7
Date	Time	Volume of generated gas $V$ ml	Temperature $T$ K	Vapour pressure of the water $p_w$ mbar	Air pressure $p_L$ mbar	Standard volume $V_0$ Nml

The test log pursuant to Table 1 must be kept for every started mixture of the sample ( $V_0 \cong V_P$ ), the reference batch ( $V_0 \cong V_R$ ) and the inoculation sludge ( $V_0 \cong V_{IS}$ ). The generated gas volume is summed step-by-step, in the readout sequence. Changes of the dead volume, due to changes in the temperature and pressure conditions between the readouts, are insignificant and thus may be neglected. [DIN 38414 Part 8]

For the purposes of further calculation, the gas volumes of the sample and of the inoculation sludge (as the arithmetic mean of the double batch) are to be entered in Table 2.

The net gas volume ( $V_N$ ) of the sample is obtained, for equal test periods, as the difference between the gas volumes of the sample and the arithmetic mean of the double batch for the inoculation sludge.

The specific gas formation  $V_S$  of der sample during the test duration is calculated step-by-step, from readout to readout, using the following equation:

$$V_s = \frac{\sum V_n \cdot 10^2}{m \cdot w_T} \quad (2) \text{ [pursuant to DIN 38414 Part 8, p. 9]}$$

$V_S$  specific volume of gas generated during the test period, with respect to the dry weight, in l/kg

$\sum V_n$  net volume of gas generated during the test duration under consideration, in ml

$m$  weight of the weighed sample, in g

$w_T$  dry weight of the sample, in %

Table 2: Model for determination of gas formation with respect to dry weight [pursuant to DIN 38414 Part 8, p. 10]

1	2	3	4	5
Test duration	Sum of standard volumes	Proportional standard volume developed from the inoculation sludge	Net gas volume of the sample (column 2 – column 3) ( $V_N$ )	Specific gas formation, with respect to the dry weight
d	$V_P$ Nml	$V_{IS}$ Nml	Nml	$V_S$ NI/kg

The reference value for gas formation is the dry weight of the sample [NI/kg TS].

The evaluation period lasts for 21 days and begins after the initial lag phase. The lag phase has ended when the mean gas formation, expressed as a 3-day mean, is 25 % of the value that results as the 3-day mean in the region of greatest increase of the gas-formation function within the first 21 days.

The volume of the gas formed during the lag phase is deducted from the volume of the gas formed throughout the entire duration of the test (lag phase + 21 days), and it must not be greater than 10 % of the total value. If this condition is not met, the measurement must not be counted.

Daily readouts, for every working day, should be taken until the maximum gas-formation rate has been reached.

The analysis function and the 3-hour means are shown by entering the test duration (in hours) on the x-axis and the summed gas volumes (in NI/kg dry weight) on the y-axis.

### 2.6.12 Listing of the result:

The result is listed, with two significant places, in NI/kg of dry weight. Both the mean and the standard deviation of the triple determination are to be listed. If one of the values of the triple determination deviates from the mean by more than 20%, then this value is to be thrown out as an outlier. In such cases, the new mean is then calculated from the 2 remaining values.

The result for the reference batches must also be listed.

### 2.7 Thermal value (Annex 2 No. 6)

DIN 51900. Part 1 (issued April 2000), DIN 51900. Parts 2 and 3 (issued August 1977)

## 2.8 Water content (Annex 3)

DIN 18121, Part 1 (issued April 1998)

## 2.9 Density (Annex 3)

Density of landfilled waste, field test, DIN 18125, Part 2 (issued August 1999)

## 3 Evaluation of measurements

3.1 For control analyses, compliance with allocation values pursuant to Annex 1 is considered achieved if the determined values do not deviate from the allocation values by more than the following amounts:

Parameter	Maximum permissible deviation
2.01 Ignition loss	50% (relative)
2.02 TOC	50% (relative)
3 Extractable lipophile substances in original substance	25% (relative)
4.01 pH value	0.5 pH units
4.02 Conductance	10% (relative)
4.03 to 4.17 Eluate criteria	in each case, 50% (relative)

3.2 For control analyses for mechanically and biologically treated waste, the allocation values of Annex 2 are considered complied with even when a parameter exceeds one of the parameter standards listed below, if the relevant standard was complied with in the previous four control analyses (the numbers in parentheses refer to Annex 2):

- TOC (No. 2): = 21%
- TOC (Eluate, No. 4.03): = 300 mg/l
- AT<sub>4</sub> (No. 5): = 10 mg/g
- GB<sub>21</sub> (No. 5): = 30 l/kg
- Upper thermal value (No. 6): = 7000 kJ/kg

For the remaining parameters of Annex 2, Number 3.1 applies mutatis mutandis.

