

The following English text of the First General Administrative Regulation Pertaining the Federal Immission Control Act (Technical Instructions on Air Quality Control – TA Luft) is a legally non-binding version. Legally binding is only the German version published in the Joint Ministerial Gazette [Gemeinsames Ministerialblatt] from 30 July 2002 (GMBL. p. 511).

Federal Ministry for Environment, Nature Conservation and Nuclear Safety

**First General Administrative Regulation Pertaining the Federal Immission Control Act
(Technical Instructions on Air Quality Control – *TA Luft*)
of 24 July 2002
(GMBL. [Gemeinsames Ministerialblatt - Joint Ministerial Gazette] p. 511)
(*Technische Anleitung zur Reinhaltung der Luft – TA Luft*)**

Pursuant to § 48 of the Federal Immission Control Act as promulgated on 14 May 1990 (BGBl. [Bundesgesetzblatt - Federal Law Gazette] I p. 880), as amended by Article 2 of the Act of 27 July 2001 (BGBl. I p. 1950), the Federal Government decrees the following General Administrative Regulation after having heard the parties concerned:

Content:

1	Scope of Application	8
2	Definitions of Terms and Units of Measurement	10
2.1	Immissions	10
2.2	Immission Indicators, Assessment Points, Grid Points	10
2.3	Immission Values	11
2.4	Waste Gas Volume and Waste Gas Volumetric Flow Rate	11
2.5	Emissions	11
2.6	Emission Ratio and Emission Reduction Ratio	12

2.7	Emission Standards and Emission Limits	13
2.8	Units and Abbreviations	13
2.9	Rounding Adjustment	14
2.10	Existing installations	14
3	General Principles for Granting a Permit, Provisional decisions and Permissions for Early Start	16
3.1	Examination of Applications for Permits to Construct and Operate New Installations	16
3.2	Examining Applications to Grant a Partial Permit (§ 8 of the Federal Immission Control Act) or to Render a Provisional Decision (§ 9 of the Federal Immission Control Act)	16
3.3	Examination of Applications for Permission of Early Start (§ 8a of the Federal Immission Control Act)	17
3.4	Examining whether an Alteration requires a Permit (§ 15 Para. 2 of the Federal Immission Control Act)	17
3.5	Examining Applications to Grant a Permit for Alteration	18
3.5.1	The Concept of Alteration	18
3.5.2	Alterations as a Consequence of Subsequent Orders	18
3.5.3	Examination Volume	18
3.5.4	Corrective Measures	19
4	Requirements for the Protection against Harmful Effects on the Environment	20
4.1	Examining the Obligation to Protect	20
4.2	Protection of Human Health	21
4.2.1	Immission Values	21
4.2.2	Granting a Permit in case of Exceeded Immission Values	22
4.2.3	Granting a Permit in case of Future Compliance with Immission Values	23
4.3	Protection against Significant Nuisances or Significant Disadvantages due to Dustfall	24
4.3.1	Immission Value for Dust Deposition	24
4.3.2	Granting a Permit in case of an Exceeded Immission Value	24
4.4	Protection against Significant Disadvantages, in particular Protection of the Vegetation and of Ecosystems	25

4.4.1	Immission Values for Sulphur Dioxide and Nitrogen Oxides	25
4.4.2	Immission Value for Hydrogen Fluoride; Ammonia	26
4.4.3	Granting a Permit in case of Exceeded Immission Values	27
4.5	Protection against Harmful Effects of Pollutant Deposition on the Environment	28
4.5.1	Immission Values for Pollutant Deposition	28
4.5.2	Granting a Permit in case of Exceeded Immission Values for Pollutant Deposition or Exceeded Examination and Action Values	29
4.5.3	Special Cases in case of Exceeded Examination and Action Values	30
4.6	Determination of Immission Indicators	30
4.6.1	General	30
4.6.2	Existing Load Determination	32
4.6.3	Existing Load Indicators	37
4.6.4	Additional Load Indicators	38
4.7	Observation of Immission Values	39
4.7.1	Annual Immission Value	39
4.7.2	Daily Immission Value	39
4.7.3	Hourly Immission Value	40
4.8	Determination without Established Immission Values and in Special Cases	40
5	Requirements to Provide Precautions against Harmful Effects on the Environment	44
5.1	General	44
5.1.1	Contents and Meaning	44
5.1.2	Taking into Account the Requirements during the Permit Procedure	46
5.1.3	Basic Requirements for Integrated Pollution Prevention and Control	48
5.2	General Requirements to Emission Limits	50
5.2.1	Total Dust, including Micro Dust	50
5.2.2	Inorganic Particulate Matter	50
5.2.3	Particulate Emissions during Transshipment, Storage or Treatment of Solid Substances	53
5.2.4	Inorganic Gaseous Substances	59
5.2.5	Organic Substances	60
5.2.6	Gaseous Emissions during the Processing, Conveying, Transfilling or Storage of Liquid Organic Substances	63

5.2.7	Carcinogenic, Mutagenic or Reproduction Toxic Substances and Slowly Degradable, Highly accumulative and Highly Toxic Organic Substances	67
5.2.8	Odour-Intensive Substances	71
5.2.9	Soil-Contaminating Substances	72
5.3	Measurement and Monitoring of Emissions	73
5.3.1	Measurement Sites	73
5.3.2	Individual Measurements	73
5.3.3	Continuous Measurement	76
5.3.4	Continuous Determination of Special Substances	82
5.3.5	Equivalency to VDI Guidelines	82
5.4	Special Provisions for Certain Types of Installations	83
5.4.1	Heat Production, Mining, Energy	83
5.4.2	Rock and Soil, Glass, Ceramics, Construction Materials	104
5.4.3	Steel, Iron and Other Metals, including their Processing	119
5.4.4	Chemical Products, Pharmaceuticals, Mineral Oil Refining and Further Processing	133
5.4.5	Surface Treatment with Organic Substances, Production of Strip-type Plastic Materials, other Processing of Resins and Plastics	147
5.4.6	Timber, Pulp	151
5.4.7	Food, Beverages, Tobacco and Animal Feed, Agricultural Products	154
5.4.8	Installations for the Recovery and Disposal of Waste and other Materials	170
5.4.9	Storage, Loading and Unloading of Materials and Preparations	186
5.4.10	Miscellaneous	188
5.5	Discharge of Waste Gases	196
5.5.1	General	196
5.5.2	Discharge through Stacks	196
5.5.3	Nomogram to Determine the Stack Height	197
5.5.4	Stack Height Determination Taking into Consideration Buildings and Vegetation, and in Uneven Terrain	200
5.5.5	Existing installations	201
6	Subsequent Orders	202
6.1	Subsequent Orders for the Protection against Harmful Environmental Effects	202
6.1.1	Discretion Restriction	202

6.1.2	Intervention Prerequisite	202
6.1.3	Measures	203
6.1.4	Time Limits	203
6.1.5	EC Air Quality Standards	203
6.2	Subsequent Orders to Provide Precautions against Harmful Environmental Effects	204
6.2.1	Principle	204
6.2.2	Immediate Rehabilitation	204
6.2.3	Granting Rehabilitation Periods	205
6.2.4	Permit Waiver	206
6.2.5	Compensation	206
7	Cancellation of Regulations	207
8	Entry into Force	207
Annex 1	Determination of the Minimum Distance from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems with Regard to the Requirements under 4.8	208
Annex 2	Curves for Deriving Mass Flows on the Basis of Immission Projections	212
Annex 3	Dispersion Calculation	217
Annex 4	Organic Substances of Class I pursuant to 5.2.5	230
Annex 4.1	Organic Substances of Class I pursuant to 5.2.5	236
Annex 5	Equivalence Factors for Dioxins and Furans	248
Annex 6	VDI Guidelines and Standards in Relation to Emission Measurement Technique	249
Annex 7	S-Values	252

Figures:

Figure 1:	Minimum Distance Curve	155
Figure 2:	Stack Height Determination Nomogram	199
Figure 3:	Graph to Assess Value J	200
Figure 4:	Minimum Distance of Installations from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages by	

	Damage Caused by the Effects of Ammonia to these Protected Resources will Occur if the Minimum Distances are not Observed	210
Figure 5:	Arsenic and Inorganic Arsenic Compounds	212
Figure 6:	Lead and Inorganic Lead Compounds	213
Figure 7:	Cadmium and Inorganic Cadmium Compounds, Thallium and Inorganic Thallium Compounds	214
Figure 8:	Nickel and Inorganic Nickel Compounds	215
Figure 9:	Mercury and Inorganic Mercury Compounds	216

Tables:

Table 1:	Substance Immission Values in order to Ensure the Protection of Human Health	21
Table 2:	Immission Value for the Protection against Significant Nuisances or Significant Disadvantages due to Dustfall	24
Table 3:	Immission Values for the Protection of Ecosystems and the Vegetation against Sulphur Dioxide and Nitrogen Oxides	25
Table 4:	Immission Value for the Protection against Significant Disadvantages due to Hydrogen Fluoride	26
Table 5:	Irrelevant Additional Load Values for Immission Values for the Protection against Significant Disadvantages	27
Table 6:	Immission Values for Pollutant Deposition	28
Table 7:	Minor Mass Flows	31
Table 8:	Deposition Values as Basic Evidence Speaking in Favour of Special-Case Examination	43
Table 9:	Emission Standards for Sulphur Dioxide and Sulphur Trioxide, to be Indicated as Sulphur Dioxide, for Installations under 2.8	108
Table 10:	Factors for the Conversion of Stocking Density into Animal Live Weight, to be Indicated as Livestock Units	155
Table 11:	Ammonia Emission Factors for Installations for Rearing or Breeding of Livestock	208
Table 12:	Deposition Velocity for Gases	218
Table 13:	Deposition and Sedimentation Velocity for Particulate Matter	219
Table 14:	Mean Roughness Length Subject to the Land Use Classes Indicated in the CORINE Land Cover Inventory	220
Table 15:	Values for Meteorological Boundary-layer Profiles	223
Table 16:	Determination of D_h	224
Table 17:	Determination of the Monin–Obukhov Length L_M	225
Table 18:	Classification of Wind Velocities	228
Table 19:	Organic Substances of Class I pursuant to 5.2.5	230
Table 20:	Equivalence Factors for Dioxins and Furans	248
Table 21:	VDI Guidelines and Standards in Relation to Emission Measurement Technique	249
Table 22:	S–Values	252

1 Scope of Application

These Technical Instructions serve to protect the general public and the neighbourhood against harmful effects of air pollution on the environment and to provide precautions against harmful effects of air pollution in order to attain a high level of protection for the environment altogether.

The provisions of these Technical Instructions shall be observed when

- a) examining applications for a permit to construct and operate a new installation (§ 6 para. 1 of the Federal Immission Control Act) as well as to alter the location, nature or operation of an existing installation (§ 16 para. 1, also in connection with para. 4 of the Federal Immission Control Act),
- b) examining applications to grant a partial permit, to render a provisional decision or to grant permission of early start (§§ 8, 8a and 9 of the Federal Immission Control Act),
- c) examining whether an alteration requires a permit (§ 15 para. 2 of the Federal Immission Control Act),
- d) deciding about subsequent orders (§ 17 of the Federal Immission Control Act) and
- e) deciding about orders concerning the determination of the type and quantity of the emissions released from an installation and the immissions occurring within the sphere of influence of such installation (§ 26, also in connection with § 28 of the Federal Immission Control Act).

This Administrative Regulation does not regulate the protection against harmful effects of odour immissions on the environment; notwithstanding this, this Administrative Regulation regulates the prevention of harmful effects of odour emissions.

The requirements under 5.1 to 5.4 shall not apply to installations requiring a permit insofar as requirements are made to the prevention and to the determination of emissions of air pollutants in Ordinances issued by the Federal Government.

Insofar as, regarding the obligations of operators of installations not requiring a permit pursuant to § 22 para. 1 nos. 1 and 2 of the Federal Immission Control Act, it shall be assessed whether harmful effects of air pollutants exist, the principles of determination and measures to assess harmful effects on the environment established under 4 shall apply. A determination of immission indicators pursuant to 4.6 shall not occur insofar as an examination on an individual basis shows that the efforts to be made for this would lack proportionality. If installations not requiring a permit substantially contribute to the development of harmful effects on the environment, it is to be checked whether the possibilities given by state of the art techniques to prevent such development have been exhausted. Harmful effects on the environment, which cannot be avoided by applying state of the art techniques, shall be kept to a minimum. Insofar as, in order to fulfil the obligations arising from § 22 para. 1 nos. 1 and 2 of the Federal Immission Control Act, requirements may be made to installations not requiring a permit, the requirements for precautions under 5, which apply to installations requiring a permit, may also be used as a source of information. In the event of an order issued pursuant to §§ 24 and 25 of the Federal Immission Control Act, clean air plans shall be observed.

2 Definitions of Terms and Units of Measurement

2.1 Immissions

For the purposes of this Administrative Regulation, immissions shall be air pollutants affecting humans, animals, plants, soil, water, the atmosphere, cultural assets and any other property.

Immissions shall be indicated as follows:

- a) mass concentration, as mass of air pollutant per unit volume of polluted air; for gaseous substances, mass concentrations are to be referenced to 293.15 K and 101.3 kPa.
- b) deposition, as mass of pollutant per unit area of ground per unit time.

2.2 Immission Indicators, Assessment Points, Grid Points

Immission indicators describe the initial load, the additional load or the total load of the respective air pollutant. The initial load shall describe the pre-existing load of a pollutant. The additional load shall characterise the concentrations, which can be expected to be caused (for planned installations) or which are actually caused (for existing installations) by the planned project. With respect to planned installations, the indicator for the total load shall be calculated on the basis of the initial load plus the additional load indicators. With respect to existing installations, this indicator equals the initial load.

Assessment points shall be those points in the vicinity of an installation for which immission indicators, indicative of the total load, are determined. Grid points shall be those points in the vicinity of an installation for which the additional load is calculated (immission projection).

2.3 Immission Values

The annual immission value shall be the concentration or deposition value of a substance averaged over one year.

The daily immission value shall be the concentration value of a substance averaged over one calendar day, taking into account the respective frequency limit for excess values (number of days) over one year.

The hourly immission value shall be the concentration value of a substance, averaged over a whole hour (e.g., from 8 a.m. to 9 a.m.), taking into account the respective frequency limit for excess values (number of hours) over one year.

2.4 Waste Gas Volume and Waste Gas Volumetric Flow Rate

For the purposes of this Administrative Regulation, waste gases shall be carrier gases with solid, liquid or gaseous emissions.

For the purposes of this Administrative Regulation, any data regarding the waste gas volume and the waste gas volumetric flow rate are referenced to standard conditions (273.15 K and 101.3 kPa) after subtraction of the water vapour content unless explicitly indicated otherwise.

2.5 Emissions

For the purposes of this Administrative Regulation, emissions shall be air pollutants originating from an installation.

Emissions shall be indicated as follows:

- a) mass of substances or groups of substances emitted as related to the volume (mass concentration)
 - aa) of waste gas under standard conditions (273.15 K and 101.3 kPa) after subtraction of the water vapour content,
 - bb) of waste gas (wet) under standard conditions (273.15 K and 101.3 kPa) before subtraction of the water vapour content,

- b) mass of substances or groups of substances emitted per unit time as a mass flow (emitted mass flow); the mass flow is the total emission occurring in one hour of normal operation of an installation under operating conditions which are most unfavourable to the maintenance of air quality;
- c) quantity of fibres emitted (fibre dust concentration), as related to the volume of waste gas under standard conditions (273.15 K and 101.3 kPa) after subtraction of the water vapour content;
- d) ratio of the mass of emitted substances or groups of substances to the mass of products generated or processed or to stocking density (emission factor); the mass ratio shall take into account the total emissions from the installation occurring over one day of normal operation of such installation under operating conditions most unfavourable to the maintenance of air quality;
- e) amount of Odour Units of odorous substances emitted, as related to the volume (odorous substances concentration) of waste gas at 293.15 K and 101.3 kPa before subtraction of the water vapour content; the odorous substances concentration is the olfactometrically-measured ratio of volume flows when diluting a waste gas sample with neutral air down to the odour threshold, indicated as a multiple to the odour threshold.

2.6 Emission Ratio and Emission Reduction Ratio

The emission ratio shall be the ratio of the mass of an air pollutant emitted in waste gas to the mass of supplied fuels or input materials; it shall be provided as a percentage.

The emission reduction ratio shall be the ratio of the mass of an air pollutant emitted in waste gas to its mass supplied in crude gas; it shall be provided as a percentage. The odour reduction ratio is an emission reduction ratio.

2.7 Emission Standards and Emission Limits

Emission standards shall provide the basis for emission limits.

The emission limits shall be established in the letter of permit or in a subsequent order as

- a) permissible fibre dust, odorous substances or mass concentrations of air pollutants in waste gas provided that
 - aa) any daily mean values do not exceed the established concentration level and
 - bb) any half-hourly mean values do not exceed twice the established concentration level,
- b) permissible mass flows, as related to one hour of operation,
- c) permissible mass ratios, as related to one day (daily mean values),
- d) permissible emission ratios, as related to one day (daily mean values),
- e) permissible emission reduction ratios, as related to one day (daily mean values), or
- f) any other requirements to provide precaution against harmful effects of air pollutants on the environment.

2.8 Units and Abbreviations

µm	micrometre:	1 µm = 0.001 mm
mm	millimetre:	1 mm = 0.001 m
m	metre:	1 m = 0.001 km
km	kilometre	
m ²	square metre	
ha	hectare:	1 ha = 10,000 m ²
l	litre:	1 l = 0.001 m ³
m ³	cubic metre	
ng	nanogram:	1 ng = 0.001 µg
µg	microgram:	1 µg = 0.001 mg
mg	milligram:	1 mg = 0.001 g
g	gram:	1 g = 0.001 kg

kg	kilogram:	1 kg = 0.001 Mg (t)
Mg	megagram (same as t: tonne)	
s	second	
h	hour	
d	day (calendar day)	
a	year	
°C	degrees Celsius	
K	Kelvin	
Pa	pascal:	1 Pa = 0.01 mbar (millibar)
kPa	kilopascal:	1 kPa = 1,000 Pa
MPa	megapascal:	1 MPa = 1,000,000 Pa
kJ	kilojoule	
kWh	kilowatt hour:	1 kWh = 3,600 kJ
MW	megawatt	
OU	odour unit	
OU/m ³	odorous substances concentration	
LU	livestock unit (1 livestock unit equals an animal live weight of 500 kg)	

2.9 Rounding Adjustment

Insofar as numerical values are to be checked in order to evaluate immissions or emissions (e.g. immission values, additional load values, irrelevance values, emission standards), the respective measurement variables and operands shall be computed with one-digit more accuracy than the numerical value used for evaluation. The last digit of the final result shall be adjusted (rounded) in compliance with No. 4.5.1 of DIN 1333 (February 1992 version) and it shall be supplied in the same unit of measurement and with the same number of digits as the numerical value.

2.10 Existing installations

For the purposes of this Administrative Regulation, existing installations shall be

1. installations for which – by 1 October 2002 -

- a) a permit for construction and operation pursuant to § 6 or § 16 of the Federal Immission Control Act or a permission of early start pursuant to § 8a of the Federal Immission Control Act has been granted and obligations pursuant to § 5 para. 1 nos. 1 or 2 of the Federal Immission Control Act are established in such permission,
 - b) a partial permit pursuant to § 8 of the Federal Immission Control Act has been issued or a provisional decision pursuant to § 9 of the Federal Immission Control Act has been rendered, insofar as obligations pursuant to § 5 para. 1 nos. 1 or 2 of the Federal Immission Control Act are established therein,
2. installations which require notification pursuant to § 67 para. 2 of the Federal Immission Control Act or which required notification pursuant to § 16 para. 4 of the Industrial Code before the Federal Immission Control Act entered into force.

3 General Principles for Granting a Permit, Provisional decisions and Permissions for Early Start

3.1 Examination of Applications for Permits to Construct and Operate New Installations

Pursuant to § 6 para. 1 no. 1 in connection with § 5 para. 1 nos. 1 and 2 of the Federal Immission Control Act, a permit for construction and operation of an installation requiring a permit shall only be granted if it is ensured that the installation is constructed and operated in a way that

- a) the air pollution originating from the installation cannot induce harmful environmental effects for the general public and the neighbourhood and
- b) precautionary measures have been taken against harmful environmental effects, which may be caused by air pollution originating from this installation.

As to the examination of the prerequisites for granting a permit, 4 and 5 of this Administrative Regulation shall apply.

3.2 Examining Applications to Grant a Partial Permit (§ 8 of the Federal Immission Control Act) or to Render a Provisional Decision (§ 9 of the Federal Immission Control Act)

Insofar as examination refers to an object with regard to which a partial permit is applied for or to the occurrence of specific prerequisites for granting a permit in a procedure to render a provisional decision, 3.1 shall apply.

In the event of a provisional decision about a site, it shall be examined pursuant to 3.1 whether there are obstacles to the construction and operation of an installation of the type envisaged on the site stated which are connected to clean-air maintenance.

In evaluating the entire installation, as it is stipulated by §§ 8 and 9 of the Federal Immission Control Act, the examination shall be restricted to whether irremovable obstacles to the project exist which are connected to clean-air maintenance. In order to evaluate the basic eligibility for granting a permit of an installation, it shall suffice

to establish that the prerequisites of 3.1 can be met by technical or operational measures; notwithstanding this, applying such measures may not alter the type of project.

3.3 Examination of Applications for Permission of Early Start (§ 8a of the Federal Immission Control Act)

Permission for early start to construct an installation shall only be granted if a decision in favour of the applicant can be expected. In this context, a summary examination of whether 4 and 5 are observed shall occur.

A positive statement may also be made if the requirements of clean-air maintenance can only be met if imposed conditions which are still to be established are observed; in this event, however, it must be excluded that such obligations may affect the construction work approved pursuant to § 8a of the Federal Immission Control Act to an extent which poses their implementation into question.

3.4 Examining whether an Alteration requires a Permit (§ 15 Para. 2 of the Federal Immission Control Act)

If an envisaged alteration of location, nature or operation of an installation requiring a permit is notified, it shall be examined whether or not such alteration requires a permit. This shall be the case if the alteration can lead to disadvantageous effects on the resources protected under § 1 of the Federal Immission Control Act, which may be relevant for the examination pursuant to § 6 para. 1 no. 1 of the Federal Immission Control Act unless the adverse effects are obviously minor and fulfilment of the obligations arising from § 6 para. 1 no. 1 of the Federal Immission Control Act is guaranteed (§ 16 para. 1 of the Federal Immission Control Act).

3.1 shall not apply to the examination of whether notified alterations may lead to disadvantageous effects on clean-air maintenance. The reason for this is that examination shall not serve to clarify whether the prerequisites for a permit have been met; the latter shall be dealt within a possible permit procedure.

Additional air pollution requires – except in cases pursuant to the second sentence of § 16 para. 1 of the Federal Immission Control Act – a permit for alteration.

3.5 Examining Applications to Grant a Permit for Alteration

3.5.1 The Concept of Alteration

Pursuant to the first sentence of § 16 para. 1 of the Federal Immission Control Act, a substantial change of location, nature or operation of an installation requiring a permit shall require a permit. In this case, alterations shall only be deemed to comprise changes of the approved condition but not extended use of an existing permit.

3.5.2 Alterations as a Consequence of Subsequent Orders

A substantial alteration shall not require a permit if its implementation serves to carry out a subsequent order pursuant to § 17 of the Federal Immission Control Act in which it is laid down definitely in which way the location, nature or operation of the installation are to be altered.

3.5.3 Examination Volume

When deciding about granting a permit for alteration, 3.1 shall apply accordingly. The components of the installation and the process stages, which are intended to be altered, and the components of the installation and the process stages, which would be affected by such alteration, shall be examined. As far as other components and process stages of the installation are concerned, it shall be examined whether precautionary requirements of this Administrative Regulation can be met with the consent of the operator of the installation when implementing the alteration envisaged. Carrying out these various measures simultaneously may result in fewer efforts and in an early adaptation to the requirements of this Administrative Regulation.

3.5.4 Corrective Measures

A permit for alteration which has been applied for may not be refused even if not all immission values are observed after such alteration has been implemented but

- a) the alteration is exclusively or to a very high extent intended to reduce immissions,
- b) such alteration is not an obstacle to the observation of immission values at a later date and
- c) the actual situation does not require the permit to be revoked.

4 Requirements for the Protection against Harmful Effects on the Environment

4.1 Examining the Obligation to Protect

The provisions of 4 include

- immission values for the protection of human health, for the protection against significant nuisances or significant disadvantages and immission values for the protection against harmful effects on the environment due to deposition,
- requirements to determine the existing, additional and total load,
- established criteria which serve to evaluate immissions by drawing up comparisons with immission values,
- requirements for the implementation of a special-case examination.

They serve the examination whether the protection against harmful effects on the environment caused by air pollutants emitted by installation operation is ensured.

In examining whether the protection against harmful effects of air pollutants on the environment is ensured (3.1 para. 1 letter a)), the competent authority shall first establish the extent of determination obligations.

As to pollutants whose immission values are established in 4.2 to 4.5, such determination of immission indicators shall -

- a) in the event of a low quantity of emission mass flows (cf. 4.6.1.1),
- b) in the event of a low existing load (cf. 4.6.2.1) or
- c) in the event of an irrelevant additional load (cf. 4.2.2 letter a), 4.3.2 letter a), third sentence of 4.4.1, 4.4.3 letter a) and 4.5.2 letter a)) -

not apply. In these cases, it can be assumed that harmful effects on the environment cannot be caused by the installation unless sufficient evidence speaks in favour of a special-case examination pursuant to 4.8, despite low mass flows pursuant to letter a) or despite a low existing load pursuant to letter b).

The establishment of immission values takes into account a tolerance range for the determination of indicators. The immission values shall also apply with several pollutants occurring simultaneously or if pollutants are subject to chemical or physical transformation.

As to pollutants for which no immission values have been established, further determination shall only be necessary if the prerequisites of 4.8 are met.

4.2 Protection of Human Health

4.2.1 Immission Values

The protection against hazards for human health due to the air pollutants listed in Table 1 is ensured if the total load determined pursuant to 4.7 does not exceed the following immission values at any assessment point.

Table 1: Substance Immission Values in order to Ensure the Protection of Human Health

Substance/Group of Substances	Concentration $\mu\text{g}/\text{m}^3$	Averaging Period	Permissible Annual Frequency of Exceeded Values
Benzene	5	1 year	–
Lead and inorganic lead compounds, contained in suspended particulate matter (PM-10), to be indicated as Pb	0.5	1 year	–
Suspended particulate matter (PM-10)	40	1 year	–
	50	24 hours	35
Sulphur dioxide	50	1 year	–
	125	24 hours	3
	350	1 hour	24

Substance/Group of Substances	Concentration $\mu\text{g}/\text{m}^3$	Averaging Period	Permissible Annual Frequency of Exceeded Values
Nitrogen dioxide	40	1 year	–
	200	1 hour	18
Tetrachloroethene	10	1 year	–

If and insofar as European Communities Directives include limit values for the protection of human health for poly-aromatic hydrocarbons, arsenic, cadmium, nickel or mercury, the provisions of this number shall apply to these immission values as of the date on which the respective national provision by which such Directives are implemented enters into force. Up to such date, an immission value of $0.02 \mu\text{g}/\text{m}^3$ shall be valid for cadmium and inorganic cadmium compounds contained in suspended particulate matter (PM-10) and to be indicated as Cd, with an averaging period of one year.

4.2.2 Granting a Permit in case of Exceeded Immission Values

If the total load of an air pollutant listed under 4.2.1 which is determined in compliance with 4.7 exceeds the immission value at any assessment point, a permit may not be refused on the grounds of such excess value, provided that, with regard to the respective pollutant,

- a) the indicator for the additional load caused by emissions from the installation at this assessment point does not exceed 3.0 per cent of the annual immission value and if it is ensured by imposed condition that further measures for clean-air maintenance, including, in particular, measures which reach beyond the state of the art techniques, are carried out or
- b) it is ensured by imposed condition that, as a rule no later than 12 months after the installation has been put into operation, rehabilitation measures (dismantling, closing down, alteration) or other measures which ensure the compliance with the immission values pursuant to 4.2.1 are carried out at existing installations of the applicant or third parties.

Improved discharge conditions shall only be taken into account when evaluating the eligibility for granting a permit if the measures taken at the installations concerned in order to limit emissions of the respective pollutant comply with state of the art techniques.

4.2.3 Granting a Permit in case of Future Compliance with Immission Values

Even if the total load of an air pollutant listed under 4.2.1 which is determined in compliance with 4.7 exceeds the immission value at any assessment point, a permit may not be refused on the grounds of such excess value, provided that, with regard to the respective pollutant,

- a) in the legislation pursuant to Article 4, para. 5 of the Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management (OJ L 296 of 21 October 1996, p. 55), a respective limit value is defined the observation of which shall become mandatory on a certain date in the future and
- b) it is ensured that the installation will not considerably contribute to the immission value to be exceeded from the given date.

The requirement under para. 1 letter b) is met if

- a) by carrying out additional measures to reduce emissions from the installation, by using other raw materials, fuels or auxiliary materials, by altering the process runs or by improving the disposal conditions, the requirements under 4.2.2 can be met and if collateral permit provisions (§ 12 of the Federal Immission Control Act) stipulate that the measures which are necessary in order to meet these requirements are carried out before the date given in the EC Directive or
- b) the compliance with an immission value can be deemed ensured because of a clean air plan, because installations are closed down or because of alterations taking place at other sources, groups of sources or on the grounds of any other information.

The second sentence of 4.2.2 shall be applied to all cases of para. 2 *mutatis mutandis*.

4.3 Protection against Significant Nuisances or Significant Disadvantages due to Dustfall

4.3.1 Immission Value for Dust Deposition

The protection against significant nuisances or significant disadvantages due to dustfall is ensured if the total load determined in compliance with 4.7 does not exceed the immission values stated in Table 2 at any assessment point.

Table 2: Immission Value for the Protection against Significant Nuisances or Significant Disadvantages due to Dustfall

Group of Substances	Deposition g/(m²·d)	Averaging Period
Dust deposition (non-hazardous dust)	0.35	1 year

4.3.2 Granting a Permit in case of an Exceeded Immission Value

If the total load of dustfall which is determined in compliance with 4.7 exceeds the immission value at any assessment point, a permit may not be refused on the grounds of such excess value, provided that

- a) the indicator for the additional load caused by emissions from the installation at this assessment point does not exceed a value of 10.5 mg/(m²·d) – taken as an annual mean value -,
- b) it is ensured by imposed condition that, as a rule no later than 6 months after the commissioning of the installation, rehabilitation measures (dismantling, closing down or alteration) which ensure the observation of the immission values are carried out at existing installations of the applicant or of third parties,
- c) observation of the immission value can be expected after a transitional period because of measures connected to a clean air plan or

- d) a special-case examination pursuant to 4.8 reveals that due to special circumstances prevailing in this individual case significant disadvantages cannot be induced.

4.4 Protection against Significant Disadvantages, in particular Protection of the Vegetation and of Ecosystems

4.4.1 Immission Values for Sulphur Dioxide and Nitrogen Oxides

The protection against hazards for ecosystems due to sulphur dioxide or for the vegetation due to nitrogen oxides is ensured if the total load determined in compliance with 4.7 does not exceed the immission values listed in Table 3 at the relevant assessment points of 4.6.2.6 para. 6.

Table 3: Immission Values for the Protection of Ecosystems and the Vegetation against Sulphur Dioxide and Nitrogen Oxides

Substance	Concentration µg/m³	Averaging Period	Protected Resource
Sulphur dioxide	20	year and winter (1 October to 31 March)	ecosystems
Nitrogen oxides, to be indicated as nitrogen dioxide	30	1 year	vegetation

It shall be checked in compliance with 4.8 whether the protection against any other significant disadvantages due to sulphur dioxide or nitrogen oxides is ensured. Such examination shall not apply if the additional load values for sulphur dioxide and nitrogen oxides pursuant to 4.4.3 are not exceeded at any assessment point.

4.4.2 Immission Value for Hydrogen Fluoride; Ammonia

Notwithstanding para. 2, the protection against significant disadvantages due to hydrogen fluorides is ensured if the total load determined in compliance with 4.7 does not exceed the immission value listed in Table 4 at any assessment point.

Table 4: Immission Value for the Protection against Significant Disadvantages due to Hydrogen Fluoride

Substance/Group of Substances	Concentration $\mu\text{g}/\text{m}^3$	Averaging Period
Hydrogen fluorides and inorganic gaseous compounds of fluorine, to be indicated as fluorine	0.4	1 year

The protection against significant disadvantages arising from damage or harm caused to highly sensitive animals, plants and material goods is ensured if, with regard to hydrogen fluoride and inorganic gaseous compounds of fluorine, to be indicated as fluorine, an immission value of $0.3 \mu\text{g}/\text{m}^3$, averaged over one year, is met.

It shall be checked in compliance with 4.8 whether the protection against significant disadvantages due to damage or harm caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems is ensured.

4.4.3 Granting a Permit in case of Exceeded Immission Values

If the total load of an air pollutant listed under 4.4.1 and 4.4.2, which is determined in compliance with 4.7, exceeds any immission value listed in Table 3, in Table 4 or 4.4.2 para. 2 at any assessment point, a permit may not be refused on the grounds of such excess value, provided that, with regard to the respective pollutant,

- a) the indicator for the additional load caused by emissions from the installation at this assessment point does not exceed the values taken as yearly mean values which are listed in Table 5,
- b) it is ensured by imposed condition that, as a rule no later than 6 months after the commissioning of the installation, remediation measures (dismantling, closing down, alteration) which ensure the observation of the immission values of 4.4.1 or 4.4.2 are carried out at existing installations of the applicant or of third parties,
- c) compliance with the immission value can be expected after a transitional period because of measures connected to a clean air plan or
- d) a special-case examination pursuant to 4.8 reveals that due to special circumstances prevailing in this individual case significant disadvantages cannot be induced.

Table 5: Irrelevant Additional Load Values for Immission Values for the Protection against Significant Disadvantages

Substance/Group of Substances	Additional Load $\mu\text{g}/\text{m}^3$
Hydrogen fluorides and inorganic gaseous compounds of fluorine, to be indicated as fluorine	0.04
Sulphur dioxide	2
Nitrogen oxides, to be indicated as nitrogen dioxide	3

4.5 Protection against Harmful Effects of Pollutant Deposition on the Environment

4.5.1 Immission Values for Pollutant Deposition

The protection against harmful effects of the deposition of air pollutants on the environment, including the protection against adverse soil alterations, is ensured if

- a) the total load which is determined in compliance with 4.7 does not exceed any immission value listed in Table 6 at any assessment point and
- b) the evidence indicating that the relevant examination and action values of Annex 2 of the Federal Soil Protection and Contaminated Sites Ordinance of 12 July 1999 (BGBl. I, p. 1554) have been exceeded by air pollutants at any assessment point is insufficient.

Table 6: Immission Values for Pollutant Deposition

Substance/Group of Substances	Deposition $\mu\text{g}/(\text{m}^2 \cdot \text{d})$	Averaging Period
Arsenic and its inorganic compounds, to be indicated as arsenic	4	1 year
Lead and its inorganic compounds, to be indicated as lead	100	1 year
Cadmium and its inorganic compounds, to be indicated as cadmium	2	1 year
Nickel and its inorganic compounds, to be indicated as nickel	15	1 year
Mercury and its inorganic compounds, to be indicated as mercury	1	1 year
Thallium and its inorganic compounds, to be indicated as thallium	2	1 year

4.5.2 Granting a Permit in case of Exceeded Immission Values for Pollutant Deposition or Exceeded Examination and Action Values

If the total load of an air pollutant listed in Table 6 which is determined in compliance with 4.7 exceeds any immission value at any assessment point or if the examination and action values pursuant to 4.5.1 are exceeded, a permit may not be refused on the grounds of such excess value, provided that, with regard to the respective pollutant,

- a) aa) the indicator for the additional load caused by deposition of emissions from the installation at any assessment point amounts to more than 5 per cent of the respective immission value listed in Table 6 or
- bb) the emissions from the tapped sources of the installation, depending upon the respective stack heights, do not exceed the mass flows listed in Annex 2 after 8,760 hours of operation or, with a total number of hours of operation other than this, the mass flow equivalent which has been calculated accordingly,
- b) it is ensured by imposed condition that, as a rule no later than 6 months after the commissioning of the installation, remediation measures (dismantling, closing down, alteration) which ensure the compliance with the immission values pursuant to 4.5.1 or of the examination and action values are carried out on existing installations of the applicant or of third parties,
- c) compliance with these values can be expected after a transitional period because of measures connected to a clean air plan or
- d) a special-case examination pursuant to 4.8 reveals that due to special circumstances prevailing in this individual case significant disadvantages including adverse soil alterations cannot be induced.

4.5.3 Special Cases in case of Exceeded Examination and Action Values

If the examination and action values pursuant to 4.5.1 letter b), the additional load values pursuant to 4.5.2 letter a) aa) and the minor emission mass flows pursuant to 4.5.2 letter a) bb) are exceeded, it shall be checked by means of a special-case examination pursuant to 4.8 whether and to which extent, on the grounds of such exceeded examination and action values, adverse soil alterations may prevail which have been caused by air pollutants. If adverse soil alterations are due to the natural characteristics of the soil or to effects other than caused by air pollutants, e.g. fertilization, legal measures to protect the soil shall be taken into account in order to avoid or reduce adverse soil alterations.

4.6 Determination of Immission Indicators

4.6.1 General

4.6.1.1 Determination within the Permit procedure

It is unnecessary to determine the immission indicators within the permit procedure for the respective emitted pollutant if

- a) the emissions disposed of pursuant to 5.5 (mass flows) do not exceed the minor mass flows listed in Table 7 and
- b) the emissions not disposed of pursuant to 5.5 (diffuse emissions) do not exceed 10 per cent of the minor mass flows listed in Table 7,

insofar as a special geographic situation or special circumstances do not require to proceed otherwise. The mass flow pursuant to letter a) is based upon averaging over the operating hours of one calendar week under operating conditions most unfavourable for clean-air maintenance during normal operation.

When determining the mass flow, the emissions contained in waste gas from the entire installation shall be taken into account; in case of a significant alteration, the emissions from the respective parts of the installation and from those parts of the installation which will be affected by the alteration shall be taken into account unless such additional emissions lead to the minor mass flows to be indicated in Table 7 to

be exceeded for the first time. In this event, the emissions from the entire installation shall be taken into account.

Table 7: Minor Mass Flows

Pollutants	Minor mass flow kg/h
Arsenic and its compounds, to be indicated as As	0.0025
Benzo(a)pyrene* (as a main component of poly-aromatic hydrocarbons)	0.0025
Benzene	0.05
Lead and its compounds, to be indicated as Pb	0.025
Cadmium and its compounds, to be indicated as Cd	0.0025
Hydrogen fluorides and inorganic gaseous compounds of fluorine, to be indicated as F	0.15
Nickel and its compounds, to be indicated as Ni	0.025
Mercury and its inorganic compounds, to be indicated as mercury	0.0025
Sulphur oxides (sulphur dioxide and sulphur trioxide), to be indicated as SO ₂	20
Dust (regardless of dust contents)	1
Nitrogen oxides (nitrogen monoxide and nitrogen dioxide), to be indicated as NO ₂	20
Tetrachloroethene	2.5
Thallium and its compounds, to be indicated as Tl	0.0025

* The minor mass flow for this pollutant shall only be relevant when an immission value for poly-aromatic hydrocarbons is established pursuant to 4. At the latest, this will be the case with the introduction of a respective immission value pursuant to 4.2.1 para. 2.

4.6.1.2 Determination within the Monitoring Procedure

In order to determine the total load within the monitoring procedure, the same procedure shall be applied as in determining the existing load within the permit procedure (cf. 4.6.2). If the possibility of imposing obligations on various polluters is considered, the immission proportions caused by each polluter shall be determined insofar as this is necessary in order to ensure due exercise of discretion. In this context, immissions shall be measured and the meteorological factors relevant to dispersion determined at the same time. The wind direction sectors and the location of the measuring sites and grid points shall be selected in a manner by which to ensure that the immissions measured and/or calculated can be allocated to the respective polluters.

4.6.2 Existing Load Determination

4.6.2.1 Criteria for the Need to Determine the Existing Load

With the competent authority's consent, it is not necessary to determine the existing load by carrying out individual measurements if it is established, subsequent to analysing the results obtained at measuring stations belonging to the immission measuring networks of the *Länder* and subsequent to an estimation or determination of the additional load or on the grounds of any other information, that the immission values for the respective pollutant can be observed at the maximum load point after the commissioning of the installation.

Moreover, notwithstanding para. 3, determination shall not be necessary if on the grounds of other information previously obtained, e.g. previous measurements, measurement results from similar areas, results of screening measurements or results of dispersion calculations or estimations, it can be established that, with regard to the respective pollutant, the following values apply at the maximum initial load point:

- the annual mean value is below 85 per cent of the concentration value,
- the maximum 24-hour value is below 95 per cent of the 24-hour concentration value (except for suspended particulate matter (PM₁₀)) and
- the maximum 1-hour value is below 95 per cent of the 1-hour concentration value,

- with regard to suspended particulate matter (PM₁₀), the 24-hour concentration value of 50 µg per m³ of air, averaged over the past three years, is not exceeded more frequently than 15 times per year.

Para. 2 shall not apply if, due to significant emissions from diffuse sources or due to special conditions in terms of operation, topography or meteorology, non compliance with immission values cannot be excluded.

4.6.2.2 Measurement Planning

Measurement shall occur in compliance with a measurement plan agreed upon with the competent authority; in such a plan, all assessment points, objects of measurement, measurement period, measurement method, measurement frequency, duration of individual measurement in relationship to the respective sources and/or heights of sources, while taking into account the meteorological situation, shall be established.

4.6.2.3 Measuring Height

As a rule, immissions shall be measured at a height of 1.5 to 4 metres above ground and at a lateral distance of 1.5 metres from buildings. In wooded areas, it may be necessary to define measurement points at larger heights, depending on the height of the timber.

4.6.2.4 Measurement Period

As a rule, measurement periods shall stretch over 1 year. A measurement period may be reduced up to a total duration of 6 months if this is to cover the season with the most immissions to be expected. In other respects, shorter measurement periods are possible if it becomes clear during a measurement process that the applicant may be exempted from the obligation of immission measurement pursuant to 4.6.2.1.

4.6.2.5 Assessment Area

The assessment area shall be the area which is perfectly located within a circle around the centre of emission drawn by a radius equal to 50 times the actual stack height and in which the additional load, with regard to a grid point, exceeds 3.0 per cent of the long-time concentration value.

Para. 1 shall apply with a disposal height for emissions of less than 20 metres above ground provided that the radius equals or exceeds 1 kilometre.

4.6.2.6 Assessment Point Determination

Within the assessment area, assessment points shall be determined, in compliance with the following paragraphs, in a manner by which it is ensured that, in the competent authority's view, an assessment of the total load is facilitated at the points with the supposed maximum relevant load with regard to protected resources which are not only temporarily exposed to such load at this place. Measurement, which can only represent a very small area, shall be avoided. Therefore, when selecting the assessment points, the load level, its relevance to assess the eligibility for granting a permit and the exposition shall be examined.