**3.3** Compliance with the allocation values mentioned in Article 5 (6), as required of owners of waste from human settlements pursuant to Article 5 (6), shall be considered achieved if the 80% percentile value of the relevant parameter does not exceed the allocation value pursuant to Number 3.1 or 3.2 and the median of all measurements of the last twelve months has complied with the relevant allocation value pursuant to Annex 1 or 2.

#### **4 Promulgations of expert authorities**

The expert authorities' promulgations listed in this Annex have been archived at the German Patent Office in Munich.

The following have been published:

- the ISO standards, EN standards and DIN standards, published by Beuth-Verlag GmbH, Berlin and Cologne,
- LAGA Guideline PN 2/78, in the Waste Manual (*Müll-Handbuch*), Index (*Kennzahl*) 1859, issue (*Lieferung*) 2/84, Erich Schmidt Verlag, Berlin and
- LAGA Guideline KW/85 in the Waste Manual (*Müll-Handbuch*), Index (*Kennzahl*) 1867, issue (*Lieferung*) 7/93, Erich Schmidt Verlag, Berlin.

## **Article 2**

### **Thirtieth Ordinance on Execution of the Federal Immission Control Act (Ordinance on Facilities for Biological Treatment of Waste – 30. BImSchV)**

#### **Contents**

#### **First Part General Regulations**

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- Art. 2 Definition of terms

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- Art. 4 Emissions-based requirements for delivery, processing, separation of materials, storage and transport
- Art. 5 Emissions-based requirements for biological treatment, process water and vapour condensates
- Art. 6 Emissions standards
- Art. 7 Conditions for withdrawal of waste gases

#### **Third Part Measurement and Monitoring**

- Art. 8 Measuring procedures and measuring equipment
- Art. 9 Continuous measurements
- Art. 10 Evaluation and assessment of continuous measurements
- Art. 11 Individual measurements
- Art. 12 Reports and assessment of individual measurements
- Art. 13 Disruptions of operations

#### **Fourth Part Requirements pertaining to old facilities**

- Art. 14 Transitional provisions

## **Fifth Part Common regulations**

- Art. 15 Notification of the public
- Art. 16 Permission of exceptions
- Art. 17 Additional requirements
- Art. 18 Administrative offences

## **First Part General Regulations**

### **Article 1 Scope of application**

(1) This Ordinance shall apply to the construction, design and operation of facilities in which waste from human settlements, and waste that can be managed like waste from human settlements, is treated, within the meaning of Article 2 Nos. 1 and 2 of the Ordinance on Storage of Waste (*Abfallablagerungsverordnung*) with biological processes, or with a combination of biological and physical processes, and in which

- biologically stabilised waste is produced, in pre-treatment for storage or prior to thermal treatment,
- thermally valuable components or substitute fuels are obtained, or
- biogases are generated for energy recovery

(biological waste-treatment facilities), and which, pursuant to Article 4 of the Federal Immission Control Act in conjunction with the Ordinance on Facilities Subject to Licensing (*Verordnung über genehmigungsbedürftige Anlagen*), are subject to licensing.

(2) This Ordinance shall not apply to facilities that

1. are intended for production of usable compost or biogas solely from biological waste pursuant to Article 2 No. 1 of the Ordinance on Biological Waste (*Bioabfallverordnung*) of 21 September 1998 (Federal Law Gazette I, p. 2955), or of products or by-products from the areas of agriculture, forestry or commercial fishing or fish-breeding, or of sewage sludges pursuant to Article 2 (2) of the Ordinance on Sewage Sludges (*Klärschlammverordnung*) of 15 April 1992

(Federal Law Gazette I, p. 912), amended by Ordinance of 6 March 1997 (Federal Law Gazette I, p. 446), or are intended for use of a mixture of the aforementioned substances, in cofermentation facilities, or

2. are intended for digestion of sewage sludge.

(3) In particular, this Ordinance contains requirements that, pursuant to Article 5 (1) No. 2 of the Federal Immission Control Act, apply to construction and operation of facilities for protection against harmful environmental impacts of air pollution.