Firstly, the grid points with calculated maximum additional loads shall be carried over from the dispersion calculation carried out during the permit procedure pursuant to Annex 3 and/or from a dispersion calculation carried out analogously during the monitoring procedure. As to pollutants for which only one immission value, a yearly mean value, has been established, only the calculated annual mean value shall be taken into account, as to pollutants with maximum daily or hourly values, such values shall be taken into account as well.

Secondly, the existing load of the assessment area caused by other sources (including domestic heating and traffic) shall be assessed while taking into consideration the load structure. In particular, the possible influence of existing low sources including roads shall be estimated. In doing so, information obtained previously shall be drawn

upon. Additional determination in order to estimate the existing load shall only occur insofar as the efforts needed to perform such determination are proportional.

Thirdly, the points with the highest total load to be expected shall be defined on the grounds of the determination pursuant to paras. 2 and 3. As a rule, two assessment points shall be selected from the range of points thus obtained so that an evaluation of the supposed maximum risk due to long-term exposure and due to an exposure to peak loads is facilitated. If only an immission value regarding the annual impact is established for the pollutant in question, one assessment point will, as a rule, suffice.

With a highly inhomogeneous structure of the existing load (e.g. complex terrain areas, special meteorological conditions, assessment areas influenced by several low polluters), the number of assessment points may be required to exceed two. If it is revealed that the immission structures of short-term peak loads and long-term load are identical, one assessment point may suffice.

Assessment points at which to check the immission values under 4.4.1 shall be defined in a way by which to ensure that they are located at a distance of more than 20 km from agglomerations or 5 km from other built-up areas, industrial installations or roads.

The definition of assessment points shall be explained in the measurement plan.

4.6.2.7 Measurement Method

As a rule, the existing load shall be determined continuously since intermittent measurement methods can only facilitate annual mean values to be derived with sufficient accuracy. Therefore, intermittent measurement methods shall only be considered if only an immission value for annual impact is established for the respective pollutant or if a determination of short-term peak load is dispensable.

Besides the methods, which are described in Ordinances or Administrative Regulations pertaining to the Federal Immission Control Act, in VDI Guidelines,

DIN, CEN or ISO standards, any other method of proven identical accuracy, may be applied.

4.6.2.8 Measurement Frequency

With continuous measurement, a minimum availability of 75 per cent shall be ensured as regards hourly mean values. If less than 90 per cent of the hourly mean values are available, the frequency of excess limit values (determined pursuant to 4.7.2 letter b) and 4.7.3 letter b)) shall be expanded in order to obtain 100 per cent. These requirements to availability shall also apply to daily mean values obtained in measuring the suspended particles load.

With intermittent measurement, the number of measurement values per measurement point shall be no less than 52. Insofar as experience shows that the requirement of an EC Directive to the data quality of the annual mean value to be derived from 52 measuring values is not met, the number of measurement values shall be increased accordingly. In order to assess the data quality of an annual mean value, DIN ISO 11222 (draft, April 2001 version) shall be drawn upon in connection with DIN V ENV 13005 (June 1999 version). The sampling periods shall be distributed evenly over the measurement period in order to ensure that sampling results are representative of the whole period.

4.6.2.9 Measurement Values

The measurement values shall be determined in compliance with the time spans to which immission values are to refer, i.e. annual mean values, daily mean values and hourly mean values. In case of intermittent measurement methods, the sampling period shall, as a rule, be one hour.

4.6.2.10 Screening Measurements

Reducing the effort necessary for measurement pursuant to 4.6.2.7 and 4.6.2.8 shall be taken into consideration in order to

- secure an annual mean value of a size known from information previously obtained or
- provide proof, by means of screening measurement, that at sites where the load criteria pursuant to 4.6.2.1 are supposed to be met or exceeded, such criteria are met or exceeded. Subsequently, depending on the result, it may be necessary to carry out measurement pursuant to 4.6.2.7.

4.6.3 Existing Load Indicators

4.6.3.1 General

Immission measurement or similar determination of immission load may be drawn upon if such measurement or determination dates back no longer than 5 years and if the circumstances decisive for evaluation have not significantly changed over this period.

The existing load indicators shall be calculated on the basis of the hourly mean values obtained through continuous measurement and/or intermittent measurement methods at each assessment point.

4.6.3.2 Determining the Existing Load Indicators

The indicator for annual existing immission load (AEIL) shall be the annual mean value derived from all hourly mean values.

The indicator for daily existing immission load (DEIL) shall be the excess frequency (number of days) by which the concentration value for 24-hour immission impact is exceeded.

The indicator for hourly existing immission load (HEIL) shall be the excess frequency (number of hours) by which the concentration value for 1-hour effective immission is exceeded.

4.6.3.3 Evaluation of the Measurement

The AEIL, DEIL and HEIL indicators shall be derived from all measurement values insofar as immission values are established for the respective pollutants and their annual, daily and hourly impact.

When indicating the DEIL and HEIL, the respective maximum daily and/or hourly mean value measured shall also be indicated.

4.6.4 Additional Load Indicators

4.6.4.1 General

The additional load indicators shall be derived from mathematical immission projections on the grounds of a mean annual frequency distribution or of a representative annual time series of wind direction, wind velocity and dispersion class. In this context, the calculating method pursuant to Annex 3 shall be applied.

4.6.4.2 Determination of the Additional Load Indicators

The indicator for the annual additional immission load (AAIL) shall be the arithmetic mean derived from all individual contributions calculated for each grid point.

The indicator for the daily additional immission load (DAIL) shall be

- ten times the AAIL arithmetic means calculated for each grid point, if a mean annual frequency distribution of meteorological parameters is used, or
- the maximum daily mean value calculated for each grid point, if a representative meteorological time sequence is used.

The indicator for the hourly additional immission load (HAIL) shall be the maximum hourly mean value calculated for each grid point.

4.7 Observation of Immission Values

4.7.1 Annual Immission Value

The annual immission value for a pollutant is met if the total of the existing load and the additional load measured at assessment points is less than or equal to the annual immission value.

4.7.2 Daily Immission Value

- a) In any event, the daily immission value is met
 - if the AEIL existing load indicator does not exceed 90 per cent of the annual immission value and
 - if the DEIL indicator reaches, as a maximum, 80 per cent of the excess frequency of the daily immission value permissible and
 - if all DAIL daily values do not exceed the equivalent of the difference between the daily immission value (concentration) and the annual immission value.

- b) In all other respects, the daily immission value is met if the total load at the respective grid points – determined by adding the yearly additional load to the daily existing load concentration values – is less than or equal to the immission concentration value for 24 hours or if an analysis shows that the permissible excess frequency is met unless special circumstances of the individual case, e.g. rarely occurring high emission levels, require to evaluate otherwise.

4.7.3 Hourly Immission Value

- a) In any event, the hourly immission value is met
 - if the AEIL existing load indicator does not exceed 90 per cent of the annual immission value and
 - if the HEIL indicator reaches, as a maximum, 80 per cent of the excess frequency of the permissible hourly immission value and
 - if no HAIL hourly values calculated for all grid points exceed the equivalent of the difference between the hourly immission value (concentration) and the annual immission value.

- b) In all other respects, the hourly immission value is met if the total load at the respective grid points – determined by adding the yearly additional load to the hourly existing load concentration values – is less than or equal to the immission concentration value for 1 hour or if an analysis shows that the permissible excess frequency is met unless special circumstances of the individual case, e.g. rarely occurring high emission levels, require to evaluate otherwise.

4.8 Determination without Established Immission Values and in Special Cases

In case of air pollutants for which no immission values are established under 4.2 to 4.5 and in those cases in which reference is made to 4.8 it is necessary to examine whether harmful effects on the environment may be induced if sufficient evidence speaks in favour of this.

Such examination shall serve the purpose of

- a) establishing to which impacts the air pollution originating from the installation leads in the evaluation area; type and extent of such establishment are governed by the principle of proportionality;
- and
- b) evaluating whether such impacts are to be deemed as hazards, significant disadvantages or significant nuisances to the general public or the

neighbourhood; such evaluation shall be based upon the state of science and general experience of life.

When evaluating whether a hazard, disadvantage or nuisance is significant, the following shall apply:

- a) Hazards to human health shall always be considered significant. Whether hazards to animals and plants, soil, water, atmosphere as well as cultural and any other property shall be considered significant shall be evaluated in compliance with letters b) and c) hereof.
- b) Disadvantages or nuisances shall be considered significant to the general public if they affect public welfare by their type, extent or duration.
- c) Disadvantages or nuisances shall be considered significant to the neighbourhood if they are intolerable due to their type, extent or duration.

When evaluating pursuant to letters b) and c), special attention shall be paid to the following:

- the use of land established in land-use plans,
- identifications under aspects of land and technical planning,
- findings and decisions contained in clean air plans,
- possible imprints of the respective pollutant,
- the use of land with respect to the principle of mutual respect governing good neighbourly relations,
- restrictions for use agreed or imposed upon and
- remediation measures carried out or to be carried out at existing installations of the applicant or of third parties which are connected to the project.

When examining whether the protection against significant disadvantages due to damage or harm caused by the effects of ammonia on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems Annex 1 Figure 4 shall be drawn upon. In this context, it is considered evidence for the occurrence of significant disadvantages if minimum distances are not observed.

Moreover, if there is evidence speaking in favour of the protection against significant disadvantages due to nitrogen deposition causing harm or damage to sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems (e.g. heathland, moorland,

forests) not being ensured, a supplementary examination shall be carried out. In this context, it shall be estimated, while taking into account the load structure, whether the installation contributes considerably to nitrogen deposition. When a livestock density of 2 livestock units per hectare of a rural district (*Landkreis*) is exceeded, this shall be deemed a point to be taken into consideration as evidence. During such examination, special attention shall be paid to the type of soil, the type of vegetation prevailing and the degree of nitrogen supply.

If evidence is obtained speaking in favour of the occurrence of significant disadvantages due to harm or damage caused by the effects of ammonia or by nitrogen deposition on sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems, the individual case shall be examined.

If a special-case examination pursuant to 4.5.2 letter d) is to be carried out, it shall, in particular, be examined whether and to which extent the deposition, with current or planned use (e.g. as a playground, as a residential area, as a park or leisure installation, as plots of land for industrial or commercial purposes and as cropland or grassland), may lead to harmful effects on the environment by indirectly affecting humans, animals, plants, foodstuffs and animal feed. As a rule, the deposition values ensure the protection of playgrounds and residential areas. As to other areas, higher deposition values may be drawn upon. In this context, the deposition values listed in Table 8 shall serve as basic evidence for the occurrence of harmful environmental effects on cropland or grassland.

Table 8: Deposition Values as Basic Evidence Speaking in Favour of Special-Case Examination

Substance/Group of Substances	Croplands $\mu\text{g}/(\text{m}^2\cdot\text{d})$	Grassland $\mu\text{g}/(\text{m}^2\cdot\text{d})$
Arsenic	1,170	60
Lead	185	1,900
Cadmium	2.5	32
Mercury	30	3
Thallium	7	25

5 Requirements to Provide Precautions against Harmful Effects on the Environment

5.1 General

5.1.1 Contents and Meaning

The following provisions contain

- emission standards, which can be avoided by applying state of the art techniques,
- requirements to emission reduction in compliance with state of the art techniques,
- other requirements to provide precautions against harmful effects of air pollutants on the environment,
- methods to determine emissions and
- requirements to the disposal of waste gases.

The provisions of 5.2 in connection with 5.3 shall apply to all installations. Insofar as divergent provisions are stipulated in 5.4, these provisions shall rank before the respective provisions of 5.2, 5.3 or 6.2. Insofar as soot levels, mass ratios, emission ratios, emission reduction ratios or turnover ratios are established for specific substances or groups of substances, the requirements to mass concentrations of these substances or substance groups under 5.2 shall not apply. In any other respects, the requirements under 5.2, 5.3 or 6.2 shall remain unaffected. Supplementary to this, the emission minimization principle pursuant to 5.2.7 shall be taken into account.

The provisions take into account possible shifts of adverse effects from one protected resource to another; they are intended to ensure a high level of environmental protection altogether.

Insofar as Reference Documents about Best Available Techniques (BAT Reference Documents) of the European Commission, which in the framework of information exchange pursuant to Art. 16 para. 2 of the Council Directive of 24 September 1996 concerning Integrated Pollution Prevention and Control (IPPC Directive, 96/61/EC,

OJ L 257 of 10 October 1996, p. 26) were available when this Administrative Regulation was issued, the information contained therein has been taken into account while drawing up the requirements under 5.2, 5.3, 5.4 and 6.2.

Insofar as new or revised BAT Reference Documents are published by the European Commission after issuance of this Administrative Regulation, the requirements stipulated in this Administrative Regulation are not annulled by this. An advisory committee established by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety which consists of expert representatives of the parties concerned pursuant to § 51 of the Federal Immission Control Act shall examine to which extent the information contained in the BAT Reference Documents points to requirements to emission reduction which reach beyond or supplement the requirements stipulated in this Administrative Regulation. This committee shall comment upon the extent of the progress made concerning state of the art techniques in respect to the provisions established in this Administrative Regulation or upon the extent by which the provisions established in this Administrative Regulation require to be supplemented. Insofar as the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has given notice about the progress achieved in respect of state of the art techniques or about a necessary supplement pursuant to the procedure stipulated by § 31a para. 4 of the Federal Immission Control Act, the authorities in charge of granting a permit and supervision shall no longer be bound to the requirements of this Administrative Regulation conflicting with such publication. In these cases, the competent authorities shall take into account the progress achieved in respect of state of the art techniques when taking decisions.

As to installations, which exist only at one German site, no respective provisions are stipulated under 5.4; in such a case, the competent authority shall have sole responsibility to evaluate the special technical features of such installation.

If requirements to take precautions against harmful effects of air pollution on the environment have already been issued for an installation requiring a permit on a case-to-case basis which exceed the requirements under 5.1 to 5.4, such requirements shall remain binding in respect of § 5 para. 1 no. 2 of the Federal Immission Control Act.

Insofar as 5.2 or 5.4 do not contain any or only incomplete provisions regarding emission reduction, BAT Reference Documents or guidelines or standards of the VDI/DIN Air Pollution Prevention Manual shall be used as a source of information when determining the state of the art techniques on a case-to-case basis.

5.1.2 Taking into Account the Requirements during the Permit Procedure

The requirements in compliance with the provisions of 5 shall be established for each emission source and for each air pollutant substance or substance group in the letter of permit insofar as a relevant proportion of such substances or substance groups is contained in crude gas. If the waste gases from several parts of the installation are gathered (collector line or collector stack), the requirements to reduce emissions shall be established in a way to ensure that the emissions generated do not exceed an emission level of the respective gases where they are disposed of individually. A substance is contained in the crude gas of an installation to a relevant extent if it cannot be excluded that a requirement under 5 is exceeded due to the composition of the crude gas.

If the observation of a specific mass flow or of a specific mass concentration is stipulated in 5, either the mass flow or –in case of an exceeded permissible mass flow – the mass concentration shall be limited in the letter of permit unless 5.2 or 5.4 contain explicit provisions stipulating that both the mass flow and the mass concentration shall be limited.

Emission limits in compliance with the permissible mass concentrations or mass flows contained in 5.2 or 5.4 can be waived if permissible mass ratios (e.g. g/Mg of the product generated, g/kWh of fuel energy used) are established instead and if it is proved by comparative observations involving state of the art process and waste gas purification cleaning techniques that higher emission mass flows do not occur.

Special arrangements shall be drawn up for start-up or shut-off processes during which values exceeding twice the established emission limit cannot be avoided. In particular, such processes include processes during which

- a waste gas purification facility has to be avoided for safety reasons (danger of deflagration, clogging-up or corrosion),
- a waste gas purification facility is not fully effective because of insufficient waste gas throughput or
- waste gas collection and purification is not feasible or only insufficiently feasible as receptacles are charged or emptied during intermittent manufacturing processes.

Insofar as averaging periods other than those stipulated in 2.7 are required for emission limits because of operational or metrological reasons (e.g. batch operation, relatively long calibration periods), these shall be established accordingly.

If waste gas from a facility is used as combustion air or as a charge material for another installation, special arrangements shall be drawn up.

The amounts of air fed into a component of the installation in order to cool or thin the waste gas shall not be considered in determining the mass concentration. Insofar as emission standards refer to the oxygen content of waste gas, the mass concentrations measured in the waste gas shall be converted in line with the following equation:

$$E_B = \frac{21 - O_B}{21 - O_M} \times E_M$$

The following definitions shall apply:

E_M mass concentration measured,

E_B mass concentration, as related to reference oxygen content,

O_M oxygen content measured,

O_B reference oxygen content.

If waste gas purification facilities are used to reduce emissions downstream, conversion may occur with regard to the substances for which the waste gas purification facility is operated only for those periods during which the oxygen content measured exceeds the reference oxygen content. In case of combustion processes involving pure oxygen or oxygen-enriched air, special arrangements shall be drawn up.

5.1.3 Basic Requirements for Integrated Pollution Prevention and Control

In order to ensure integrated emission prevention or minimization, techniques and measures shall be applied through which emission levels to air, water and soil are prevented or limited and through which a high level of environmental protection is achieved altogether; facilities safety, the impact of waste disposal on the environment and the economical and efficient use of energy shall be taken into account.

Unavoidable waste gases shall be collected at their place of origin insofar as the efforts necessary to achieve this are proportional. Any measures taken in order to limit emissions must be in compliance with state of the art techniques. The requirements of this Administrative Regulation may not be met by applying measures by means of which environmental pollution is shifted to other media such as water or soil, despite the state of the art. These measures shall be targeted at both reducing the mass concentrations and the mass flows or mass ratios of the air pollutants originating from a facility. They shall be applied accordingly while the installation is in operation.

When establishing the requirements, special attention shall be paid to the following:

- selecting integrated process technologies with maximum product yields and minimum emission levels to the environment altogether,
- process optimisation, e.g. by optimising the use of charge materials and through coupled production,
- substituting carcinogenic, mutagenic or reproduction toxic charge materials,
- reducing the waste gas volume, e.g. by applying air circulation systems, while taking into account the requirements of work safety legislation,

- saving energy and reducing emissions of gases with an impact on climate, e.g. by applying energetic optimisation methods in planning, building and operating facilities, through installation-internal energy recovery systems, by applying heat-insulation measures,
- preventing or reducing emissions of ozone-depleting substances, supplementary to the measures stipulated by the Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 (OJ L 244/1 of 29 September 2000), e.g. by substituting these substances, casing the installations, encapsulating parts of installations, generating a depression in encapsulated spaces and preventing installations leakage, collecting the substances during waste processing, applying optimised waste gas purification technologies and due disposal of recovered substances and of waste,
- optimising start-up and shut-off processes and any other special conditions of operation,
- the requirements of animal protection and of the physiological conditions of animals.

If substances pursuant to 5.2.2 Classes I or II, 5.2.4 Classes I or II, 5.2.5 Class I or 5.2.7 may be emitted, the charge materials (raw and auxiliary materials) shall be selected, if possible, in a way as to ensure that emissions are kept at a low level.

Process cycles, which may lead to increased emissions of substances pursuant to 5.2.2 Classes I or II or pursuant to 5.2.7 due to accumulation, shall, if possible, be avoided by applying technical or operational measures. Insofar as these process cycles are necessary for operation, e.g. when reclaiming production residues in order to recover metals, measures shall be taken in order to avoid increased emission levels, e.g. by means of targeted outward transfer of substances or by installing highly effective waste gas purification facilities.

Operational processes, which involve cut-offs or the omission of waste gas purification facilities, shall be designed and operated with a view to low emission levels and be specially monitored by recording suitable process indicators. Measures shall be provided for possible breakdowns of emission-reducing devices so as to

reduce emissions immediately as much as possible while taking into consideration the principle of proportionality.

5.2 General Requirements to Emission Limits

5.2.1 Total Dust, including Micro Dust

The dust emissions contained in waste gas may not exceed a

mass flow of	0.20 kg/h
or a	
mass concentration of	20 mg/m ³ .

Even with a mass flow smaller than or equal to 0.20 kg/h, a mass concentration of 0.15 g/m³ in waste gas may not be exceeded.

Notwithstanding this, 5.2.5 para. 3 shall apply.

5.2.2 Inorganic Particulate Matter

With regard to the inorganic particulate matter listed hereunder, the following total mass concentrations or mass flows contained in waste gas may not be exceeded; notwithstanding this, the requirements for Class I substances shall refer to individual substances:

Class I

— mercury and its compounds, to be indicated as Hg	
— thallium and its compounds, to be indicated as Tl	
mass flow, per substance	0.25 g/h
or	
mass concentration, per substance	0.05 mg/m ³ ;

Class II

- lead and its compounds, to be indicated as Pb
 - cobalt and its compounds, to be indicated as Co
 - nickel and its compounds, to be indicated as Ni
 - selenium and its compounds, to be indicated as Se
 - tellurium and its compounds, to be indicated as Te
- | | |
|--------------------|-------------------------|
| mass flow | 2.5 g/h |
| or | |
| mass concentration | 0.5 mg/m ³ ; |

Class III

- antimony and its compounds, to be indicated as Sb
 - chromium and its compounds, to be indicated as Cr
 - easily soluble cyanides (e.g. NaCN), to be indicated as CN
 - easily soluble fluorides (e.g. NaF), to be indicated as F
 - copper and its compounds, to be indicated as Cu
 - manganese and its compounds, to be indicated as Mn
 - vanadium and its compounds, to be indicated as V
 - tin and its compounds, to be indicated as Sn
- | | |
|--------------------|-----------------------|
| mass flow | 5 g/h |
| or | |
| mass concentration | 1 mg/m ³ . |

As to an occurrence of substances belonging to different classes, irrespective of para. 1, the total emission standards of Class II may not be exceeded if substances of Classes I and II occur simultaneously in waste gas and the emission standards of Class III may not be exceeded if substances of Classes I and III, of Classes II and III or of Classes I to III occur simultaneously in waste gas.

The inorganic particulate matter not listed under names (substances of categories K3, M3, RE3 or RF3, risk phrases R 40, R 62 or R 63) for which there is good cause to believe it holds a potential of being carcinogenic, mutagenic or reproduction toxic shall be allocated to Class III. In this context,

- the Index of Substances which can Cause Cancer, Genetic Changes or Limit Reproductive Capability (Technical Rules for Hazardous Substances 905) and
- Annex I of the Council Directive 67/548/EEC that corresponds to the list of hazardous substances pursuant to § 4a para. 1 of the Ordinance on Hazardous Substances (*Gefahrstoffverordnung, GefStoffV*)

shall be taken into account. In the event of classification differences among categories K, M or R, the stricter classification stipulated by the Technical Rules for Hazardous Substances or in the Ordinance on Hazardous Substances shall be binding.

As long as the Technical Rules for Hazardous Substances or the Ordinance on Hazardous Substances do not contain any classification or evaluation, assessments by recognized scientific panels may be drawn upon, e.g. the classification of the Senate Commission for the Investigation of Health Hazards of Chemical Substances in the Work Area of the *Deutsche Forschungsgemeinschaft*. Moreover, the classifications of § 4a para. (3) of the Ordinance on Hazardous Substances shall apply.

Insofar as preparations are subject to classification pursuant to § 4b of the Ordinance on Hazardous Substances, their components and the respective proportions thereof shall be determined and taken into account when establishing the requirements to limit the emission level.

If waste gas disposal ensues under physical conditions (pressure, temperature) under which substances may be liquid or gaseous, the mass concentrations or mass flows pursuant to para. 1 shall be observed with regard to the total amount of solid, liquid and gaseous emissions.

5.2.3 Particulate Emissions during Transshipment, Storage or Treatment of Solid Substances

5.2.3.1 General

Suitable requirements shall be made to emission reduction with regard to installations at which solid substances are loaded or unloaded, conveyed, transported, treated, prepared or stored if these substances may cause dust emissions due to their density, grain size distribution, grain shape, surface condition, abrasion resistance, shearing and breaking strength, composition or due to their low humidity content.

When establishing such requirements in particular

- the type and properties of solid substances and of their components (e.g. hazardousness and toxicity rating pursuant to § 4 of the Ordinance on Hazardous Substances, possible effects on soil and water, possible formation of explosive mixtures of dust/air, potentially dusty nature, humidity),
- the transshipment equipment or the transshipment method,
- the mass flow and the period, during which emissions occur,
- the meteorological conditions,
- the location of the transshipment site (e.g. distance to residential areas)

shall be considered taken into account the principle of proportionality.

The measures shall be established while also taking into account their possible effects on water and soil.

5.2.3.2 Loading or Unloading

When establishing requirements for loading or unloading, the following measures may be considered:

MEASURES RELATING TO THE TRANSSHIPMENT PROCESS

- minimization of the free fallheight while dumping (e.g. dump pits with guiding sheets or louvre-type grids),
- automated dumping height adjustment for changing heap heights,
- adapting the equipment to the respective bulk material (e.g. for grabs avoiding overloading and intermediate dumpings),
- smooth start of loaded grabs,
- closing empty grabs before reverse slewing,
- minimization of trimming work and cleaning operations,
- automation of transshipment;

MEASURES RELATING TO THE TRANSSHIPMENT EQUIPMENT

- regular equipment maintenance (e.g. testing of grab lips for tightness in order to reduce flow losses),
- completely or extensive closed grabs to avoid or reduce materials being blown away from the bulk surface by wind erosion,
- minimization caking(especially for grabs or, for example, with loading bellows which can be tightened used on vertical loaders/telescopic pipes),
- discharge pipes fitted with loading head and dust extraction systems,
- vertical loaders fitted with cones and dust extraction systems,
- reducing the speed of descent by installing baffles inside fill pipes or by using cascade chutes,
- applying thrower belt conveyors outside closed rooms only to a very small extent,
- if possible, using front-end loader only for humidified materials or not drift sensitive materials;

MEASURES RELATED TO THE TRANSSHIPMENT SITE

- complete or to a large-scale enclosed(e.g. by gates or strip curtains at entrances and exits) installations for loading and unloading of vehicles (e.g. filling stations, dump pits, trench bunkers and other dumping sites)
- extracting hoppers, transfer points, dump pits, loading pipes (sufficiently designed and sized extracting capacity),
- improvement of extracting efficiency (e.g. by guiding sheets),

- applying hoppers (e.g. with louvre-type grid closure, flap valve bottom, rotary locks, cover lid),
- applying fine water fog at outlets and discharge hoppers,
- applying windbreakers for open loading and unloading processes,
- extending the grab's dwell time after dumping at the dumping point,
- transshipment restrictions at high wind velocities,
- planning where to locate the transshipment site on the operating area of the enterprise;

MEASURES RELATED ON THE SOLID SUBSTANCES

- moistening the material, if necessary, by adding surface tension relaxation agents, if moistening does not conflict with subsequent further processing, storage properties or the product quality of the materials handled,
- applying dust-binding substances,
- pelletizing,
- standardization of grain size (removing fines),
- avoidance lumpy contamination in particular,
- reduction of transshipment operations.

5.2.3.3 Conveying or Transport

If vehicles are used for transport, closed vessels (silo vehicles, containers, tarpaulins) shall be applied. Moreover, when materials are conveyed or transported on the operation area, completely closed or to a large-scale enclosed facilities (e.g. enclosed conveyor belts, bucket conveyors, worm or screw conveyors or pneumatic conveyors) shall be applied. As to pneumatic conveyors, conveyed air, which contains dust, shall be fed into a dedusting system or kept within a closed cycle. Continuous open conveying/transporting facilities (e.g. conveyor belts) shall be encapsulated or enclosed if possible.

If closed transportation vessels are charged with solid substances, the displaced air shall be collected and fed into a dedusting system.

Open transfer points shall be moistened, insofar as such moistening does not conflict with subsequent further processing, storage properties or the product quality of the materials transshipped. Alternatively, the transfer points may be encapsulated; dust loaded air shall be fed into a dedusting system.

Openings in rooms (e.g. gates, windows) in which solid substances are transported or handled openly shall be kept closed where possible. Gates may only be opened if this is required for vehicles arriving or departing.

If dust emissions may be formed due to the use of roadways, within the operation area such roadways shall be fitted with hard surface of asphalt concrete, concrete or similar materials, they shall be kept in good condition and cleaned according to the amount of dirt accumulated on them. It shall be ensured that dirt accumulated on roadways caused by vehicles shall be avoided or removed after departure from the operation area. For this purpose, a tyre washing facility, sweeping machines, tyre-cleaning grates, for example, or other suitable systems shall be used. The first sentence regularly shall not be applied to roadways within quarries and sites on which mineral resources are extracted.

5.2.3.4 Treatment or Preparation

Machines, equipment or other systems for the treatment of solid substances (e.g. by breaking, grinding, sifting, screening, mixing, pelletizing, briquetting, heating, drying, cooling) shall be encapsulated or fitted with emission-reducing technologies of similar effect.

Charging points and discharging points shall be encapsulated; dust loaded air shall be fed into a dedusting system. Alternatively, charging points and discharging points can be moistened, insofar as such humidifying does not conflict with subsequent further processing, storage properties or the product quality of the materials transshipped.

Dust loaded waste gas from the treatment units shall be collected and abated.

5.2.3.5 Storage

5.2.3.5.1 Enclosed Storage

When establishing the requirements for storage, enclosed construction systems (e.g. silos, bunkers, storehouses, hangars, containers) shall preferably be applied. Insofar as storage facilities are not completely enclosed, the formation of dust shall be minimized – especially in passable storage facilities – by using storage vessels or storage sites and by using devices for charging or removal of materials stored which are designed appropriately in terms of dimensions. Waste gases from charging or discharging units and displaced air from vessels shall be collected and fed into a dedusting system. All charging devices shall be provided with an anti-overcharging mechanism. Silo and container discharging outlets may be emptied or sealed in a dust-tight manner, e.g. by applying bellows with an integrated exhaust system and a cone; likewise, it is possible to use rotary valves combined with a discharging conveyor or pneumatic transport mechanism.

5.2.3.5.2 Open Storage

When establishing requirements for the erection or removal of stockpiles as well as the operation of open homogenisation facilities, the following measures may be considered:

- covering the surface (e.g. with mats),
- grassing-over of the surface,
- spraying the stockpile with dust-binding substances while the stockpile is erected,
- solidification of the surface,
- stockpiles, transferpoints and discharging points shall be moistened sufficiently, where necessary by applying surface tension relaxation agents, insofar as such moistening does not conflict with subsequent further processing, storage properties or the product quality of the materials stored.

- charging or removal activities behind walls,
- conveyor belts with adjustable height,
- protective plantings,
- aligning the longitudinal axis of the stockpile with the main wind direction,
- limiting stockpiles in height,
- discontinuation, to a large extent, of erection and removal activities during weather conditions, which particularly favour emission formation (e.g. long-lasting droughts, freeze periods, high wind velocities).

By applying roofing, enclosing or combination of both measures, the storage, including peripheral facilities, may be converted – taking into account the provisions of 5.2.3.1 para. 2 – into partly or completely enclosed storage.

5.2.3.6 Special Components

If solid substances contain substances pursuant to 5.2.2 Classes I or II, pursuant to 5.2.5 Class I or pursuant to 5.2.7 or if such substances have been adsorbed by solid substances, the most efficient measures in compliance with 5.2.3.2 to 5.2.3.5 shall be applied; storage shall occur pursuant to 5.2.3.5.1. The first sentence shall not be applied on a regular basis if the content of the special substances in the fine fraction, which has been separated from the bulk materials by sifting with a 5-millimetre mesh, does not exceed the following values, with respect to dry mass:

- substances pursuant to 5.2.2 Class I, 5.2.7.1.1 Class I or 5.2.7.1.2 50 mg/kg,
- substances pursuant to 5.2.2 Class II, 5.2.7.1.1 Class II or 5.2.7.1.3 0.50 g/kg,
- substances pursuant to 5.2.7.1.1 Class III 5.0 g/kg.

5.2.4 Inorganic Gaseous Substances

The mass concentrations or mass flows of the inorganic gaseous substances listed hereunder shall not be exceeded, in terms of waste gas content:

Class I

- arsine
 - cyanogen chloride
 - phosgene
 - phosphine
- | | |
|----------------------------------|-------------------------|
| mass flow per substance | 2.5 g/h |
| or | |
| mass concentration per substance | 0.5 mg/m ³ ; |

Class II

- bromine and its gaseous compounds, to be indicated as hydrogen bromide
 - chlorine
 - hydrocyanic acid
 - fluorine and its gaseous compounds, to be indicated as hydrogen fluoride
 - hydrogen sulphide
- | | |
|----------------------------------|-----------------------|
| mass flow per substance | 15 g/h |
| or | |
| mass concentration per substance | 3 mg/m ³ ; |

Class III

- ammonia
 - gaseous inorganic compounds of chlorine, unless included in Class I or Class II, to be indicated as hydrogen chloride
- | | |
|----------------------------------|------------------------|
| mass flow per substance | 0.15 kg/h |
| or | |
| mass concentration per substance | 30 mg/m ³ ; |

Class IV

- sulphur oxides (sulphur dioxide and sulphur trioxide), to be indicated as sulphur dioxide
- nitrogen oxides (nitrogen monoxide and nitrogen dioxide), to be indicated as nitrogen dioxide

mass flow per substance	1.8 kg/h
or	
mass concentration per substance	0.35 g/m ³ .

In waste gas generated by thermal or catalytic post-combustion facilities, nitrogen monoxide and nitrogen dioxide emissions, to be indicated as nitrogen dioxide, may not exceed a mass concentration of 0.20 g/m³; simultaneously, carbon monoxide emissions may not exceed a mass concentration of 0.10 g/m³. Insofar as the gases fed into the post-combustion system contain concentrations of nitrogen oxides or other nitrogen compounds which are not low, case-to-case requirements shall be established; in this context, nitrogen monoxide and nitrogen dioxide emissions, to be indicated as nitrogen dioxide, may not exceed a mass flow of 1.8 kg/h or a mass concentration of 0.35 g/m³.

5.2.5 Organic Substances

With regard to organic substances contained in waste gas, except organic particulate matter,

a total mass flow of	0.50 kg/h
or	
a total mass concentration of	50 mg/m ³ ,
each of which to be indicated as total carbon,	

shall not be exceeded.

With regard to **existing installations** with an annual mass flow of organic substances amounting to as much as 1.5 Mg/a, to be indicated as total carbon, the emissions of organic substances contained in waste gas shall not exceed a mass flow of 1.5 kg/h, to be indicated as total carbon, notwithstanding para. 1. The amount of hours of

operation during which mass flows ranging above 0.5 kg/h up to 1.5 kg/h shall not exceed 8 hours of operation per day.

With regard to organic particulate matter, except for substances of Class I, the requirements under 5.2.1 shall apply.

Within the mass flow or the mass concentration for total carbon, the organic substances allocated to Classes I (substances pursuant to Annex 4) or II, even if several substances of identical class occur simultaneously, shall in total not exceed the following mass concentrations or mass flows contained in waste gas, each of which to be indicated as mass of organic substances:

Class I

mass flow	0.10 kg/h
or	
mass concentration	20 mg/m ³ ;

Class II

— 1-bromo-3-chloropropane	
— 1,1-dichloroethane	
— 1,2-dichloroethylene, cis and trans	
— ethanolic acid	
— methyl formiate	
— nitroethane	
— nitromethane	
— octamethylcyclotetrasiloxane	
— 1,1,1-trichloroethane	
— 1,3,5-trioxane	
mass flow	0.50 kg/h
or	
mass concentration	0.10 g/m ³ .

Supplementary to the requirements pursuant to the first sentence of para. 4, as to an occurrence of substances belonging to different classes, the total emission values of

Class II shall not be exceeded if substances of Classes I and II occur simultaneously in waste gas.

The organic substances or their secondary products not listed in Annex 4 which comply with one of the following categories or meet one of the following criteria:

- substances which are suspected of carcinogenic or mutagenic effects (categories K3 or M3 with risk phrase R 40),
- substances which are suspected of reproduction toxic effects (categories RE3 or RF3 with risk phrases R 62 or R 63) while taking into account their effective strength,
- limit value for air at the workplace below 25 mg/m³ applicable,
- they are toxic or very toxic,
- may cause irreversible harm or damage,
- may cause sensitization when inhaled,
- they are highly odour-intensive,
- slowly degradable and highly accumulative,

shall, on principle, be allocated to Class I. In this context,

- the Index of Limit Values relating to the Air at the Workplace (Technical Rules for Hazardous Substances 900), the Index of Substances which can Cause Cancer, Genetic Changes or Limit Reproductive Capability (Technical Rules for Hazardous Substances 905) and
- Annex I of the Council Directive 67/548/EEC which corresponds to the list of hazardous substances pursuant to § 4a para. 1 of the Ordinance on Hazardous Substances

shall be taken into account. In the case of classification differences among categories K, M or R, the stricter classification stipulated by the Technical Rules for Hazardous Substances or in the Ordinance on Hazardous Substances shall be binding. Insofar as the emission standards of Class I cannot be observed with proportional efforts as regards organic substances which are allocated to Class I on the grounds of the criteria mentioned above, emission limits shall be established on a case-to-case basis.

As long as the Technical Rules for Hazardous Substances or the Ordinance on Hazardous Substances do not contain any classification or evaluation, assessments by recognized scientific panels may be drawn upon, e.g. the classification of the Senate

Commission for the Investigation of Health Hazards of Chemical Substances in the Work Area of the *Deutsche Forschungsgemeinschaft*. Moreover, the classifications of § 4a para. 3 of the Ordinance on Hazardous Substances shall apply.

Insofar as preparations are subject to classification pursuant to § 4b of the Ordinance on Hazardous Substances, the components of such preparations and the respective proportions of such components shall be determined and taken into account when establishing emission-limiting requirements.

5.2.6 Gaseous Emissions during the Processing, Conveying, Transfilling or Storage of Liquid Organic Substances

When processing, hoisting, transfilling or storing liquid organic substances

- a) whose steam pressure is equal to or greater than 1.3 kPa at a temperature of 293.15 K,
- b) with a mass content of more than 1 per cent of substances pursuant to 5.2.5 Class I, 5.2.7.1.1 Classes II or III or 5.2.7.1.3,
- c) with a mass content of more than 10 mg per kg of substances pursuant to 5.2.7.1.1 Class I or 5.2.7.1.2 or
- d) which contain substances pursuant to 5.2.7.2

the measures by which to avoid and reduce emissions pursuant to 5.2.6.1 to 5.2.6.7 shall be applied.

5.2.6.1 Pumps

Pumps technologically designed to be tight such as canned motor pumps, magnetically coupled pumps, pumps with multiple mechanical seals and a quench or buffer system, pumps with multiple mechanical seals and seals dry to atmosphere, diaphragm pumps or bellows pumps.

Existing pumps for liquid organic substances pursuant to 5.2.6 letter a) which do not comply with any of the features listed under letters b) to d) and which do not meet the requirements pursuant to para. 1 may continue to be used until replaced by new pumps. After this Administrative Regulation has entered into force, the competent

authority shall demand inventories to be drawn up and monitor the continuous replacement of pumps and the maintenance work done prior to such replacement in the framework of plant supervision.

5.2.6.2 Compressors

If gases or vapours which meet one of the criteria pursuant to 5.2.6 letters b) to d) are compressed, multiple sealing systems shall be used. If wet sealing systems are used, the sealing liquid applied on the compressor may not be degassed into the open. If dry sealing systems are used, e.g. when feeding inert gas or exhausting leaking materials to be conveyed, escaping waste gases shall be collected and fed into a gas collection system.

5.2.6.3 Flanged Joints

As a rule, flanged joints shall only be used where they are necessary for reasons regarding process technology, safety or maintenance. In this event, technically tight-flanged joints in compliance with VDI Guideline 2440 (November 2000 version) shall be used.

When selecting the seal and designing the flanged joints, the characteristic sealing values pursuant to DIN 28090-1 (September 1995 version) or DIN V ENV 1591-2 (October 2001 version) shall apply.

The observation of a specific leakage ratio amounting to 10^{-5} kPa·l/(s·m) shall be proved by carrying out type testing in compliance with VDI Guideline 2440 (November 2000 version).

As to **existing flanged joints**, 5.2.6.1 para. 2 regarding the replacement of seals shall apply. With regard to existing flanged joints, inventories need not be drawn up.

5.2.6.4 Shutoff Devices

In order to seal shaft bushings of shutoff devices such as valves or gates,

- metal bellows with a high-grade seal and a downstream safety packing gland or
- sealing systems of similar effect

shall be used.

Sealing systems shall be deemed to be of similar effect if the temperature-specific leakage ratios can be kept during the proof procedure pursuant to VDI Guideline 2440 (November 2000 version).

As to **existing shutoff devices**, 5.2.6.1 para. 2 shall be applied *mutatis mutandis*.

5.2.6.5 Sampling Points

Sampling points shall be encapsulated or fitted with blockage and control devices in a way to ensure that emissions may only occur when sampling; in sampling, the forward run shall either be re-fed or collected completely.

5.2.6.6 Transfilling

In transfilling, it is a priority to take measures to avoid emissions, e.g. the vapour recovery technique in connection with bottom loading or top-submerged loading. Suction and conduct of the waste gas to a waste gas purification facility may be approved if the vapour recovery technique is not a feasible technical option or where the necessary efforts are disproportionate.

Vapour recovery systems shall be operated in a way to ensure that the flow of organic substances is only released when the vapour recovery system is connected and in a way that the vapour recovery system and the facilities connected to it may not let out gas to the atmosphere during the vapour recovery process, except for emissions released for safety reasons.

5.2.6.7 Storage

In order to store liquid organic substances, fixed roof tanks connected to vapour collection lines or connected to a waste gas purification facility shall be used.

Notwithstanding the first sentence, crude oil to be stored in storage tanks with a volume of more than 20,000 m³ may also be stored in floating roof tanks sealed effectively at their edges or in fixed roof tanks with an internal floating deck if emissions are reduced by at least 97 per cent as compared to fixed roof tanks without an internal floating deck.

Moreover, notwithstanding the first sentence, the tank need not be connected to vapour collection lines or to a waste gas purification facility as regards liquid organic substances pursuant to 5.2.6 letter a) which do not meet any of the criteria of letters b) to d) and which are stored in fixed roof tanks with a volume below 300 m³.

Insofar as storage tanks are set up and operated above ground, the outer wall and the roof shall be covered with suitable paint whose total heat reflection ratio permanently amounts to a minimum of 70 per cent.

Gases and vapours let out from pressure relief fittings and discharging facilities shall be disposed of to the vapour collection system or fed into a waste gas purification facility insofar as this does not conflict with safety-related aspects.

Waste gases occurring during inspection or while the storage tanks are cleaned shall be fed into a post-combustion system or similar measures shall be applied to reduce emissions.

5.2.7 Carcinogenic, Mutagenic or Reproduction Toxic Substances and Slowly Degradable, Highly accumulative and Highly Toxic Organic Substances

The emissions of carcinogenic, mutagenic or reproduction toxic substances or emissions of slowly degradable, highly accumulative and highly toxic organic substances which are contained in waste gas shall be limited as much as possible while taking into account the principle of proportionality (emissions minimization principle).

5.2.7.1 Carcinogenic, Mutagenic or Reproduction Toxic Substances

Substances shall be deemed carcinogenic, mutagenic or reproduction toxic if,

- in the Index of Substances which can Cause Cancer, Genetic Changes or Limit Reproductive Capability (Technical Rules for Hazardous Substances 905) or
- in Annex I of the Council Directive 67/548/EEC, which corresponds to the list of hazardous substances pursuant to § 4a para. 1 of the Ordinance on Hazardous Substances,

they are allocated to one of the following categories: K1, K2, M1, M2, RE1, RE2, RF1 or RF2 (risk phrases R 45, R 46, R 49, R 60 or R 61). In the event of classification differences among categories K, M or R, the stricter classification stipulated by the Technical Rules for Hazardous Substances or in the Ordinance on Hazardous Substances shall be binding.

As long as the Technical Rules for Hazardous Substances or the Ordinance on Hazardous Substances do not contain any classification or evaluation, assessments by recognized scientific panels may be drawn upon, e.g. the classification of the Senate Commission for the Investigation of Health Hazards of Chemical Substances in the Work Area of the *Deutsche Forschungsgemeinschaft*. Moreover, the classifications of § 4a para. 3 of the Ordinance on Hazardous Substances shall apply.

Insofar as preparations are subject to classification pursuant to § 4b of the Ordinance on Hazardous Substances, the components of such preparations and the respective proportions of such components shall be determined and taken into account when establishing emission-limiting requirements.

5.2.7.1.1 Carcinogenic Substances

With regard to the substances listed hereunder, the following total mass concentrations or mass flows contained in waste gas may not be exceeded as a minimum requirement, even where several substances of one class occur simultaneously:

Class I

- arsenic and its compounds (except for arsine), to be indicated as
As
- benzo(a)pyrene
- cadmium and its compounds, to be indicated as Cd
- water-soluble compounds of cobalt, to be indicated as Co
- chromium(VI) compounds (except for barium chromate and lead chromate), to be indicated as Cr
 - mass flow 0.15 g/h
 - or
 - mass concentration 0.05 mg/m³;

Class II

- acrylamide
- acrylonitrile
- dinitrotoluenes
- ethylene oxide
- nickel and its compounds (except for nickel metal, nickel alloys, nickel carbonate, nickel hydroxide, nickel tetracarbonyl), to be indicated as Ni
- 4-vinyl-1,2-cyclohexene-diepoxy
 - mass flow 1.5 g/h
 - or
 - mass concentration 0.5 mg/m³;

Class III

— benzene	
— bromoethane	
— 1,3-butadiene	
— 1,2-dichloroethane	
— 1,2-propylene oxide (1,2-epoxy propane)	
— styrene oxide	
— o-toluidine	
— trichloroethene	
— vinyl chloride	
mass flow	2.5 g/h
or	
mass concentration	1 mg/m ³ .

As to an occurrence of substances belonging to different classes, notwithstanding para. 1, the total emission standards of Class II may not be exceeded if substances of Classes I and II occur simultaneously in waste gas and the emission standards of Class III may not be exceeded as a total if substances of Classes I and III, of Classes II and III or of Classes I to III occur simultaneously in waste gas.

The carcinogenic substances not listed under their names shall be allocated to the classes of substances to which they are best comparable with regard to effective strength; in this context, an evaluation of effective strength shall be carried out on the grounds of a risk calculation, e.g. by applying the unit-risk approach. Insofar as emission standards pertaining to the class determined for carcinogenic substances which have been classified on the basis of the allocation system described above cannot be observed with proportional efforts, emission limits shall be determined on a case-to-case basis while taking into account the emissions minimization principle.

Fibres

The following fibre dust concentrations may not be exceeded with regard to emissions of the carcinogenic fibrous substances listed hereunder where they are contained in waste gas:

— asbestos fibres	1·10 ⁴ fibres/m ³
-------------------	---

- (e.g. chrysotile, crocidolite, amosite),
- biopersistent ceramic fibres 1.5·10⁴ fibres/m³
(e.g. consisting of aluminium silicate, aluminium oxide, silicon carbide, potassium titanate), insofar as they are included in No. 2.3 of the Technical Rules for Hazardous Substances 905 as “man-made crystalline ceramic fibres” or comprised in Annex I of the Council Directive 67/548/EEC (which corresponds to the list of hazardous substances pursuant to § 4a para. 1 of the Ordinance on Hazardous Substance) under the entry “ceramic mineral fibres”
 - biopersistent mineral fibres 5·10⁴ fibres/m³,
insofar as they meet the criteria established for “inorganic fibre dusts (except for asbestos)” under No. 2.3 of the Technical Rules for Hazardous Substances 905 or for “biopersistent fibres” pursuant to Annex IV No. 22 of the Ordinance on Hazardous Substances.

In the event that criteria of the Technical Rules for Hazardous Substances and of the Ordinance on Hazardous Substances diverge from each other, the respective stricter criteria shall be binding.

In individual cases, the emissions of carcinogenic fibrous substances may be limited by determining a total dust emissions value while taking into account the emissions minimization principle.

5.2.7.1.2 Mutagenic Substances

Insofar as mutagenic substances or preparations are not covered by the requirements made to carcinogenic substances, a mass flow below 0.15 g/h or a mass concentration below 0.05 mg/m³ shall be achieved with regard to emissions of mutagenic substances contained in waste gas. Insofar as these emission standards cannot be observed with proportional efforts, emissions of such substances contained in waste gas shall be limited while taking into account the emissions minimization principle.

5.2.7.1.3 Reproduction Toxic Substances

Insofar as reproduction toxic substances or preparations are not covered by the requirements made to carcinogenic or mutagenic substances, emissions of reproduction toxic substances contained in waste gas are to be limited while taking into account the emissions minimization principle and while taking into consideration the effective strength of the substance.

5.2.7.2 Slowly Degradable, Highly accumulative and Highly Toxic Organic Substances

The dioxins and furans listed in Annex 5, to be indicated as totals pursuant to the procedure established therein, may not exceed

a mass flow in waste gas of 0.25 µg/h

or

a mass concentration in waste gas of 0.1 ng/m³,

as a minimum requirement. The sampling period shall be at least 6 hours; it shall not exceed 8 hours.

As to further organic substances which are slowly degradable, highly accumulative and highly toxic at the same time or which, due to other highly harmful effects on the environment, may not be allocated to Class I of 5.2.5 (e.g. polybrominated dibenzodioxins, polybrominated dibenzofurans or polyhalogenated biphenyles), emissions shall be limited while taking into account the emissions minimization principle.

5.2.8 Odour-Intensive Substances

Requirements shall be made to reduce emissions at installations which may emit odour-intensive substances during normal operation or due to operational fault liability, including e.g. encasement of installations, encapsulation of parts of installations, generation of underpressure in encapsulated spaces, appropriate storage of charge substances, products and wastes, process control.

As a rule, odour-intensive waste gases shall be fed into waste gas purification facilities or equivalent measures shall be taken. Waste gases shall be discharged as stipulated in 5.5.

When determining the extent of the requirements on a case-to-case basis, special attention shall be paid to the waste gas volume flow, the mass flow of odour-intensive substances, local dispersion conditions, the duration of emission and the distance between the installation and the next area of protected use (e.g. residential area) existing or such area established in a development plan. Insofar as the surroundings of the installation can be expected to be affected by odour, any options to further reduce emissions by applying state of the art techniques shall be used.

Insofar as it is not possible or not sufficient to limit emissions of individual substances or substance groups, e.g. with regard to amines, or of total carbon, the emission-reducing requirement shall be determined for installations with waste gas purification facilities as an odour reduction ratio to be determined olfactometrically or as an odorous substance concentration value.

5.2.9 Soil-Contaminating Substances

If the precautionary values for soil pursuant to Annex 2 of the Federal Soil Protection and Contaminated Sites Ordinance (*Bundes-Bodenschutz- und Altlastenverordnung*), the mass flows pursuant to Annex 2 and the additional load values pursuant to 4.5.2 letter a) aa) are exceeded, precautionary measures shall be identified by which to determine the obligations to take precautions in detail in compliance with the second sentence of § 3 para. 3 of the Federal Soil Protection and Contaminated Sites Ordinance, such measures reaching beyond the measures stipulated in 5 of this Administrative Regulation if the annual loads established in 5 of Annex 2 of the Federal Soil Protection and Contaminated Sites Ordinance are exceeded during the operation of the installation.

5.3 Measurement and Monitoring of Emissions

5.3.1 Measurement Sites

If a permit is issued for an installation, measurement sites or sampling points shall be demanded to be provided for and they shall be determined in detail. Measurement sites shall be sufficiently large, easily passable, designed and selected in a way by which to facilitate that emission measurement will be representative of the emissions from the installation and that such measuring will be accurate from a metrological point of view. The recommendations of VDI Guideline 4200 (December 2000 version) shall be taken into account.

5.3.2 Individual Measurements

5.3.2.1 Initial and Repeated Measurements

It shall be demanded that after construction, significant alteration and subsequently, the emissions levels of all air pollutants for which emissions limits are to be determined in compliance with the letter of permit pursuant to 5.1.2 shall be determined repeatedly through measurements carried out by an agency according to § 26 of the Federal Immission Control Act.

Initial measurements after construction or significant alteration shall be carried out when undisturbed operation is reached, not before, however, three months of operation and not later than six months after start of operation.

Initial or repeated measurements shall not be required if emissions are determined in accordance to 5.3.3 or 5.3.4.

Individual measurements according to para. 1 need not be carried out if other tests, e.g. with regard to furnishing proof about the effectiveness of emission-reducing facilities, the composition of fuels or charge materials or process conditions, provide sufficiently reliable results to establish that emission limits are not exceeded.

Repeated measurements shall be demanded after expiry of three-year periods. As to installations whose emissions are limited as a mass flow, such periods may be extended to five years.

5.3.2.2 Measurement Planning

Measurements for determining emissions shall be carried out in such a manner that the results will be representative of the emissions from the installation and that they will be comparable to similar installations and operating conditions. Measurement planning shall be in compliance with VDI Guideline 4200 (December 2000 version) and VDI Guideline 2448 Part 1 (April 1992 version). The competent authority may require measurement plans to be previously agreed with it.

With regard to installations where operating conditions remain unchanged to a great extent in terms of time, at least 3 individual measurements shall be carried out during undisturbed operation with a maximum emission level and at least one additional measurement shall be carried out for regular operation conditions with a changing emission behaviour, e.g. for cleaning or regenerating operations or during relatively long start-up or shut-off periods. With regard to installations where operating conditions are subject to vary in terms of time, a sufficient number of measurements shall be carried out, at least, however, six measurements shall be carried out during states of operation, which may cause maximum emission levels by experience.

As a rule, individual measurements shall be carried out over half an hour; the result of such individual measurement shall be determined and indicated as a half-hourly mean value. In special cases, e.g. in case of batch operation or low mass concentrations contained in waste gas, averaging periods shall be adjusted accordingly.

With regard to substances, which occur in various states of aggregation, special measures shall be taken in the measurement process in order to collect all respective proportions (e.g. in compliance with VDI Guideline 3868 Part 1, December 1994 version).

5.3.2.3 Selection of Measurement Procedures

Measurements to determine emissions shall be carried out using measurement methods and instruments, which comply with state of the art measurement technologies. The detection limit for the measurement method should amount to less than one tenth of the emission limit to be monitored. Emissions shall be measured according to the methods of the guidelines of the VDI Manual on Air Quality Control listed in Annex 6. Sampling shall comply with VDI Guideline 4200 (December 2000 version). Moreover, measurement methods of guidelines on emission reduction contained in the VDI/DIN Air Pollution Prevention Manual shall be taken into account.

Total carbon shall be determined by means of suitable continuous measuring instruments (e.g. based upon the measurement principle of a flame ionisation detector). In case of emissions of defined substances or substance mixtures, the used measuring instruments shall be calibrated with these substances or substance mixtures, or calibration shall be carried out mathematically on the grounds of response factors to be defined on the basis of propane calibration. In the event of complex substance mixtures, a representative response factor shall be drawn upon. In cases justified as exceptions, total carbon may also be determined by determining the amount of carbon, which can be detected by silica gel adsorption.

5.3.2.4 Evaluation and Assessment of the Measurement Results

A report on the outcome of the measurements shall be prepared and submitted immediately. The measurement report shall contain information on the measurement planning, the result of each individual measurement, the measurement methods used and the operating conditions, which are important for the assessment of individual data and measurement results. It must also include information on the fuel and raw material as well as on the operating state of the installation and of the emission control facilities; it shall comply with Annex B of VDI Guideline 4220 (September 1999 version).

In the case of initial measurements after construction, of measurements taken after significant alteration or of repeated measurements the requirements shall in any event be deemed observed if the result of each individual measurement, including measurement uncertainty, does not exceed the emission limit established in the letter of permit.

If subsequent orders, which are based upon the determination of emissions, demand additional measures to reduce emissions, measurement uncertainty shall be taken into account to the operator's benefit.

An examination as to whether the measurement method complies with state of the art measurement technologies, especially with regard to its measurement uncertainty, shall be required in cases in which the measurement result, including measurement uncertainty, exceeds the established emission limit. In case of excess values, further examination (e.g. examining installation-specific reasons) shall be required.

5.3.2.5 Measurement of Odour-Intensive Substances

If the permit of an installation involves emission control for highly odorous substances by determination of the odour reduction ratio of a waste gas purification system or the concentration of odour-intensive substances, this value shall be checked by carrying out olfactometric measurements.

5.3.3 Continuous Measurement

5.3.3.1 Measurement Programme

Emissions from relevant sources shall be monitored through continuous measurement, taking into consideration para. 4, if mass flows established in 5.3.3.2 are exceeded and respective emission limits are established. A source shall, as a rule, be considered relevant if its emissions constitute over 20 per cent of the entire mass flow of the installation. When mass flows are determined, the stipulations in the letter of permit shall prevail.

If it can be expected that an installation will repeatedly exceed the mass concentrations defined in the letter of permit, e.g. when changing its mode of operation, or due to the malfunctioning of an emission control facility, continuous emission measurement may also be demanded for lower mass flows than those outlined in 5.3.3.2. For installations whose emission control will have to be repeatedly shut down during undisturbed operations for safety reasons, or the efficiency of which has to be reduced considerably, mass flows resulting from the remaining precipitation capacities shall be assumed.

The requirement of continuous monitoring of a source shall be waived if it emits for less than 500 hours in any one year or is less than 10 % of the annual emission of the installation.

Where there is a constant relationship between the pollutants in the waste gas, continuous measurement may be restricted to the main component. Continuous emission measurements may again be waived if the fulfilment of emission standards can be sufficiently proved by applying other tests, e.g. continuous efficiency demonstrating the effectiveness of emission reduction facilities (e.g. by measuring the combustion chamber temperature in a thermal post-combustion facility instead of measuring the mass concentration of organic substances, or by determining the differential pressure in fabric filters instead of measuring the mass concentration of the particles in waste gas), composition of fuels or raw materials, or processing conditions.

5.3.3.2 Mass flow thresholds for continuous monitoring

Installations with particles mass flows of 1 to 3 kg/h shall be equipped with measuring instruments at their relevant sources which are capable of continuously monitoring the functioning of the waste gas purification facility and the established emission limits (qualitative measuring instruments).

Installations with particles mass flows of over 3 kg/h shall be equipped with measuring instruments at their relevant sources which continuously determine particles emission mass concentrations.

Installations with particulate matter emissions of substances under 5.2.2 or 5.2.5 Class I or 5.2.7 shall be equipped with measuring instruments at their relevant sources which continuously determine the total particles concentrations if the emission mass flow is more than five times greater than one of the relevant mass flows.

At installations emitting gaseous substances in excess of the following mass flows, relevant sources shall be equipped with measuring instruments, which continuously determine the mass concentrations of the respective substances:

— sulphur dioxide	30 kg/h,
— nitrogen monoxide and nitrogen dioxide, to be indicated as nitrogen dioxide	30 kg/h,
— carbon monoxide as lead substance for evaluating the efficiency of combustion processes	5 kg/h,
— carbon monoxide, all other cases	100 kg/h,
— fluorine and gaseous inorganic fluorine compounds, to be indicated as hydrogen fluoride	0.3 kg/h,
— gaseous inorganic chlorine compounds, to be indicated as hydrogen chloride	1.5 kg/h,
— chlorine	0.3 kg/h,
— hydrogen sulphide	0.3 kg/h.

If sulphur dioxide mass concentrations are to be measured continuously, sulphur trioxide mass concentrations shall be determined during calibration and included in the calculation. If individual measurements show that nitrogen dioxide proportions in the nitrogen oxide emissions account for less than 10 per cent, continuous measuring of nitrogen dioxide shall be waived and its proportion be calculated.

Installations with mass flows of organic substances, to be indicated as total amount of carbon, exceeding for

— substances under 5.2.5 Class I	1 kg/h,
— substances under 5.2.5	2.5 kg/h

shall be equipped with measuring instruments at their relevant sources which continuously determine the total carbon.

Installations with mass flows of mercury and its compounds of over 2.5 g/h, to be indicated as Hg, shall be equipped with measuring instruments at their relevant sources which continuously determine mercury mass concentrations, unless it has been reliably proven that the mass concentrations are less than 20 per cent of those specified in 5.2.2 Class I.

The competent authority shall require installations emitting substances listed under 5.2.2 Classes I and II or substances listed under 5.2.7 to be equipped with continuous measuring instruments to determine the mass concentrations if the mass flow exceeds one of the respective mass flows over five times and if suitable measuring instruments are available.

5.3.3.3 Reference Values

Installations with emission mass concentrations requiring permanent monitoring shall be equipped with measuring and evaluation instruments for the continuous determination and recording of operational parameters, e.g. waste gas temperature, waste gas volume flow, humidity content, pressure, oxygen content, each including relevant status signals, which allow the evaluation and assessment of continuous measuring.

The continuous measuring of operational parameters may be waived if these, from experience, show only slight deviations which are negligible for emission evaluation, or may be determined by other methods with sufficient certainty.

5.3.3.4 Selection of Instruments to Determine Emissions

Continuous measuring shall be carried out by suitable measuring and evaluation instruments, which allow permanent value determination and recording of the factors to be monitored according to 5.3.3.2, 5.3.3.3 or 5.3.4 as well as the assessment according to 5.3.3.5.

A requirement shall be that an agency, which has been determined by the authority responsible under Land law, certifies the correct installation of the continuous measuring instrument.

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety shall publish in the GMBL. [*Gemeinsames Ministerialblatt* – Joint Ministerial Gazette], after consultation with the competent *Land* authorities, guidelines for the qualification test, installation, calibration and maintenance of measuring instruments. The measuring instruments recognized as suitable by the *Länder* shall be published in the *Bundesanzeiger* (Federal Gazette) by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

5.3.3.5 Evaluation and Assessment of Measurement Results

Measured values shall in principle be used to form half-hourly mean values for each successive half hour. If necessary, the half-hourly mean values shall be converted to the respective reference units and kept on file with the relevant status signals. The evaluation shall be made using suitable emissions calculators whose installation and parameterisation has been inspected by a designated agency. The data shall be transmitted to the authority by telemetry upon request.

For each calendar day, a daily mean value, related to the daily operating time, shall be formed from the half-hourly mean values and kept on file.

The installation complies with requirements if the emission limits established in the letter of permit or in a subsequent order are not exceeded; if limits are exceeded, this shall be reported separately and the competent authority shall be informed immediately.

The operator shall be required to draw up evaluations of the continuous measurement results in a calendar year, which shall be submitted to the competent authority within three months after the end of each calendar year. Measurement results shall be kept on file by the operator for at least 5 years. The requirement to submit the evaluation shall not apply if the data are submitted to the competent authority by telemetry.

5.3.3.6 Calibration and Functional Testing of Instruments for the Continuous Determination of Emissions

It is a requirement for instruments for the continuous determination of emissions to be calibrated and tested with regard to their functioning by an agency determined by the competent *Land* authority for calibrations. The calibration shall be carried out pursuant to VDI Guideline 3950 Part 1 (December 1994 version). In special cases, e.g. during batch operation, for calibration periods exceeding half an hour, or for other averaging periods, the averaging period shall be adapted accordingly.

Calibrations of measuring instruments shall be repeated subsequent upon significant alteration, otherwise every 3 years. Reports on the outcome of the calibration and the functional tests shall be submitted to the competent authority within 8 weeks.

Functional testing of instruments for continuously determining emissions shall be repeated annually.

The operator shall be required to ensure regular maintenance and functional tests of the measuring instruments.

5.3.4 Continuous Determination of Special Substances

A requirement for installations emitting substances according to 5.2.2, 5.2.5 Class I or 5.2.7 shall be the daily determination of the mass concentration of these substances in waste gas, as a daily mean value in relation to the daily operating time if the mass flows established therein are exceeded more than ten times.

If daily mean values vary only slightly, determining the daily mean value of the mass concentration of these substances in waste gas may also be carried out after longer periods of time, e.g. on a weekly, monthly or annual basis. Determining special substance emissions may be waived if other tests, e.g. continuous functional control of the waste gas purification facility, show with sufficient certainty that emission limits are not exceeded.

The observation of the requirements according to 5.2.7.2 shall be proven by permanently recording or determining suitable operational values or waste gas parameters if continuous emission monitoring cannot be requested due to missing measurement technique preconditions.

The operator shall be required to draw up evaluations of the permanent monitoring of special substances emissions, which shall be submitted to the competent authority within three months after the end of each calendar year. The operator shall keep measurement results on file for at least 5 years.

5.3.5 Equivalency to VDI Guidelines

In addition to the procedures described in the VDI Guidelines referred to in 5.3, other procedures established as equivalent may also be applied.

5.4 Special Provisions for Certain Types of Installations

The special requirements for certain types of installations contained in 5.4 are arranged according to the Annex of the Ordinance on Installations Requiring a permit (4. BImSchV) as promulgated on 14 March 1997 (BGBl. I, p. 504), as last amended by Article 4 of the Act of 27 July 2001 (BGBl. I, p. 1950), and shall apply only to those types which are particularly mentioned. Notwithstanding this, the provisions of 5.1.1, para. 2, shall apply.

5.4.1 Heat Production, Mining, Energy

5.4.1.2 Installations under 1.2: Combustion installations

5.4.1.2.1 Installations for the Generation of Electricity, Steam, Hot Water, Process Heat or Hot Waste Gas in Combustion Installations by Use of Coal, Coke, including Petroleum Coke, Coal Briquettes, Peat Briquettes, Fuel Peat or Untreated Wood with a Rated Thermal Input of less than 50 MW

REFERENCE VALUES

Emission standards for furnaces designed for the use of coal, coke, including petroleum coke, or coal briquettes refer to a volume content of oxygen in waste gas of 7 per cent and for furnaces designed for the use of peat briquettes, fuel peat or untreated wood to a volume content of oxygen in waste gas of 11 per cent.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST

Dust emissions in waste gas shall not exceed the following mass concentrations:

- a) for installations with a rated thermal input of 5 MW or more 20 mg/m³,
- b) for installations with a rated thermal input of less than 5 MW 50 mg/m³,
- c) for installations with a rated thermal input of less than 2.5 MW,
which exclusively use untreated wood, 100 mg/m³.

INORGANIC PARTICULATE MATTER

5.2.2 shall not apply, with the exception of furnaces using petroleum coke.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed the mass concentration of 0.15 g/m³.

For individual furnaces with a rated thermal input of less than 2.5 MW, the emission standard shall apply to nominal load operations only.

NITROGEN OXIDES

Nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed the following mass concentrations:

- | | | |
|----|--|-------------------------|
| a) | for the use of untreated wood | 0.25 g/m ³ , |
| b) | for the use of other fuels | |
| | aa) for fluidised bed furnaces | 0.30 g/m ³ , |
| | bb) for other furnaces in installations with a rated thermal input | |
| | — of 10 MW or more | 0.40 g/m ³ , |
| | — of less than 10 MW | 0.50 g/m ³ . |

For fluidised bed furnaces designed for the use of coal, dinitrogen oxide emissions in waste gas shall not exceed the mass concentration of 0.15 g/m³.

SULPHUR OXIDES

When fossil fuels are used, the sulphur dioxide and sulphur trioxide emissions in waste gas, to be indicated as sulphur dioxide, shall not exceed the following mass concentrations:

- | | | |
|----|--|------------------------|
| a) | for fluidised bed furnaces | 0.35 g/m ³ |
| | or, in case this mass concentration cannot be complied with by proportional efforts, a sulphur emission ratio of | 25 per cent, |
| b) | for other furnaces | |
| | aa) in case of the use of hard coal | 1.3 g/m ³ , |
| | bb) in case of the use of other fuels | 1.0 g/m ³ . |

When untreated wood is used, 5.2.4 shall not apply.

HALOGEN COMPOUNDS

5.2.4 shall not apply.

ORGANIC SUBSTANCES

When untreated wood is used, emissions of organic substances in waste gas, to be indicated as total carbon, shall not exceed a mass concentration of 10 mg/m³. The requirements in 5.2.5 for emissions of organic substances of Classes I and II shall not apply.

CONTINUOUS MEASUREMENT

Individual furnaces with a rated thermal input of 5 to 25 MW shall be equipped with measuring instruments which continuously determine dust emission mass concentrations qualitatively.

Individual furnaces with a rated thermal input of more than 25 MW shall be equipped with measuring instruments, which continuously determine dust emission mass concentrations.

Individual furnaces with a rated thermal input of 2.5 MW or more shall be equipped with measuring instruments which continuously determine carbon monoxide emission mass concentrations.

The second sentence of 5.3.3.1, para. 4, shall apply with respect to sulphur oxides emissions insofar as the operator keeps a record of the sulphur content and the net

calorific value of the fuel used, and of the addition of sorbents, keeps the record on file for five years and submits it, upon request, to the competent authority.

EXISTING INSTALLATIONS

Existing installations shall comply with the requirements to restrict dust, carbon monoxide, and sulphur oxides emissions no later than eight years after the entry into force of this Administrative Regulation.

For individual furnaces with a rated thermal input of less than 2.5 MW, the carbon monoxide emissions in waste gas shall not exceed a mass concentration of 0.25 g/m³; the emission standard shall apply to nominal load operations only.

CONTINUOUS MEASUREMENT

The requirement to be equipped with a measuring instrument, which continuously determines carbon monoxide emission mass concentrations, shall not apply to existing individual furnaces with a rated thermal input of 2.5 to 25 MW.

5.4.1.2.2 Installations for the Generation of Electricity, Steam, Hot Water, Process Heat or Hot Waste Gas in Combustion installations by the Use of Fuel Oils, Emulsified Natural Bitumen, Methanol, Ethanol, Untreated Vegetable Oils or Vegetable Oil Methyl Esters with a Rated Thermal Input of less than 50 MW

REFERENCE VALUES

Emission standards refer to a volume content of oxygen in waste gas of 3 per cent.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST

When fuel oils listed in DIN 51603 Part 1 (March 1998 version), methanol, ethanol, untreated vegetable oils or vegetable oil methyl esters are used, 5.2.1 shall not apply. When these substances are used, the soot level shall not exceed the value 1. Waste gases shall be free of oil derivatives insofar that filter paper used for soot measurement does not show any visible marks of oil derivatives.

When other liquid fuels are used, notwithstanding 5.2.1, a higher dust emission standard up to a maximum of 50 mg/m³ may be approved, insofar as the emission standards of 5.2.2 and 5.2.7.1.1 are not exceeded.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed the mass concentration of 80 mg/m³.

NITROGEN OXIDES

Nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed the following mass concentrations:

- a) When fuel oils defined in DIN 51603 Part 1 (March 1998 version), are used in boilers with a setting value of a safety device (e.g. safety temperature limiter, safety pressure valve) to protect against an exceedance of
 - aa) a temperature lower than 110 °C or an excess pressure lower than 0.05 MPa 0.18 g/m³,
 - bb) a temperature of 110 to 210 °C or an excess pressure of 0.05 to 1.8 MPa 0.20 g/m³,
 - cc) a temperature higher than 210 °C or an excess pressure higher than 1.8 MPa 0.25 g/m³,with respect to the reference value for organically combined nitrogen of 140 mg/kg pursuant to Annex B of DIN EN 267 (November 1999 version),
- b) for the use of other liquid fuels 0.35 g/m³.

When fuel oils defined in DIN 51603 Part 1 (March 1998 version) are used, the organically combined nitrogen content of the fuel shall be determined pursuant to ASTM 4629–91 (1991 version). The measured mass concentrations of nitrogen

monoxide and nitrogen dioxide, to be indicated as nitrogen dioxide, shall be converted to the reference value for organically combined nitrogen, as well as to the reference conditions of 10 g/kg air humidity and 20 °C combustion air temperature.

SULPHUR OXIDES

When liquid fuels with a higher mass content of sulphur are used than the sulphur content required for light fuel oil pursuant to the Ordinance on the Sulphur Content of Light Fuel Oil and Diesel Fuel (3. BImSchV) of 15 January 1975 (BGBl. I, p. 264), as last amended on 21 December 2000 (BGBl. I, p. 1956), as currently applicable, the sulphur dioxide and sulphur trioxide emissions in waste gas, to be indicated as sulphur dioxide, shall not exceed the mass concentration of 0.85 g/m³.

Divergent to the first sentence, individual furnaces with a rated thermal input of up to 5 MW shall only use liquid fuels other than fuel oils with a mass content of sulphur for light fuel oil pursuant to the 3. BImSchV, as currently applicable, if it is ensured (e.g. by the sulphur content in the fuel or by desulphurisation facilities) that no higher sulphur dioxide emissions are generated than if a light fuel oil with a mass content of sulphur pursuant to the 3. BImSchV, as currently applicable, is used.

INDIVIDUAL MEASUREMENTS

When fuel oils listed in DIN 51603 Part 1 (March 1998 version), which do not exceed the approved sulphur mass content for light fuel oil of the 3. BImSchV, as currently applicable, methanol, ethanol, untreated vegetable oils or vegetable oil methyl esters are used, 5.3.2.1 shall not apply to total dust and sulphur oxides.

CONTINUOUS MEASUREMENT

Individual furnaces with a rated thermal input of 10 MW or more for the use of fuel oils listed in DIN 51603 Part 1 (March 1998 version), of methanol, ethanol, untreated vegetable oils or vegetable oil methyl esters which form part of a common installation with a rated thermal input of 20 MW or more, shall be equipped with measuring instruments which continuously determine the soot level pursuant to DIN 51402 Part 1 (October 1986 version) and the carbon monoxide emission mass concentration in waste gas.

Individual furnaces with a rated thermal input of 20 MW or more for the use of methanol or ethanol shall be equipped with a measuring instrument, which

continuously determines carbon monoxide emission mass concentrations in waste gas.

Individual furnaces with a rated thermal input of less than 20 MW for the use of fuel oils, with the exception of fuel oils listed in DIN 51603 Part 1 (March 1998 version), or emulsified natural bitumen shall be equipped with a measuring instrument which continuously determines dust emission mass concentrations qualitatively; individual furnaces with a rated thermal input of 20 MW or more shall be equipped with measuring instruments which continuously determine mass concentrations of particles and carbon monoxide emissions in waste gas.

EXISTING INSTALLATIONS

Existing installations for the use of fuel oils – with the exception of fuel oils listed in DIN 51603 Part 1 (March 1998 version), which do not exceed the approved sulphur mass content for light fuel oil of the 3. BImSchV, as currently applicable – shall comply with the requirements to restrict dust and sulphur oxides emissions no later than ten years after the entry into force of this Administrative Regulation.

5.4.1.2.3 Installations for the Generation of Electricity, Steam, Hot Water, Process Heat or Hot Waste Gas in Combustion Installations by the Use of Gaseous Fuels, particularly Coke Oven Gas, Mine Gas, Basic Oxygen Furnace Gas, Refinery Gas, Synthesis Gas, Petroleum Gas from Tertiary Mineral Oil Production, Sewage Gas, Biogas, Untreated Natural Gas, Liquid Gas, Gases from Public Gas Supply or Hydrogen, with a Rated Thermal Input of less than 50 MW

REFERENCE VALUES

Emission standards refer to a volume content of oxygen in gas of 3 per cent.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST

Dust emissions in waste gas shall not exceed the following mass concentrations:

- | | |
|---|------------------------|
| a) when gases from public gas supply, liquid gas, hydrogen, refinery gas, sewage gas or biogas are used | 5 mg/m ³ , |
| b) when other gases are used | 10 mg/m ³ . |

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed a mass concentration of 50 mg/m³ when gases from public gas supply are used, and 80 mg/m³ when other gases are used.

NITROGEN OXIDES

Nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed the following mass concentrations:

- a) when fuel oils from public gas supply are used in boilers with a setting value of the safety device (e.g. safety temperature limiter, safety pressure valve) to protect against an exceedance of
 - aa) a temperature lower than 110 °C or an excess pressure lower than 0.05 MPa 0.10 g/m³,
 - bb) a temperature of 110 to 210 °C or an excess pressure of 0.05 to 1.8 MPa 0.11 g/m³,
 - cc) a temperature higher than 210 °C or an excess pressure higher than 1.8 MPa 0.15 g/m³,
- b) when other gases are used, with the exception of process gases containing nitrogen compounds, 0.20 g/m³;
- c) when process gases containing nitrogen compounds are used, nitrogen oxides emissions in waste gas shall be reduced using state of the art techniques.

SULPHUR OXIDES

Sulphur dioxide and sulphur trioxide emissions in waste gas, to be indicated as sulphur dioxide, shall not exceed the following mass concentrations:

- a) for the use of liquid gas 5 mg/m³,
- b) for the use of gases from public gas supply 10 mg/m³,
- c) for the use of coke oven gas or refinery gas 50 mg/m³,
- d) for the use of biogas or sewage gas 0.35 g/m³,
- e) for the use of mineral oil gas used as fuel for steam production during tertiary measures in mineral oil mining, 1.7 g/m³,
- f) for the use of fuel gases commonly used by iron and steel plants and coking plants,
 - aa) for the use of blast furnace gas 0.20 g/m³,
 - bb) for the use of coke oven gas 0.35 g/m³,
- g) for the use of other fuels 35 mg/m³.

5.4.1.2.4 Mixed Fuel and Multiple Fuel Combustion installations with a Rated Thermal Input of less than 50 MW

MIXED FUEL FURNACES

For mixed fuel furnaces, the emission standards determined for the respective fuels shall be established by comparing the energy supplied by each fuel to the total amount of supplied energy. The emission standards relevant to the furnace are calculated by adding the values determined in the above-mentioned manner.

Divergent to para. 1, the provisions shall apply to the fuel for which the highest emission standard applies if, during the operation of the installation, this fuel accounts for at least 70 per cent of the total amount of supplied energy and, in the case of installations in mineral oil refineries, for at least 50 per cent. In plants using distillation and conversion residues of mineral oil treatment processes for internal consumption, the percentage of the most relevant fuel may be lower if the emission concentration in waste gas which shall be attributed to this most relevant fuel does not exceed the value given for this fuel in the first sentence.

MULTIPLE FUEL COMBUSTION INSTALLATIONS

For multiple fuel combustion installations, the regulations for the particular fuels shall apply respectively; notwithstanding, the requirements for solid fuels concerning the reduction of dust emissions shall apply for a period of four hours after the change-over from solid to gaseous fuels or to fuel oils listed in DIN 51603 Part 1 (March 1998 version).

FLUIDISED BED FURNACES

For fluidised bed furnaces operated as mixed fuel furnaces or multiple fuel furnaces, the emission standards for total dust of 5.4.1.2.1 shall apply.

5.4.1.2.5 Furnaces of Drying Installations

The requirements under 5.4.1.2.1, 5.4.1.2.2 or 5.4.1.2.3 shall apply to furnaces the waste gases or flames of which dry goods not in direct contact. The following requirements shall apply to furnaces where goods are dried in direct contact to their waste gases or flames.

REFERENCE VALUES

Emission standards refer to a volume content of oxygen in waste gas of 17 per cent; insofar as a volume content of oxygen in waste gas other than this is required for processing or product quality reasons, the reference oxygen content shall be defined on an individual basis.

FUELS

Furnaces shall be operated with the following fuels:

- a) gaseous fuels,
- b) liquid fuels which do not cause higher sulphur oxides emissions than fuel oils listed in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light fuel oil pursuant to the 3. BImSchV, as currently applicable, or
- c) coals which do not cause higher sulphur oxides emissions than hard coal with a sulphur mass content of less than 1 per cent, as related to a net calorific value of 29.3 MJ/kg; for individual processes using other solid combustible materials, special arrangements shall be drawn up.

5.4.1.3 Installations under 1.3:

Installations for the Generation of Electricity, Steam, Hot Water, Process Heat or Hot Waste Gas in Combustion Installations by the Use of other Solid or Liquid Fuels than Mentioned in Category 1.2

When straw or similar plant products (e.g. cereals, grasses, miscanthus) are used, the following requirements shall apply to combustion installations with a rated thermal input of less than 50 MW:

REFERENCE VALUES

Emission standards refer to a volume content of oxygen in waste gas of 11 per cent.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST

Dust emissions in waste gas shall not exceed the following mass concentrations:

- a) for installations with a rated thermal input of 1 MW or more 20 mg/m³,
- b) for installations with a rated thermal input of less than 1 MW 50 mg/m³.

INORGANIC PARTICULATE MATTER

5.2.2 shall not apply.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed a mass concentration of 0.25 mg/m³.

For individual furnaces with a rated thermal input of less than 2.5 MW, the emission standard shall apply to nominal load operation only.

NITROGEN OXIDES

Nitrogen monoxide and nitrogen dioxide emissions in waste gas may not exceed the following mass concentrations, to be indicated as nitrogen dioxide:

- a) for installations with a rated thermal input equal to or higher than 1 MW 0.40 g/m³,
- b) for installations with a rated thermal input lower than 1 MW 0.50 g/m³.

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that the requirements for emissions of organic substances of Classes I and II shall not apply.

CONTINUOUS MEASUREMENT

Individual furnaces with a rated thermal input of 5 to 25 MW shall be equipped with measuring instruments, which continuously determine dust emission mass concentrations qualitatively.

Individual furnaces with a rated thermal input of more than 25 MW shall be equipped with measuring instruments, which continuously determine dust emission mass concentrations.

Individual furnaces with a rated thermal input equal to or higher than 2.5 MW shall be equipped with measuring instruments, which continuously determine carbon monoxide emission mass concentrations.

EXISTING INSTALLATIONS

TOTAL DUST

Existing installations shall comply with the requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

CONTINUOUS MEASUREMENT

The requirement to be equipped with a measuring instrument, which continuously determines carbon monoxide emission mass concentrations, shall not apply to existing individual furnaces with a rated thermal input of 2.5 to 25 MW.

5.4.1.4 Installations under 1.4:

Stationary Internal Combustion Engines (including Stationary Internal Combustion Engines under 1.1 and 1.2)

REFERENCE VALUES

Emission standards refer to a volume content of oxygen in waste gas of 5 per cent.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST, INCLUDING THE CONTENT OF CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

Dust emissions in waste gas from compression ignition engines operated on liquid fuels shall, as a minimum requirement, not exceed the mass concentrations of 20 mg/m³.

Dust emissions in waste gas from stationary internal combustion engines exclusively designed for emergencies or operated for up to 300 hours per year during periods of peak load (e.g. for electricity generation, gas or water supply) shall not exceed, as a minimum requirement, the mass concentration of 80 mg/m³.

The possibilities to further reduce emissions by engine design and other state of the art techniques shall be exhausted.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed the following mass concentrations:

- | | |
|---|-------------------------|
| a) for compression ignition engines and spark ignition engines operated on liquid fuels, and for compression ignition engines (jet ignition engines) and spark ignition engines operated on gaseous fuels, with the exceptions of biogas, sewage gas or mine gas, | 0.30 g/m ³ , |
| b) for spark ignition engines operated on biogas or sewage gas with a rated thermal input of | |
| aa) 3 MW or more | 0.65 g/m ³ , |
| bb) less than 3 MW | 1.0 g/m ³ , |
| c) for spark ignition engines operated on mine gas, | 0.65 g/m ³ , |
| d) for jet ignition engines operated on biogas or sewage gas with a rated thermal input of | |
| aa) 3 MW or more | 0.65 g/m ³ , |
| bb) less than 3 MW | 2.0 g/m ³ ; |

when biogas, sewage gas or mine gas are used, the possibilities to further reduce carbon monoxide emissions by engine design and other state of the art techniques shall be exhausted.

Carbon monoxide emission standards shall not apply to stationary internal combustion engines exclusively designed for emergencies or operated for up to 300 hours per year during periods of peak load (e.g. for electricity generation, gas or water supply); the possibilities of emission reduction by measures of engine design shall be exhausted.

NITROGEN OXIDES

Nitrogen monoxide and nitrogen dioxide emissions in waste gas shall not exceed the following mass concentrations, to be indicated as nitrogen dioxide:

- a) for compression ignition engines operated on liquid fuels with a rated thermal input of
 - aa) 3 MW or more 0.50 g/m³,
 - bb) less than 3 MW 1.0 g/m³,
- b) for compression ignition engines (jet ignition engines) and spark ignition engines operated on gaseous fuels
 - aa) for jet ignition engines operated on biogas or sewage gas with a rated thermal input of
 - 3 MW or more 0.50 g/m³,
 - less than 3 MW 1.0 g/m³,
 - bb) for lean-burn engines and other four-stroke Otto engines operated on biogas or sewage gas, 0.50 g/m³,
 - cc) for jet ignition engines and lean-burn engines operated on other gaseous fuels, 0.50 g/m³,
- c) for other four-stroke Otto engines 0.25 g/m³,
- d) for two-stroke engines 0.80 g/m³;

when biogas or sewage gas are used in jet ignition engines with a rated thermal input of less than 3 MW, the possibilities to further reduce nitrogen oxides emissions by measures of engine design shall be exhausted.

Nitrogen oxides emission standards shall not apply to stationary internal combustion engines designed exclusively for emergencies or operated for up to 300 hours per year during periods of peak load (e.g. for electricity generation, gas or water supply).

SULPHUR OXIDES

When liquid mineral fuels are used, only fuel oils listed in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light fuel oil pursuant to the 3. BImSchV, as currently applicable, or diesel fuels with a sulphur mass content pursuant to the 3. BImSchV, as currently applicable, may be used, or equivalent measures to reduce emissions shall be applied.

When gaseous fuels are used, the requirements under 5.4.1.2.3 shall apply, provided that a conversion to a reference oxygen content in waste gas of 5 per cent is made.

When biogas or sewage gases are used, the possibilities to further reduce emissions by state of the art primary techniques (gas purification) shall be exhausted.

ORGANIC SUBSTANCES

Formaldehyde emissions in waste gas shall not exceed the mass concentration of 60 mg/m³. The requirements in 5.2.5 shall not apply to emissions of other organic substances.

The possibilities to further reduce organic substances emissions by engine design and other state of the art techniques shall be exhausted.

5.4.1.5 Installations under 1.5:

Gas Turbine Plants with a Rated Thermal Input of less than 50 MW (including Gas Turbine Plants under 1.2)

REFERENCE VALUES

Emission standards refer to a volume content of oxygen in waste gas of 15 per cent.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

TOTAL DUST

5.2.1 shall not apply.