## **Article 2 Definition of terms**

For the purposes of this Ordinance, the following definitions shall apply:

1. Waste gases:

carrier gases, with solid, liquid or gaseous emissions;

2. Waste-gas scrubbing systems:

systems for reduction of emissions of emissions-relevant air pollution in waste gases of biological waste-treatment facilities, especially systems that limit emissions of odorous substances, climate-relevant gases, organic substances and dusts and that reduce amounts of viable, reproduction-capable micro-organisms;

3. Old facilities:

biological waste-treatment facilities for which, until the time at which this Ordinance comes into force,

a) notification is required pursuant to Article 67 (2) or (7) or Article 67a (1) of the Federal Immission Control Act or, prior to the entry into force of the Federal Immission Control Act, notification was required pursuant to Article 16 (4) of the Industrial Code (*Gewerbeordnung*),

- b) a plan-approval decision, pursuant to Article 7 (1) of the Waste Avoidance and Waste Management Act of 27 August 1986 (Federal Law Gazette I, p. 1410, 1501), has been issued for construction and operation,
- c) a plan-approval decision pursuant to Article 31 (2), or a permit pursuant to Article 31 (3) of the Closed Substance Cycle and Waste Management Act of 27 September 1994 (Federal Law Gazette I, p. 2705), has been issued for construction and operation,
- d) in a plan-approval procedure pursuant to Article 31 (2) of the Closed Substance Cycle and Waste Management Act, commencement of execution pursuant to Article 33 (1) of the Closed Substance Cycle and Waste Management Act was permitted prior to approval of the relevant plan,
- e) a construction and operation permit, pursuant to Article 4 or Article 16 of the Federal Immission Control Act, has been issued, or
- f) a partial license pursuant to Article 8 of the Federal Immission Control Act, permission of early start of operations pursuant to Article 8a of the Federal Immission Control Act, or a provisional decision pursuant to Article 9 of the Federal Immission Control Act has been issued, where such license, permission or decision defines requirements pursuant to Article 5 (1) No. 2 of the Federal Immission Control Act;

4. Produced waste:

all solid or liquid waste that is produced by the biological waste-treatment facility;

5. Waste with biologically degradable components:

waste with large organic components within the meaning of the waste mentioned in Annex 1 No. 1 of the Ordinance on Biological Waste, as well as other waste with large biologically degradable components that, in keeping with its nature or composition, is managed like waste from human settlements, especially sewage sludges from wastewater-treatment facilities for treatment of municipal wastewater or wastewater with similarly low pollutant contamination, faeces, faecal sludge, residues from wastewater facilities, water-purification sludges, building

waste and production-specific waste. Waste from treatment of waste from human settlements and of waste pursuant to the 1<sup>st</sup> sentence also falls within this category;

6. Biological waste-treatment facility:

waste-treatment facility in which waste from human settlements, or other waste with biologically degradable components, is treated by means of biological processes or of a combination of biological and physical processes, where such a facility produces biologically stabilised waste, thermally valuable components, substitute fuels or biogases. In particular, biological waste-treatment facilities include

- facilities for biological treatment of process substances, or of produced waste, under aerobic conditions (rotting) or under anaerobic conditions (fermentation), along with the relevant spreading, input, air-routing and waste-gas-routing and conversion systems, and
- facilities for mechanical processing or physical separation of process substances, or of produced waste, as pre-treatment and post-treatment facilities used before and after biological treatment (such as facilities for removal and sorting out of metals, foils or other interfering or valuable substances, for drainage of moisture/water, for homogenising or mixing, for classification or sorting with sieves, air separation or hydraulic separation, for pelleting, for drying, for pressing or for cutting or crushing),
- facilities for delivery, checking (upon delivery) and unloading of process substances, for storage of process substances and produced waste and for their transport, transfer and dosage,
- facilities for waste-gas collection,
- facilities for the waste-gas scrubbing and for treatment of process water and vapour condensates,
- facilities for discharging waste gas into the atmosphere,
- facilities for operational monitoring of treatment processes and intermediate storage, and for monitoring of treatment and storage conditions, and
- facilities for monitoring emissions;

7. Process substances:

all waste from human settlements, or other waste with biologically degradable components, that is delivered to a biological waste-treatment facility;

8. Emissions:

the air pollution emitted by a biological waste-treatment facility; it is described in terms of:

- a) mass concentration, in units of milligrams per cubic metre ( $\text{mg}/\text{m}^3$ ), with respect to the waste-gas volume in the standard state (273 K, 1013 hPa), and after deduction of the moisture content as water vapour,
- b) mass ratio, in units of grams per megagram ( $\text{g}/\text{Mg}$ ), and expressing the ratio between the mass of emitted substances and the mass of input process substances, in the state in which such substances are delivered,
- c) odorous-substance concentration, in units of smell unit per cubic metre ( $\text{GE}/\text{m}^3$ ), an olfactometrically measured relationship of relevant volume streams following dilution of a waste-gas sample with neutral air to the smell threshold, and expressed as a multiple of the smell threshold;

9. Emissions standards:

permissible levels of emissions in the waste gas, determined using the criteria defined in Article 10 (4) and Article 12 (2);

10. Waste from human settlements:

domestic waste, and waste from other areas, that, in keeping with its nature or composition, is similar to domestic waste, especially domestic waste, bulky waste, commercial waste similar to domestic waste, waste from gardens and parks, market waste and waste from road cleaning.

## **Second Part**

### **Requirements pertaining to construction, design and operation**

#### **Article 3 Minimum distance from residential areas**

In construction of biological waste-treatment facilities, facilities should be placed so that they are at least 300 m from the nearest existing residential area or residential development called for in a development plan (*Bebauungsplan*).

#### **Article 4 Emissions-based requirements for delivery, processing, separation of materials and storage and transport**

- (1) Unloading areas, bunkers for receiving or discharging materials, or other facilities for delivery, transport and storage of process substances, must be constructed in closed rooms with airlocks in which the air pressure is kept below atmospheric pressure, via gas/air suction in the airlock area or in the area for loading and unloading and storage. Suctioned-off waste gas must be fed into a waste-gas scrubbing system.
- (2) Machines, devices or other facilities for mechanical processing or physical separation of process substances, or of produced waste (for example, by cutting or crushing, grouping, sorting, mixing, homogenising, draining, drying, pelleting, pressing), must be encapsulated. Where equipment cannot be waste-gas-tight, or can be only partially waste-tight, especially at sites for discharging, spreading or transfer, waste-gas streams from relevant facilities must be collected and routed to a waste-gas scrubbing system.
- (3) The waste-gas streams pursuant to paragraph 1 2<sup>nd</sup> sentence and paragraph 2 2<sup>nd</sup> sentence may also serve as input air for the process air required for rotting.
- (4) Closed containers must be used for materials that emit dust during transport away from the facility.

(5) Roadways in the area of the biological waste-treatment facility must be paved with asphalt material for road construction, with cement concrete or with an equivalent material, and must be cleaned as necessary in keeping with the degree to which they are soiled. Vehicles must be prevented from causing considerable soiling or dirtying after they leave the facility area (and any such soiling or dirtying must be cleaned) – for example, by means of tyre-washing systems or regular cleaning of roadways.

**Article 5 Emissions-based requirements for biological treatment, process water and vapour condensates**

(1) Facilities for biological treatment of process substances, or of produced waste, under aerobic conditions (rotting) or under anaerobic conditions (fermentation), must be encapsulated or constructed in closed rooms with airlocks in which the air pressure is kept below atmospheric pressure, via gas/air suction in the airlock area or in the area for biological treatment. Where equipment cannot be waste-gas-tight, or can be only partially waste-tight, especially at sites for discharging, spreading or transfer, and for processing of the material for rotting, waste-gas streams from relevant facilities must be collected and routed to a waste-gas scrubbing system.

(2) All of the waste gas produced during rotting, in rotting systems, must be routed to a waste-gas scrubbing system.

(3) The biogases producing during fermentation, in facilities for wet or dry fermentation, must be routed to a gas-scrubbing system, for conversion in a usable gas, as long as they cannot be directly used for energy recovery in a combustion system.

(4) Available possibilities for reducing emissions, via use of low-emissions processes and technologies – for example, multiple use of waste gas as process air, in rotting processes, or process-integrated recycling of produced process water or sludgy residues, must be exploited.

(5) Conveyor and storage systems, and the facility's treatment systems for process water and vapour condensates, must be designed and operated in such a manner that they cannot emit relevant diffuse emissions.