When liquid fuels are used, the soot level shall not exceed the value 2 during continuous operation and the value 4 during start-up.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas shall not exceed a mass concentration of 0.10 g/m³ during operation with a load of 70 per cent or more.

NITROGEN OXIDES

When natural gas is used, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 75 mg/m³, to be indicated as nitrogen dioxide, during operation with a load of 70 per cent or more. For single cycle gas turbines with an efficiency of more than 32 per cent at 15 °C, 101.3 kPa and a relative air humidity of 60 per cent (ISO conditions), the emission standard of 75 mg/m³ shall be increased in line with the improvement of efficiency in percent.

When other gaseous or liquid fuels are used, emissions of nitrogen monoxide and nitrogen dioxide in waste gas from gas turbines shall not exceed the mass concentration of 0.15 g/m³, to be indicated as nitrogen dioxide.

Emission standards for nitrogen oxides shall not apply to gas turbines designed exclusively for emergencies or operated for up to 300 hours per year during periods of peak load in gas supply.

SULPHUR OXIDES

When liquid fuels are used, only fuel oils listed in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light fuel oil pursuant to the 3. BImSchV, as currently applicable, or diesel fuels with a sulphur mass content pursuant to the 3. BImSchV, as currently applicable, may be used, or equivalent measures to reduce emissions shall be applied.

EXISTING INSTALLATIONS

NITROGEN OXIDES

Existing installations shall comply with the requirements to restrict nitrogen dioxides emissions no later than ten years after the entry into force of this Administrative Regulation; the requirements for new facilities to restrict nitrogen oxides emissions shall not apply to existing individual aggregates with a mass flow of nitrogen oxides of up to 20 Mg/a, to be indicated as nitrogen dioxide.

5.4.1.9/10 Installations under 1.9 and 1.10:

5.4.1.9.1 Installations for Grinding or Drying of Coal

5.4.1.10.1 Installations for Briquetting of Lignite or Hard Coal

TOTAL DUST

a) Hard coal

Dust emissions in swaths and vapours shall not exceed the mass concentration of 75 mg/m³ (wet).

b) Lignite

Dust emissions in waste gas of vapour dedusting, prop dedusting and prop jaw fog dispersals shall not exceed a mass concentration of 75 mg/m³ (wet).

EXISTING INSTALLATIONS

TOTAL DUST

Lignite

For existing installations, dust emissions in waste gas of the interior dedusting shall not exceed a mass concentration of 75 mg/m^3 if, because of the risk of explosion, wet waste gas purification processes have to be used.

5.4.1.11 Installations under 1.11:

Installations for Dry Distillation of Hard Coal (Coke Oven Plants)

UNDERGRATE FIRING

a) Reference value

Emission standards for combustion waste gases refer to a volume content of oxygen of 5 per cent in waste gas.

b) Dust

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m^3 .

c) Nitrogen oxides

During the first measurement, nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed 0.50 g/m^3 ; the possibilities to reduce an increase of emissions caused by aging by combustion technique and other state of the art techniques shall be exhausted.

d) Fuel

The mass concentration of sulphur compounds in the undergrate gas, to be indicated as sulphur, shall not exceed 0.80 g/m^3 .

CHARGING COKE OVENS

Dust emissions shall be avoided when drawing off coal from the coal bunker into the lorry.

Filling gases shall be collected. During bulk feeding operations, filling gases shall be fed into the crude gas. During compacting, filling gases shall be passed on to the crude gas or the adjacent oven as far as possible. Filling gases, which cannot be

passed on, shall be supplied to combustion. Dust emissions in the combustion waste gas shall not exceed the mass concentration of 10 mg/m³.

When the coal is graded, filling gas emissions shall be reduced and, as far as possible, prevented by sealing the grading opening.

CHARGING HOLE LIDS

Emissions at charging hole lids shall be avoided as far as possible, e.g. by using charging hole lids with large sealing surfaces, by packing the charging hole lids after each charging of the oven, and by regular cleaning of charging hole frames and charging hole lids before closing the charging holes. Oven ceilings shall be cleaned of coal residues regularly.

ASCENSION PIPE LIDS

Ascension pipe lids shall be equipped with water dip tanks or adequate systems in order to avoid emissions; ascension pipes shall be cleaned regularly.

COKE OVEN OPERATING MACHINERY

The machinery for operating the coke oven shall be equipped with systems for cleaning the sealing surfaces on the oven door-frames.

COKE OVEN DOORS

Coke oven doors with a technically gas-tight seal shall be used. The gaskets shall be pushed against the frame of the chamber exerting spring resistance or using other technology, which seals as efficiently. The sealing surfaces of the coke oven doors shall be cleaned regularly. The possibilities to further reduce emissions by single-chamber pressure regulation, exhaust systems or other measures according to state of the art techniques shall be exhausted.

COKE PUSHING

Waste gases shall be collected during coke pushing operations and fed into a dedusting system; dust emissions shall not exceed a mass concentration of 5 mg/m³ or the mass ratio of 5 g per Mg of coke.

COKE QUENCHING

Low-emission procedures shall be applied for coke quenching, e.g. dry coke quenching; dust emissions in waste gas from dry coke quenching shall not exceed a mass concentration of 15 mg/m³ and dust emissions from wet coke quenching shall not exceed the mass ratio of 10 g per Mg of coke.

OPERATING MANUAL

The measures for emission reduction in coke oven operations shall be established in an operating manual, particularly so as to guarantee properly sealed openings, ensure that only completely roasted coke is pushed out, and prevent the escape of unburned gases into the atmosphere.

COKING BY-PRODUCT PLANTS

The requirements under 5.4.4.1m.2, 5.4.4.1p.1 and 5.4.4.4 shall apply accordingly to installations in the category of coking by-product plants. If the process gas also contains hydrogen sulphide in addition to ammonia, and post-combustion is applied, the waste gas shall be supplied to a sulphuric acid or sulphur recovery installation.

EXISTING INSTALLATIONS

COKE COOLING

For existing installations with a wet quenching installation for coke cooling, dust emissions from the quenching tower shall not exceed the mass ratio of 25 g per Mg of coke. In the event of a basic renewal of the coke cooling system, the requirements for new facilities shall be observed.

5.4.2 Rock and Soil, Glass, Ceramics, Construction Materials

5.4.2.3 Installations under 2.3:

Installations for the Production of Cement Clinker or Cements, insofar as Fuels under 1.2 are Used Exclusively

STORAGE

Clinker materials shall be stored in silos or in enclosed rooms equipped with exhaust and dedusting systems.

REFERENCE VALUES

Emission standards refer to a volume content of oxygen of 10 per cent in waste gas.

AMMONIA

The requirements in 5.2.4 shall not apply to ammonia emissions. If wastes with relevant quantities of substances containing ammonium are used as raw materials and their use is not regulated by the Ordinance on Incinerators for Waste and Similar Combustible Materials (17. BImSchV) of 23 November 1990 (BGBl. I, p. 2545), last amended by the Ordinance of 23 February 1999 (BGBl. I, p. 186), as currently applicable, the materials shall be supplied via the kiln inlet or the calcinator.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas from cement kilns shall not exceed a mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide. The possibilities to further reduce emissions by combustion techniques and other state of the art techniques, shall be exhausted.

ORGANIC SUBSTANCES

The requirements under 5.2.5 shall not apply. Insofar as wastes containing relevant quantities of organic substances are used as raw materials and their use is not regulated by the 17. BImSchV, as currently applicable, the materials shall be supplied via the kiln inlet or the calcinator.

CARCINOGENIC SUBSTANCES

5.2.7.1.1 shall apply, provided that emissions of benzene in the waste gas of cement kilns shall not exceed a mass concentration of 1 mg/m³ if possible, and shall not exceed a mass concentration of 5 mg/m³.

CONTINUOUS MEASUREMENT

The requirements under 5.3.3.2 shall not apply to emissions of carbon monoxide, fluorine and inorganic gaseous fluorine compounds as well as inorganic gaseous chlorine compounds.

5.4.2.4 Installations under 2.4: Installations for Burning or Calcination of Lime Stone, Bauxite, Dolomite, Gypsum, Diatomite, Magnesite, Quartzite or Clay to produce Chamotte

REFERENCE VALUES

For installations producing hydrated lime or hydrated dolomite, emission standards refer to moist waste gas.

TOTAL DUST

When electrostatic precipitators are used, divergent to 2.7 a) bb), all half-hourly mean values shall not exceed a mass concentration of 50 mg/m³.

NITROGEN OXIDES

Emissions of nitrogen dioxide and nitrogen monoxide in waste gas shall not exceed the mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide. For the manufacture of hard burned lime or sintered dolomite in rotary kilns, divergent to the first sentence, nitrogen dioxide and nitrogen monoxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed the mass concentration of 1.5 g/m³; the possibilities to reduce emissions by combustion technique and other state of the art techniques shall be exhausted.

WASTE GAS RECYCLING

For rotary kilns for burning gypsum, a mass concentration of sulphur dioxide and sulphur trioxide, to be indicated as sulphur dioxide, and of nitrogen dioxide and nitrogen monoxide, to be indicated as nitrogen dioxide, determined for operation with waste gas recycling shall be converted to the waste volume flow for operation without waste gas recycling.

EXISTING INSTALLATIONS

TOTAL DUST

Existing installations for burning gypsum which are equipped with electrostatic precipitators and using lignite dust as fuel shall comply with the requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

HYDROGEN SULPHIDE

For lime shaft kilns with mixed fuels, hydrogen sulphide emissions in waste gas shall not exceed a mass concentration of 3 g/m³ if possible; the possibilities to reduce hydrogen sulphide emissions by state of the art primary and other techniques shall be exhausted.

5.4.2.7 Installations under 2.7: Installations for Expanding of Perlite, Slate or Clay

REFERENCE VALUES

Emission standards refer to moist waste gas and to a volume content of oxygen of 14 per cent in the waste gas.

SULPHUR OXIDES

5.2.4 shall apply to installations for expanding clay or slate, provided that emissions of sulphur dioxide and sulphur trioxide in waste gas, to be indicated as sulphur dioxide, shall not exceed the mass concentration of 0.75 g/m³.

CARCINOGENIC SUBSTANCES

5.2.7.1.1 shall apply to installations for expanding clay or slate, provided that emissions of Class III substances in waste gas shall not exceed a mass concentration of 1 mg/m³ if possible, and shall not exceed a mass concentration of 3 mg/m³.

5.4.2.8 Installations under 2.8: Installations for the Production of Glass, also in Cases of Using Waste Glass as Raw Material, including Installations for the Production of Glass Fibres

REFERENCE VALUE

Emission standards are referenced to a volume content of oxygen of 8 per cent in waste gas for flame-heated glass melting furnaces, and to a volume content of oxygen of 13 per cent in the waste gas for flame-heated pot furnaces and day tanks.

INORGANIC PARTICULATE MATTER

If the use of lead or selenium is required for reasons of product quality, 5.2.2 shall apply, provided that emissions of Class II substances in waste gas do not exceed the mass concentration of 3 mg/m³; if substances from several classes are present, irrespective of 5.2.2 para. 1, the mass concentration for coinciding Classes II and III or coinciding Classes I to III substances shall not exceed 4 mg/m³. The use of lead or selenium shall be documented.

If external cullet is used for the production of container glass, 5.2.2 shall apply, provided that emissions of lead and its compounds in waste gas shall not exceed the mass concentration of 0.8 mg/m³, to be indicated as Pb; if several Class II substances are present, the emissions of substances of this class shall not exceed a mass concentration of 1.3 mg/m³ in total. If substances of several classes are present, irrespective of 5.2.2 para. 1, the mass concentration for coinciding Classes II and III or coinciding Classes I to III substances shall not exceed 2.3 mg/m³. The input of external cullet shall be documented.

FLUORINE AND ITS INORGANIC GASEOUS COMPOUNDS

5.2.4 shall apply, provided that emissions of fluorine and its inorganic gaseous compounds in waste gas, to be indicated as hydrogen fluoride, shall not exceed the mass concentration of 5 mg/m³. The possibilities to reduce emissions of fluorine and its inorganic gaseous compounds by using raw materials with lower concentrations of fluorine compounds shall be exhausted; if the use of fluorides is required for reasons of product quality, the quantity used shall be documented and restricted to the minimum necessary extent.

SULPHUR OXIDES

Sulphur dioxide and sulphur trioxide emissions in waste gas, to be indicated as sulphur dioxide, shall not exceed the mass concentrations listed in Table 9:

Table 9: Emission Standards for Sulphur Dioxide and Sulphur Trioxide, to be Indicated as Sulphur Dioxide, for Installations under 2.8

Installations for the Production of Glass	Gas-fired (g/m³)	Oil-fired (g/m³)	Operating Conditions
Container glass or flat glass	0.40	0.80	
Container glass	0.80	1.5	Near stoichiometric operation mode for primary NO _x reduction, full recirculation of filter dust, sulphate refining as well as content of internal and external of more than 40 mass per cent, as related to the batch.
Flat glass	0.80	1.5	Near stoichiometric operation mode for primary NO _x reduction, full recirculation of filter dust and a sulphate content required for glass quality of more than 0.45 mass per cent, as related to the mixture.

Installations for the Production of Glass	Gas-fired (g/m³)	Oil-fired (g/m³)	Operating Conditions
Domestic glass	0.20	0.50	
Domestic glass	0.50	1.4	Near stoichiometric operation mode for primary NO _x reduction, full recirculation of filter dust and a sulphate content required for glass quality of more than 0.45 mass per cent, as related to the batch.
Glass fibres	0.20	0.80	
Glass fibres	0.80	1.4	Complete recirculation of filter dust; for a sulphate content required for glass quality of more than 0.40 mass per cent, as related to the mixture.
Glass wool	0.050	0.80	
Glass wool	0.10	1.4	Content of internal and external cullet of more than 40 mass per cent, as related to the mixture
Special glass	0.20	0.50	
Special glass	0.40	1.0	Full recirculation of filter dust
Water glass	0.20	1.2	
Frits	0.20	0.50	

In operating conditions other than those indicated in Table 9 for the maximum permissible emission standards for a glass product, lower emission standards shall be defined on an individual basis if these operating conditions involve a lower sulphur input into the mixture or lower mass concentrations of sulphur oxides in the crude gas.

Emission limits for mixed fuel furnaces or multiple fuel furnaces shall be defined on a case-to-case basis.

The recirculation of filter dusts, the use of external cullet and the sulphate content in the mixture shall be documented.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide. For end-fired furnaces and cross-fired furnaces with a waste gas volume flow of less than 50 000 m³/h, divergent to the first sentence, nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed a mass concentration of 0.50 g/m³ if possible, and shall not exceed a mass concentration of 0.80 g/m³; the possibilities to reduce emissions by combustion techniques and other state of the art techniques shall be exhausted.

If nitrate refining is required for reasons of product quality, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 1.0 g/m³, to be indicated as nitrogen dioxide, during the nitrate refining process. The nitrate input shall be documented.

CARCINOGENIC SUBSTANCES

5.2.7.1.1 shall apply to the production of container glass, provided that emissions of Class I substances shall not exceed, as a minimum requirement, the mass concentration of 0.5 mg/m³ in waste gas.

If the use of arsenic compounds as refining agents is required for reasons of product quality, 5.2.7.1.1 shall apply, provided that emission standards for Class I substances, except arsenic and its compounds, apply; in this case, emissions of arsenic and its compounds in waste gas, to be indicated as As, shall not exceed, as a minimum requirement, the mass flow of 1.8 g/h or the mass concentration of 0.7 mg/m³; the possibilities to reduce emissions of arsenic, e.g. by using refining processes without arsenic or antimony, shall be exhausted.

If the use of cadmium compounds is required for glass colouring for reasons of product quality, 5.2.7.1.1 shall apply, provided that emission standards for Class I substances, except cadmium and its compounds, apply; in this case, emissions of cadmium and its compounds in waste gas, to be indicated as Cd, shall not exceed, as a minimum requirement, the mass flow of 0.5 g/h or the mass concentration of 0.2 mg/m³.

The input of arsenic and cadmium compounds shall be documented.

SPECIAL PROVISIONS

Special provisions shall be made for glass oxygen-fuel fired furnaces and electrically heated furnaces. The specific energy consumption of comparable modern glass furnaces fired by air fuel and the efficiency of waste gas cleaning facilities shall be used as criteria. Reference is made to VDI Guideline 2578 (November 1999 version).

EXISTING INSTALLATIONS

TOTAL DUST

For existing installations equipped with electrostatic precipitators and meeting the requirements of 6.2.3.3, dust emissions in waste gas shall not exceed the mass concentration of 30 mg/m³.

NITROGEN OXIDES

For existing installations with end-fired furnaces or cross-fired furnaces, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.80 g/m^3 , to be indicated as nitrogen dioxide; moreover, it shall be examined to what extent, with additional waste gas cleaning techniques, an emission standard of 0.50 g/m^3 may be requested.

These requirements to restrict nitrogen oxides emissions shall be observed no later than eight years after the entry into force of this Administrative Regulation; during the specified period, at the end of each furnace's lifetime, appropriate constructional alterations to the furnace shall be carried out, applying state of the art techniques to reduce nitrogen oxides emissions.

If nitrate refining is required for reasons of product quality, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the following mass concentrations, to be indicated as nitrogen dioxide, during the nitrate refining process:

- | | | |
|----|---|-----------------------|
| a) | for a waste gas volume flow of $5,000 \text{ m}^3/\text{h}$ or more | 1.0 g/m^3 , |
| b) | for a waste gas volume flow of less than $5,000 \text{ m}^3/\text{h}$ | 1.2 g/m^3 . |

The nitrate input shall be documented.

5.4.2.10 Installations under 2.10: Installations for Baking Ceramic Products

REFERENCE VALUE

Emission standards refer to a volume content of oxygen of 17 per cent in waste gas.

TOTAL DUST

5.2.1 shall apply to the use of packed bed filters, provided that during the intermittent dosage or intermittent circulation of the sorption agent dust emissions in waste gas shall not exceed the mass concentration of 40 mg/m^3 .

INORGANIC PARTICULATE MATTER

5.2.2 shall apply to the use of glazes or bodies containing lead, provided that emission standards for Class II substances, except lead and its compounds, apply. For emissions of lead and its compounds in waste gas, to be indicated as Pb, a mass flow of 2.5 g/h or a mass concentration of 0.5 mg/m³ shall not be exceeded if possible and a mass concentration of 3 mg/m³ shall not be exceeded. The possibilities to further reduce emissions of lead and its compounds by using lead-free glazes and bodies shall be exhausted.

FLUORINE AND ITS INORGANIC GASEOUS COMPOUNDS

5.2.4 shall apply, provided that emissions of fluorine and its inorganic gaseous compounds in waste gas, to be indicated as hydrogen fluoride, shall not exceed the mass concentration of 5 mg/m³. For intermittently operated kilns, divergent to the first sentence, emissions of fluorine and its inorganic gaseous compounds in waste gas, to be indicated as hydrogen fluoride, shall not exceed a mass flow of 30 g/m³ or a mass concentration of 10 mg/m³.

The possibilities to further reduce emissions of fluorine and its inorganic gaseous compounds by the choice of raw materials with lower concentrations of fluorine compounds and other state of the art primary and secondary techniques, shall be exhausted.

SULPHUR OXIDES

Emissions of sulphur dioxide and sulphur trioxide in waste gas shall not exceed the mass concentration of 0.50 g/m³, to be indicated as sulphur dioxide.

NITROGEN OXIDES

Emissions of nitrogen dioxide and nitrogen monoxide in waste gas shall not exceed the mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide.

ORGANIC SUBSTANCES

If post-combustion takes place outside the kiln, emissions of organic substances in waste gas shall not exceed the mass concentration of 20 mg/m³, to be indicated as total carbon; the requirements for emissions of Classes I and II organic substances defined in 5.2.5 shall not apply.

CARCINOGENIC SUBSTANCES

5.2.7.1.1 shall apply to kilns without external post-combustion, provided that emissions of benzene in waste gas shall not exceed a mass concentration of 1 mg/m³ if possible, and shall not exceed a mass concentration of 3 mg/m³.

EXISTING INSTALLATIONS

TOTAL DUST

For existing installations operated with a packed bed filter or without a dedusting system, dust emissions in waste gas shall not exceed the mass concentration of 40 mg/m³; the possibilities to further reduce dust emissions by state of the art techniques shall be exhausted.

SULPHUR OXIDES

For existing installations, emissions of sulphur dioxide and sulphur trioxide in waste gas, to be indicated as sulphur dioxide, shall not exceed the mass concentration of 750 mg/m³.

5.4.2.11 Installations under 2.11:

Installations for Melting of Mineral Matters, including Installations for the Production of Mineral Fibres

REFERENCE VALUE

For installations fired with fossil fuels, emission standards are referenced to a volume content of oxygen of 8 per cent in waste gas.

FLUORINE AND ITS INORGANIC GASEOUS COMPOUNDS

5.2.4 shall apply, provided that emissions of fluorine and its inorganic gaseous compounds in waste gas, to be indicated as hydrogen fluoride, shall not exceed the mass concentration of 5 mg/m³. The possibilities to further reduce emissions of fluorine and its inorganic gaseous compounds by the choice of raw materials with low concentrations of fluorine compounds shall be exhausted; if the use of fluorides is required for reasons of product quality, the quantity used shall be restricted to the minimum necessary extent and documented.

SULPHUR OXIDES

For the production of stone wool, emissions of sulphur dioxide and sulphur trioxide in waste gas, to be indicated as sulphur dioxide, shall not exceed the following mass concentrations:

- | | |
|---|-------------------------|
| a) for the exclusive use of natural stones or a mixture | 0.60 g/m ³ , |
| b) for the use of less than 45 mass per cent of minerally combined bricks, as related to the mixture, | 1.1 g/m ³ , |
| c) for the use of 45 mass per cent or more of minerally combined bricks, as related to the mixture, and with full recirculation of filter dust, | 1.5 g/m ³ . |

For other proportions of minerally combined bricks or when there is no complete recirculation of filter dust, emission standards shall be defined on an individual basis.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide. For end-fired furnaces and cross-fired furnaces with a waste gas volume flow of less than 50 000 m³/h, divergent to the first sentence, nitrogen monoxide and nitrogen dioxide emissions in waste gas, to be indicated as nitrogen dioxide, shall not exceed a mass concentration of 0.50 g/m³ if possible, and shall not exceed a mass concentration of 0.80 g/m³; the possibilities to reduce emissions by combustion technique and other state of the art techniques, shall be exhausted.

For cupola furnaces with thermal post-combustion, divergent to 5.2.4, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 0.35 g/m³, to be indicated as nitrogen dioxide.

EXISTING INSTALLATIONS

TOTAL DUST

For existing installations equipped with electrostatic precipitators and meeting the requirements of 6.2.3.3, dust emissions in waste gas shall not exceed the mass concentration of 30 mg/m³.

NITROGEN OXIDES

For existing installations with end-fired furnaces or cross-fired furnaces, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 0.80 g/m³, to be indicated as nitrogen dioxide; moreover, it shall be examined to what extent, including additional waste gas purification techniques, an emission standard of 0.50 g/m³ may be requested.

These requirements to restrict nitrogen oxides emissions shall be observed no later than eight years after the entry into force of this Administrative Regulation; during the specified period, at the end of each tank's lifetime, appropriate constructional alterations to the melting tank shall be carried out using state of the art techniques to reduce nitrogen oxides emissions.

If nitrate refining is required for reasons of product quality, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the following mass concentrations, to be indicated as nitrogen dioxide, during the nitrate purification process:

- | | | |
|----|--|------------------------|
| a) | for a waste gas volume flow of 5,000 m ³ /h or more | 1.0 g/m ³ , |
| b) | for a waste gas volume flow of less than 5,000 m ³ /h | 1.2 g/m ³ . |

The nitrate input shall be documented.

5.4.2.15 Installations under 2.15: Asphalt Mixing Plants

REFERENCE VALUES

Emission standards are referenced to a volume content of oxygen of 17 per cent in waste gas, and, divergent to this, to a volume content of oxygen in waste gas of 3 per cent for thermal oil curing aggregates.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases containing dust from the mineral rotary dryer, the asphalt granulate dryer (parallel dryer), the transport units for hot minerals, the washer and the mixer shall be collected and fed into a dedusting system.

Crushers for recycled asphalt shall be encapsulated and equipped with effective installations to reduce dust emissions, e.g. water sprinklers.

The possibilities to reduce the production temperature for asphalt according to state of the art techniques, e.g. by means of additives or processing measures, shall be exhausted.

CARBON MONOXIDE

When gaseous or liquid fuels are used, carbon monoxide emissions in waste gas shall not exceed the mass concentration of 0.50 g/m^3 . When solid fuels are used, carbon monoxide emissions in waste gas shall not exceed a mass concentration of 0.50 g/m^3 if possible, and shall not exceed a mass concentration of 1.0 g/m^3 .

ORGANIC SUBSTANCES

Waste gases containing organic substances from the vicinity of the mixer outflow, the transfer points from the mixer, the transport units for the bituminous mixture and the transfer points to the loading silos shall be collected and fed into a suitable waste gas purification facility (e.g. by feeding the waste gases into the mineral rotary dryer as combustion air).

Emissions of organic substances when the bitumen storage tanks are filled shall preferably be avoided by using the vapour recovery technique.

The requirements in 5.2.5 for emissions of Classes I and II organic substances shall not apply.

CARCINOGENIC SUBSTANCES

5.2.7.1.1 shall apply, provided that emissions of Class III substances in waste gas do not exceed a mass concentration of 1 mg/m^3 if possible, and do not exceed a mass concentration of 5 mg/m^3 .

EXISTING INSTALLATIONS

ORGANIC SUBSTANCES

For existing installations, during the operation of an asphalt granulate dryer (parallel dryer), emissions of organic substances in waste gas, to be indicated as total carbon, shall not exceed a mass concentration of 50 mg/m³ if possible, and shall not exceed a mass concentration of 0.10 g/m³; the requirements for emissions of Classes I and II organic substances defined in 5.2.5 shall not apply.

For existing installations, waste gases containing organic substances from the vicinity of the mixer outflow, transfer points from the mixer, transport units for the bituminous mixture and transfer points to the loading silos shall be collected and fed into the waste gas stack of the dedusting facility; moreover, it shall be examined whether additional emission reduction measures, e.g. feeding the waste gases into the mineral rotary dryer as combustion air, may be requested.

When the bitumen storage tanks are being filled, less expensive measures may be used for existing installations than for new installations, e.g. feeding waste gases containing organic substances into the transport units for hot minerals.

Collection of waste gases from the vicinity of the mixer outflow, transfer points from the mixer, transport units for the bituminous mixture and transfer points to the loading silos, as well as the use of the vapour recovery technique or a comparable waste gas purification facility, may be waived if, for installations with a production capacity of

- a) 200 Mg per hour or more, there is a minimum distance of 500 m,
 - b) less than 200 Mg per hour, there is a minimum distance of 300 m
- to the next residential area, existing or planned.

5.4.3 Steel, Iron and Other Metals, including their Processing

5.4.3.1 Installations under 3.1:

Installations for Roasting, Smelting or Sintering Ores

5.4.3.1.1 Iron Ore Sintering Plants

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected warm at the point of origin, e.g. sintering belt, coke grinding equipment, mixing bunker, in the range of sintering belt discharge, sinter cooling and sinter screening, and fed into a waste gas purification facility.

Filter dust shall be supplied to recycling as far as possible.

INORGANIC PARTICULATE MATTER

5.2.2 shall apply, provided that lead emissions in waste gas from the sintering belt shall not exceed a mass concentration of 1 mg/m³.

STANDSTILLS CAUSED BY MALFUNCTIONS

The requirements for total dust and inorganic particulate matter shall not apply during standstills of the sintering belt caused by malfunctions until normal operation is resumed; however, the dedusting system shall be operated at maximum precipitation capacity.

SULPHUR OXIDES

Emissions of sulphur dioxide and sulphur trioxide in waste gas from the sintering belt shall not exceed the mass concentration of 0.50 g/m³, to be indicated as sulphur dioxide.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas from the sintering belt shall not exceed the mass concentration of 0.40 g/m³, to be indicated as nitrogen dioxide.

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that emissions of organic substances in waste gas from the sintering belt shall not exceed the mass concentration of 75 mg/m³, to be indicated as total carbon.

DIOXINS AND FURANS

5.2.7.2 shall apply, provided that emissions of dioxins and furans in waste gas shall not exceed the mass concentration of 0.1 ng/m³ if possible, and shall not exceed the mass concentration of 0.4 ng/m³.

EXISTING INSTALLATIONS

TOTAL DUST

For existing installations equipped with electrostatic precipitators, warm dust emissions in waste gas from the sintering belt and in the range of sintering belt discharge, sinter cooling and sinter screening (area dedusting), shall not exceed the mass concentration of 50 mg/m³.

INORGANIC PARTICULATE MATTER

For existing installations equipped with electrostatic precipitators, 5.2.2 shall apply, provided that lead emissions in waste gas from the sintering belt shall not exceed a mass concentration of 2 mg/m³.

5.4.3.1.2 Installations for Roasting, Smelting or Sintering Non-ferrous Metal Ores

5.4.3.1.1 shall apply accordingly.

5.4.3.2 Installations under 3.2:

Installations for the Production, Manufacture or Smelting of Pig Iron or Steel

5.4.3.2a Integrated Iron and Steel Plants

5.4.3.2a.1 Blast Furnaces

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases containing dust shall be collected at the point of origin, e.g. in the blast furnace pouring bay, at the point of blast furnace burdening, at the point of blast furnace charging, and fed into a waste gas purification facility; notwithstanding, their development may also be prevented during blast furnace tapping by extensive inert gas blanketing, e.g. by a nitrogen atmosphere.

BLAST FURNACE TOP GAS

Blast furnace top gas shall be energetically recovered; if blast furnace top gas cannot be recycled for safety reasons or in emergencies, it shall be fed into a flare.

COWPER

REFERENCE VALUES

Emission standards refer to a volume content of oxygen of 3 per cent in waste gas.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

5.4.3.2a.2 Basic Oxygen Steelmaking

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases containing dust shall be collected at the point of origin, e.g. at the point of pig iron decanting, deslagging, desulphurisation, converter charging and emptying, crude steel treatment, and fed into a dedusting system; notwithstanding, their development during transfilling of liquid pig iron may also be prevented by extensive inert gas blanketing, e.g. a carbon dioxide atmosphere.

Filter dust shall be supplied to recycling as far as possible.

CONVERTER GAS

Converter gas shall be energetically recovered. If converter gas cannot be recovered for safety reasons or in emergencies, it shall be fed into a flare.

EXISTING INSTALLATIONS

TOTAL DUST

Existing secondary dedusting systems equipped with electrostatic precipitators shall comply with requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

CONVERTER GAS

In existing installations, converter gas shall be energetically recovered if possible. If converter gas cannot be recovered, it shall be fed into a flare; in this event, the dust content in the flare gas after dedusting shall not exceed a mass concentration of 50 mg/m³.

5.4.3.2b Installations for the Production or Smelting of Pig Iron or Steel including Continuous Casting

5.4.3.2b.1 Electric Steelmaking

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. for electric arc furnaces using extraction facilities at the hole in the furnace roof and using suction or casing for the process stages of charging, smelting and tapping, and fed into a waste gas purification facility.

Filter dust shall be supplied to recycling as far as possible.

TOTAL DUST

Dust emissions in waste gas from steel works with electric arc furnaces shall not exceed the mass concentration of 5 mg/m³; divergent to 2.7 a) bb), all half-hourly mean values shall not exceed three times this mass concentration.

EXISTING INSTALLATIONS

TOTAL DUST

Dust emissions in waste gas from electric arc furnaces, to be indicated as the daily mean value, shall not exceed a mass concentration of 10 mg/m³.

5.4.3.2b.2 Electroslag Remelting Plants

FLUORINE AND ITS INORGANIC GASEOUS COMPOUNDS

Emissions of fluorine and its inorganic gaseous compounds in waste gas shall not exceed the mass concentration of 1 mg/m³, to be indicated as hydrogen fluoride.

5.4.3.3 Installations under 3.3:

Installations for the Production of Non-ferrous Crude Metals

5.4.3.3.1 Installations for the Production of Non-ferrous Crude Metals except Aluminium and Ferro-alloys

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. at the point of loading, smelting, refining and casting, and fed into a waste gas purification facility.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 5 mg/m³.

INORGANIC PARTICULATE MATTER

5.2.5 shall apply, provided that emissions of inorganic particulate matter in waste gas shall not exceed the following mass concentrations:

- a) Class II substances a mass concentration of 1 mg/m³ in total, in lead works a mass concentration of 2 mg/m³,
- b) Class III substances a mass concentration of 2 mg/m³ in total.

SULPHUR OXIDES

5.4.4.1m.2 shall apply accordingly to waste gases with a high content of sulphur dioxide.

MEASUREMENT AND MONITORING OF SULPHUR OXIDES EMISSIONS

For installations with operating conditions which primarily are changeable with time, for individual measurement, the duration of the averaging period shall correspond to the batch duration, but not exceed 24 hours; for continuous measurement, divergent to 2.7 a) bb), all half-hourly mean values shall not exceed three times the mass concentrations established.

FUELS

When liquid or solid fuels are used, the sulphur mass content in the fuel shall not exceed 1 per cent, as related to a net calorific value of 29.3 MJ/kg for solid fuels, unless an equivalent emission standard for sulphur oxides is achieved by means of a waste gas purification facility; when coals are used, only coals which do not cause higher sulphur oxides emissions than hard coal with a sulphur mass content of less than 1 per cent, as related to a net calorific value of 29.3 MJ/kg, shall be used.

CARCINOGENIC SUBSTANCES

In copper smelters, 5.2.7.1.1 shall apply, provided that emission standards for Class I substances, except arsenic and its compounds, apply. Emissions of arsenic and its compounds (except arsine) in waste gas, to be indicated as As, shall not exceed, as a minimum requirement, the mass flow of 0.4 g/h or the mass concentration of 0.15 mg/m³; notwithstanding, in waste gas from anode furnaces, these emissions shall, as a minimum requirement, not exceed the mass concentration of 0.4 mg/m³.

DIOXINS AND FURANS

5.2.7.2 shall apply, provided that emissions of dioxins and furans in waste gas do not exceed a mass concentration of 0.1 ng/m³ if possible, and do not exceed a mass concentration of 0.4 ng/m³.

EXISTING INSTALLATIONS

SULPHUR OXIDES

For existing installations, emissions of sulphur dioxide and sulphur trioxide in waste gas – except process waste gases fed into installations pursuant to 5.4.4.1m.2 – shall not exceed a mass concentration of 0.50 g/m³, to be indicated as sulphur dioxide.

5.4.3.3.2 Installations for the Production of Ferro-alloys in Electrothermal or Metallothermal Processes

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 5 mg/m³.

5.4.3.3.3 Installations for the Production of Aluminium from Ores in Electrolytic Processes with Preburnt Discontinuous Anodes

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Electrolytic furnaces shall be built as enclosed constructions. Opening of the furnaces and the frequency of the anode effect shall be limited to an extent unavoidable for operational requirements; the operation mode of the electrolytic furnaces shall be automated as far as possible.

Filter dust shall be supplied to recycling as far as possible.

TOTAL DUST

Dust emissions in waste gas

- a) of the electrolytic furnaces shall not exceed the mass concentration of 10 mg/m³ and
- b) of the electrolytic furnaces including waste gases discharged from the furnace house shall not exceed the mass ratio of 2 kg per Mg of Al.

FLUORINE AND ITS INORGANIC GASEOUS COMPOUNDS

Emissions of fluorine and its inorganic gaseous compounds, to be indicated as hydrogen fluoride, in waste gas

- a) of the electrolytic furnaces shall not exceed the mass concentration of 1 mg/m³ and
- b) of the electrolytic furnaces including waste gases discharged from the furnace house shall not exceed the mass ratio of 0.5 kg per Mg of Al.

5.4.3.3.4 Installations for the Production of Aluminium from Secondary Raw Materials

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. at the point of loading, smelting, refining, alloying and casting.

Hexachloroethane shall not be used for smelting.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide, to be indicated as nitrogen dioxide, in waste gas from rotary drum furnaces operated on oxygen fuel burners shall not exceed a mass concentration of 0.50 g/m³.

FUELS

When liquid fuels are used, only liquid fuels that do not cause higher sulphur oxides emissions than fuel oils defined in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light fuel oil pursuant to the 3. BImSchV, as currently applicable, shall be used.

5.4.3.4 Installations under 3.4: Installations for Smelting, Alloying or Refining of Non-ferrous Metals

5.4.3.4.1 Installations for Smelting, Alloying or Refining of Non-ferrous Metals except Aluminium

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. at the point of loading, smelting, refining, alloying and casting.

Hexachloroethane shall not be used for smelting.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass flow of 50 g/h or the mass concentration of 5 mg/m³.

INORGANIC PARTICULATE MATTER

5.2.2 shall apply, provided that emissions of inorganic particulate matter of Class II substances in waste gas from lead refining installations shall not exceed a mass concentration of 1 mg/m³ in total.

FUELS

When liquid fuels are used, only liquid fuels that do not cause higher sulphur oxides emissions than fuel oils defined in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light fuel oil pursuant to the 3. BImSchV, as currently applicable, shall be used.

DIOXINS AND FURANS

5.2.7.2 shall apply, provided that emissions of dioxins and furans in waste gas from copper shaft furnaces shall not exceed a mass concentration of 0.1 ng/m³ if possible, and shall not exceed a mass concentration of 0.4 ng/m³.

5.4.3.4.2 Smelting Installations for Aluminium

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, e.g. at the point of loading, smelting, refining, alloying and casting.

Hexachloroethane shall not be used for smelting.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 10 mg/m³.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide, to be indicated as nitrogen dioxide, in waste gas from rotary drum furnaces operated on oxygen fuel burners shall not exceed a mass concentration of 0.50 g/m³.

FUELS

When liquid fuels are used, only liquid fuels that do not cause higher sulphur oxides emissions than fuel oils defined in DIN 51603 Part 1 (March 1998 version) with a sulphur mass content for light fuel oil pursuant to the 3. BImSchV, as currently applicable, shall be used.

5.4.3.6 Installations under 3.6: Rolling mills

5.4.3.6.1 Thermal and Thermal Treatment Furnaces

REFERENCE VALUES

Emission standards shall refer to a volume content of oxygen of 5 per cent in waste gas.

NITROGEN OXIDES

For thermal furnaces, e.g. pusher furnaces and walking beam furnaces, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide.

ORGANIC SUBSTANCES

For thermal treatment furnaces for aluminium foils, the requirements in 5.2.5 shall not apply to emissions of organic substances. The possibilities to reduce emissions of organic substances by process techniques or other state of the art techniques shall be exhausted.

5.4.3.7/8 Installations under 3.7 and 3.8: Foundries

5.4.3.7.1 Iron, Malleable Iron and Steel Foundries

5.4.3.8.1 Foundries for Non-ferrous Metals

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin as far as possible, e.g. in the range of sand reprocessing, moulding, casting, cooling, pouring, core moulding and cleaning of castings, with the exception of iron, malleable iron and steel foundries with a production capacity of less than 20 Mg cast parts per day and foundries for non-ferrous metals with a production capacity of less than 4 Mg per day for lead and cadmium, or less than 20 Mg per day for other non-ferrous metals; this exemption shall also apply to installations for smelting non-ferrous metals. Waste gases from the smelting installations in iron, malleable iron and steel foundries shall be collected irrespective of the production capacity.

In principle, hexachloroethane shall not be used for smelting. Insofar as the use of hexachloroethane is required for smelting in the manufacture of cast products from aluminium alloys with high quality and safety standards, and for grain refining of the magnesium alloys AZ81, AZ91 and AZ92, the consumption of hexachloroethane shall not exceed 1.5 kg per day. The input of hexachloroethane shall be documented.

CARBON MONOXIDE

Waste gases containing carbon monoxide in cupola furnaces with lower blast furnace gas offtake shall be collected and post-combusted. Carbon monoxide emissions in waste gas shall not exceed 0.15 g/m³.

SULPHUR OXIDES

Emissions of sulphur dioxide and sulphur trioxide in waste gas shall not exceed a mass concentration of 0.50 g/m³, to be indicated as sulphur dioxide.

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that amine emissions in waste gas shall not exceed the mass flow of 25 g/h or the mass concentration of 5 mg/m³. The requirements under 5.2.5 para. 1 for total carbon shall not apply.

BENZENE

5.2.7.1.1 shall apply, provided that benzene emissions in waste gas shall not exceed the mass flow of 5 g/h or the mass concentration of 5 mg/m³. The possibilities to further reduce benzene emissions by process techniques and other state of the art techniques shall be exhausted, e.g. by changes concerning the input materials for core production and casting, blasting air into shell casting installations, using waste gases containing benzene as combustion air in cupola furnaces.

EXISTING INSTALLATIONS

TOTAL DUST

Existing installations equipped with wet scrubbers shall comply with requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

CARBON MONOXIDE

Existing cupola furnaces with lower blast furnace gas offtake shall comply with requirements to restrict carbon monoxide emissions no later than eight years after the entry into force of this Administrative Regulation.

ORGANIC SUBSTANCES

Existing installations shall comply with requirements to restrict amine emissions no later than eight years after the entry into force of this Administrative Regulation.

**5.4.3.9 Installations under 3.9:
Installations for Coating Metallic Protective Layers**

**5.4.3.9.1 Installations for Coating Metallic Protective Layers on Metal Surfaces by
Means of Molten Baths containing Fluxing Agents**

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

In hot galvanizing facilities, waste gases from the galvanizing kettle shall be collected e.g. by casing or exhaust hoods, and fed into a waste gas purification facility.

TOTAL DUST

Dust emissions in waste gas from the galvanizing kettle shall not exceed a mass concentration of 5 mg/m³.

The result of an individual measurement shall be established over several dips; the measuring period corresponds to the total of the individual dipping periods and shall normally be half an hour. The dipping period equals the time span between the first and last contact of the object to be galvanized and the galvanizing bath.

INORGANIC CHLORINE COMPOUNDS

Hot galvanizing facilities shall be constructed and operated so that through sufficient pickling capacities and the observation of the pickling parameters “temperature” and “acid concentration”, emissions of inorganic gaseous chlorine compounds from the pickling bath in waste gas are minimized and the mass concentration of 10 mg/m³, to be indicated as hydrogen chloride, is not exceeded. The existence of sufficient pickling capacities and the observation of the pickling parameters shall be documented.

If a hydrogen chloride concentration in waste gas of 10 mg/m³ can be exceeded owing to the pickling parameters “temperature” and “acid concentration”, the waste gases shall be collected and fed into a waste gas purification facility. Emissions of gaseous inorganic chlorine compounds in waste gas shall not exceed a mass concentration of 10 mg/m³, to be indicated as hydrogen chloride.

5.4.3.10 Installations under 3.10:

Installations for Surface Treatment of Metals by Pickling or Etching Using Concentrated Hydrofluoric Acid or Nitric Acid

EXISTING INSTALLATIONS

NITROGEN OXIDES

For existing installations for the continuous pickling of high-grade steels with mixed acids containing nitric acid, nitrogen monoxide and nitrogen dioxide emissions, to be indicated as nitrogen dioxide, in waste gas shall not exceed the mass concentration of 0.35 g/m³ if possible and shall not exceed a mass concentration of 0.70 g/m³.

5.4.3.21 Installations under 3.21:

Installations for the Production of Lead Accumulators

SULPHURIC ACID FUMES

Sulphuric acid fumes occurring during forming shall be collected and fed into a waste gas purification facility; emissions of sulphuric acid in waste gas shall not exceed a mass concentration of 1 mg/m³.

5.4.4 Chemical Products, Pharmaceuticals, Mineral Oil Refining and Further Processing

5.4.4.1 Installations under 4.1:

Installations for the Production of Substances or Groups of Substances by Chemical Transformation

EXISTING INSTALLATIONS

TOTAL DUST

5.2.1 shall apply, provided that emissions of dust particles in waste gas from existing installations operating intermittently or quasi-continuously which do not emit more per year than installations with a mass flow of 0.20 kg/h, when operating continuously, shall not exceed a mass concentration of 50 mg/m³.

5.4.4.1b Installations for the Production of Oxygen-Containing Hydrocarbons

5.4.4.1b.1 Installations for Cyclohexane Oxidation

BENZENE

Benzene emissions in waste gas shall not exceed, as a minimum requirement, the mass concentration of 3 mg/m³.

5.4.4.1d Installations for the Production of Nitrogenous Hydrocarbons

5.4.4.1d.1 Installations for the Production of Acrylonitrile

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases from the reaction system and the absorber shall be fed into a combustion installation. Waste gases resulting from the cleaning of reaction products (distillation) as well as from refilling processes shall be fed into a waste gas scrubber.

ACRYLONITRILE

Acrylonitrile emissions in waste gas from the combustion installation shall, as a minimum requirement, not exceed the maximum mass concentration of 0.2 mg/m³.

5.4.4.1d.2 Installations for the Production of Caprolactam

CAPROLACTAM

Caprolactam emissions in waste gas shall not exceed a mass concentration of 0.10 g/m³.

5.4.4.1h Installations for the Production of Basic Plastic Materials

5.4.4.1h.1 Installations for the Production of Polyvinyl Chloride (PVC)

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Dryer waste gas shall be used as combustion air in furnaces if possible.

MONOMERIC RESIDUES

Vinyl chloride (VC) residues contained in the polymer shall be kept as low as possible at the transition point between the closed system and treatment or drying within the open system; as a minimum requirement, the following monthly mean values shall not be exceeded:

- a) suspension PVC 80 mg of VC per kg of PVC,
- b) emulsion PVC and microsuspension PVC 0.50 g of VC per kg of PVC.

The possibilities to further reduce vinyl chloride (VC) residues by primary techniques (e.g. multi-stage de-aerating) or other state of the art techniques shall be exhausted.

5.4.4.1h.2 Installations for the Production of Viscose Products

HYDROGEN SULPHIDE AND CARBON DISULPHIDE

In the total waste gas, including the extracted indoor air and air additionally extracted from the machine

- a) for the manufacture of textile rayons
 - aa) hydrogen sulphide emissions shall not exceed a mass concentration of 50 mg/m³
 - bb) and carbon disulphide emissions shall not exceed a mass concentration of 0.15 g/m³,
- b) for the manufacture of artificial sausage skin and sponge cloth
 - aa) hydrogen sulphide emissions shall not exceed the mass concentration of 50 mg/m³
 - bb) and carbon disulphide emissions shall not exceed the mass concentration of 0.40 g/m³.

2.7 a) bb) shall not apply.

The possibilities to further reduce emissions of hydrogen sulphide and carbon disulphide by encapsulation of the machines with waste gas collection and purification or other state of the art techniques shall be exhausted.

5.4.4.1h.3 Installations for the Production of Polyurethane Foams, except Installations under 5.11

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin if possible.

ORGANIC SUBSTANCES

The requirements under 5.2.5 shall not apply to installations for the manufacture of thermally insulating polyurethane foams operated on pure hydrocarbons (e.g. pentane) as propellant.

5.4.4.1h.4 Installations for the Production of Polyacrylonitrile Fibres

EXISTING INSTALLATIONS

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

In existing installations, dryer waste gas shall be used as combustion air in furnaces if possible.

ACRYLONITRILE

For existing installations, acrylonitrile emissions in waste gas from dryers shall not exceed, as a minimum requirement, the mass concentration of 15 mg/m³. Waste gases containing acrylonitrile from reaction boilers, intensive de-aerating, suspension collectors and washing filters shall be supplied to waste gas scrubbing or adsorption; acrylonitrile emissions in waste gas shall not exceed, as a minimum requirement, the mass concentration of 5 mg/m³.

In existing installations, when polymers are spun into fibres, waste gases with an acrylonitrile content of more than 5 mg/m³ shall be fed into a waste gas purification facility. Acrylonitrile emissions in waste gas from the washers during wet spinning shall not exceed, as a minimum requirement, the mass concentration of 5 mg/m³.

The possibilities to further reduce acrylonitrile emissions by primary measures (particularly reduction of the monomeric residues) or other state of the art techniques shall be exhausted.

5.4.4.1h.5 Installations for the Production of Polyethylene by Polymerisation under High Pressure

EXISTING INSTALLATIONS

ORGANIC SUBSTANCES

In existing installations, emissions of organic substances in waste gas from the granulate de-aerating system shall not exceed the mass concentration of 80 mg/m³, to be indicated as total carbon. The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply.

5.4.4.1l Installations for the Production of Gases

5.4.4.1n Installations for the Production of Bases

5.4.4.1l.1/5.4.4.1n.1 Installations for the Production of Chlorine or Alkali

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Installations for the production of chlorine or alkali shall not be constructed for the diaphragm process using asbestos or for the amalgam process.

CHLORINE

Chlorine emissions in waste gas shall not exceed a mass concentration of 1 mg/m³; notwithstanding, in installations for the production of chlorine with total liquefaction, chlorine emissions in waste gas shall not exceed a mass concentration of 3 mg/m³.

EXISTING INSTALLATIONS

MERCURY

In existing installations for chlor-alkali electrolysis using the amalgam process, mercury emissions in the cell room waste air shall not exceed an annual average mass ratio of 1.0 g per Mg of permitted chlorine production.

If alkali and dithionite or alcoholates are produced simultaneously in one installation, mercury emissions from cell room waste air shall not exceed an annual average mass ratio of 1.2 g per Mg of permitted chlorine production.

The possibilities to further reduce mercury emissions from chlor-alkali electrolysis using the amalgam process by state of the art techniques shall be exhausted.

5.4.4.1m Installations for the Production of Acids

5.4.4.1m.1 Installations for the Production of Nitric Acid

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed a mass concentration of 0.20 g/m³, to be indicated as nitrogen dioxide.

Dinitrogen oxide emissions in waste gas shall not exceed a mass concentration of 0.80 g/m³.

EXISTING INSTALLATIONS

NITROGEN OXIDES

Existing installations shall comply with the requirements to restrict emissions of nitrogen monoxide, nitrogen dioxide and dinitrogen oxide no later than eight years after the entry into force of this Administrative Regulation.

5.4.4.1m.2 Installations for the Production of Sulphur Dioxide, Sulphur Trioxide, Sulphuric Acid and Oleum

SULPHURIC ACID

The formation of sulphuric acid aerosols shall be restricted as much as possible during handling of sulphuric acid or oleum.

SULPHUR DIOXIDE

a) Waste gas conduct

In installations for the production of pure sulphur dioxide by liquefaction, the waste gas shall be fed into a sulphuric acid production installation or another treatment facility.

b) Conversion factors

aa) When the dual-contact process is used, a conversion factor of at least 99.8 per cent shall be maintained or, if a conversion factor of only at least 99.6 per cent is maintained, sulphur dioxide and sulphur trioxide emissions shall be further reduced by using downstream emission reduction technology, a fifth hurdle, or equivalent measures.

Divergent to these requirements, when the mean volume content of SO₂ is less than 8 per cent, with varying SO₂ feed concentrations and varying volume flows of the feed gas, a conversion factor of at least 99.5 per cent shall be maintained.

bb) When the contact process without intermediate absorption is used and

(i) for a volume content of sulphur dioxide in the feed gas of 6 per cent or more, a conversion factor of at least 98.5 per cent, or

(ii) for a volume content of sulphur dioxide of less than 6 per cent in the feed gas, a conversion factor of at least 97.5 per cent

shall be maintained.

Sulphur dioxide and sulphur trioxide emissions in waste gas shall be further reduced in these types of processes using downstream emission reduction technology.

cc) When wet catalysis is used, a conversion factor of at least 98 per cent shall be maintained.

SULPHUR TRIOXIDE

Sulphur trioxide emissions in waste gas shall not exceed a mass concentration of 60 mg/m³.

5.4.4.1o Installations for the Production of Salts such as Ammonium Chloride, Potassium Chlorate, Potassium Carbonate, Sodium Carbonate, Perborate and Silver Nitrate

5.4.4.1o.1 Installations for the Production of Sodium Carbonate

EXISTING INSTALLATIONS

AMMONIA

In existing installations, ammonia emissions in waste gas shall not exceed the mass concentration of 50 mg/m³.

5.4.4.1p Installations for the Production of Inorganic Compounds

5.4.4.1p.1 Installations for the Production of Sulphur

SULPHUR EMISSION RATIO

- a) In Claus systems with a sulphur production capacity of up to 20 Mg of sulphur per day, a sulphur emission ratio of 3 per cent shall not be exceeded.
- b) In Claus systems with a sulphur production capacity of more than 20 Mg up to 50 Mg of sulphur per day, a sulphur emission ratio of 2 per cent shall not be exceeded.
- c) In Claus systems with a sulphur production capacity of more than 50 Mg of sulphur per day, a sulphur emission ratio of 0.2 per cent shall not be exceeded.

SULPHUR OXIDES

The requirements under 5.2.4 for emissions of sulphur oxides shall not apply.

CARBON OXYSULPHIDE AND CARBON DISULPHIDE

Waste gases shall be fed into a post-combustion facility; emissions of carbon oxysulphide (COS) and carbon disulphide (CS₂) in waste gas shall not exceed the mass concentration of 3 mg/m³ as a total, to be indicated as sulphur.

The first sentence shall not apply to Claus systems for processing natural gas.

HYDROGEN SULPHIDE

In Claus systems for processing natural gas, divergent to 5.2.4, hydrogen sulphide emissions shall not exceed the mass concentration of 10 mg/m³.

EXISTING INSTALLATIONS

SULPHUR EMISSION RATIO

For existing installations, the following sulphur emission ratios shall not be exceeded:

- a) for Claus systems with a sulphur production capacity of up to 20 Mg of sulphur per day 3 per cent,
- b) for Claus systems with a sulphur production capacity of more than 20 Mg up to 50 Mg of sulphur per day 2 per cent,
- c) for Claus systems with a sulphur production capacity of more than 50 Mg of sulphur per day
 - aa) for Claus systems with an integrated MODOP process, 0.6 per cent,
 - bb) for Claus systems with an integrated Sulfreen process, 0.5 per cent,
 - cc) for Claus systems with an integrated Scott process, 0.2 per cent,

5.4.4.1q Installations for the Production of Phosphorous-, Nitrogen- or Potassium-Based Fertilizers (Simple or Compound Fertilizers) including Ammonium Nitrate and Urea

EXISTING INSTALLATIONS

TOTAL DUST

For existing installations, during prilling, granulation and drying, dust emissions in waste gas shall not exceed a mass concentration of 50 mg/m³.

AMMONIA

For existing installations, during prilling, ammonia emissions in waste gas shall not exceed the mass concentration of 60 mg/m³.

For existing installations, during granulation and drying, ammonia emissions in waste gas shall not exceed the mass concentration of 50 mg/m³.

5.4.4.1r Installations for the Production of Basic Plant Health Products and of Biocides

TOTAL DUST, INCLUDING SLOWLY DEGRADABLE, HIGHLY ACCUMULATIVE AND HIGHLY TOXIC ORGANIC SUBSTANCES

Dust emissions in waste gas shall not exceed, as a minimum requirement, the mass flow of 5 g/h or the mass concentration of 2 mg/m³.

5.4.4.2 Installations under 4.2:

Installations where Plant Health Products, Insecticides or their Active Ingredients are Ground or Mechanically Mixed, Packed or Transfilled

TOTAL DUST, INCLUDING SLOWLY DEGRADABLE, HIGHLY ACCUMULATIVE AND HIGHLY TOXIC ORGANIC SUBSTANCES

Waste gases containing dust shall be collected at the place of origin and fed into a dedusting system. Dust emissions in waste gas shall, as a minimum requirement, not exceed the mass flow of 5 g/h or the mass concentration of 5 mg/m³. For dust

emissions consisting of 10 per cent or more of very toxic substances or preparations, the mass concentration in waste gas shall not exceed 2 mg/m³.

5.4.4.4 Installations under 4.4: Mineral Oil Refineries

PRESSURE RELIEF FITTINGS AND BLOW-DOWN SYSTEMS

Gases and vapours of organic substances, hydrogen and hydrogen sulphide which escape from pressure relief fittings and blow-down systems shall be fed into a gas collection system. The collected gases shall be combusted as far as possible in process furnaces. If this is not possible, the gases shall be fed into a flare.

WASTE GAS CONDUCT

Waste gases continually generated by processing installations and waste gases occurring during the regeneration of catalysts, during inspections and cleaning operations shall be conducted to a post-combustion facility, or equivalent measures to reduce emissions shall be applied.

START-UP AND SHUT-DOWN PROCESSES

Gases produced during start-up or shut-down of the installation, shall, as far as possible, be re-fed into the process using a gas collection system or be combusted in process furnaces. If this is not possible, the gases shall be fed into a flare. The flares shall at least meet the requirements for flares for the combustion of gases originating from breakdowns and safety valves.

HYDROGEN SULPHIDE

Gases produced by desulphurisation plants or other sources with a hydrogen sulphide volume content of more than 0.4 per cent and a hydrogen sulphide mass flow of more than 2 Mg/d shall be further processed. Gases, which are not further processed, shall be fed into a post-combustion facility. Water containing hydrogen sulphide shall only be conducted in a way that gaseous emissions into the atmosphere are prevented.

PROCESS WATER AND BALLAST WATER

Process water and surplus ballast water shall only be passed into an open system after de-aeration; the gases shall be fed into a waste gas purification facility.

CATALYTIC CRACKING

Dust emissions and sulphur oxides emissions in waste gas from installations for catalytic cracking in the fluidised bed process shall not exceed the following mass concentrations during the regeneration of the catalyst:

- a) dust 30 mg/m³,
- b) sulphur dioxide and sulphur trioxide, to be indicated as sulphur dioxide, 1.2 g/m³.

The possibilities to further reduce sulphur oxides emissions by measures regarding the process technology shall be exhausted.

CALCINATION

Dust emissions in waste gas from calcination installations shall not exceed a mass concentration of 30 mg/m³.

ORGANIC SUBSTANCES

The requirements for organic substances under 5.4.9.2 shall apply accordingly to the storage of inflammable fluids.

GASEOUS EMISSIONS

The requirements for new and existing installations in 5.4.9.2 concerning gaseous emissions shall apply accordingly during processing, conveyance, transfilling or storage.

EXISTING INSTALLATIONS

CATALYTIC CRACKING

Dust emissions in waste gas from existing installations for catalytic cracking in the fluidised bed process shall not exceed the mass concentration of 40 mg/m³ during the regeneration of the catalyst.

CALCINATION

Dust emissions in waste gas from calcination installations shall not exceed a mass concentration of 40 mg/m³.

The requirements under 5.2.4, Class IV, first indent, (sulphur oxides) shall be observed no later than ten years after the entry into force of this Administrative Regulation.

5.4.4.6 Installations under 4.6: Installations for the Production of Carbon Black

5.4.4.6.1 Installations for the Production of Carbon Black

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Process gases from installations producing furnace and lamp black shall be fed into a post-combustion facility and the residual energy recovered.

REFERENCE VALUES

Emission standards for the waste gases from the post-combustion, the steam generating or electricity generating systems of installations producing furnace and lamp black shall refer to a volume content of oxygen in the waste gas of 3 percent.

CARBON MONOXIDE

Carbon monoxide emissions in waste gas from installations producing gas black shall not exceed the mass concentration of 0.50 g/m³.

NITROGEN OXIDES

For installations producing furnace and lamp black, divergent to 5.2.4, emissions of nitrogen monoxide and nitrogen dioxide in waste gas from the post-combustion facility shall not exceed the mass concentration of 0.6 g/m³, to be indicated as nitrogen dioxide. The possibilities to further reduce emissions by using improved combustion techniques shall be exhausted.

SULPHUR OXIDES

For installations producing furnace and lamp black, emissions of sulphur dioxide and sulphur trioxide in waste gas from the post-combustion facility shall not exceed the mass concentration of 0.85 g/m³, to be indicated as sulphur dioxide.

ORGANIC SUBSTANCES

For installations producing gas black, emissions of organic gaseous substances shall not exceed the mass concentration of 0.10 g/m³, to be indicated as total carbon.

BENZENE

For installations producing gas black, benzene emissions shall not exceed the maximum mass concentration of 5 mg/m³.

5.4.4.7 Installations under 4.7: Installations for the Production of Carbon (Hard-burnt Coal) or Electrographite Materials by Baking or Graphitizing

EXISTING INSTALLATIONS

BAKING

For existing installations producing carbon shapes, emissions of organic gaseous substances in waste gas from ring furnaces with electrostatic precipitators, dry sorption facilities, or a combination of both waste gas purification facilities, shall not exceed the mass concentration of 0.15 g/m³, to be indicated as total carbon, and benzene emissions shall not exceed, as a minimum requirement, the mass concentration of 3 mg/m³.

5.4.4.10 Installations under 4.10:

Installations for the Production of Paint or Coating Materials (Glazes, Oil Coatings, Lacquers, Dispersion Dyes) or Printing Inks

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

5.4.5 Surface Treatment with Organic Substances, Production of Strip-type Plastic Materials, other Processing of Resins and Plastics

5.4.5.1 Installations under 5.1:

Installations for the Treatment of Surfaces of Materials, Objects or Products, including Related Drying Units, if Organic Solvents are Used

TOTAL DUST

Dust emissions in waste gas (particles of lacquer) shall not exceed the mass flow of 15 g/h or the mass concentration of 3 mg/m³.

5.4.5.2 Installations under 5.2:

Installations Using Synthetic Resins for Coating, Waterproofing, Laminating, Painting or Impregnating of Objects, Glass or Mineral Fibres or Strip-type or Plate-type Materials, including Related Drying Units

5.4.5.2.1 Installations for Coating, Waterproofing, Laminating, Painting or Impregnating of Glass or Mineral Fibres

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the place of origin, e.g. at the smelting tanks, cupola furnaces, collection chambers, hardening furnaces, sawing and packaging points, and fed into a waste gas purification plant.

AMMONIA

5.2.4 shall apply to impregnating and drying glass wool or rock wool, provided that ammonia emissions in waste gas shall not exceed the mass concentration of 65 g/m³.

If organic emissions are reduced by thermal post-combustion, ammonia emissions in waste gas shall not exceed the mass concentration of 0.10 g/m³.

5.2.4 shall apply to coating glass fibre or mineral fibre fabric, provided that ammonia emissions in waste gas shall not exceed the mass concentration of 80 mg/m³.

NITROGEN OXIDES

When a thermal post-combustion facility is used, divergent to 5.2.4, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 0.35 g/m³, to be indicated as nitrogen dioxide.

EXISTING INSTALLATIONS

TOTAL DUST

For existing installations, except for packaging and hardening furnaces – insofar as waste gases from hardening furnaces are collected and treated separately, dust emissions in waste gas shall not exceed the mass concentration of 80 mg/m³; moreover, it is to be examined whether, including additional waste gas reduction measures, an emission standard of 50 mg/m³ may be requested.

Existing installations shall comply with the requirements to restrict dust emissions for new installations no later than eight years after the entry into force of this Administrative Regulation.

PHENOL AND FORMALDEHYDE

During impregnating and drying of mineral fibres, phenol and formaldehyde emissions in waste gas shall not exceed the mass concentration of 30 mg/m³ in total.

5.4.5.4 Installations under 5.4:

Installations for the Impregnation or Coating of Materials or Objects with Tar, Tar Oil or Hot Bitumen

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Installations shall be constructed and operated so that pollutants cannot penetrate into the soil and groundwater. The entry of water shall be minimized (e.g. by covering or roofing) to prevent the elutriation of pollutants or the development of organic emissions from conversion processes.

ORGANIC SUBSTANCES

Emissions of organic substances in waste gas shall not exceed the mass concentration of 20 mg/m³, to be indicated as total carbon. The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply.

5.4.5.5 Installations under 5.5:

Installations for the Insulation of Wires Using Phenol- or Cresol-Containing Wire Enamels

EXISTING INSTALLATIONS

CARBON MONOXIDE

5.2.4 shall apply, provided that emissions of carbon monoxide in waste gas shall not exceed the mass concentration of 0.50 g/m³; the possibilities to further reduce carbon monoxide emissions by state of the art primary or other techniques shall be exhausted.

5.4.5.7 Installations under 5.7:

Installations for Processing of Liquid, Unsaturated Polyester Resins with Styrene as Additive or Liquid Epoxy Resins with Amines

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that emissions of organic substances in waste gas shall not exceed the mass concentration of 85 mg/m³, to be indicated as total carbon. The possibilities to further reduce styrene emissions by primary techniques, e.g. by using low-styrene or styrene-free resins, shall be exhausted.

5.4.5.8 Installations under 5.8:

Installations for the Production of Objects Using Aminoplasts or Phenoplasts such as Furan, Urea, Phenolic or Xylene Resins by means of Thermal Treatment

AMMONIA

Ammonia emissions in waste gas shall not exceed the mass concentration of 50 mg/m³.

5.4.5.11 Installations under 5.11:

Installations for the Production of Polyurethane Mouldings or Components Using Polyurethane, Box-shaped Polyurethane Blocks or for Filling Moulded Cavities with Polyurethane

ORGANIC SUBSTANCES

The requirements under 5.2.5 shall not apply to installations for the production of thermally insulating polyurethane foams operating on pure hydrocarbons (e.g. pentane) as propellant.

5.4.6 Timber, Pulp

5.4.6.1 Installations under 6.1:

Installations for the Production of Pulp from Timber, Straw or Similar Fibrous Materials

STOCKYARDS

The requirements under 5.2.3.5 and 5.2.3.6 shall not apply to the storage of undressed timber or wood logs.

5.4.6.2 Installations under 6.2:

Installations for the Production of Paper, Paperboard or Board

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

If dust emissions may occur during filling processes, waste gases from containers and silos shall be collected and fed into a dedusting system.

Waste gases from the production of groundwood pulp and from TMP (Thermo-Mechanical Pulp) installations shall be collected and fed into a furnace as combustion air if possible.

ORGANIC SUBSTANCES

Emissions of organic substances in waste gas shall be minimized by using low-emission raw materials, e.g. synthetic resins or elastomeric compounds with low monomeric residue content.

For installations with directly fired drying aggregates, emissions of organic substances in waste gas shall be minimized, e.g. by an adaptation to changing loads and by optimising combustion with respect to emissions in the drying aggregates fired by natural gas; the requirements under 5.4.1.2.5 with respect to the reference value for the volume content of oxygen in waste gas shall not apply.

Start-up and shut-down processes shall be optimised with respect to low emissions.

The requirements under 5.2.5 shall not apply to the production of ground wood pulp and TMP installations.

The possibilities to further reduce emissions of organic substances by primary or other state of the art techniques shall be exhausted, e.g. for TMP facilities by condensation in heat recovery installations.

ODOUR-INTENSIVE SUBSTANCES

Through good planning and construction, as well as optimisation of process technology and operation management, emissions of odour-intensive substances shall be prevented as far as possible, e.g. from waste paper stock, waste paper treatment, interim storage and transportation of waste from waste paper treatment, process water cycles, the wastewater treatment plant and sludge dewatering. If odour impacts are to be expected in the vicinity of an installation, more advanced state of the art techniques to reduce odours shall be used, e.g. encapsulation of the installation components, collection of waste gas and supply to a waste gas treatment facility.

5.4.6.3 Installations under 6.3:

Installations for the Production of Chipboards, Wood Fibreboards or Wood Fibre Mats

STOCKYARDS

The requirements under 5.2.3.5 and 5.2.3.6 shall not apply to the storage of undressed timber or wood logs.

For industrial scrap wood which may create dust in a dry state (e.g. milling chips, wood shavings, sawdust), or for timber where the separable fraction by sifting with a maximum mesh size of 5 mm exceeds the value of 5.0 g/kg (as related to the dry mass), operational and technical measures shall ensure that unloading takes place exclusively in enclosed material delivery stations and their related silos; waste gases shall be collected and fed into a dedusting system.

TOTAL DUST, INCLUDING THE CONTENT OF CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

Dust emissions in waste gas shall not exceed, as a minimum requirement, the following mass concentrations:

- | | |
|-------------------------------------|-----------------------------|
| a) for grinders | 5 mg/m ³ , |
| b) for indirectly fired chip dryers | 10 mg/m ³ (wet), |
| c) for other dryers | 15 mg/m ³ (wet). |

FUELS

When liquid or solid fuels are used in chip dryers or fibre dryers, the sulphur mass content in the fuel shall not exceed 1 per cent, as related to a net calorific value of 29.3 MJ/kg for solid fuels, unless an equivalent emission standard for sulphur oxides is achieved by means of a waste gas purification facility; when coals are used, only coals which do not cause higher sulphur oxides emissions than hard coal with a sulphur mass content of less than 1 per cent, as related to a net calorific value of 29.3 MJ/kg, shall be used.

ORGANIC SUBSTANCES

For dryers, emissions of organic substances in waste gas, to be indicated as total carbon, shall not exceed the mass concentration of 300 mg/m³ (wet). For fibre dryers in air-circulating mode, emissions of Class I organic substances under 5.2.5 may exceed the mass concentration defined in 5.2.5 if the mass flow per hour is less than that which would be reached without air-circulating mode in compliance with the mass concentration defined in 5.2.5.

For presses, emissions of Class I organic substances under 5.2.5 in waste gas shall not exceed a mass ratio of 0.06 kg per cubic metre of slabs produced.

The possibilities to further reduce emissions of organic substances by primary techniques, e.g. by using low-emission binding agents, particularly low-formaldehyde or formaldehyde-free binding agents, or other state of the art techniques shall be exhausted.

5.4.7 Food, Beverages, Tobacco and Animal Feed, Agricultural Products

5.4.7.1 Installations under 7.1:

Installations for Rearing or Breeding of Livestock

MINIMUM DISTANCE

Installations shall be constructed at the minimum distance resulting from Figure 1 from the nearest residential area, existing or planned, taking into consideration the individual animal mass pursuant to Table 10.

The minimum distance may be less if emissions of odorous substances are reduced by means of primary measures, or odorous waste gas is treated in a waste gas purification facility. The possible reduction of the minimum distance by reducing emissions of odorous substances shall be determined using an adequate method of odour dispersion calculation, the suitability of which shall be proved to the competent authority.

The minimum distance for installations for rearing or breeding species other than those in Table 10, or when they are kept in different conditions, shall be defined on an individual basis.

Figure 1: Minimum Distance Curve

(The top curve shows the minimum distance for poultry and the bottom curve shows the minimum distance for pigs.)

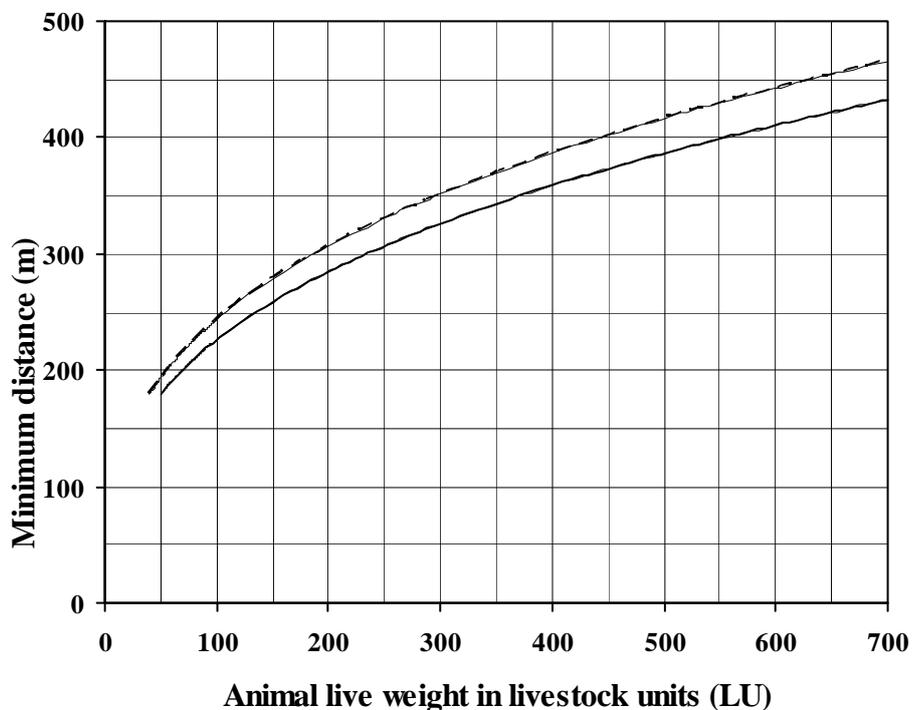


Table 10: Factors for the Conversion of Stocking Density into Animal Live Weight, to be Indicated as Livestock Units*

(1 livestock unit (LU) = 500 kg of animal live weight)

Species	Mean Individual Animal Mass (LU/Animal)
Pigs	
Sows during early pregnancy and barren sows, boars	0.30
Sows with piglets up to 10 kg	0.40
Weaner (up to 25 kg)	0.03
Gilts (up to 90 kg)	0.12
Fattening pigs (up to 110 kg)	0.13
Fattening pigs (up to 120 kg)	0.15

* For production processes which vary considerably from those listed in this table, the mean individual animal's mass (in LU/animal) may be determined on an individual basis.

Species	Mean Individual Animal Mass (LU/Animal)
Poultry	
Laying hens	0.0034
Chickens (up to 18 weeks)	0.0014
Broilers up to 35 days	0.0015
Broilers up to 49 days	0.0024
Breeding Peking ducks (up to 3 weeks)	0.0013
Fattening Peking ducks (up to 7 weeks)	0.0038
Breeding muscovy ducks (up to 3 weeks)	0.0012
Fattening muscovy ducks (up to 10 weeks)	0.0050
Breeding muscovy ducks (up to 3 weeks)	0.0022
Fattening turkeys, hens (up to 16 weeks)	0.0125
Fattening turkeys, roosters (up to 21 weeks)	0.0222

When installations are erected, there must be, as a rule, a minimum distance of 150 m from plants sensitive to nitrogen (e.g. tree nurseries, cultivated plants) and sensitive ecosystems (e.g. heath, moor, forests).

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

As a rule, the following constructional and operational requirements shall be applied:

- a) Highest possible level of cleanliness and dryness in the stall
 This includes keeping the feeding racks, areas for droppings, running and lying, the aisles, the stall installations and the outside areas around the stall clean and dry. Loss of drinking water shall be avoided by using water-saving technology.
- b) The amount of feed put down shall be measured so that there is as little as possible left over; leftovers shall be removed regularly from the stall. Rotten or inedible feed or leftovers shall not be stored in the open. If odour-intensive feedstuffs (e.g. waste food, whey) are used as fodder, they shall be stored in closed containers or covered.
- c) Feeding must be adapted to the nutritional requirements of the animals.

d) Optimum climate in the stall

For stalls with forced ventilation, DIN 18910 (1992 version) shall be observed. The type of waste air conduction shall be adapted to the conditions of each particular location on an individual basis.

If possible, naturally ventilated stalls shall be aligned with a ridge axis perpendicular to the main wind direction allowing air to flow freely and have additional apertures for ventilation in the gable ends.

e) When a solid manure system is used, sufficient bedding shall be spread to reduce odour emissions. The bedding must be dry and clean.

Dung yards for storage of solid manure with a dry mass content of less than 25 per cent shall be erected on an impermeable concrete slab pursuant to DIN 1045 (1988 version) or an equally suitable sealing material. The liquid manure generated shall be fed into containers with no drainage. In order to reduce wind-induced emissions, the dung yard shall be walled in on three sides and shall have as small a surface as possible.

f) In order to reduce odour emissions from the stall, when slurry systems are used, droppings and urine generated shall be transferred to the slurry store continuously or at short intervals. A stench trap shall be installed between the stall and external slurry channels and stores.

g) Installations for storing and transfilling commercial liquid fertilizer shall be erected pursuant to DIN 11622 (1994 version) and DIN 1045 (1988 version).

For interim storage of slurry in the stall (in the slurry cellar), the capacity shall be dimensioned in a way that, in case of under-floor suction, the maximum fill level is 50 cm below the slatted floor; otherwise, 10 cm are sufficient.

When under-floor suction is being carried out, air from the stall shall be sucked out directly under the slatted floor at low speed (maximum 3 m/s).

h) Slurry shall be stored (outside the stall) in enclosed containers, or equivalent emission reduction measures achieving an emission reduction ratio, as related to the open uncovered container, of at least 80 per cent of the emissions of odour-intensive substances and ammonia shall be applied.

After agitating or land spreading of the slurry, any artificial floating cover shall subsequently be immediately restored to its functional state.

When liquid cattle manure is stored, no additional cover is required if a natural floating crust is formed.

- i) The storage capacity for commercial liquid fertilizer to use as fertilizer for own purposes shall be dimensioned in a way that it is sufficient for at least 6 months, plus a supplement for generated precipitation water and cleaning water; the supplement for precipitation water may be waived if a suitable cover ensures that no rainwater can enter into the containers. For commercial liquid fertilizer, which is passed on to third parties for further use, correct storage and application shall be secured by contract.

The following supplementary requirements shall apply to installations for rearing or breeding poultry:

- j) In cage rearing, drying or ventilation of the dropping belt is obligatory (drying rate at least 60 per cent). Dried poultry droppings shall be stored in a way that there is no re-humidification (e.g. by rainwater) in the area of the installation.
When the poultry are free-range, the installation and adjacent runs shall be planned and designed in a way that nutritional depositions by the droppings do not lead to harmful environmental impacts, particularly with respect to soil and water conservation.

The following supplementary requirements shall apply to installations for breeding fur-bearing animals:

- k) Fresh feed for carnivorous fur-bearing animals shall be delivered daily in the summer months and at least three times a week in winter. The animal feed shall be stored in closed insulated containers (storage temperature of the animal feed 4 °C or less). If, notwithstanding this, longer storage periods or animal feed deliveries at longer intervals are necessary, the animal feed shall be stored sealed and frozen.

- l) Sufficient bedding shall be spread under the cages in order to reduce emissions of odour-intensive substances.
- m) Manure under the cages shall be removed at least once a week.
- n) Storage of excrements is only permissible in enclosed rooms or containers.

Constructional and operational requirements shall be weighed up against the requirements of animal husbandry appropriate to the species, if this form of animal husbandry leads to higher emissions.

GERMS

The possibilities to reduce emissions of germs and endotoxins by state of the art techniques shall be examined.

5.4.7.2 Installations under 7.2: Installations for Slaughtering Animals

MINIMUM DISTANCE

When installations are erected, there shall be a minimum distance of 350 m to the next residential area, existing or planned, if possible. The minimum distance may be less if emissions of odorous substances are reduced by means of primary measures, or odorous waste gas is treated in a waste gas purification facility. A potential decrease in the minimum distance by reducing emissions of odorous substances shall be determined with the aid of a suitable model for odour dispersion calculation, the suitability of which must be proved to the competent authority. The minimum distance may also be decreased if the utilisation of the slaughterhouse does not exceed 250 h/a; in this case, a special evaluation is required.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational requirements shall be applied:

- a) Unloading shall in principle be carried out with the hall gates closed.
Livestock housing, slaughter and dressing lines, installations for processing slaughterhouse waste and by-products shall in principle be provided for in enclosed rooms. Open interim storage shall be avoided.

- b) Blood leaking from cattle and pigs shall be stored at temperatures of less than 10 °C. Coagulation of blood shall be avoided by pumping. The vapour recovery technique shall be applied for emptying the blood tank. The blood tank shall be cleaned regularly.
- c) Slaughterhouse waste and by-products shall be stored in enclosed containers or rooms. The temperature of slaughterhouse waste and by-products shall be less than 10 °C or they shall in principle be kept in rooms with a room temperature of less than 5 °C or be removed daily. For removal to the rendering plant, they must be loaded into covered containers.
- d) Waste gas from production facilities, installations for processing and storing slaughterhouse by-products and waste shall be collected and fed into a waste gas purification facility, or equivalent emission reduction measures shall be applied.

The following additional requirements shall apply to installations for the slaughtering of poultry and for the slaughtering of other animals of more than 10 Mg live weight per day:

- e) As soon as the vehicles have been emptied, straw and droppings from the vehicles shall be stored at the manure pits. The vehicles used shall be cleaned with a pressure washer at a washing bay near the manure pits. Boxes shall be cleared out as soon as they have been emptied, and sprayed clean. Equipment shall be provided to spray the pigs with water in the livestock housing.
- f) When the blood tank is being filled, the displaced air shall be collected and fed into a waste gas purification facility (e.g. activated carbon filter).
- g) Scalding tunnels used in pig slaughtering shall be designed in a way that the retention period of the waste gas in the reaction zone is 1 second if possible, but at least 0.5 seconds. The temperature in the reaction zone shall be between 600 °C and 700 °C. Low-odour-emission operation of the scalding tunnels shall be ensured by careful setting of the gas/air mixture. Scalding tunnels shall only be operated on natural gas.

- h) Supplementary to c), the temperature of slaughterhouse waste and by-products shall be less than 10 °C or they shall in principle be kept in rooms with a room temperature of less than 5 °C. Slaughterhouse waste and by-products shall be transported to the rendering plant or to another approved installation on the day of slaughter.

5.4.7.3/4 Installations under 7.3 and 7.4:

5.4.7.3.1 Installations for the Production of Edible Fats from Raw Materials of Animal Origin or for Melting Animal Fats

5.4.7.4.1 Installations for the Production of Conserved Meat or Vegetables or Installations for the Factory-made Production of Animal Feed by Heating of Ingredients of Animal Origin

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational requirements shall apply:

- a) In installations for the production of edible fats from raw materials of animal origin or for melting animal fats, the dry melting process shall be preferably be used as process technique.
- b) Unloading shall in principle be carried out with the hall doors closed. Process facilities, including the stockyards, shall be accommodated in closed rooms.
- c) Waste gas from the process facilities as well as from the stocks shall be collected; waste gas with odour-intensive substances shall be fed into a waste gas purification facility, or equivalent emission reduction measures shall be applied.
- d) Raw and intermediate products shall be stored in enclosed containers or rooms at temperatures of less than 10 °C. Open interim storage shall be avoided.

**5.4.7.5 Installations under 7.5:
Installations for Smoking Meat or Fish Products**

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational requirements shall be applied:

- a) Smoking installations shall be erected and operated in a way that
 - the release of smoking gas from the smoking chamber is only possible if the waste gas purification facility has obtained its efficiency with regard to the compliance with emission standards,
 - generated waste is stored in enclosed containers.Furthermore, the smoking chambers must not be opened during the smoking process; this shall not apply to cold-smokers and to installations where there is under pressure and where fumes cannot escape when the smoking chamber door is opened.
- b) Waste gas shall be collected at the point of origin (e.g. smoking chamber) and fed into a waste gas purification facility, or equivalent emission reduction measures shall be applied.
- c) Production waste shall be stored in enclosed containers at temperatures of less than 10 °C.
- d) Fish products shall be stored in enclosed, ventilated rooms.

5.4.7.8 – 12 Installations under 7.8 to 7.12:

5.4.7.8.1 Installations for the Production of Gelatine, Hide Glue, Leather Glue or Bone Glue

5.4.7.9.1 Installations for the Production of Animal Feed or Fertilizers or Technical Fats from Slaughterhouse By-products such as Bones, Animal Hair, Feathers, Horns, Claws or Blood)

5.4.7.10.1 Installations for Storing or Processing of Untreated Animal Hair

5.4.7.11.1 Installations for Storing Untreated Bones

5.4.7.12.1 Installations for the Disposal or Recycling of Animal Carcasses or Animal Waste as well as Installations where Animal Carcasses, Parts of Animal

Carcases Wastes of Animal Origin are Collected or Stored to be Processed in such Installations

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational requirements shall be applied:

- a) Unloading shall in principle be carried out with the hall gates closed.
Process facilities, including the storage facility, shall be accommodated in closed rooms.
- b) Waste gas from the process facilities as well as from the storage facilities shall be collected; waste gas with odour-intensive substances shall be fed into a waste gas purification facility, or equivalent emission reduction measures shall be applied.
- c) Raw and intermediate products shall be stored in enclosed containers or rooms and, in principle, kept cool. Open interim storage shall be avoided.
- d) Contaminated transport containers shall only be stored and cleaned in enclosed rooms.

5.4.7.15 Installations under 7.15: Installations for Drying Dung

MINIMUM DISTANCE

When installations are erected, there shall be a minimum distance of 500 m to the next residential area, existing or planned.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Process facilities, including the storage facilities, shall be accommodated in enclosed rooms. Waste gas from process and storage facilities shall be collected and fed into a waste gas purification facility.

GERMS

The possibilities to reduce emissions of germs and endotoxins by state of the art techniques shall be examined.

**5.4.7.21 Installations under 7.21:
Mills for Food or Animal Feed**

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gas containing particles shall be collected at the point of origin, e.g. at the cereal delivery point, in the packaging area, and fed into a dedusting facility.

**5.4.7.22 Installations under 7.22:
Installations for the Production of Yeast or Starch Flours**

5.4.7.22.1 Installations for the Production of Yeast

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that emissions of organic substances in waste gas shall not exceed the mass concentration of 80 mg/m³, to be indicated as total carbon. The possibilities to further reduce organic substances emissions by primary and other state of the art techniques shall be exhausted.

**5.4.7.23 Installations under 7.23:
Installations for the Production of Oils or Fats from Vegetable Raw
Materials**

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gas shall be collected at the point of origin, e.g. seed silo, seed treatment, toasting, drying, cooling, groats silo, pelletisation, groats loading, and fed into a waste gas purification facility, or equivalent emissions reduction measures shall be applied.

HYDROGEN SULPHIDE

If a biofilter is used to reduce odours, 5.2.4 shall apply, provided that the requirements for hydrogen sulphide emissions shall not apply.

EXISTING INSTALLATIONS

TOTAL DUST

If emissions of moist dusts occur, e.g. during seed conditioning, seed treatment, in the dryer sections of toasters and coolers, during groats drying and cooling, during pelletisation, existing installations shall comply with requirements to restrict dust emissions no later than eight years after the entry into force of this Administrative Regulation.

5.4.7.24 Installations under 7.24: Installations for the Production or Refining of Sugar

5.4.7.24.1 Beet-pulp Dryers

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Installations for drying beet-pulp shall be constructed for indirect drying (steam drying) processes, or equivalent emission reduction measures shall be applied. In the event of a substantial change to the installation in the area of drying or the energy central, it shall be examined whether indirect drying (steam drying) processes may be requested, taking into consideration the principle of proportionality.