## Article 6 Emissions standards

The operator must construct and operate the biological waste-treatment facility in such a manner that, in the waste-gas streams for discharge into the atmosphere, pursuant to Article 4 (1) 2<sup>nd</sup> sentence and (2) 2<sup>nd</sup> sentence and Article 5 (1) 2<sup>nd</sup> sentence and (2)

1. no daily mean value exceeds the following emissions standards:

- |   |                      |
|---|----------------------|
| a) total dust                                     | 10 mg/m <sup>3</sup> |
| b) organic substances, expressed as total carbon, | 20 mg/m <sup>3</sup> |

2. no half-hour mean value exceeds the following emissions standards:

- |   |                      |
|---|----------------------|
| a) total dust                                     | 30 mg/m <sup>3</sup> |
| b) organic substances, expressed as total carbon, | 40 mg/m <sup>3</sup> |

3. no monthly mean value, determined as the mass ratio pursuant to Article 10 (2), exceeds the following emissions standards:

- |   |          |
|---|----------|
| a) nitrous oxide                                  | 100 g/Mg |
| b) organic substances, expressed as total carbon, | 55 g/Mg  |

4. no measured value for a sample exceeds the following emissions standard:

odorous substances	500 GE/m <sup>3</sup>
--------------------	-----------------------

and

5. no mean value produced throughout the relevant sampling period exceeds the following emissions standard:

dioxins/furans, expressed as the sum value pursuant to Annex to the 17 <sup>th</sup> Ordinance on the Execution of the Federal Immission Control Act (BImSchV),	0.1 ng/m <sup>3</sup> .
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### **Article 7 Conditions for withdrawal of waste gases**

The operator must withdraw waste-gas streams pursuant to Article 4 (1) 2<sup>nd</sup> sentence and (2) 2<sup>nd</sup> sentence and Article 5 (1) 2<sup>nd</sup> sentence and (2) in such a manner that their removal via free air currents is undisturbed; discharge via chimneys is required.

## **Third Part**

### **Measurement and monitoring**

#### **Article 8 Measuring procedures and measuring equipment**

- (1) For measurements, measuring stations are to be installed in keeping with specifications of the competent authority; such stations must be sufficiently large, easily accessible and designed and selected in a manner that ensures that measurements are representative and proper.
- (2) For emissions measurements and for measurements for determination of relevant reference and operational values, measuring procedures and suitable measuring equipment in accordance with the best available technology, and in keeping with specifications of the competent authority, must be applied or used.
- (3) Certification must be provided, from an authority announced by the competent authority under Land (state) law, to the effect that measuring equipment for continuous monitoring has been properly installed.
- (4) The operator must have measuring equipment used for continuous measurement of emissions calibrated, and checked once a year for proper function, by an authority announced by the competent authority under Land (state) law, and prior to start-up of the facility; calibration is required prior to start-up whenever a facility has been significantly modified, and otherwise it must be repeated every three years. Reports on the result of calibration, and on checks of proper functioning, must be submitted to the competent authority within eight weeks after they have been received.

## **Article 9 Continuous measurements**

The operator must continuously measure and register

1. mass concentrations of emissions pursuant to Article 6 Nos. 1 and 2,
2. mass concentrations of emissions of nitrous oxide and
3. the relevant reference values needed for evaluation and assessment of proper function, especially waste-gas temperature, waste-gas volume stream, pressure, water-vapour content and weight of input process substances in their delivered states,

and evaluate the same pursuant to Article 10 (1) and (2). Equipment for measuring the water-vapour content is not needed if the waste gas is dried before the mass concentrations of emissions are determined.

## **Article 10 Evaluation and assessment of continuous measurements**

(1) During the operation of the biological waste-treatment facility, the half-hour mean of the measured values pursuant to Article 9 1<sup>st</sup> sentence must be obtained, for each successive half hour, and converted to the conditions pursuant to Article 2 No. 8 letter a. The half-hour mean values must be used to obtain the daily mean values for each day with respect to the daily operating period, including delivery and offloading/temporary storage procedures.

(2) The daily mean values of mass concentrations for organic substances, obtained pursuant to paragraph 1 2<sup>nd</sup> sentence and expressed as total carbon, and for nitrous oxide, and the total waste-gas amounts, expressed as the daily sum of waste-gas streams pursuant to Article 4 (1) 2<sup>nd</sup> sentence and (2) 2<sup>nd</sup> sentence and Article 5 (1) 2<sup>nd</sup> sentence and (2), are to be used to determine the daily emitted amounts of such air pollution. The daily emitted amounts are to be used to obtain the amounts emitted monthly during operations of the biological waste-treatment facility. The monthly process-substance amount is to be recorded as the monthly sum of input process substances in the state in which they are delivered. The masses emitted monthly, pursuant to the 2<sup>nd</sup> sentence, and the

monthly process-substance amounts, pursuant to the 3<sup>rd</sup> sentence, are to be used to calculate the mass ratios pursuant to Article 2 No. 8 letter b.