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that emissions of organic substances in waste gas shall not exceed the mass flow of 0.65 kg/h, to be indicated as total carbon. The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply.

The possibilities to further reduce emissions of organic substances by primary or other state of the art techniques shall be exhausted.

EXISTING INSTALLATIONS

The following requirements refer to existing installations using the direct drying process.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

In order to reduce odour emissions, the drum feed temperature shall not exceed 750 °C.

REFERENCE VALUE

5.4.1.2.5 shall apply, provided that emission standards are referenced to a volume content of oxygen of 12 per cent in waste gas.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 60 mg/m³ (wet).

FUELS

5.4.1.2.5 shall apply, provided that liquid fuels other than those referred to in b) may also be used.

SULPHUR OXIDES

When liquid fuels other than fuel oil with a mass content of sulphur for light fuel oil pursuant to the 3. BImSchV, as currently applicable, are used, emissions of sulphur dioxide and trioxide in waste gas shall not exceed the mass concentration of 0.85 g/m³, to be indicated as sulphur dioxide; in this case, 5.1.2. para. 8 shall apply, provided that, irrespective of whether or not a downstream waste gas purification facility is used, the conversion may only be made for periods when the measured oxygen content is above the reference oxygen content.

Divergent to 6.2.3.3, installations shall comply with these requirements to restrict sulphur oxides emissions no later than eight years after the entry into force of this Administrative Regulation.

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 0.40 g/m³, to be indicated as nitrogen dioxide; in this case, 5.1.2 para. 8 shall apply, provided that the conversion is only made for periods when the measured oxygen content is more than the reference oxygen content, irrespective of whether a downstream waste gas purification facility is used.

ORGANIC SUBSTANCES

Emissions of organic substances, to be indicated as total carbon, shall not exceed the mass ratio of 0.08 kg per Mg of processed beets. This emission standard refers to organic substances, to be indicated as total carbon, which can be detected by means of adsorption to silica gel; if measurement is carried out using a flame ionisation detector, a corresponding conversion shall be made.

The possibilities to further reduce emissions of organic substances by primary or other state of the art techniques shall be exhausted; as far as technically possible and taking into consideration the principle of proportionality, existing installations shall switch to indirect drying methods (steam drying). The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply.

Installations shall comply with requirements to restrict organic substances emissions no later than eight years after the entry into force of this Administrative Regulation.

5.4.7.25 Installations under 7.25: Installations for Drying Green Stuff

MINIMUM DISTANCE

Installations shall be constructed at a minimum distance of 500 m from the nearest residential area, existing or planned. The minimum distance may be less if emissions of odorous substances are reduced by primary measures, or the odorous waste gas is treated in a waste gas purification facility. A possible decrease in the minimum distance by reducing emissions of odorous substances shall be determined with the aid of an appropriate model of odour dispersion calculation, the suitability of which shall be proved to the competent authority.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The possibility of constructing installations using indirect drying techniques in at least one stage of the process shall be examined.

The dryer shall be operated, e.g. by adjusting the drying feed temperature, in a way that the operational reference value for CO is not exceeded.

TOTAL DUST

Dust emissions in waste gas shall not exceed a mass concentration of 75 mg/m³ (wet).

ORGANIC SUBSTANCES

The requirements under 5.2.5 shall not apply. Specific emissions of organic substances, to be indicated as total carbon, shall not exceed 0.25 kg per Mg of water vaporisation, and specific emissions of formaldehyde, acetaldehyde, acrolein and furfural shall, as a total, not exceed 0.10 kg per Mg of water vaporisation.

CONTINUOUS MEASUREMENT OF CARBON MONOXIDE

Installations shall be equipped with a measuring unit that continuously monitors the mass concentration of carbon monoxide emissions.

On the basis of emission measurements, the maximum carbon monoxide concentration in waste gas shall be determined in a way that specific emissions of organic substances and aldehydes in waste gas are not exceeded (operational reference value for CO).

5.4.7.29/30 Installations under 7.29 to 7.30:

5.4.7.29.1 Installations for Roasting or Grinding of Coffee or for Packaging of Ground Coffee

5.4.7.30.1 Installations for Roasting Coffee Substitutes, Cereals, Cocoa Beans or Nuts

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational measures shall be applied:

- a) Unloading shall, in principle, take place when the hall doors are closed.
Processing facilities, including storage facilities, shall be accommodated in enclosed rooms. Open interim storage shall be avoided.
- b) Waste gas shall be collected at the place of origin, e.g. roasting facilities including cooling air, the vacuum facility, the central aspiration for ground coffee, the silo facility; waste gases with odour-intensive substances shall be fed into a waste gas purification facility, or equivalent measures for reducing emissions shall be applied.
Recirculation of roasting waste gas into the combustion chamber shall be aspired, insofar as this does not affect safety conditions.

NITROGEN OXIDES

5.2.4 shall apply, provided that nitrogen monoxide and nitrogen dioxide emissions in the waste gas, to be indicated as nitrogen dioxide, do not exceed the mass flow of 1.8 kg/h or the mass concentration of 0.35 g/m³ if possible; the possibilities to reduce emissions by primary and other state of the art techniques shall be exhausted.

EXISTING INSTALLATIONS

NITROGEN OXIDES

Requirements for new facilities to restrict nitrogen oxides emissions shall not apply to existing installations with a production capacity of less than 250 kg of roasted coffee per hour.

5.4.8 Installations for the Recovery and Disposal of Waste and other Materials

5.4.8.1 Installations under 8.1:

Installations for the Disposal or Recovery of Solid and Liquid Waste, Gaseous Waste Collected in Tanks, or of Landfill Gas with Combustible Components by Thermal Processes

5.4.8.1a Installations under 8.1a:

Installations for the Disposal or Recovery of Solid and Liquid Wastes or Gaseous Waste Collected in Tanks, or of Landfill Gas with Combustible Components by Thermal Processes and Installations for Flaring Landfill Gas or Other Combustible Gaseous Substances

5.4.8.1a.1 Installations for Disposal or Recycling of Landfill Gas with Combustible Components by Thermal Processes

When landfill gas is used in combustion installations, the requirements for biogas or sewage gas under 5.4.1.2.3 shall apply.

5.4.8.1a.2 Installations for Flaring Landfill Gas or other Combustible Gaseous Substances

Provisions under 5.4.8.1a.2 shall not apply to flares for the combustion of gases due to breakdowns or safety valves; emission-limiting requirements shall be determined on an individual basis.

5.4.8.1a.2.1 Installations for Flaring Landfill Gas or other Combustible Gaseous Substances from Waste Treatment Facilities

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

If collected landfill gases or other combustible gaseous substances (e.g. sewage gas, biogas) are not to be combusted in combustion installations or in stationary internal combustion engines with energy recovery, but instead combusted without energy recovery due to poor gas quality, or due to low quantities of gas or an unavoidable

standstill of the energy utilization facility, these gases shall be conducted to a ground flare (isolated high-temperature flare or muffle).

The waste gas temperature from the flame tip shall measure at least 1,000 °C and the retention period of hot waste gas in the combustion chamber shall measure, as a minimum, 0.3 seconds from the flame tip.

REFERENCE VALUE

Emission standards are referenced to a volume content of oxygen of 3 per cent in waste gas.

MASS FLOWS

The mass flows established in 5.2 shall not apply.

ORGANIC SUBSTANCES

The requirements under 5.2.5 shall not apply.

MEASUREMENT

In order to monitor the burnout, installations shall be equipped with measuring instruments that continuously determine and register the temperature in the combustion chamber; measurement points shall be positioned at the end of the retention distance.

5.4.8.1a.2.2 Installations for Flaring Combustible Gaseous Substances that are not Derived from Waste Treatment Facilities

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Combustible gaseous substances that are not combusted in combustion installations or stationary internal combustion engines with energy recovery, but shall instead, either for safety reasons or special operational requirements, be combusted without energy recovery shall be fed into a waste gas purification facility with thermal or catalytic post-combustion if possible. If this is not possible (e.g. if, as a result of discontinuously generated or highly varying quantities of gas, or of gas quantities occurring only during short periods of time, a waste gas purification facility cannot be operated efficiently, even using a gas buffer, or, if due to the hazardous nature of

the gases, a waste gas purification facility cannot be operated with proportional expense, these combustible gaseous substances shall be supplied to a flare. Halogenated combustible gaseous substances shall not be supplied to these flares. The minimum temperature of the flares shall be 850 °C in the flame.

SULPHUROUS OXIDES, NITROGEN OXIDES AND CARBON MONOXIDE

The requirements under 5.2.4 shall not apply.

ORGANIC SUBSTANCES

The requirements under 5.2.5 shall not apply. The minimum emission reduction ratio for organic substances is 99.9 per cent, as related to total carbon, and a mass concentration of 20 mg/m³, as related to total carbon, shall not be exceeded; notwithstanding, the minimum emission reduction ratio for flares for the combustion of gases originating from breakdowns and security valves is 99 per cent (as related to total carbon).

MEASUREMENT

In order to monitor the burnout temperature, installations shall be equipped with measuring units that continuously determine and register the temperature at an appropriate location in the combustion chamber; if this is not possible, appropriate proof of compliance with requirements for burnout must be provided to the competent authority.

The compliance with the emission reduction ratio for organic substances shall be proved to the competent authority; in this context, special arrangements shall be drawn up.

5.4.8.1b Installations under 8.1b:

Stationary Internal Combustion Engines for the Use of Waste Oil or Landfill Gas

5.4.8.1b.1 Stationary Internal Combustion Engines for the Use of Waste Oil or Landfill Gas

When landfill gas is used, the requirements under 5.4.1.4 for biogas and sewage gas shall apply; notwithstanding, emissions of carbon monoxide in waste gas shall not

exceed the mass concentration of 0.65 g/m^3 , and emissions of nitrogen oxides in waste gas shall not exceed the mass concentration of 0.50 g/m^3 , to be indicated as nitrogen dioxide. When landfill gas is used, the possibilities to further reduce carbon monoxide emissions by engine design and other state of the art techniques shall be exhausted.

5.4.8.2 Installations under 8.2

Installations for the Generation of Electricity, Steam, Hot Water, Process Heat or Hot Waste Gas Using

- a) Painted, Varnished or Coated Wood, as well as all Resultant Residues, if neither Wood Preservatives have been Applied, nor, as a Consequence of a Treatment, are Contained nor Coatings Consist of Halogenated Organic Compounds,**
 - b) Plywood, Chipboards, Fibre boards or other Glued Wood and all Resultant Residues, if no Wood Preservatives have been Applied nor, as a Consequence of a Treatment, are Contained, nor Coatings Consist of Halogenated Organic Compounds,**
- with a Rated Thermal Input of less than 50 MW**

The requirements under 5.4.1.2.1 for the use of untreated timber, including requirements for existing installations, shall apply with the following exceptions:

TOTAL DUST

Dust emissions in waste gas in installations with a rated thermal input of less than 2.5 MW shall not exceed the mass concentration of 50 mg/m^3 .

NITROGEN OXIDES

Emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 0.40 g/m^3 , to be indicated as nitrogen dioxide.

EXISTING INSTALLATIONS

NITROGEN OXIDES

In existing installations, emissions of nitrogen monoxide and nitrogen dioxide in waste gas shall not exceed the mass concentration of 0.50 g/m³, to be indicated as nitrogen dioxide.

5.4.8.4 Installations under 8.4:

Installations where Materials Contained in Waste Generated by Households or Similar Waste, subject to the Regulations of the Closed Substance Cycle and Waste Management Act, are Sorted for Recovery in the Production Cycle

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Installations shall be constructed and operated in a way that for the duration of the treatment process, including delivery and removal, dust emissions shall be prevented as far as possible.

Waste gases shall be collected at the place of origin and fed into a waste gas purification facility, especially for the purpose of odour reduction.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

5.4.8.5 Installations under 8.5:

Installations for the Production of Compost from Organic Waste

MINIMUM DISTANCE

Installations with an annual throughput capacity of 3,000 Mg or more shall be constructed at a minimum distance

- a) for enclosed installations (bunkers, active phase and curing phase) of 300 m,
 - b) for open installations (windrow composting) of 500 m
- from the nearest residential area, existing or planned. The minimum distance may be less if emissions of odorous

substances are reduced by primary measures, or if odorous waste gas is treated in a waste gas purification facility. A possible decrease in the minimum distance through reducing odorous substances shall be determined with the aid of an appropriate model of odour dispersion calculation, the suitability of which shall be proved to the competent authority.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational requirements shall apply:

- a) On the basis of estimated monthly utilization, adequate dimensioning, particularly of storage space, shall be provided. Installations shall be erected and operated in a way to prevent that leachate water enters into the soil.
- b) Feeding bunkers shall be constructed enclosed and with a vehicle sluice; in case of opened halls and during unloading of waste vehicles, the bunker waste gases shall be removed by suction and fed into a waste gas purification facility.
- c) Installations shall be erected enclosed as far as possible. This shall apply particularly to installations processing odour-intensive moist or poorly structured biowaste (e.g. kitchen or canteen waste) or sludge. Installations (bunkers, active composting phase) with a throughput capacity of 10,000 Mg per year or more shall be erected enclosed.
- d) In open composting, condensed vapours from aeration of the windrows as well as the generated leachate water shall be used for moistening the compost only if olfactory nuisances are avoided and the hygienic process is not impaired.
- e) In enclosed installations or open installations with an exhaust system, waste gases containing dust shall be collected as far as possible at the point of origin, e.g. during crushing, straining or windrow turning.

Waste gases from reactors and aerated windrows shall be supplied to a biofilter or an equivalent waste gas purification facility. The efficiency of biofilters shall be regularly checked in order to guarantee that they comply with their required purification performance; this may be done by carrying out a compliance audit at least once annually to ensure that the odorous substance concentration of 500 OU/m³ in the waste gas is not exceeded.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

ODOUR-INTENSIVE SUBSTANCES

In installations with an annual throughput capacity of 10,000 Mg or more, emissions of odour-intensive substances in waste gas shall not exceed an odorous substance concentration of 500 OU/m³.

GERMS

The possibilities to reduce emissions of germs and endotoxins by using state of the art techniques shall be examined.

5.4.8.6 Installations under 8.6: Installations for the Biological Treatment of Waste

5.4.8.6.1 Installations for the Fermentation of Biowaste and Installations Co-processing Biowaste in Co-fermentation Installations

MINIMUM DISTANCE

Installations with a throughput capacity of 10 Mg of waste per day or more shall be constructed at a minimum distance

- a) for enclosed installations (bunkers, fermentation and curing phase) of 300 m,
- b) for open installations of 500 m

from the nearest residential area, existing or planned. The minimum distance may be less if emissions of odorous substances are reduced by primary measures or the odorous waste gas is treated in a waste gas purification facility. A possible decrease in the minimum distance through reducing odorous substances may be determined using an appropriate model for odour dispersion calculation, the suitability of which shall be proved to the competent authority.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational requirements shall apply:

- a) On the basis of estimated monthly utilization, adequate dimensioning, particularly of the storage space, shall be provided. If necessary, a curing phase must be provided.
Installations shall be constructed and operated in a way to prevent the entry of leachate water into the soil.
- b) Feeding bunkers shall be constructed enclosed with a vehicle sluice; in case of an opened hall and during unloading of waste vehicles, the bunker waste gas shall be removed by suction and fed into a waste gas purification facility.
- c) Processing water is to be retained securely and put to in-process use.
- d) In open composting, condensed vapours from aeration of the windrows (curing phase) as well as the generated leachate water shall be used for moistening the compost only if olfactory nuisances are avoided.
- e) In enclosed facilities or open facilities with an exhaust system, waste gases containing dust shall be collected as far as possible at the point of origin, e.g. during crushing, sifting or windrow turning.
- f) Waste gases from the curing phase of ventilated windrows shall be fed into a biofilter or an equivalent waste gas purification facility. The efficiency of biofilters shall be regularly checked in order to guarantee that they comply with their required purification performance; this may be done by carrying out a compliance audit at least once annually to ensure that the odorous substance concentration of 500 OU/m³ in the waste gas is not exceeded.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

ODOUR-INTENSIVE SUBSTANCES

For installations with a daily throughput capacity of 30 Mg or more, emissions of odour-intensive substances in waste gas shall not exceed an odorous substance concentration of 500 OU/m³.

GERMS

The possibilities to reduce emissions of germs and endotoxins by state of the art techniques shall be examined.

5.4.8.10/11 Installations under 8.10 to 8.11: Installations for the Treatment of Waste

5.4.8.10 Installations under 8.10:

Installations for the Physicochemical Treatment of Waste

5.4.8.11 Installations under 8.11:

Installations for other Treatment of Waste

5.4.8.10.1 Installations for Drying Waste

MINIMUM DISTANCE

The installations shall be constructed at a minimum distance of 300 m from the nearest residential area, existing or planned.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational requirements shall apply:

- a) For unloading sites, feeding and reception bunkers as well as other installations for delivery, transport and storage of input material, enclosed rooms with sluice gates shall be constructed, where the air pressure is kept lower than atmospheric pressure by exhaust in the sluice area or in the loading and unloading areas and in storage. Waste gas shall be fed into a waste gas purification facility.
- b) Waste gas shall be collected at the point of origin, e.g. directly at the dryer or at the point of emission from the encasement and fed into a waste gas purification facility.

- c) Waste gas from installations for drying waste shall be discharged through stacks in such a way that adequate dilution and undisturbed removal with free air flow occurs; this is normally achieved if the requirements under 5.5.2 para. 1 are observed when determining the stack height.
- d) The possibilities to reduce emissions by the use of low-emission processes and technologies, e.g. by minimizing the amount of waste gas and multiple use of waste gas (if necessary, after reducing the humidity level) as process air for drying, or other state of the art techniques shall be exhausted.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

AMMONIA

Ammonia emissions in waste gas shall not exceed the mass flow of 0.10 kg/h or the mass concentration of 20 mg/m³.

INORGANIC GASEOUS CHLORINE COMPOUNDS

Emissions of inorganic gaseous chloride compounds under 5.2.4 Class III, to be indicated as hydrogen chloride, shall not exceed the mass flow in waste gas of 0.10 kg/h or the mass concentration of 20 mg/m³.

ORGANIC SUBSTANCES

The minimum emission reduction ratio for emissions of organic substances in waste gas is 90 per cent, as related to total carbon; even if an emission reduction ratio of 90 per cent is observed or exceeded, emissions of organic substances in waste gas, to be indicated as total carbon, shall not exceed the mass concentration of 20 mg/m³.

The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply.

ODOUR-INTENSIVE SUBSTANCES

Emissions of odour-intensive substances in waste gas shall not exceed the odorous substances concentration of 500 OU/m³.

5.4.8.10.2 Installations for Drying Sewage Sludge

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gas shall be collected at the point of origin, e.g. directly at the dryer or at the point of emission from the encapsulation and fed into a waste gas purification facility.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

AMMONIA

Ammonia emissions in waste gas shall not exceed the mass flow of 0.10 kg/h or the mass concentration of 20 mg/m³.

INORGANIC GASEOUS CHLORINE COMPOUNDS

Emissions of inorganic gaseous chloride compounds under 5.2.4 Class III, to be indicated as hydrogen chloride, shall not exceed the mass flow in waste gas of 0.10 kg/h or the mass concentration of 20 mg/m³.

ORGANIC SUBSTANCES

Emissions of organic substances in waste gas shall not exceed the mass concentration of 20 mg/m³, to be indicated as total carbon.

The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply.

ODOUR-INTENSIVE SUBSTANCES

Emissions of odour-intensive substances in waste gas shall not exceed the odorous substances concentration of 500 OU /m³.

5.4.8.11.1 Installations for the Mechanical Treatment of Mixed Municipal Waste and Similarly Composed Waste

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational requirements shall apply:

- a) For unloading sites, feeding and reception bunkers as well as other installations for delivery, transport and storage of the input material, enclosed rooms with sluice gates shall be erected, where the air pressure is kept lower than atmospheric pressure by suction in the sluice area or in the loading, unloading and storage areas. Waste gas shall be fed into a waste gas purification facility.
- b) Machines, appliances and other installations for mechanical treatment for physical separation of the input materials or the generated wastes (e.g. by crushing, grading, sorting, mixing, homogenizing, dehydrating, drying, pelletizing, pressing) shall be erected in enclosed rooms. The waste gas streams from these installations shall be collected and fed into a waste gas purification facility.
- c) Waste gas from installations for the mechanical treatment of waste shall be discharged through stacks in such a manner that adequate dilution and undisturbed dispersion is made possible by free air flow; this is normally achieved if the requirements under 5.5.2 para. 1 are observed when determining the stack height.
- d) The possibilities to reduce emissions by use of low-emission processes and technologies, e. g. by direct collection of relevant emission sources, separate treatment of heavily polluted waste gas flows or other state of the art techniques shall be exhausted.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

INORGANIC GASEOUS CHLORINE COMPOUNDS

Emissions of inorganic gaseous chlorine compounds under 5.2.4 Class III, to be indicated as hydrogen chloride, shall not exceed the mass flow in waste gas of 0.10 kg/h or the mass concentration of 20 mg/m³.

ORGANIC SUBSTANCES

Emissions of organic substances in waste gas shall not exceed the mass concentration of 20 mg/m³, to be indicated as total carbon.

The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply.

ODOUR-INTENSIVE SUBSTANCES

Emissions of odour-intensive substances in waste gas shall not exceed the odorous substances concentration of 500 OU/m³.

5.4.8.11.2 Installations for other Treatment of Waste

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Installations shall be constructed and operated in a way that during the entire treatment process, including delivery and removal, dust emissions are prevented as far as possible.

TOTAL DUST

Dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

ORGANIC SUBSTANCES

Emissions of organic substances in waste gas shall not exceed the mass concentration of 20 mg/m³, to be indicated as total carbon.

The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply to installations for other treatment of waste not requiring special supervision.

5.4.8.10.3/5.4.8.11.3 Installations for the Disposal of Cooling Appliances or Cooling Units Containing Chlorofluorocarbons (CFCs)

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational measures shall be applied to installations where cooling appliances or cooling units are disposed of which contain CFCs pursuant to Annex I of Regulation (EC) No. 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer (OJ L 244/1 of 29 September 2000):

- a) Installations shall be constructed and operated in a way that emissions of these substances are prevented to a large extent or reduced as far as possible.
- b) Appliances or units with coolants containing CFCs or ammonia shall be treated in a way that coolants and refrigerator lubricant can be removed from the cooling circuit to a large extent without loss and completely removed from the closed system and recovered (removal of all fluids). CFCs shall be removed as completely as possible from the refrigerator lubricant. The coolants shall be collected as completely as possible and supplied to proper disposal.
- c) When appliances and units containing other coolants (e.g. hydrocarbons such as butane, pentane, or insulation material foamed with such hydrocarbons, are treated, appropriate measures against deflagration must be taken, e.g. by inert gas blanketing of the pulverization level.
- d) The reliability of the removal of liquids shall be tested by an agency approved by the competent *Land* authority; coolants containing CFCs shall be removed and collected from a minimum of 100 appliances or units with intact cooling systems. The total amount of collected CFC coolants shall be at least 90 wt. % of the total amount of CFC coolants indicated on the identification plates of the appliances and units. The quantity of CFCs in the degassed refrigerator lubricants shall not exceed 2 g of total halogen/kg.

- e) When CFCs are released from insulation materials, CFC emissions shall be prevented as far as possible, e.g. by the following measures:
- The appliances or units freed of all fluids shall be treated in an encapsulated installation, which is secured against CFC loss e.g. by sluice systems upon entry and removal.
 - The transfer points for insulation material fractions containing CFCs shall be technically impermeable to gas.
 - Waste gas containing CFCs shall be collected at the point of origin, (e.g. during pressing of insulation material) and fed into a waste gas purification facility; the recovered CFCs shall be properly disposed of.
- f) By appropriate monitoring measures, e.g. smoke candles, the installations shall be regularly checked to ensure that there are no leaks: the result shall be documented. Annual checks to establish whether installations do not have leaks and on internal monitoring documentation shall be conducted by an institution approved by the competent *Land* authority.
- g) In parts of the installation for the release of CFCs from insulation material, adhesions of insulation material to the output fractions (e. g. metals and plastics) shall be prevented as far as is technically possible; the adhesion of these substances to output metal and plastic fractions shall not exceed 0.5 wt. % for each fraction.

The CFCs content of insulation material fractions destined for material recycling shall not exceed 0.2 wt. %. Insulation material fractions with a higher CFCs content shall be supplied to a thermal waste treatment installation (waste incineration plant) or to another waste treatment installation with an equivalent destruction efficiency for CFCs; in the latter case, the equivalent destruction efficiency shall be proved to the competent authority.

CHLOROFLUOROCARBONS

CFC emissions in the waste gas from the recovery of CFCs shall not exceed the mass flow of 10 g/h and the mass concentration of 20 mg/m³; the possibilities to further reduce emissions by state of the art techniques shall be exhausted.

CONTINUOUS MEASUREMENT

The mass concentration of CFC emissions in waste gas shall be continuously determined, or it shall be proved by other continuous tests of the efficiency of the waste gas purification facility that the established emission limit is not exceeded.

EXISTING INSTALLATIONS

CHLOROFLUOROCARBONS

For existing installations, CFC emissions in the waste gas of CFC recovery shall not exceed the mass flow of 25 g/h and the mass concentration of 50 mg/m³; the possibilities to further reduce emissions by state of the art techniques shall be exhausted.

5.4.8.12 – 14 Installations under 8.12 to 8.14: Installations for the Storage of Waste

5.4.8.12.1 Installations for the Temporary Storage of Waste, Subject to the Regulations of the Closed Substance Cycle and Waste Management Act

5.4.8.13.1 Installations for the Temporary Storage of Sludge

5.4.8.14.1 Installations for the Storage of Waste, Subject to the Regulations of the Closed Substance Cycle and Waste Management Act, where Waste is Stored for a Period of more than one Year before its Disposal or Recovery

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Installations shall be constructed and operated in a way that pollutants cannot penetrate into the soil and groundwater. The entry of water shall be minimized (e.g. using covering or roofing) to prevent the leaching of pollutants or the development of organic emissions through conversion processes.

5.4.9 Storage, Loading and Unloading of Materials and Preparations

5.4.9.2 Installations under 9.2:

Installations for Storing Inflammable Liquids

ORGANIC SUBSTANCES

For products containing mineral oil with a steam pressure of less than 1.3 kPa at 293.15 K, the mass flow of 3 kg/h shall apply to organic substances under 5.2.5, first sentence, and to continuous measurement pursuant to 5.3.3.2, para. 6, second indent. The requirements under 5.2.5 for emissions of Class I organic substances shall not apply to gas oils with the risk phrase R 40 and to diesel fuel pursuant to DIN EN 590 (February 2000 version), to fuel oils pursuant to DIN 51603 Part 1 (March 1998 version) and similar products.

GASEOUS EMISSIONS

Insofar as safety conditions are not affected and inflammable liquids do not demonstrate the characteristics defined in 5.2.6 b) to d) or a final boiling point of 150 °C or less, divergent to 5.2.6.3, not technically tight soft seals pursuant to VDI Guideline 2440 (November 2000 version) can be used for flanges with a gasket up to a maximum nominal pressure of 2.5 MPa.

The requirements under 5.2.6.6 and 5.2.6.7 shall not apply to gas oils with the risk phrase R 40 and to diesel fuel pursuant to DIN EN 590 (February 2000 version), to fuel oils pursuant to DIN 51603 Part 1 (March 1998 version) and similar products.

EXISTING INSTALLATIONS

GASEOUS EMISSIONS

Existing installations in which gas oils with the risk phrase R 40, diesel fuel pursuant to DIN EN 590 (February 2002 version), fuel oils pursuant to DIN 51063 Part 1 (March 1998 version) or similar products are conveyed, transfilled or stored, which do not comply with the requirements under 5.2.6.1, 5.2.6.3 or 5.2.6.4, may continue operating until the replacement by new sealing systems or aggregates. After the entry into force of this Administrative Regulation, the competent authority shall, within the framework of installation supervision, demand an inventory for pumps and shutoff

devices and observe the continuous replacement of sealing units or aggregates as well as the maintenance work until their replacement.

5.2.6.7, first sentence, shall apply to existing installations for the storage of inflammable liquids pursuant to 5.2.6 a), which do not fulfil any of the specifications referred to in b) to d), provided that the liquid organic products may be stored in floating roof tanks sealed effectively at their edges or in fixed roof tanks with an inner floating deck if an emission reduction of at least 97 per cent is achieved in comparison to fixed roof tanks without an inner floating deck. This shall apply accordingly to the storage of products containing mineral oil with a benzene content of less than 1 per cent.

Existing Installations

- a) in which inflammable liquids fulfilling one of the specifications under 5.2.6 a) to d) are conveyed or transfilled,
- b) in which inflammable liquids fulfilling one of the specifications under 5.2.6 a) to d) are stored,

shall comply with requirements under 5.2.6. no later than twelve years after the entry into force of this Administrative Regulation.

5.4.9.36 Installations under 9.36:

Installations for Storing Liquid Manure which Operate Independent of Installations of 7.1

MINIMUM DISTANCE

Installations shall be constructed at a minimum distance of 300 m from the nearest residential area, existing or planned. The minimum distance may be less if emissions of odorous substances are reduced by primary measures, or the odorous waste gas is treated in a waste gas purification facility. A possible decrease in the minimum distance by reducing emissions of odorous substances shall be determined with the aid of a suitable model for odour dispersion calculation, the suitability of which is to be proved to the competent authority.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The following constructional and operational requirements shall apply:

- a) Installations for storing and transacting commercial liquid fertilizer shall be erected pursuant to DIN 11622 (1994 version) and DIN 1045 (1988 version).
- b) Liquid manure shall be stored (outside the stall) in enclosed containers, or equivalent emission reduction measures shall be applied, achieving an emission reduction ratio, as related to the open uncovered container, of at least 80 per cent of emissions of odour-intensive substances and ammonia.

After agitating or land spreading of the slurry, any artificial floating cover shall subsequently be immediately restored to its functional state.

- c) For commercial liquid fertilizer, which is passed on to third parties for further use, proof of correct storage and utilization of the commercial liquid fertilizer shall be furnished.

5.4.10 Miscellaneous

5.4.10.7 Installations under 10.7:

Installations for Vulcanising Natural or Synthetic Rubber

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Waste gases shall be collected at the point of origin, if possible, and fed into a waste gas purification facility.

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that emissions of organic substances in waste gas shall not exceed the mass concentration of 80 mg/m³, to be indicated as total carbon.

5.4.10.8 Installations under 10.8:

Installations for the Production of Building Protective Agents, Cleaning Agents or Wood Preservatives as well as Installations for the Production of Adhesives

TOTAL DUST

When building protective agents, cleaning agents or wood preservatives are produced, dust emissions in waste gas shall not exceed the mass concentration of 5 mg/m³.

When adhesives are produced, dust emissions in waste gas shall not exceed the mass concentration of 10 mg/m³.

5.4.10.15 Installations under 10.15: Test Stands

5.4.10.15.1 Test Stands for or with Combustion Engines

TOTAL DUST, INCLUDING THE CONTENT OF CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES AND SULPHUR OXIDES

For test stands for or with series motors with a rated thermal input of less than 2 MW of the individual aggregate operated on diesel fuel, not exceeding the permissible mass content of sulphur pursuant to the 3. BImSchV, as currently applicable, waste gases shall be supplied to a soot filter or emissions shall be reduced using an equivalent method.

For test stands for or with other motors operated on diesel fuel, not exceeding the permissible mass content of sulphur pursuant to the 3. BImSchV, as currently applicable, special regulations to reduce dust emissions shall be established. The possibilities to reduce dust emissions by engine design and other state of the art techniques shall be exhausted.

If motors operate, in compliance with regulations, on residual oils or comparable fuels, special regulations to reduce dust emissions and sulphur dioxide emissions shall be established. The possibilities to reduce dust emissions by engine design and other state of the art techniques shall be exhausted.

NITROGEN OXIDES

5.2.4 shall not apply. For test stands with or for compression ignition engines operated on liquid fuels, emissions shall be reduced by engine design or other state of the art techniques.

ORGANIC SUBSTANCES

5.2.5 shall not apply. Emissions of organic substances shall be reduced by engine design or other state of the art techniques.

5.4.10.20 Installations under 10.20:

Installations for Cleaning Tools, Devices or other Metallic Objects by Thermal Processes

REFERENCE VALUE

Emission standards shall be referenced to a volume content of oxygen of 11 per cent in waste gas, except in case of catalytic post-combustion facilities.

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that emissions of organic substances in waste gas do not exceed the mass flow of 0.10 kg/h or the mass concentration of 20 mg/m³, to be indicated as total carbon. The requirements in 5.2.5 for emissions of Classes I and II organic substances shall not apply.

5.4.10.21 Installations under 10.21:

Installations for Internal Cleaning of Rail Tank Cars, Road Tank Vehicles, Tank Ships or Tank Containers as well as Installations for the Automatic Cleaning of Barrels if the Barrels are Cleaned from Organic Compounds

5.4.10.21.1 Installations for Internal Cleaning of Rail Tank Cars, Road Tank Vehicles, Tank Ships or Tank Containers

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

Installations shall be constructed and operated with waste gas collection and purification, wastewater collection and treatment and sufficient storage areas for waste. For the treatment of wastewater, a suitable existing treatment facility may also be used.

Operating instructions for the stages of treatment, e.g. removal of residues, degassing, purification, waste gas collection and purification, wastewater collection and purification, waste collection and classification are to be determined with reference to the groups of substances. The stages of treatment are to be carried out in a way that emissions are minimized. In order to reduce the generation of emissions, substances having a steam pressure of 10 Pa or more at a temperature of 293.15 K shall be rinsed with a cold wash solution before washing. Direct treatment of volatile substances with steam or hot water is not permissible.

ORGANIC SUBSTANCES

Emissions of organic substances in waste gas, to be indicated as total carbon, shall, as a total, not exceed the mass flow of 0.10 kg/h or the mass concentration of 20 mg/m³. The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply.

CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

Emissions of organic substances under 5.2.7.1 shall not exceed, as a minimum requirement, the total mass flow of 2.5 g/h or the total mass concentration of 5 mg/m³.

5.4.10.21.2 Installations for Automatic Cleaning of Barrels or Comparable Containers (e.g. Tank Pallets) including Related Processing Plants

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The washing area shall be encapsulated. Waste gases emitted e. g. during opening of containers, removal of residues from the containers, pneumatic bulge of the containers, scrapping (e.g. pressing) of non-recyclable barrels or during transport of opened, uncleaned barrels shall be collected. Storage containers for residues removed from containers, the facilities for the treatment of wash water and wastewater and related storage containers shall be designed and operated as closed systems as far as possible.

Prior to the washing process, containers shall be emptied as far as possible (removal of residues).

While operating the barrel or container cleaning installations, it should be observed that barrels or containers contaminated with substances under 5.2.2 Class I or substances under 5.2.7.1 are charged alternately with barrels or containers contaminated with less dangerous substances. Operating instructions about this shall be drawn up and an operator's handbook maintained.

ORGANIC SUBSTANCES AND CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

For installations where also barrels or containers contaminated with substances under 5.2.5 Class I or substances under 5.2.7.1 are cleaned, emissions of organic substances under 5.2.5 in waste gas, to be indicated as total carbon, shall not exceed the total mass flow of 0.10 kg/h or the total mass concentration of 20 mg/m³. Further requirements shall be determined on an individual basis for installations where mainly barrels or containers are cleaned which are contaminated with organic substances under 5.2.7.1.

For installations where barrels or containers not contaminated with organic substances under 5.2.5 Class I or under 5.2.7.1 are cleaned, emissions of organic substances under 5.2.5 in waste gas shall not exceed the total mass concentration of 75 mg/m³, to be indicated as total carbon, if possible.

The requirements under 5.2.5 for emissions of Classes I and II organic substances shall not apply.

5.4.10.23 Installations under 10.23: Installations for Textile Finishing

5.4.10.23.1 Installations for Textile Finishing by Heat Setting, Applying the Thermosol Process, Coating, Impregnating or Finishing, including Related Drying Units

Insofar as installations must meet requirements to restrict emissions of volatile organic compounds pursuant to the Ordinance on the Curbing of Emissions of Volatile Organic Compounds when using Organic Solvents (31. BImSchV) of 21 August 2001 (BGBl. I, p. 2180), as currently applicable, the following requirements for organic substances shall specify and supplement the provisions of Annex IV C No 5 of this Ordinance.

CONSTRUCTIONAL AND OPERATIONAL REQUIREMENTS

The content of emission-relevant substances in or on the textile goods to be finished (e.g. monomeric residues, preparations such as spinning oils, softeners, slashing products) shall be reduced as far as possible. For this purpose, one or several of the following measures shall be implemented in particular:

- a) use of thermostable preparations
- b) reduction of the applied quantity,
- c) pre-treatment of the textile goods to be finished, e.g. by washing,
- d) optimisation of pre-cleaning (e.g. increase of washing efficiency).

REFERENCE VALUE

The mass concentrations are referenced to an air-textile goods-ratio of 20 m³/kg; the air-textile goods-ratio is the quotient of the total waste gas volume flow (in m³/h) of a thermal treatment aggregate during a process (finishing stage) and the throughput of the textiles to be finished (in kg/h). Multiplying the permissible mass concentration of emitted substances by the reference air-textile goods ratio of 20 m³/kg gives the permissible specific emission factor (masses of emitted substances (in g) per masses of textiles to finish (in kg)).

ORGANIC SUBSTANCES

5.2.5 shall apply, provided that

- a) emissions of organic substances in waste gas, to be indicated as total carbon, may not exceed the mass flow of 0.80 kg/h or the mass concentration of 40 mg/m³;
- b) an additional mass concentration of no more than 20 mg/m³, to be indicated as total carbon, may be emitted from carry-overs and residues of preparations;
- c) if, for processing reasons, one or more of the finishing stages recorded in 10.23 of the Annex of the 4. BImSchV are carried out simultaneously in the same treatment aggregate with a finishing stage not recorded there, the process shall be optimised so that the total mass concentration of 40 mg/m³ for emissions of organic substances in waste gas, to be indicated as total carbon, shall not be exceeded if possible. If installations subject to the requirements of the 31. BImSchV, as currently applicable, coat and print simultaneously, emissions of organic substances in waste gas shall, pursuant to this Ordinance, not exceed a mass concentration of 40 mg/m³, to be indicated as total carbon.

Even if the requirements under a) to c) are fulfilled, total emissions of organic substances in waste gas shall still not exceed, as a total, 80 mg/m³, to be indicated as total carbon; if installations subject to the requirements of the 31. BImSchV, as currently applicable, coat and print simultaneously, – divergent to the first part of the sentence and pursuant to this Ordinance – emissions of organic substances in waste gas shall not exceed, as a total, the mass concentration of 60 mg/m³, to be indicated as total carbon.

The requirements for emissions of Classes I and II organic substances shall not apply.

In justified exceptional cases, e.g. for coatings and technical textiles, these regulations may be waived; in such cases 5.2.5 shall apply unamended.

CARCINOGENIC, MUTAGENIC OR REPRODUCTION TOXIC SUBSTANCES

Supplementary to 5.2.7.1, substances and preparations defined in 5.2.7.1 shall immediately be replaced by less harmful substances and preparations.

MEASUREMENT

In order to determine the operating conditions (recipes), which lead to the highest emissions, emission calculations may be made on the basis of substance emission factors insofar as these substance emission factors are established using a scientifically acknowledged method.

Divergent to 5.3.2.2 para. 2, second sentence, up to three individual measurements may be substituted by calculating emissions on the basis of substance emission factors, insofar as, within the framework of initial and repeated emission measurement, substance emission factors for the components of at least three recipes are technically established by a measurement office recognized pursuant to Article 26.

EVALUATION OF MEASUREMENTS

The actual air-textile goods-relation shall be determined and documented for each measurement

Emission standards shall also be considered to be observed if the specific emission factors determined by the air-textile goods ratio and the measured mass concentrations do not exceed the permissible specific emission factors.

EXISTING INSTALLATIONS

ORGANIC SUBSTANCES

A supplementary stipulation shall apply to existing installations stating that for directly heated treatment aggregates, emissions of organic substances resulting from combustion up to a maximum mass concentration of 20 mg/m³, to be indicated as total carbon, shall be disregarded; the possibilities to further reduce emissions by combustion technique and other state of the art techniques, e. g. by optimisation of combustion, carrying out maintenance at least once annually, shall be exhausted. Insofar as the operator proves, e.g. by an expert's opinion of the manufacturer of the burner or the stenter frame, that emissions of organic substances from combustion

cannot comply with the maximum mass concentration of 20 mg/m^3 , to be indicated as total carbon and these emissions cannot be further reduced by primary measures, the emission limit shall be determined on an individual basis.

5.5 Discharge of Waste Gases

5.5.1 General

Waste gases shall be discharged in such a manner that an undisturbed dispersion is made possible by free air stream. As a rule, a discharge through stacks is required, the height of which shall be determined pursuant to 5.5.2 to 5.5.4, notwithstanding better cognition.

5.5.2 Discharge through Stacks

Stacks shall have a minimum height of 10 m above ground level and project 3 m, as a minimum, above the ridge of the roof. In case of a roof with a slope of less than 20° , the height of the ridge shall be calculated by taking as a basis a roof sloop of 20° ; notwithstanding this, the height of stacks shall, however, not exceed twice the height of the building.

In case of several stacks of approximately equal height with similar emissions, it shall be examined to what extent these emissions are to be combined in the determination of the stack height. This shall apply in particular if the horizontal distance between the individual stacks does not exceed 1.4 times the stack height and insofar as different stack heights are required in order to avoid a superimposition of the waste gas plumes.

If, for a stack height determined on the basis of para. 1, the characteristic value of the total load (4.7), which is to be assessed by means of the measurement and evaluation method (4.6), exceeds the immission value for the calendar year (4.2 to 4.5), emission reduction shall first be attempted. If this is not possible, the height of the stacks shall be increased to such extent that an exceeding of the immission value for the calendar year is thereby prevented.

The height of stacks pursuant to 5.5.3 shall, notwithstanding any other provisions, not exceed 250 m; with stacks higher than 200 m, further measures to reduce emissions shall be applied.

The stack height specified in 5.5.3 shall, notwithstanding deviating provisions, not exceed 250 m; if a greater stack height than 200 m is obtained, further-reaching measures shall be attempted to limit the emissions.

Para. 1 shall neither be applied to non-firing plants with low emission mass flows nor in cases where waste gases, for safety reasons, are emitted only for a few hours of the year; in these cases, the requirements established in VDI Guideline 3781 Part 4 (November 1980 version) or in VDI Guideline 2280 Section 3 (August 1977 version) shall be applied *mutatis mutandis* in order to ensure a sufficient dilution and an undisturbed dispersion of the waste gases by free air stream.

5.5.3 Nomogram to Determine the Stack Height

The stack height shall be determined pursuant to Figure 2.