(3) The operator must prepare measurement reports on evaluation of continuous measurements and on determination of relevant mass ratios, and must submit such reports to the competent authority within three months after the end of each calendar year. After preparation of measurement reports, the operator must store relevant records made by measuring equipment for a period five years. The 1<sup>st</sup> sentence shall not apply in cases in which the competent authority requires telemetric transmission of measurements.

(4) Emissions standards shall be considered complied with if no daily mean value pursuant to Article 6 No. 1, no half-hour mean value pursuant to Article 6 No. 2 and no monthly mean value pursuant to Article 6 No. 3 exceeds the relevant emissions standard.

#### **Article 11 Individual measurements**

(1) Following construction or significant modification of a biological waste-treatment facility, the operator must have an authority announced pursuant to Article 26 of the Federal Immission Control Act carry out measurements in order to determine whether the requirements pursuant to Article 6 Nos. 4 and 5 are fulfilled. Following start-up of the relevant facility, such measurements must be carried out on at least one day every two months, over a twelve-month period, and then must be carried out recurrently on at least three days of every subsequent twelve-month period. The measurements should be carried out while the facility is operating at the highest performance level at which the facility is licensed for permanent operation with the process substances used during the measurements.

(2) For each individual measurement, at least three samples should be taken from each emissions source. Olfactometrical analysis must be carried out immediately following sampling.

(3) Following construction or significant modification of a biological waste-treatment facility, the competent authority may require the operator to have an authority announced pursuant to Article 26 Federal Immission Control Act carry out measurements to determine whether operation of the facility is causing smell emissions in the neighbourhood that represent a significant nuisance within the

meaning of Article 3 (1) Federal Immission Control Act. Immissions levels are to be established via olfactory inspections during walking tours of the facility. Such measurements are to be carried out following attaining of undisturbed operation, and no later than twelve months following start-up of the facility. They should also be carried out while the facility is operating at the highest performance level at which the facility is licensed for permanent operation with the process substances used during the measurements.

### **Article 12 Reports and assessment of individual measurements**

(1) The operation shall prepare a report on the results of measurements pursuant to Article 11 and shall submit such report to the competent authority without delay. Such measurement reports must contain information regarding the measurement planning, the result of each individual measurement, the measuring procedures used and the operational conditions that are significant with regard to assessment of measurements.

(2) The emissions standards pursuant to Article 6 Nos. 4 and 5 shall be considered complied with if no result of an individual measurement exceeds these emissions standards.

### **Article 13 Disruptions of operations**

(1) If measurements and other obvious signs indicate that requirements for the operation of the facilities, or for limitation of emissions, are not being fulfilled, the operator must report this to the competent authority immediately. The operator is required to take immediate measures to ensure proper operation.

(2) With respect to technically unavoidable shutdowns, disruptions or failures of the waste-gas scrubbing systems, the authority shall specify the period of time during which the facility may deviate from emissions standards pursuant to Article 6, under certain conditions. Under the conditions mentioned in the 1<sup>st</sup> sentence, the biological waste-treatment facility may not continue to operate for more than eight successive hours, and may not continue to operate for more than 96 hours within a calendar year. Emissions of total dust may not exceed a mass concentration of 100 milligrams per cubic metre of waste gas, measured as a half-hour mean; Article 2 No. 8 shall apply mutatis mutandis.

(3) Whenever operation of waste-gas scrubbing systems stops, suctioned-off waste gas must be discharged pursuant to Article 7. If operational interruptions of longer than eight hours are expected, the operator must take additional measures and inform the competent authority about this fact immediately.

#### **Fourth Part**

##### **Requirements pertaining to old facilities**

#### **Article 14 Transitional provisions**

(1) For old facilities, the requirements of this Ordinance apply when five years have elapsed since this Ordinance came into force.

(2) If a biological waste-treatment facility is so expanded, through addition of one or more additional waste-treatment facilities, that the existing facility and the new facilities form a joint facility, then the requirements for the new waste-treatment facilities are determined in accordance with the provisions of the second and third parts of this Ordinance, the requirements for the existing facility are determined in accordance with the provisions of the fourth part of this Ordinance.

#### **Fifth Part**

##### **Common regulations**

#### **Article 15 Notification of the public**

The operator of a biological waste-treatment facility shall notify the public, following initial calibration of measuring equipment for continuous measurement of emissions pursuant to Article 8 (4) and initial individual measurements pursuant to Article 11 (1), once per year about evaluation of emissions measurements, and shall so notify the public following measurements pursuant to Article 11 (3). The competent authority may specify the manner and form in which such public notification takes place. The 1<sup>st</sup> and 2<sup>nd</sup> sentences shall not apply to information from which conclusions regarding operational or business secrets could be drawn. Notwithstanding the 1<sup>st</sup> and 2<sup>nd</sup> sentences, operators of companies registered in the directory called for by Council Regulation (EEC) No 1836/93 of 29 June 1993 allowing voluntary participation by companies in the industrial sector in a

of 29 June 1993 allowing voluntary participation by companies in the industrial sector in a Community eco-management and audit scheme (OJ. EC No. L 168 p. 1) may notify the public by means of documents prepared within the framework of the relevant eco-management system, as long as such documents contain the necessary information.

### **Article 16 Permission of exceptions**

Notwithstanding the requirement of Article 5 (1) 1<sup>st</sup> sentence calling for encapsulation of facilities for biological waste treatment or the design of such facilities in closed rooms with airlocks, and the requirement of Article 5 (2) calling for routing of all waste gas generated in the rotting process to a waste-gas scrubbing system, the competent authority, at the operator's application, may permit, in a multi-step biological waste-treatment facility, subsequent treatment under aerobic conditions (post-rot process) within non-encapsulated facilities or unclosed rooms without waste-gas collection and waste-gas scrubbing, if the waste intended for the post-rot process falls below a value of 20 mg O<sub>2</sub>/g dry weight, determined as breathing activity pursuant to Annex 4 No. 2.5 of the Ordinance on environmentally compatible storage of waste from human settlements of 20 February 2001 (Federal Law Gazette I, p.305), and if it is ensured, by means of other operational measures, that sufficient precautions against harmful environmental impacts have been taken by other means.

### **Article 17 Additional requirements**

The competent authority's authority to issue other or more extensive requirements, especially requirements for prevention of harmful environmental impacts pursuant to Article 5 (1) No. 1 of the Federal Immission Control Act, shall not be affected.

### **Article 18 Administrative offences**

An administrative offence within the meaning of Article 62 (1) No. 2 of the Federal Immission Control Act shall be deemed to have been committed by anyone who, wilfully or negligently,

1. in contravention of Article 6, fails to construct or operate a facility correctly,

2. in contravention of Article 8 (4) 1<sup>st</sup> sentence, fails to calibrate a measuring device, fails to calibrate a measuring device on time, fails to have a measuring device checked or checked on time, fails to repeat the calibration, or fails to repeat the calibration on time,
3. in contravention of Article 8 (4) 2<sup>nd</sup> sentence, Article 10 (3) 1<sup>st</sup> sentence or Article 12 (1) 1<sup>st</sup> sentence, fails to submit a report or fails to submit a report on time,
4. in contravention of Article 9 1<sup>st</sup> sentence, fails to evaluate the mass concentrations of emissions or a reference value specified by this provision, or fails to evaluate such concentrations or reference value correctly or completely,
5. in contravention of Article 10 (3) 2<sup>nd</sup> sentence, fails to store a record or fails to store a record for at least five years,
6. in contravention of Article 11 (1) 1<sup>st</sup> or 2<sup>nd</sup> sentence, fails to have a measurement carried out, or fails to have a measurement carried out on time,
7. in contravention of Article 13 (1) 1<sup>st</sup> sentence, fails to provide notification, or fails to provide notification correctly, completely, or on time, or
8. in contravention of Article 15 1<sup>st</sup> sentence, fails to notify the public, or fails to notify the public correctly, completely, or on time.

**Article 3**  
**Ordinance for Amendment of the Ordinance on Wastewater**  
**(Abwasserverordnung)**

The Ordinance on Wastewater (*Abwasserverordnung*), in the version promulgated on 9 February 1999 (Federal Law Gazette I p. 86), amended by Ordinance of 29 May 2000 (Federal Law Gazette I, p. 751), shall be amended as follows:

1. Annex 51 Part D Paragraph 2 shall be amended as follows:

After the words "with other wastewater", a comma shall be inserted, and the words "except for wastewater that originates from facilities for biological treatment of waste," shall be inserted.