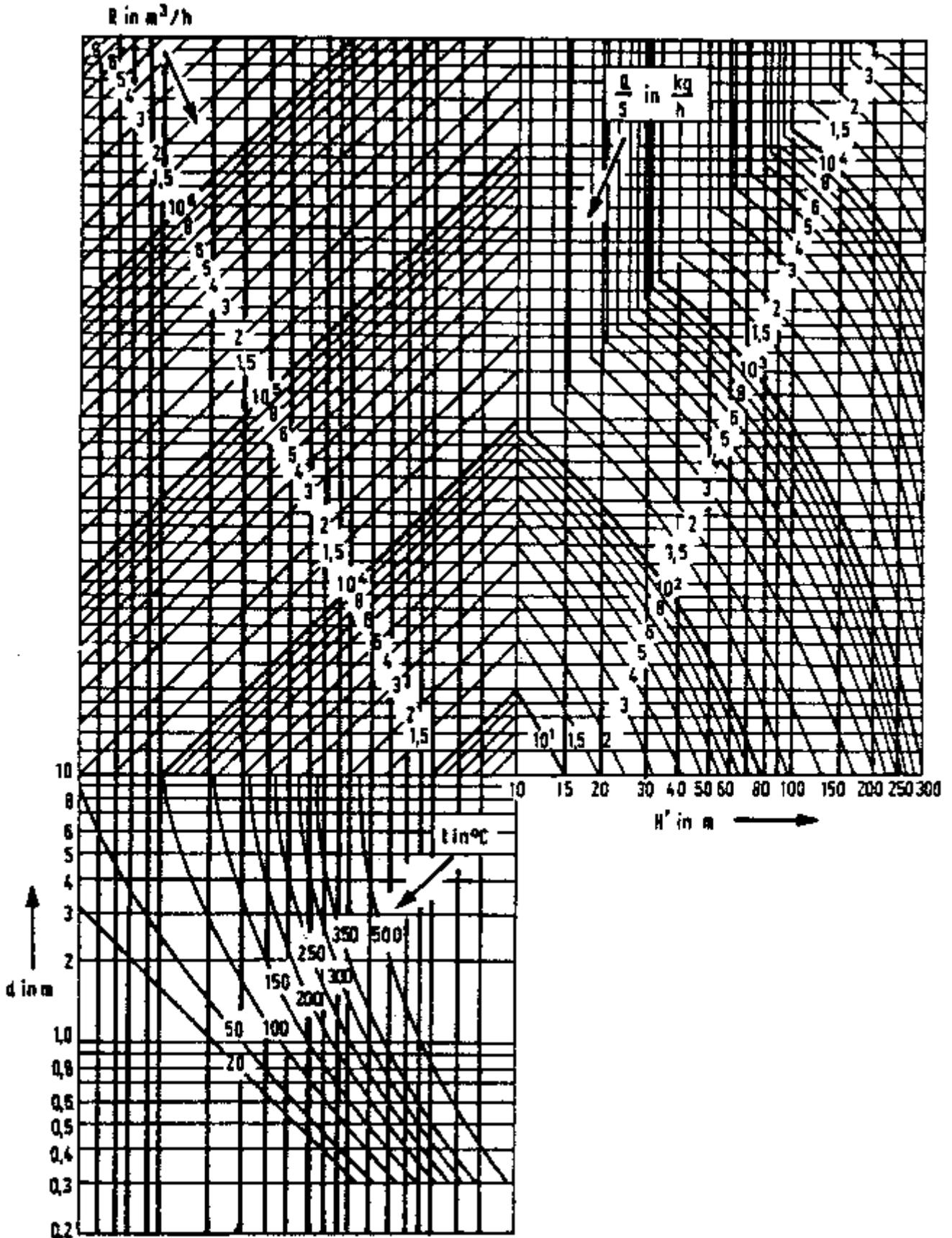
Explanation:

H' in m	stack height taken from the nomogram;
d in m	inside diameter of the stack or equivalent inside diameter of cross section;
t in °C	temperature of the waste gas at the stack mouth;
R in m ³ /h	volume flow of the waste gas in standard conditions after subtraction of the water vapour content;
Q in kg/h	emission mass flow of the emitted air pollutant from the emission source; as to fibres, the quantity of fibres emitted per time unit shall be converted into a mass flow;
S	stack height determination factor; as a rule, S shall be defined by the values specified in Annex 7.

For t , R and Q , those values shall be applied which are obtained during correct operation under the most adverse operating conditions in regard to air pollution control, in particular in regard to the use of fuels and raw materials. For nitrogen monoxide emissions, a transformation rate of 60 per cent to nitrogen dioxide shall be taken as a basis; this implies that the emission mass flow of nitrogen monoxide must be multiplied by factor 0.92 and used in the nomogram as the emission mass flow Q of nitrogen dioxide.

The competent *Land* authority may prescribe lower values S in areas subject to investigation pursuant to § 44 para. 3 of the Federal Immission Control Act and in the cases pursuant to 4.8. Such values are not to be lower than 75 per cent of the S values specified in Annex 7.

Figure 2: Stack Height Determination Nomogram



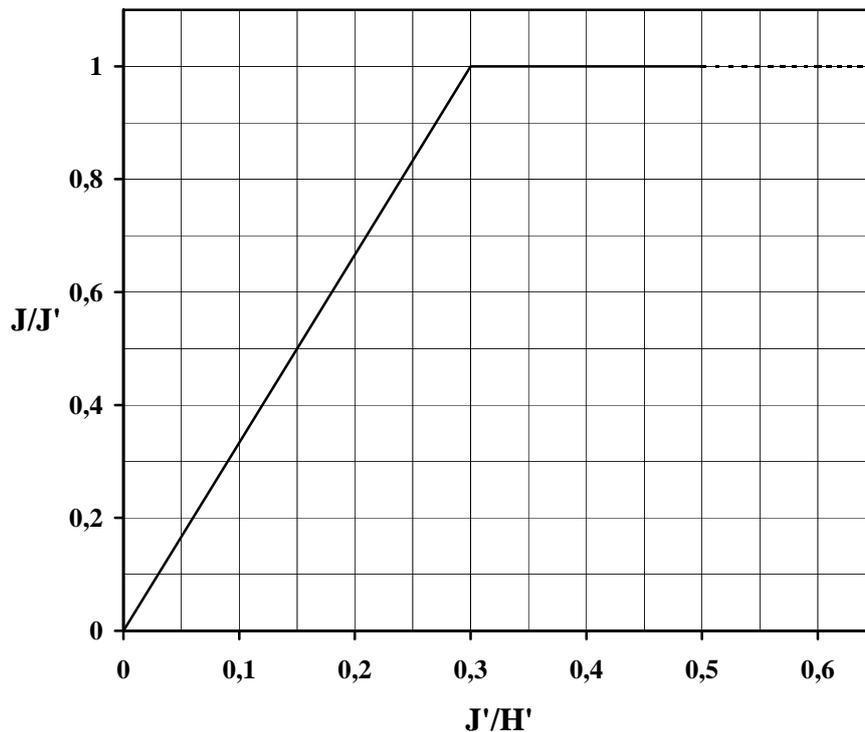
5.5.4 Stack Height Determination Taking into Consideration Buildings and Vegetation, and in Uneven Terrain

In those cases where the closed, existing or – based on a zoning plan – permissible construction or the overall vegetation covers more than 5 per cent of the surface of the evaluation area, the stack height H' obtained on the basis of 5.5.3 is increased by the additional amount J . Value J in m is to be taken from Figure 3.

Explanation:

H in m	building height of stack ($H = H' + J$);
J' in m	average height of the closed, existing or – based on a zoning plan - permissible construction or the overall vegetation above ground

Figure 3: Graph to Assess Value J



When determining the stack height, unevenness of terrain must be considered if the installation is located in a valley or if emission dispersion is impaired by terrain elevations. In cases where the prerequisites to apply VDI Guideline 3781 Part 2

(August 1981 version) are given, the stack height determined pursuant to 5.5.3 and 5.5.4 para. 1 shall be corrected accordingly.

5.5.5 Existing installations

The requirements under 5.5.2 to 5.5.4 shall not apply to existing installations, which meet the requirements of the Technical Instructions on Air Quality Control (*TA Luft*) of 27 February 1986 (GMBI. p. 95).

6 Subsequent Orders

Insofar as existing installations do not meet the requirements under 4 and 5, the competent authorities shall issue the necessary orders to fulfil the obligations arising from § 5 para. 1 nos. 1 and 2 of the Federal Immission Control Act in compliance with the following provisions. The periods to meet the requirements specified in 5.4 and 6 commence with the entry into force of this Administrative Regulation.

6.1 Subsequent Orders for the Protection against Harmful Environmental Effects

6.1.1 Discretion Restriction

Pursuant to the second sentence of § 17 para. 1 of the Federal Immission Control Act, subsequent orders shall be issued if the protection of the general public or the neighbourhood against harmful effects on the environment or any other hazards, significant disadvantages or significant nuisances is inadequate. In such cases, subsequent orders may only be waived if special circumstances prevail, which justify to evaluate otherwise. In the event of concrete health hazards, the authority shall always intervene.

6.1.2 Intervention Prerequisite

The protection against harmful effects of air pollutants on the environment is not ensured to a sufficient extent if

- a) the immission values in order to ensure the protection of human health pursuant to 4.2.1 are exceeded at a place within the sphere of influence of the installation, which is permanently accessible for humans,
- b) the immission values in order to ensure the protection against significant nuisances pursuant to 4.3.1 are exceeded within the sphere of influence of the installation and if it cannot be excluded that intolerable nuisances actually occur in the area affected,
- c) the immission values in order to ensure the protection against significant disadvantages, especially the protection of the vegetation and of ecosystems,

pursuant to 4.4.1 or 4.4.2 are exceeded within the sphere of influence of the installation and if ecosystems requiring protection exist in the area affected,

d) a special-case examination pursuant to 4.8 is to be carried out and has the result that air pollutant immissions lead to hazards, significant disadvantages or significant nuisances for the general public or the neighbourhood

and if the operation of the installation contributes to the harmful effects on the environment to a relevant extent.

6.1.3 Measures

If adequate protection against harmful effects on the environment cannot be ensured by applying measures to implement state of the art techniques, further measures to reduce emissions shall be ordered. If such measures do not suffice either, the conditions of discharge shall be demanded to be improved. In cases pursuant to the second sentence of § 17 para. 1 of the Federal Immission Control Act, it shall be checked whether the permit is to be completely or partially revoked.

6.1.4 Time Limits

Subsequent orders for the protection against harmful effects on the environment shall be issued immediately after clarification of the prerequisites for intervention. If several polluters contribute to harmful effects on the environment to a relevant extent, the prerequisites for intervention shall be clarified with regard to all polluters concerned and, if necessary, several orders issued. Taking into account the principle of proportionality, a time limit may be allowed within which measures must be implemented. The third sentence only applies if no concrete health hazards can occur during the transitional period and if nuisances or disadvantages of limited duration can be tolerated by those affected.

6.1.5 EC Air Quality Standards

If immission values pursuant to 4 are exceeded, the observation of which shall only become mandatory as of a certain date in the future in compliance with Daughter Directives of the Council Directive 96/62/EC of 27 September 1996 on ambient air

quality assessment and management (“Air Quality Framework Directive”), the installation may be approved to contribute to excess immission values until expiry of the transitional period. The measures required for future observation of immission values shall be ordered no later than when drawing up a clean air plan.

6.2 Subsequent Orders to Provide Precautions against Harmful Environmental Effects

6.2.1 Principle

If an installation does not meet the requirements to provide precautions against harmful effects on the environment specified in this Administrative Regulation, the competent authority shall issue the necessary orders by which to adapt the installation to the state of the art techniques pursuant to 5 and to the other requirements to provide precautions specified there under. If the emission standards pursuant to 5 are only exceeded to a low extent, ordering extensive corrective measures may lack proportionality. In all other respects, the principle of proportionality (§ 17 para. 2 of the Federal Immission Control Act) shall, as a rule, be observed by granting a period of compliance pursuant to 5.4 to 6.

6.2.2 Immediate Rehabilitation

If an installation does not meet the requirements to take precautions against harmful effects on the environment specified in the Technical Instructions on Air Quality Control (*TA Luft*) of 27 February 1986 (GMBI. p. 95), a period of compliance shall only be granted in a subsequent order insofar as this is indispensable for carrying out the measures. If such requirements have been specified on a case-to-case basis by imposed condition or by subsequent order, they shall be implemented immediately.

6.2.3 Granting Rehabilitation Periods

Insofar as new requirements are established in this Administrative Regulation, periods of compliance shall be granted taking into consideration

- the technical efforts required,
- the extent of deviation from such requirements and
- the significance for the general public and the neighbourhood.

6.2.3.1 Rehabilitation Periods for Measures the Implementation of which requires only Organisational Changes or Few Technical Efforts

It shall be determined in subsequent orders the implementation of which requires only organisational changes or few technical efforts, especially by shifting to lower-emission fuels or input substances and by carrying out simple changes of process management or improvements in the efficiency of existing waste gas purification facilities that the implementation of such measures shall be completed within three years after the entry into force of such new requirements.

6.2.3.2 Rehabilitation Periods for Measures by which to Meet the Existing and New Requirements Simultaneously

As to installations, which meet neither the requirements of the Technical Instructions on Air Quality Control of 1986 nor the new requirements, it shall be attempted to implement measures to meet both the existing and the new requirements simultaneously. The period within which to meet all requirements shall not exceed three years.

All requirements shall be met no later than by 30 October 2007 by installations pursuant to no. 7.1 letter b) of the Annex of the 4.BImSchV, which require notification as of 3 August 2001 pursuant to § 67 para. 2 of the Federal Immission Control Act.

6.2.3.3 General Rehabilitation Period

As to installations which have up to now complied with state of the art techniques all requirements shall be demanded – notwithstanding any other provisions of 6.2.3.1, 6.2.3.4 and 6.2.3.5 – to be met no later than by 30 October 2007.

6.2.3.4 Special Rehabilitation Periods pursuant to 5.4 of this Administrative Regulation

Insofar as special rehabilitation periods are specified for certain installation types in 5.4, these shall take precedence over any other provisions.

6.2.3.5 Rehabilitation Periods in Clean Air Plans pursuant to § 47 of the Federal Immission Control Act

Insofar as clean air plans pursuant to § 47 of the Federal Immission Control Act contain rehabilitation periods, these shall take precedence over the periods specified in 5.4 and 6.2.3.1 to 6.2.3.3.

6.2.4 Permit Waiver

Subsequent orders shall not be issued if the operator has expressed a waiver in writing to the permitting authority renouncing to operate the installation over a period exceeding the periods specified in 6.2.3.2 to 6.2.3.4. The first sentence shall not apply to subsequent orders pursuant to 6.2.3.1 and 6.2.3.5.

6.2.5 Compensation

In cases pursuant to § 17 para. 3a of the Federal Immission Control Act, the competent authority shall refrain from issuing subsequent orders.

7 Cancellation of Regulations

The Technical Instructions on Air Quality Control (*TA Luft*) of 27 February 1986 (GMBI. p. 95) shall be cancelled as of entry into force of this General Administrative Regulation.

8 Entry into Force

This General Administrative Regulation shall enter into force on the first day of the third calendar month after publication.

Approved by the *Bundesrat*.

Berlin, 24 July 2002

IG I 2 – 50139/1

Gerhard Schröder

Chancellor

Jürgen Trittin

Federal Minister

for Environment, Nature Conservation and Nuclear Safety

Annex 1 Determination of the Minimum Distance from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems with Regard to the Requirements under 4.8

Examination pursuant to 4.8 as to whether there is adequate protection ensured against significant disadvantages by damage to sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems caused by the effects of ammonia

The provisions under 4.8 stipulate that it is considered an indication for the occurrence of significant disadvantages by damage to sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems caused by the effects of ammonia if the minimum distances given in Figure 4 are not observed.

As to installations for rearing or breeding of livestock, the emission factors in Table 11 shall be used to determine the yearly ammonia emissions expected - under conditions most unfavourable - for the respective installation according to species, production specialization, livestock housing and commercial fertilizer storage and according to the respective stocking density. In the event of different species and different types of rearing and use of the animals, the respective yearly ammonia emissions shall be added up. This yearly ammonia emission can be used to identify the minimum distance from Figure 4. It is considered an indication for the occurrence of significant disadvantages if such a minimum distance is not observed.

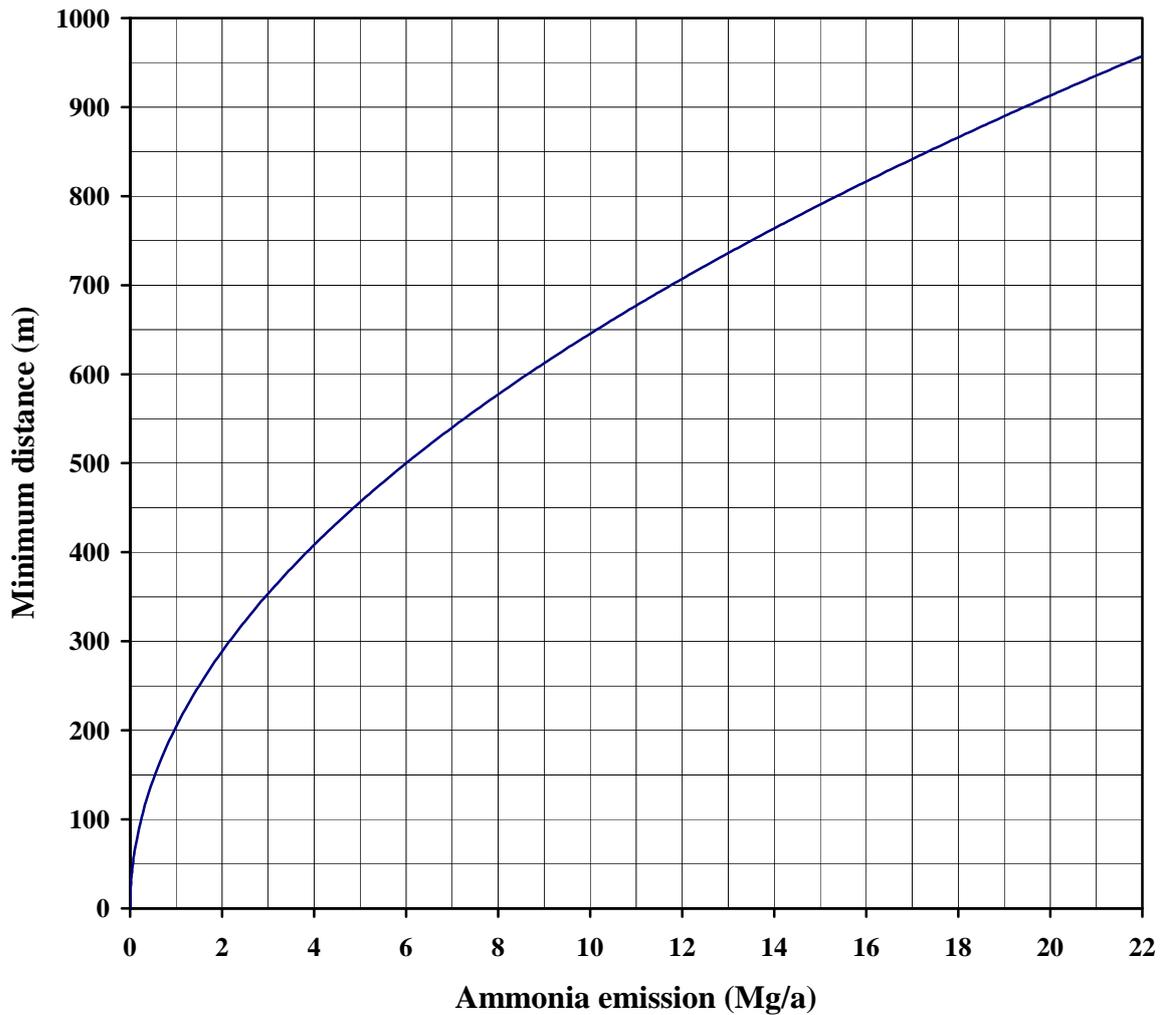
Table 11: Ammonia Emission Factors for Installations for Rearing or Breeding of Livestock*

Species, Production Specialization, Livestock Housing, Commercial Fertilizer Storing	Ammonia Emission Factor (kg/(Stocking Rate· a))
Fattening pigs	
Compulsory ventilation, liquid manure system (partially or fully slated floors)	3.64
Compulsory ventilation, solid manure system	4.86

* If facilities for farming or breeding of livestock significantly diverge from the procedures listed in Table 11 in relation to species, production specialization, livestock housing, feeding or commercial fertilizer storage, diverging emission factors for calculation may be drawn upon on the basis of plausible reasoning (e.g. measuring reports, practical examinations).

Species, Production Specialization, Livestock Housing, Commercial Fertilizer Storing	Ammonia Emission Factor (kg/(Stocking Rate· a))
Naturally ventilated housing, kennel housing (liquid or solid manure system)	2.43
Naturally ventilated housing, deep litter or composting system	4.86
Swine nursery (breeding sow management)	
All areas and types of livestock housing (breeding sows incl. piglets up to 25 kg)	7.29
Laying hens	
Cage rearing using ventilated dropping belts	0.0389
Aviary housing using ventilated dropping belts	0.0911
Floor management/free-range (manure removal 1 time per turn)	0.3157
Feeding poultry	
Broilers, floor management	0.0486
Ducks	0.1457
Turkeys	0.7286
Dairy cattle	
Tied housing, liquid or solid manure system	4.86
Cubicle housing, liquid or solid manure system	14.57
Free stall, deep litter system	14.57
Free stall, sloping floor straw yard system	15.79
Fattening bullock, young cattle incl. breeding (6 months up to 2 years)	
Tied housing, liquid or solid manure system	2.43
Free stall, liquid manure system	3.04
Free stall, sloping floor straw yard system	3.64

Figure 4: Minimum Distance of Installations from Sensitive Plants (e.g. Tree Nurseries, Cultivated Plants) and Ecosystems for which Significant Disadvantages by Damage Caused by the Effects of Ammonia to these Protected Resources will Occur if the Minimum Distances are not Observed



For calculating the minimum distance according to Figure 4 the following equation shall apply:

$$X_{\min} = \sqrt{F \cdot Q}$$

F shall be $41,668 \text{ m}^2 \cdot \text{a/Mg}$ and Q the yearly ammonia emission in Mg/a. This equation may also be used in the event of yearly ammonia emissions higher than the value of 22 Mg/a depicted in Figure 4.

If it is proved by a dispersion calculation pursuant to Annex 3, taking into consideration the conditions in which the animals are kept, that at a distance smaller than the value determined by Figure 4, the additional load for ammonia of $3 \mu\text{g}/\text{m}^3$ is not exceeded in any significant assessment point, it is considered an indication for the occurrence of significant disadvantages by damage to sensitive plants (e.g. tree nurseries, cultivated plants) and ecosystems caused by the effects of ammonia if such newly determined distance is not met.

It is not considered an indication for the occurrence of significant disadvantages if the total load of ammonia does not exceed $10 \mu\text{g}/\text{m}^3$ at any assessment point.

The minimum distance curve has been derived for sources close to the ground and does not take into consideration that the immission concentration may be reduced due to the discharge of waste gases through stacks pursuant to 5.5. A dispersion calculation pursuant to Annex 3 may be carried out to take into consideration such discharge conditions.

Annex 2 Curves for Deriving Mass Flows on the Basis of Immission Projections

Figure 5: Arsenic and Inorganic Arsenic Compounds

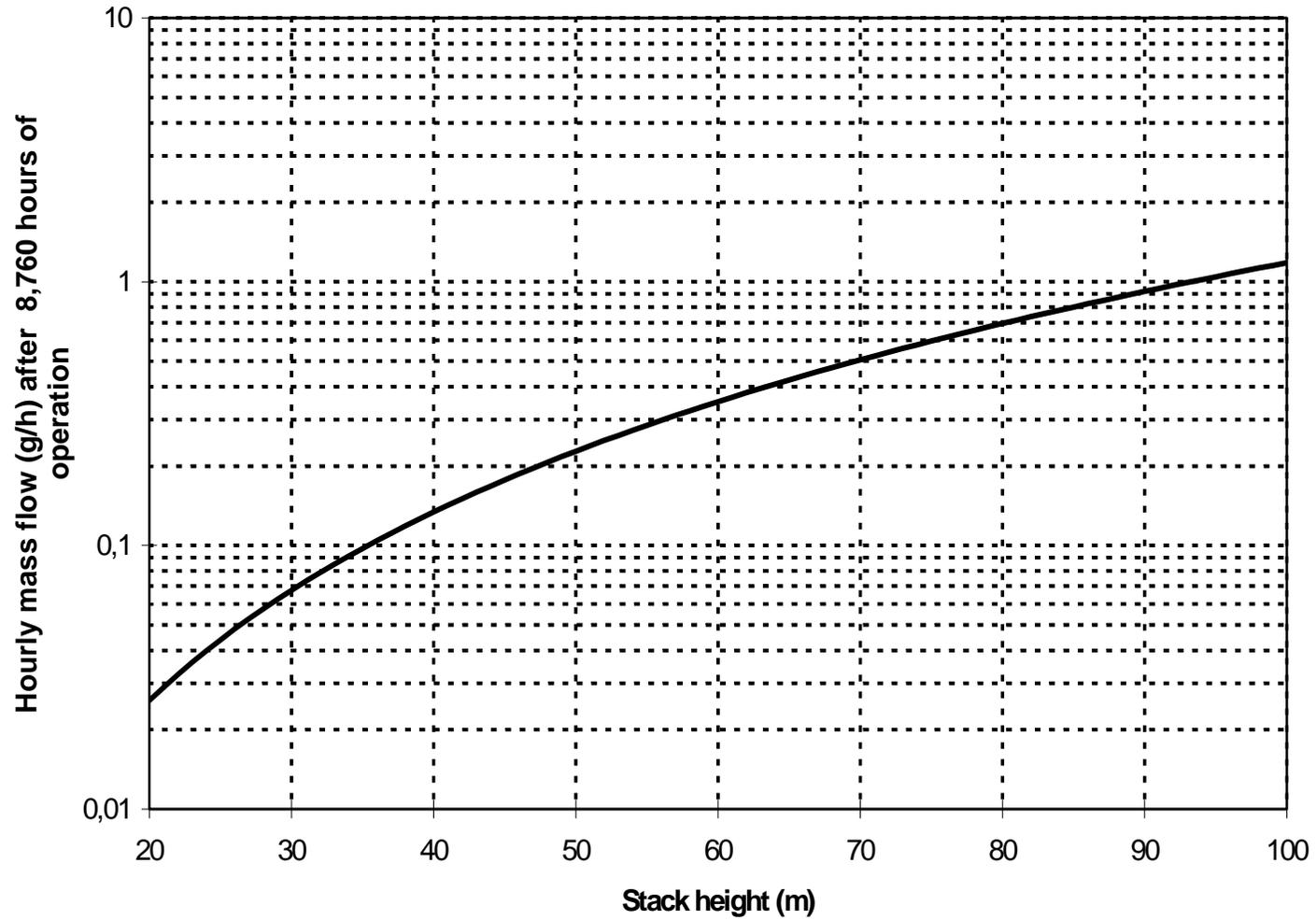


Figure 6: Lead and Inorganic Lead Compounds

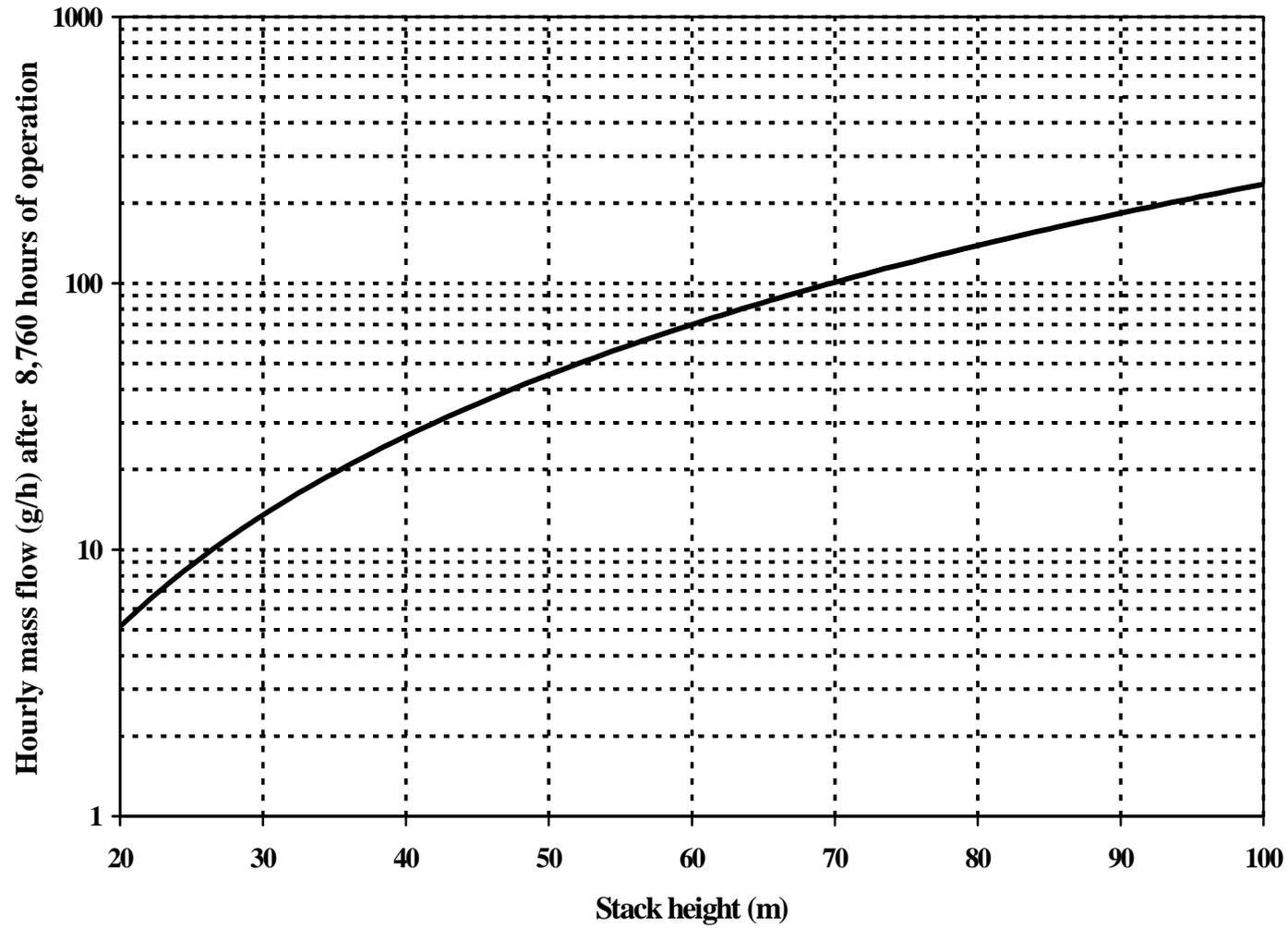


Figure 7: Cadmium and Inorganic Cadmium Compounds, Thallium and Inorganic Thallium Compounds

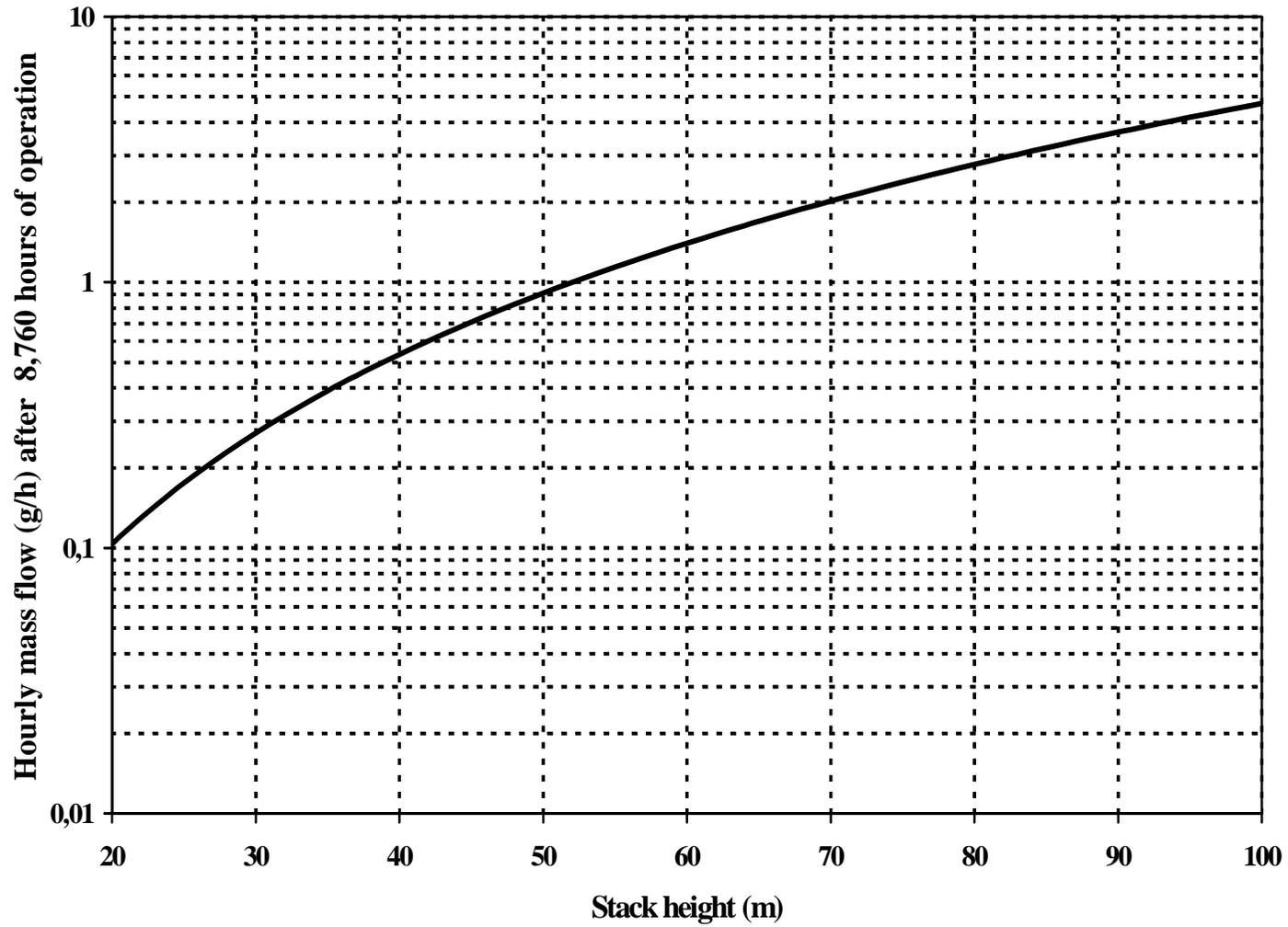


Figure 8: Nickel and Inorganic Nickel Compounds

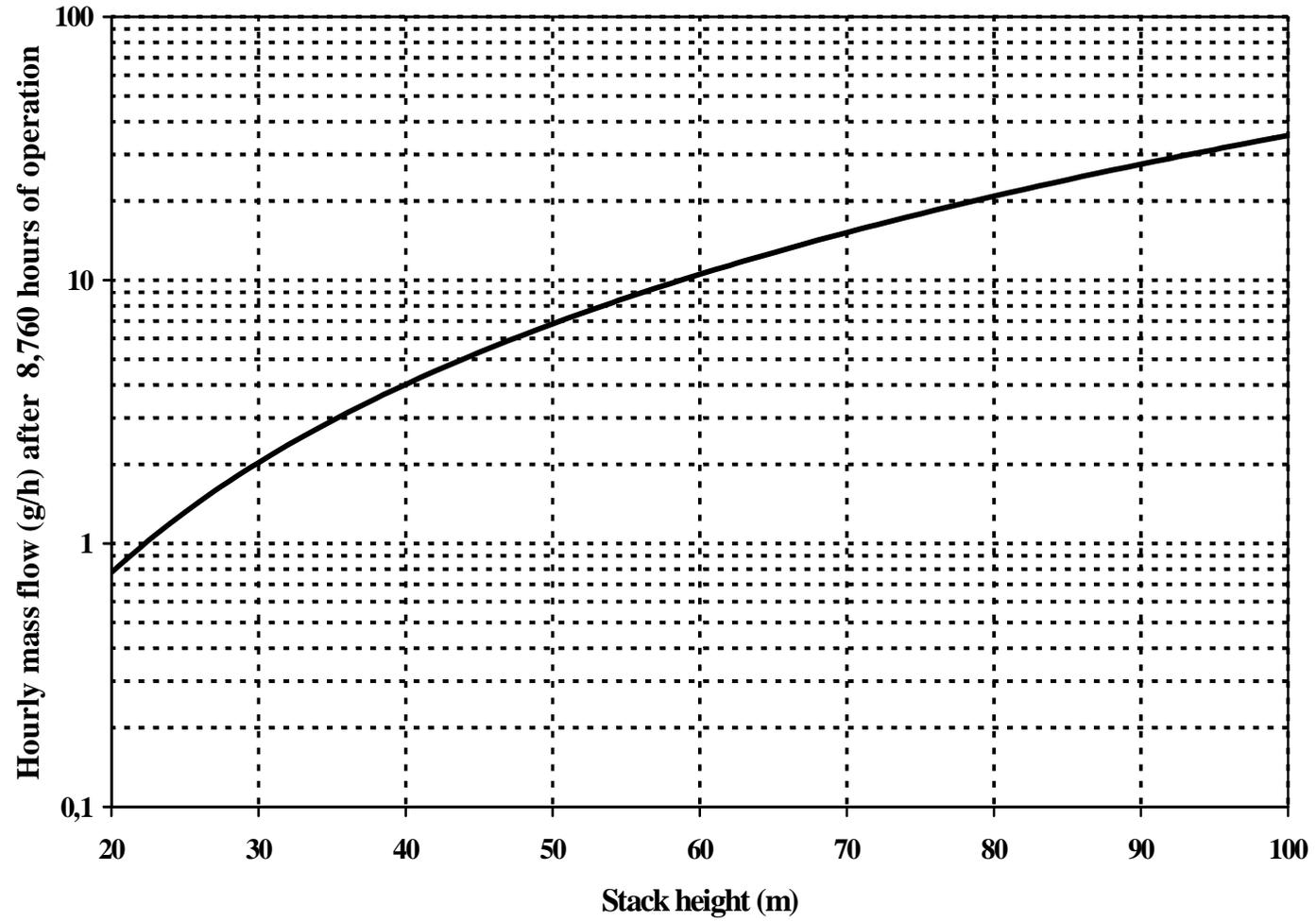
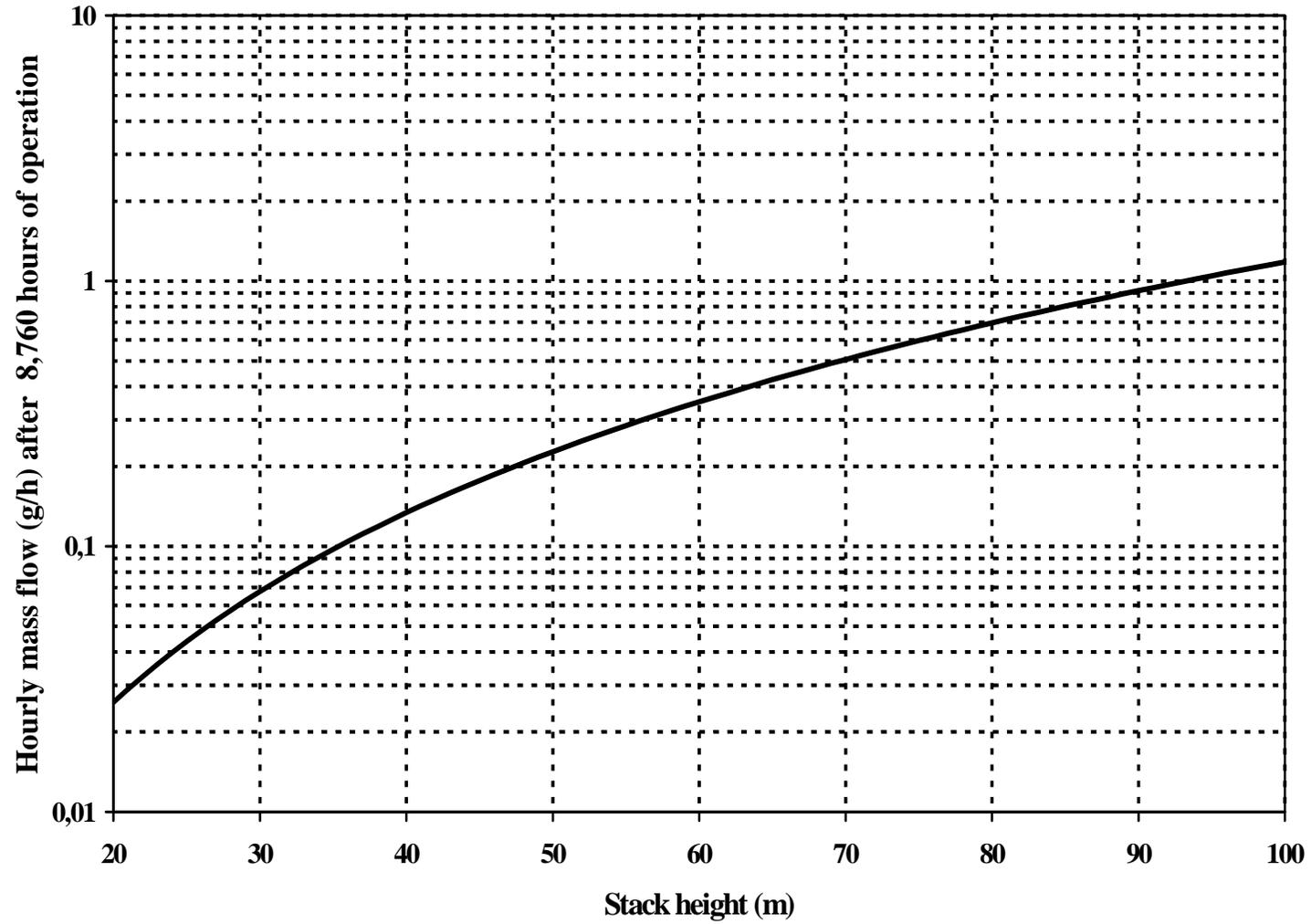


Figure 9: Mercury and Inorganic Mercury Compounds



Annex 3 Dispersion Calculation

1 General

The dispersion calculation for gases and particulate matter shall be carried out as a time series calculation over a period of one year respectively or on the basis of a frequency distribution of dispersion situations over a period of several years according to the procedure described herein using the particle model of the VDI Guideline 3945 Part 3 (September 2000 version) and under consideration of other Guidelines quoted further below.

When using a time series calculation the dispersion model yields the concentration of a substance (as mass/volume) and the deposition (as mass/(surface · time)) for each hour of the year at the specified grid points. When using a frequency distribution according to chapter 12 in this Annex, the dispersion model yields the corresponding annual mean values.

The results of a calculation for a raster of grid points shall serve to select the assessment points pursuant to 4.6.2.5.

The results at the assessment points represent the additional load and serve, together with the time series of the measured initial loads, to determine the total load.

2 Determination of Emissions

Emission sources are the points to be determined where air pollutants are released from the installation into the atmosphere. The release conditions prevailing at the discharge of the emission shall be taken into account.