2. After Annex 22, the following Annex 23 shall be inserted:

**"Annex 23**

**Facilities for Biological Treatment of Waste**

**A Scope of application**

(1) This Annex shall apply to

1. wastewater whose pollutant load originates mainly from facilities for biological treatment of waste from human settlements and for other waste that is to be treated like waste from human settlements, and
2. the precipitation water contaminated, through operations, within such facilities.

(2) This Annex shall not apply to wastewater from facilities for treatment of separately collected biological waste, from facilities for production of compost, from indirect cooling systems and from processing of process water.

## **B General requirements**

(1) The stream volume and pollutant load of wastewater from facilities pursuant to Part A Paragraph 1 shall be kept as small as possible by means of the following measures:

1. Extensive recycling and multiple use of process water,
2. Prevention of entry of precipitation water into waste-storage and waste-treatment areas, by means of enclosures, roofs or covers.

(2) The wastewater may be discharged into water bodies only insofar as process water from process and waste-air treatment in mechanical-aerobic-biological treatment facilities cannot be used completely in internal processes. In such cases, the requirements pursuant to Part C and D shall apply.

## **C Requirements pertaining to wastewater for the point of discharge**

(1) The following requirements shall apply to wastewater for the point of discharge into the relevant water body:

	Qualified random sample or 2-hour mixed sample	
Chemical oxygen requirement (CSB)	mg/l	200
Biochemical oxygen requirement in 5 days (BSB <sub>5</sub> )	mg/l	20
Total nitrogen, as the sum of ammonium, nitrite and nitrate nitrogen (N <sub>total</sub> )	mg/l	70
Total phosphorous	mg/l	3
Total carbon	mg/l	10
Fish toxicity G <sub>F</sub>		2

The requirement for total carbon refers to the random sample.

(2) A standard defined for total nitrogen shall be considered complied with if the standard is measured and complied with as "total bound nitrogen (TN<sub>b</sub>)".

## D Requirements pertaining to wastewater prior to mixing

(1) The following requirements shall apply to wastewater prior to mixing with other wastewater:

	Qualified random sample or 2-hour mixed sample mg/l
Adsorbable organically bound halogens (AOX)	0.5
Mercury	0.05
Cadmium	0.1
Chromium	0.5
Chromium VI	0.1
Nickel	1
Lead	0.5
Copper	0.5
Zinc	2
Arsenic	0.1
Cyanide, easily released	0.2
Sulphide	1

For AOX, chromium VI, cyanide, easily released, and sulphide, the values apply to the random sample.

(2) The wastewater may be mixed with other wastewater, except for wastewater from above-ground storage of waste, for the purpose of joint biological treatment, only if it can be expected that at least one of the following prerequisites is fulfilled:

1. In determination of the fish, phosphorescent-bacteria and daphnia toxicity of a representative wastewater sample, the following values are not exceeded, following execution of an elimination test with a biological, laboratory-scale continuous-flow treatment system (such as a system in keeping with DIN 38412 L26):

Fish toxicity  $G_F = 2$ ,

Daphnia toxicity  $G_D = 4$  and

Phosphorescent-bacteria toxicity  $G_L = 4$ .

Measures such as nitrification in the biological laboratory-scale treatment system, or maintenance of a constant pH level, must be carried out to ensure that ammonia (NH<sub>3</sub>) does not cause the G<sub>F</sub> value to be exceeded. For start-up of the biological, laboratory-scale continuous-flow treatment system, the wastewater may be diluted to any extent. If the wastewater lacks nutrients, nutrients may be added. No dilution water may be added during the test phase.

2. A DOC elimination degree of 75 percent, in keeping with Number 408 of the Annex "Analysis and measuring procedures", is achieved.
3. Prior to joint biological treatment with other wastewater, the wastewater already has a CSB concentration of less than 400 mg/l.

In cases of significant modifications, and at least every 2 years, proof of compliance with these prerequisites must be provided."

#### **Article 4**

#### **Entry into Force**

This Ordinance shall enter into force on the first day of the calendar month following its promulgation.

The Bundesrat has given its approval.

Berlin, 20 February 2001

The Federal Chancellor  
Gerhard Schröder

The Federal Minister  
for the Environment, Nature Conservation and Nuclear Safety  
Jürgen Trittin