The emission parameters of the emission source (emission mass flow, waste gas temperature, waste gas volume flow) shall be specified as hourly mean values. If the emission parameters vary in time, e.g. in batch operation, they are to be indicated as time series. If such a time series is not available or cannot be used, the most unfavourable conditions with respect to clean air maintenance during normal

operation shall be assumed. If the emission rate is dependent on the wind velocity (wind-induced sources), this shall be taken into account accordingly.

3 Dispersion Calculation for Gases

As to gases for which no immission values have been established for deposition, the dispersion calculation shall be carried out without taking account of the deposition. For ammonia and gaseous mercury the deposition velocity values v_d as listed in Table 12 shall be used:

Table 12: Deposition Velocity for Gases

Substance	v_d in m/s
Ammonia	0.010
Mercury	0.005

The conversion times indicated in VDI Guideline 3782 Part 1 (December 2001 version) shall be used to calculate the conversion of NO to NO₂.

4 Dispersion Calculation for Particulate Matter

The dispersion calculation for particulate matter must take dry deposition and sedimentation into account. The calculation shall be carried out for the following classes of particle sizes, characterised by the aerodynamic diameter $d_{a,s}$ of the emitted mass flow, using the corresponding values for deposition velocity v_d and sedimentation velocity v_s :

Table 13: Deposition and Sedimentation Velocity for Particulate Matter

Class	d_a in μm	v_d in m/s	v_s in m/s
1	less than 2.5	0.001	0.00
2	2.5 to 10	0.01	0.00
3	10 to 50	0.05	0.04
4	more than 50	0.20	0.15

The dispersion calculation for a particle size class must be carried out using the emission mass flow of the respective particle size class. To calculate the deposition of particulate matter in total, the deposition values of the individual particle size classes shall be added up. The individual concentration values for PM-10 (aerodynamic diameter less than 10 μm) are made up of the sum of the individual concentration values of the particle size classes 1 and 2.

In cases where the particle size distribution is not known, PM-10 shall be considered as particulate matter of Class 2. For particulate matter having an aerodynamic diameter larger than 10 μm the value 0.07 m/s shall be used for v_d and 0.06 m/s for v_s .

5 Surface Roughness

The surface roughness of the terrain is described by a mean roughness length z_0 . Such surface roughness shall be determined according to Table 14 on the basis of the land use classes of the CORINE Land Cover Inventory* (the indicated numbers correspond to the CORINE land cover nomenclature):

* Data on ground cover in the Federal Republic of Germany (“*Daten zur Bodenbedeckung der Bundesrepublik Deutschland*”) provided by the Federal Statistical Office, Wiesbaden

Table 14: Mean Roughness Length Subject to the Land Use Classes Indicated in the CORINE Land Cover Inventory

z_0 in m	CORINE Classes
0.01	Beaches, dunes and sand plains (331); Water bodies (512)
0.02	Landfills and Mining Dumps(132); Pastures (231); Natural Grassland (321); Sparsely vegetated areas (333); Salt marshes (421); Intertidal flats (423); Water courses (511); Estuaries (522)
0.05	Mineral extraction sites (131); Sport and leisure facilities (142); Non irrigated arable land (211); Glaciers and perpetual snow (335); Coastal lagoons (521)
0.10	Airports (124); Inland marshes (411); Peat bogs (412); Sea and ocean (523)
0.20	Road and rail networks and associated land (122); Green urban areas (141); Vineyards (221); Complex cultivation patterns (242); Land principally occupied by agriculture with significant areas of natural vegetation (243); Moors and heathland (322); Bare rock (332)
0.50	Port areas (123); Fruit tree and berry plantations (222); Transitional woodland scrub; (324)
1.00	Discontinuous urban fabric (112); Industrial or commercial units (121); construction sites (133); coniferous forest (312)
1.50	Broad-leaved forest (311); Mixed forest (313)
2.00	Continuous urban fabric (111)

The roughness length shall be determined for an area that is located within a circle around the stack, drawn with a radius equal to 10 times the construction height of the stack. If such area is composed of units having different surface roughness, a mean roughness length shall be determined by calculating the arithmetic mean weighting with respect to the proportion of the respective area unit and subsequently be rounded to the closest value in the table. It is to be examined whether the use of land has changed considerably, since the inventory was drawn up, or whether a significant change with respect to the immission projection can be expected.

If the surface roughness varies strongly within the area under consideration, it shall be examined how the roughness length value effects the additional load calculated.

6 Effective Source Height

The effective source height shall be determined pursuant to VDI Guideline 3782 Part 3 (June 1985 version). The emitted heat flow M in MW shall be calculated using the following equation:

$$M = 1.36 \cdot 10^{-3} \cdot R' \cdot (T - 283.15 \text{ K}) \quad (1)$$

M being the heat flow in MW, R' the waste gas volumetric flow rate (wet) under normal conditions in m^3/s and T the waste gas temperature in K.

If waste gases are discharged via cooling towers, VDI Guideline 3784 Part 2 (March 1990 version) shall be applied accordingly.

7 Calculation Area and Grid Points

The calculation area applied to a single emission source is the area that is located within a circle around the centre of emission drawn with a radius equal to 50 times the stack height. If several sources contribute to the additional load, the calculation area is composed of the calculation areas of the individual sources. In cases of unusual terrain it may be necessary to select a larger calculation area.

The raster for calculating concentration and deposition shall be selected in such a way, that it will be possible to determine the location and amount of the maximum immission values in a sufficiently reliable way. As a rule this is the case when the horizontal mesh size does not exceed the stack height. At distances from the source higher than 10 times the stack height, it is possible to select a proportionally larger horizontal mesh size.

The concentration at the grid points shall be calculated as a mean value over the vertical interval from ground level up to 3 m above ground, and thus is representative of a grid point height of 1.5 m above ground. The mean values thereby calculated for

a volume or a mesh of the calculation reticule shall be considered as valid point values for the grid points contained therein.

8 Meteorological Data

8.1 General

Meteorological data shall be specified as hourly mean values, with the wind velocity determined as a vector average. The values used should be characteristic for the location of the installation. If no measurements are available at the location of the installation, data shall be used from a suitable station of the German Weather Service (*Deutscher Wetterdienst*) or from another accordingly equipped station. It shall be examined whether these data can be transferred to the location of the installation; such examination can be carried out e.g. by comparing the data to data determined in a location study. Measurement gaps that do not exceed more than 2 hourly values may be filled in via interpolation. Data availability shall be at least 90 per cent of the hours within a year.

The meteorological boundary-layer profiles required for the particle model shall be determined pursuant to VDI Guideline 3783 Part 8.* In this context, the following values are required:

* The profiles indicated in the following publications shall be used until VDI Guideline 3783 Part 8 will have been introduced: L. Janicke, U. Janicke: “*Vorschlag eines meteorologischen Grenzschichtmodells für Lagrangesche Ausbreitungsmodelle*“. *Berichte zur Umweltphysik 2*, Ingenieurbüro Janicke, ISSN 1439-8222, September 2000 (“Proposal for a meteorological boundary-layer model for Lagrangian dispersion models“).

Table 15: Values for Meteorological Boundary-layer Profiles

r_a	Wind direction in anemometer height h_a
u_a	Wind velocity in anemometer height h_a
L_M	Monin–Obukhov Length
h_m	Mixing layer height
Z_0	Roughness length
D_0	Displacement height

8.2 Wind Direction

The wind direction is the direction from which wind blows and shall be indicated at anemometer height as an angle in integer degrees clockwise from north. If the meteorological time series used for calculating the dispersion only contains rounded values for wind direction (sector information), a uniformly-distributed random wind direction within the respective sector shall be used for calculating the dispersion.

For low-speed, meandering winds an equally-distributed random wind direction shall be selected from the sector 1° to 360° . For time intervals with calm winds, having a duration of up to 2 hours, the wind direction shall be determined by linear interpolation between the last value prior to the start of the calm and the first value after the end of the calm. For intervals longer than two hours the wind direction shall be selected randomly according to the wind direction distribution for wind velocities up to 1.2 m/s.

The vertical directional shear D of the wind direction r in the mixing layer shall be taken into consideration as a function of the height z above ground according to the equations 2 and 3:

$$r(z) = r_a + D(z) - D(h_a) \quad (2)$$

$$D(z) = 1.23 D_h [1 - \exp(-1.75 z/h_m)] \quad (3)$$

The value for D_h shall be derived as function of the Monin–Obukhov Length L_M (chapter 8.4 of this Annex) and the mixing layer height h_m (chapter 8.5 of this Annex) from Table 16:

Table 16: Determination of D_h

D_h in degree	Stability
0	$h_m/L_M < -10$
$45 + 4.5 h_m/L_M$	$-10 \leq h_m/L_M < 0$
45	$L_M > 0$

For heights above the mixing layer height the wind direction at the mixing layer height shall be used.

8.3 Wind Velocity

The wind velocity in anemometer height shall be specified in m/s, including the first digit to the right of the decimal point. If the wind velocity is given in intervals larger than 0.1 m/s in the meteorological time series, an equally distributed random velocity from within the interval shall be chosen for calculating the dispersion.

For calm and for wind speeds lower than 0.8 m/s at anemometer height a calculational value of 0.7 m/s shall be used for the wind velocity at anemometer height.

8.4 Monin–Obukhov Length

The atmospheric stability is specified by indicating the Monin–Obukhov length L_M . If the value of the Monin–Obukhov length is not known, a dispersion class shall be determined according to Klug/Manier pursuant to VDI Guideline 3782 Part 1 (December 2001 version) and the Monin–Obukhov length shall be determined in metres pursuant to Table 17:

Table 17: Determination of the Monin–Obukhov Length L_M

Dispersion Class according to Klug/Manier	Roughness Length z_0 in m								
	0.01	0.02	0.05	0.10	0.20	0.50	1.00	1.50	2.00
I (very stable)	7	9	13	17	24	40	65	90	118
II (stable)	25	31	44	60	83	139	223	310	406
III/1 (neutral)	99999	99999	99999	99999	99999	99999	99999	99999	99999
III/2 (neutral)	-25	-32	-45	-60	-81	-130	-196	-260	-326
IV (unstable)	-10	-13	-19	-25	-34	-55	-83	-110	-137
V (very unstable)	-4	-5	-7	-10	-14	-22	-34	-45	-56

The value of the Monin–Obukhov length at the boundary of two dispersion classes is the harmonic mean value of the values in the neighbouring dispersion classes, i.e. the reciprocal value is determined by calculating the arithmetic mean of the reciprocal values. Such boundaries between classes shall be used if reference is explicitly made to dispersion classes according to Klug/Manier.

8.5 Mixing Layer Height

If the mixing layer height is unknown, it shall be determined using the following method. For values of the Monin–Obukhov length in the range of the dispersion classes IV and V, a mixing layer height h_m of 1,100 m shall be used for calculation. Otherwise a value of 800 m shall be used for calculation, unless Equation 4 results in a lower value:

$$h_m = \begin{cases} \alpha \frac{u_*}{f_c} & \text{for } L_M \geq \frac{u_*}{f_c} \\ \alpha \frac{u_*}{f_c} \left(\frac{f_c L_M}{u_*} \right)^{1/2} & \text{for } 0 < L_M < \frac{u_*}{f_c} \end{cases} \quad (4)$$

α equals 0.3 and the Coriolis parameter f_c equals 10^{-4} s^{-1} . The friction velocity u_* shall be determined on the basis of the wind profile of the meteorological boundary layer model.

8.6 Displacement Height

The displacement height d_0 indicates, how far the theoretical meteorological profiles shall be shifted in the vertical due to vegetation or built-up areas. The displacement height shall be assumed 6 times the roughness length z_0 (chapter 5 of this Annex), for high-density areas 0.8 times the mean building height of the respective areas. Below a height of $6 z_0 + d_0$ the wind velocity shall be interpolated in a linear way up to a value of zero if z equals zero; all other meteorological parameters shall be kept constant.

9 Accounting for Statistical Uncertainties

The immission indicators calculated by using the method described herein show statistical uncertainties due to the statistical nature of the method indicated in VDI Guideline 3945 Part 3 (September 2000 version). It shall be observed that the model-related statistical uncertainty, calculated as a statistical scatter of the calculated values, may not exceed 3 per cent of the annual immission value and 30 per cent of the daily immission value. If necessary, the statistical uncertainty shall be reduced by increasing the particle number.

If the assessment points are located at points of maximum additional load, it shall not be necessary to take the statistical uncertainty separately into account. Otherwise the yearly, daily and hourly immission indicators calculated shall be increased by the respective statistical uncertainty. In this context the relative statistical uncertainty of the hourly immission indicator shall be set equal the relative statistical uncertainty of the daily immission indicator.

10 Accounting for Building Influences

Influences of built-up areas on the immission in the calculation area shall be taken into consideration. If the stack height is 1.2 times higher than the height of the buildings or if buildings, for which this requirement is not met, are located at a distance of more than 6 times of their respective height from the emission source, the following, as a rule, can be applied:

- a) If the height of the stack is more than 1.7 times the heights of the buildings, it suffices to account for the built-up area through the roughness length (chapter 5 of this Annex) and the displacement height (chapter 8.6 of this Annex).
- b) If the height of the stack is less than 1.7 times the heights of the buildings and if a free flow off can be ensured, the influences can be taken into account by using a diagnostic wind field model for airflow around buildings. Until a suitable VDI Guideline has been introduced, such wind field models shall be used whose suitability has been proved to the competent *Land* authority.

All buildings that are located at a distance of less than 6 times the stack height from the emission source shall be significant for evaluating the building heights pursuant to a) or b).

11 Accounting for Complex Terrain

As a rule, complex terrain shall only be taken into account if within the calculation area, differences in elevation relative to the emission location exceed 0.7 times the height of the stack and slope gradients are in excess of 1:20. In this context the gradient shall be determined on the basis of the difference in elevation over a distance that corresponds to twice the height of the stack.

Generally, complex terrain can be taken into account using a meso-scale diagnostic wind field model provided that the gradient of the terrain does not exceed the value of 1:5 and if significant influences of local wind systems or other meteorological peculiarities can be ruled out.

Until a suitable VDI Guideline will be introduced, a wind field model the suitability of which has been proved to the competent *Land* authority shall be used.

12 Use of a Frequency Distribution for the Hourly Dispersion Situation

A frequency distribution of hourly dispersion conditions may be used if hourly mean values of wind velocities lower than 1 m/s occur at the installation's location for less than 20 per cent of the yearly hours. A dispersion situation is determined by wind velocity class, wind direction sector and dispersion class.

The wind velocities u_a in anemometer height h_a shall be classified as follows:

Table 18: Classification of Wind Velocities

Wind Velocity Class	Wind Velocity u_a in ms^{-1}	Operand u_R in ms^{-1}
1	< 1.4	1
2	1.4 to 1.8	1.5
3	1.9 to 2.3	2
4	2.4 to 3.8	3
5	3.9 to 5.4	4.5
6	5.5 to 6.9	6
7	7.0 to 8.4	7.5
8	8.5 to 10.0	9
9	> 10.0	12

The wind direction shall be classified in 36 sectors of 10° respectively. The first sector comprises the wind directions 6° to 15° , the other sectors follow clockwise. As to the wind velocity class 1 the same distribution to the wind direction sectors shall prevail as for velocity class 2.

Cases of low-speed, meandering winds are allocated to the corresponding dispersion and wind velocity class; the distribution to the wind direction sectors shall be carried out according to the wind direction distribution in the respective wind velocity class.

The dispersion class shall be determined according to VDI Guideline 3782 Part 1 Annex A (December 2001 version).

For each dispersion situation quoted in the frequency distribution as having a probability of larger than zero, a time-independent dispersion calculation shall be carried out according to the method specified for the time series calculation. In this context the arithmetic value u_R shall be used as wind velocity u_a . The dispersion calculation for a wind direction sector of 10° width shall be carried out through separate calculations at 5 wind directions, spaced 2° apart, and arithmetic averaging of the results. For the first sector, results are computed at the wind directions 6° , 8° , 10° , 12° , 14° and correspondingly for the subsequent sectors.

The calculated annual mean value for concentration or deposition is the mean value of the concentration and/or deposition values to be calculated for the individual dispersion situations, each weighted with the corresponding probability of occurrence.

Annex 4 Organic Substances of Class I pursuant to 5.2.5

Table 19: Organic Substances of Class I pursuant to 5.2.5

Substance	CAS-Number
Acetaldehyde	75-07-0
Acetamide	60-35-5
Acetamide, N-phenyl-	103-84-4
Acetic acid anhydride	108-24-7
Acetic acid ethenyl ester	108-05-4
Acetic acid, chloro-	79-11-8
Acetic acid, chloro-, methyl ester	96-34-4
Acetic acid, methoxy-	625-45-6
Acetic acid, trichloro-	76-03-9
Acrylic acid	79-10-7
Alkyl-lead compounds	
Allyl chloride	107-05-1
4-Amino-2-nitrophenol	119-34-6
Aniline	62-53-3
Aniline, N-methyl-	100-61-8
Benzenamine, 2,4-dimethyl-	95-68-1
Benzenamine, 2-methyl-5-nitro-	99-55-8
Benzenamine, 4-methoxy-	104-94-9
Benzenamine, 5-chloro-2-methyl-	95-79-4
Benzenamine, N,N-dimethyl-	121-69-7
Benzene, (dichloromethyl)-	98-87-3
Benzene, 1,1'-methylenebis[4-isocyanato-	101-68-8
Benzene, 1,2,4,5-tetrachloro-	95-94-3
Benzene, 1-chloro-2-nitro	88-73-3
Benzene, 1-chloro-4-nitro-	100-00-5
Benzene, 1-methyl-3-nitro-	99-08-1
Benzene, 1-methyl-4-nitro-	99-99-0
Benzene, 2,4-dichloro-1-methyl-	95-73-8
Benzene, nitro-	98-95-3

Substance	CAS-Number
1,2-Benzenediol (Pyrocatechin)	120-80-9
Benzenesulfonyl chloride	98-09-9
1,2,4-Benzenetricarboxylic acid	528-44-9
p-Benzoquinone	106-51-4
Benzoyl chloride	98-88-4
Benzoyl peroxide	94-36-0
Biphenyl (Diphenyl)	92-52-4
Bis(2-ethylhexyl)phthalate	117-81-7
N,N-Bis-(3-aminopropyl)-methylamine	105-83-9
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	87-68-3
1-Butanamine,	109-73-9
1-Butanethiol	109-79-5
2-Butenal (Crotonaldehyde)	123-73-9
Butylamine, iso-	78-81-9
2-Butyne-1,4-diol	110-65-6
Camphor	76-22-2
Caprolactam	105-60-2
Carbamic chloride, diethyl-	88-10-8
Carbon tetrachloride	56-23-5
Carbonyl sulfide	463-58-1
2-Chloro-1,3-butadiene (Chloroprene)	126-99-8
Chloroacetic acid isopropyl ester	105-48-6
Chloroform (Trichloromethane)	67-66-3
Chloromethane	74-87-3
Chloropicrin (Trichloronitromethane)	76-06-2
Cresole	1319-77-3
2-Cyano-2-propenoic acid, methyl ester (Mecrylate)	137-05-3
2-Cyclohexen-1-one, 3,5,5-trimethyl-	78-59-1
3,3'-Diamino-benzidine	91-95-2
Diaminoethane (Ethylenediamine)	107-15-3
Dichlorophenols	
Diglycidyl ether	2238-07-5
Di-n-butyltindichloride	683-18-1

Substance	CAS-Number
Dinitronaphthalene (all isomers)	27478-34-8
1,4-Dioxane	123-91-1
Diphenyl ether	101-84-8
Diphenylamine	122-39-4
Diphenylmethane-2,4'-Diisocyanate	5873-54-1
Ethanamine, N-ethyl-	109-89-7
Ethane, 1,1,2,2-tetrachloro-	79-34-5
Ethane, 1,1,2-trichloro-	79-00-5
Ethane, 1,1-dichloro-1-nitro-	594-72-9
Ethane, hexachloro-	67-72-1
Ethane, pentachloro-	76-01-7
Ethanedial (Glyoxal)	107-22-2
1,2-Ethanediamine, N-(2-aminoethyl)-	111-40-0
1,2-Ethanediol, dinitrate	628-96-6
Ethanethiol (Ethyl mercaptan)	75-08-1
Ethanol, 2-chloro-	107-07-3
Ethanolamine	141-43-5
Ethene, 1,1-dichloro-	75-35-4
Ethene, 1,1-difluoro- (Genetron 1132a)	75-38-7
2-Ethoxyethyl acetate	111-15-9
Ethyl chloride	75-00-3
Ethyl chloroacetate	105-39-5
Ethylamine	75-04-7
Ethylene	74-85-1
Formaldehyde	50-00-0
Formamide	75-12-7
Formic acid	64-18-6
2-Furancarboxaldehyde (Furfural)	98-01-1
2,5-Furandione	108-31-6
2-Furanmethanamine	617-89-0
Glutaraldehyde (1,5-Pentandial)	111-30-8
Hexahydrophthalic Anhydride	85-42-7
1,6-Hexamethylene diisocyanate	822-06-0

Substance	CAS-Number
1,6-Hexanediamine	124-09-4
Hexanoic acid, 2-ethyl-	149-57-5
2-Hexanone	591-78-6
Hydrazine, phenyl-	100-63-0
Hydroquinone (1,4-Benzenediol)	123-31-9
2-Imidazolidinethione	96-45-7
Isophorone diisocyanate	4098-71-9
Ketene	463-51-4
Lead acetate (monobasic)	1335-32-6
Methanamine, N-methyl-	124-40-3
Methane, isocyanato-	624-83-9
Methane, tribromo-	75-25-2
Methanethiol (Methyl mercaptan)	74-93-1
Methyl bromide	74-83-9
Methyl iodide	74-88-4
4-Methyl-3-oxa-1-pentanol	109-59-1
2-Methyl-m-phenylenediamine	823-40-5
N-Methyl-N,2,4,6-tetranitroaniline (tetryl)	479-45-8
Methylamine	74-89-5
Methylene chloride	75-09-2
4,4'-Methylenebis(2-methylcyclohexylamine)	6864-37-5
Montanic acid waxes, Zn-salts	73138-49-5
Morpholine	110-91-8
1-Naphthalenamine	134-32-7
Naphthalene, 1,5-diisocyanato-	3173-72-6
1,5-Naphthalenediamine	2243-62-1
2-Naphthyl phenyl amine	135-88-6
2-Nitro-p-phenylenediamine,2	5307-14-2
m-Nitroaniline	99-09-2
o-Nitroaniline	88-74-4
p-Nitroaniline	100-01-6
Nitrocresols	
Nitrophenols	

Substance	CAS-Number
Nitropyrenes	5522-43-0
Nitrotoluene (all isomers)	1321-12-6
Oxalic acid	144-62-7
Pentachloronaphthalene	1321-64-8
N,N,N',N'',N'''- Pentamethyldiethylenetriamine	3030-47-5
Phenol	108-95-2
Phenol, 2,4,5-trichloro-	95-95-4
Phenol, p-tert-butyl	98-54-4
Phenyl-1-(p-tolyl)-3-dimethylaminopropane,1-	5632-44-0
Phthalic anhydride	85-44-9
Phthalonitrile	91-15-6
Piperazine	110-85-0
2-Propanamine, 2-methyl-	75-64-9
Propane, 1,2-dichloro-	78-87-5
Propane, 1-bromo-	106-94-5
1,2-Propanediol, dinitrate	6423-43-4
1,2,3-Propanetriol, trinitrate	55-63-0
Propanoic acid, 2,2-dichloro-	75-99-0
2-Propenal (Acrolein, Acrylaldehyde)	107-02-8
1-Propene, 3-chloro-2-methyl-	563-47-3
2-Propenoic acid, butyl ester	141-32-2
2-Propenoic acid, ethyl ester (Ethyl acrylate)	140-88-5
2-Propenoic acid, methyl ester	96-33-3
2-Propyn-1-ol	107-19-7
Pyridine	110-86-1
Sodium chloroacetate	3926-62-3
Sodium Trichloroacetate	650-51-1
4-Tert-butyltoluene	98-51-1
1,1,2,2-Tetrabromoethane	79-27-6
Tetrachloroethylene	127-18-4
Thioalcohols	
Thioethers	
Thiourea	62-56-6

Substance	CAS-Number
Toluene-2,4-diisocyanate-	584-84-9
Toluene-2,6-diisocyanate-	91-08-7
p-Toluidine	106-49-0
Trichlorobenzenes (all isomers)	12002-48-1
Trichloroethylene	79-01-6
Trichloronaphtalene	1321-65-9
Trichlorophenols	
Tricresyl phosphate (ooo,oom,oop,omm,omp,opp)	78-30-8
Triethylamine	121-44-8
Trimellitic anhydride	552-30-7
Tri-n-butylphosphate	126-73-8
2,4,7-Trinitrofluorenone	129-79-3
Trinitrotoluene (TNT)	118-96-7
N-Vinylpyrrolidone	88-12-0
Xylenols (except for 2,4-Xylenol)	1300-71-6

Annex 4.1 Organic Substances of Class I pursuant to 5.2.5

(This additional annex 4.1 is not part of the original German text and is only added to make it easier to find a substance in the English translation. Table 19.1 contains the substances in the order of the CAS-numbers and Table 19.2 a comparison of the German and English terms.)

**Table 19.1: Organic Substances of Class I pursuant to 5.2.5
in the order of the CAS-Numbers**

Substance	CAS-Number
Alkyl-lead compounds	
Dichlorophenols	
Nitrocresols	
Nitrophenols	
Thioalcohols	
Thioethers	
Trichlorophenols	
Formaldehyde	50-00-0
1,2,3-Propanetriol, trinitrate	55-63-0
Carbon tetrachloride	56-23-5
Acetamide	60-35-5
Aniline	62-53-3
Thiourea	62-56-6
Formic acid	64-18-6
Chloroform (Trichloromethane)	67-66-3
Ethane, hexachloro-	67-72-1
Methyl bromide	74-83-9
Ethylene	74-85-1
Chloromethane	74-87-3
Methyl iodide	74-88-4
Methylamine	74-89-5
Methanethiol (Methyl mercaptan)	74-93-1
Ethyl chloride	75-00-3
Ethylamine	75-04-7
Acetaldehyde	75-07-0
Ethanethiol (Ethyl mercaptan)	75-08-1

Substance	CAS-Number
Methylene chloride	75-09-2
Formamide	75-12-7
Methane, tribromo-	75-25-2
Ethene, 1,1-dichloro-	75-35-4
Ethene, 1,1-difluoro- (Genetron 1132a)	75-38-7
2-Propanamine, 2-methyl-	75-64-9
Propanoic acid, 2,2-dichloro-	75-99-0
Ethane, pentachloro-	76-01-7
Acetic acid, trichloro-	76-03-9
Chloropicrin (Trichloronitromethane)	76-06-2
Camphor	76-22-2
Tricresyl phosphate (ooo,oom,oop,omm,omp,opp)	78-30-8
2-Cyclohexen-1-one, 3,5,5-trimethyl-	78-59-1
Butylamine, iso-	78-81-9
Propane, 1,2-dichloro-	78-87-5
Ethane, 1,1,2-trichloro-	79-00-5
Trichloroethylene	79-01-6
Acrylic acid	79-10-7
Acetic acid, chloro-	79-11-8
1,1,2,2-Tetrabromoethane	79-27-6
Ethane, 1,1,2,2-tetrachloro-	79-34-5
Hexahydrophthalic Anhydride	85-42-7
Phthalic anhydride	85-44-9
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	87-68-3
Carbamic chloride, diethyl-	88-10-8
N-Vinylpyrrolidone	88-12-0
Benzene, 1-chloro-2-nitro	88-73-3
o-Nitroaniline	88-74-4
Toluene-2,6-diisocyanate-	91-08-7
Phthalonitrile	91-15-6
3,3'-Diamino-benzidine	91-95-2
Biphenyl (Diphenyl)	92-52-4
Benzoyl peroxide	94-36-0
Benzenamine, 2,4-dimethyl-	95-68-1
Benzene, 2,4-dichloro-1-methyl-	95-73-8
Benzenamine, 5-chloro-2-methyl-	95-79-4
Benzene, 1,2,4,5-tetrachloro-	95-94-3

Substance	CAS-Number
Phenol, 2,4,5-trichloro-	95-95-4
2-Propenoic acid, methyl ester	96-33-3
Acetic acid, chloro-, methyl ester	96-34-4
2-Imidazolidinethione	96-45-7
2-Furancarboxaldehyde (Furfural)	98-01-1
Benzenesulfonyl chloride	98-09-9
4-Tert-butyltoluene	98-51-1
Phenol, p-tert-butyl	98-54-4
Benzene, (dichloromethyl)-	98-87-3
Benzoyl chloride	98-88-4
Benzene, nitro-	98-95-3
Benzene, 1-methyl-3-nitro-	99-08-1
m-Nitroaniline	99-09-2
Benzenamine, 2-methyl-5-nitro-	99-55-8
Benzene, 1-methyl-4-nitro-	99-99-0
Benzene, 1-chloro-4-nitro-	100-00-5
p-Nitroaniline	100-01-6
Aniline, N-methyl-	100-61-8
Hydrazine, phenyl-	100-63-0
Benzene, 1,1'-methylenebis[4-isocyanato-	101-68-8
Diphenyl ether	101-84-8
Acetamide, N-phenyl-	103-84-4
Benzenamine, 4-methoxy-	104-94-9
Ethyl chloroacetate	105-39-5
Chloroacetic acid isopropyl ester	105-48-6
Caprolactam	105-60-2
N,N-Bis-(3-aminopropyl)-methylamine	105-83-9
p-Toluidine	106-49-0
p-Benzoquinone	106-51-4
Propane, 1-bromo-	106-94-5
2-Propenal (Acrolein, Acrylaldehyde)	107-02-8
Allyl chloride	107-05-1
Ethanol, 2-chloro-	107-07-3
Diaminoethane (Ethylenediamine)	107-15-3
2-Propyn-1-ol	107-19-7
Ethanedial (Glyoxal)	107-22-2
Acetic acid ethenyl ester	108-05-4

Substance	CAS-Number
Acetic acid anhydride	108-24-7
2,5-Furandione	108-31-6
Phenol	108-95-2
4-Methyl-3-oxa-1-pentanol	109-59-1
1-Butanamine,	109-73-9
1-Butanethiol	109-79-5
Ethanamine, N-ethyl-	109-89-7
2-Butyne-1,4-diol	110-65-6
Piperazine	110-85-0
Pyridine	110-86-1
Morpholine	110-91-8
2-Ethoxyethyl acetate	111-15-9
Glutaraldehyde (1,5-Pentandial)	111-30-8
1,2-Ethanediamine, N-(2-aminoethyl)-	111-40-0
Bis(2-ethylhexyl)phthalate	117-81-7
Trinitrotoluene (TNT)	118-96-7
4-Amino-2-nitrophenol	119-34-6
1,2-Benzenediol (Pyrocatechin)	120-80-9
Triethylamine	121-44-8
Benzenamine, N,N-dimethyl-	121-69-7
Diphenylamine	122-39-4
Hydroquinone (1,4-Benzenediol)	123-31-9
2-Butenal (Crotonaldehyde)	123-73-9
1,4-Dioxane	123-91-1
1,6-Hexanediamine	124-09-4
Methanamine, N-methyl-	124-40-3
Tri-n-butylphosphate	126-73-8
2-Chloro-1,3-butadiene (Chloroprene)	126-99-8
Tetrachloroethylene	127-18-4
2,4,7-Trinitrofluorenone	129-79-3
1-Naphthalenamine	134-32-7
2-Naphthyl phenyl amine	135-88-6
2-Cyano-2-propenoic acid, methyl ester (Mecrylate)	137-05-3
2-Propenoic acid, ethyl ester (Ethyl acrylate)	140-88-5
2-Propenoic acid, butyl ester	141-32-2
Ethanolamine	141-43-5
Oxalic acid	144-62-7

Substance	CAS-Number
Hexanoic acid, 2-ethyl-	149-57-5
Ketene	463-51-4
Carbonyl sulfide	463-58-1
N-Methyl-N,2,4,6-tetranitroaniline (tetryl)	479-45-8
1,2,4-Benzenetricarboxylic acid	528-44-9
Trimellitic anhydride	552-30-7
1-Propene, 3-chloro-2-methyl-	563-47-3
Toluene-2,4-diisocyanate-	584-84-9
2-Hexanone	591-78-6
Ethane, 1,1-dichloro-1-nitro-	594-72-9
2-Furanmethanamine	617-89-0
Methane, isocyanato-	624-83-9
Acetic acid, methoxy-	625-45-6
1,2-Ethandiol, dinitrate	628-96-6
Sodium Trichloroacetate	650-51-1
Di-n-butyltindichloride	683-18-1
1,6-Hexamethylene diisocyanate	822-06-0
2-Methyl-m-phenylenediamine	823-40-5
Xylenols (except for 2,4-Xylenol)	1300-71-6
Cresole	1319-77-3
Nitrotoluene (all isomers)	1321-12-6
Pentachloronaphthalene	1321-64-8
Trichloronaphtalene	1321-65-9
Lead acetate (monobasic)	1335-32-6
Diglycidyl ether	2238-07-5
1,5-Naphthalenediamine	2243-62-1
N,N,N',N'',N''- Pentamethyldiethylenetriamine	3030-47-5
Naphthalene, 1,5-diisocyanato-	3173-72-6
Sodium chloroacetate	3926-62-3
Isophorone diisocyanate	4098-71-9
2-Nitro-p-phenylenediamine,2	5307-14-2
Nitropyrenes	5522-43-0
Phenyl-1-(p-tolyl)-3-dimethylaminopropane,1-	5632-44-0
Diphenylmethane-2,4'-Diisocyanate	5873-54-1
1,2-Propanediol, dinitrate	6423-43-4
4,4'-Methylenebis(2-methylcyclohexylamine)	6864-37-5
Trichlorobenzenes (all isomers)	12002-48-1

Substance	CAS-Number
Dinitronaphthalene (all isomers)	27478-34-8
Montanic acid waxes, Zn-salts	73138-49-5

**Table 19.2: Organic Substances of Class I pursuant to 5.2.5
in comparison of the German and English terms**

Substance (English terms)	Stoff (German terms)	CAS-Number
Acetaldehyde	Acetaldehyd	75-07-0
Acetamide	Acetamid	60-35-5
Acetamide, N-phenyl-	Phenyl-acetamid,N-	103-84-4
Acetic acid anhydride	Essigsäureanhydrid	108-24-7
Acetic acid ethenyl ester	Vinylacetat	108-05-4
Acetic acid, chloro-	Chloressigsäure	79-11-8
Acetic acid, chloro-, methyl ester	Monochloressigsäuremethylester	96-34-4
Acetic acid, methoxy-	Methoxyessigsäure	625-45-6
Acetic acid, trichloro-	Trichloressigsäure	76-03-9
Acrylic acid	Acrylsäure	79-10-7
Alkyl-lead compounds	Alkylbleiverbindungen	
Allyl chloride	Chlorpropen,3-	107-05-1
4-Amino-2-nitrophenol	Nitro-4-aminophenol,2-	119-34-6
Aniline	Anilin	62-53-3
Aniline, N-methyl-	Methylanilin,N-	100-61-8
Benzenamine, 2,4-dimethyl-	Xylidin,2,4-	95-68-1
Benzenamine, 2-methyl-5-nitro-	Amino-4-nitrotoluol,2-	99-55-8
Benzenamine, 4-methoxy-	Methoxyanilin,4-	104-94-9
Benzenamine, 5-chloro-2-methyl-	Chlor-o-toluidin,5-	95-79-4
Benzenamine, N,N-dimethyl-	Dimethylanilin,N,N-	121-69-7
Benzene, (dichloromethyl)-	Dichlortoluol,a,a-	98-87-3
Benzene, 1,1'-methylenebis[4-isocyanato-	Diphenylmethan-4,4'-diisocyanat	101-68-8
Benzene, 1,2,4,5-tetrachloro-	Tetrachlorbenzol,1,2,4,5-	95-94-3
Benzene, 1-chloro-2-nitro	Chlor-2-nitrobenzol,1-	88-73-3
Benzene, 1-chloro-4-nitro-	Chlor-4-nitrobenzol,1-	100-00-5
Benzene, 1-methyl-3-nitro-	Nitrotoluol,3-	99-08-1
Benzene, 1-methyl-4-nitro-	Nitrotoluol,4-	99-99-0
Benzene, 2,4-dichloro-1-methyl-	Dichlortoluol,2,4-	95-73-8
Benzene, nitro-	Nitrobenzol	98-95-3
1,2-Benzenediol (Pyrocatechin)	Dihydroxybenzol,1,2- (Brenzcatechin)	120-80-9
Benzenesulfonyl chloride	Benzolsulfonylchlorid	98-09-9

Substance (English terms)	Stoff (German terms)	CAS-Number
1,2,4-Benzenetricarboxylic acid	Benzoltricarbonsäure,1,2,4-	528-44-9
p-Benzoquinone	Benzochinon,p-	106-51-4
Benzoyl chloride	Benzoylchlorid	98-88-4
Benzoyl peroxide	Dibenzoylperoxid	94-36-0
Biphenyl (Diphenyl)	Diphenyl (Biphenyl)	92-52-4
Bis(2-ethylhexyl)phthalate	Di-(2-ethylhexyl)-phthalat	117-81-7
N,N-Bis-(3-aminopropyl)- methylamine	Bis(3-aminopropyl)- methylamin,N,N-	105-83-9
1,3-Butadiene, 1,1,2,3,4,4- hexachloro-	Hexachlor-1,3- butadien,1,1,2,3,4,4-	87-68-3
1-Butanamine,	Butylamin,n-	109-73-9
1-Butanethiol	Butanthiol	109-79-5
2-Butenal (Crotonaldehyde)	Butenal,2-(Crotonaldehyd)	123-73-9
Butylamine, iso-	Butylamin,iso-	78-81-9
2-Butyne-1,4-diol	Butin-1,4-diol-2	110-65-6
Camphor	Kampfer	76-22-2
Caprolactam	Caprolactam	105-60-2
Carbamic chloride, diethyl-	Diethylcarbamidsäurechlorid	88-10-8
Carbon tetrachloride	Tetrachlormethan	56-23-5
Carbonyl sulfide	Kohlenoxidsulfid	463-58-1
2-Chloro-1,3-butadiene (Chloroprene)	Chlor-1,3-butadien,2- (Chloropropen)	126-99-8
Chloroacetic acid isopropyl ester	Monochloressigsäure-1- methylethylester	105-48-6
Chloroform (Trichloromethane)	Trichlormethan (Chloroform)	67-66-3
Chloromethane	Chlormethan	74-87-3
Chloropicrin (Trichloronitromethane)	Trichlornitromethan	76-06-2
Cresole	Kresole	1319-77-3
2-Cyano-2-propenoic acid, methyl ester (Mecrylate)	Cyanacrylsäuremethylester	137-05-3
2-Cyclohexen-1-one, 3,5,5- trimethyl-	Trimethyl-2-cyclohexen-1- on,3,5,5-	78-59-1
3,3'-Diamino-benzidine	Diaminobenzidin,3,3'-	91-95-2
Diaminoethane (Ethylenediamine)	Diaminoethan,1,2- (Ethylenediamin)	107-15-3
Dichlorophenols	Dichlorphenole	
Diglycidyl ether	Diglycidlether	2238-07-5

Substance (English terms)	Stoff (German terms)	CAS-Number
Di-n-butyltindichloride	Di-n-butylzinnchlorid	683-18-1
Dinitronaphthalene (all isomers)	Dinitronaphtaline (alle Isomere)	27478-34-8
1,4-Dioxane	Dioxan,1,4-	123-91-1
Diphenyl ether	Diphenylether	101-84-8
Diphenylamine	Diphenylamin	122-39-4
Diphenylmethane-2,4'- Diisocyanate	Diphenylmethan-2,4'-diisocyanat	5873-54-1
Ethanamine, N-ethyl-	Diethylamine	109-89-7
Ethane, 1,1,2,2-tetrachloro-	Tetrachlorethan,1,1,2,2-	79-34-5
Ethane, 1,1,2-trichloro-	Trichlorethan,1,1,2-	79-00-5
Ethane, 1,1-dichloro-1-nitro-	Dichlornitroetahn,1,1-	594-72-9
Ethane, hexachloro-	Hexachlorethan	67-72-1
Ethane, pentachloro-	Pentachlorethan	76-01-7
Ethanedial (Glyoxal)	Ethandial (Glyoxal)	107-22-2
1,2-Ethanediamine, N-(2- aminoethyl)-	Diethylentriamin (3-Azapentan- 1,5-diamin)	111-40-0
1,2-Ethandiol, dinitrate	Ethylenglycoldinitrat	628-96-6
Ethanethiol (Ethyl mercaptan)	Ethanthiol (Ethylmercaptan)	75-08-1
Ethanol, 2-chloro-	Chlorethanol,2-	107-07-3
Ethanolamine	Aminoethanol,2-	141-43-5
Ethene, 1,1-dichloro-	Dichlorethylen,1,1-	75-35-4
Ethene, 1,1-difluoro- (Genetron 1132a)	Difluorethen,1,1-(R1132a)	75-38-7
2-Ethoxyethyl acetate	Essigsäure-(2-ethoxyethyl)-ester	111-15-9
Ethyl chloride	Chlorethan	75-00-3
Ethyl chloroacetate	Monochloressigsäureethylester	105-39-5
Ethylamine	Ethylamin	75-04-7
Ethylene	Ethen	74-85-1
Formaldehyde	Formaldehyd	50-00-0
Formamide	Formamid	75-12-7
Formic acid	Ameisensäure	64-18-6
2-Furancarboxaldehyde (Furfural)	Furaldehyd,2-(Furfuraldehyd)	98-01-1
2,5-Furandione	Maleinsäureanhydrid	108-31-6
2-Furanmethanamine	Furanmethanamin,2-	617-89-0
Glutaraldehyde (1,5-Pentandial)	Glutardialdehyd	111-30-8
Hexahydrophthalic Anhydride	Cyclohexandicarbonsäureanhydri d,1,2-	85-42-7

Substance (English terms)	Stoff (German terms)	CAS-Number
1,6-Hexamethylene diisocyanate	Hexamethylendiisocyanat	822-06-0
1,6-Hexanediamine	Hexamethylendiamin	124-09-4
Hexanoic acid, 2-ethyl-	Ethylhexansäure,2-	149-57-5
2-Hexanone	Hexanon,2-	591-78-6
Hydrazine, phenyl-	Phenylhydrazin	100-63-0
Hydroquinone (1,4-Benzenediol)	Dihydroxybenzol,1,4- (Hydrochinon)	123-31-9
2-Imidazolidinethione	Ethylenthioharnstoff	96-45-7
Isophorone diisocyanate	Isocyanatmethyl-3,5,5- trimethylcyclohexylisocyanat,3-	4098-71-9
Ketene	Keten	463-51-4
Lead acetate (monobasic)	Bleiacetat (basisch)	1335-32-6
Methanamine, N-methyl-	Dimethylamin	124-40-3
Methane, isocyanato-	Methylisocyanat	624-83-9
Methane, tribromo-	Tribrommethan	75-25-2
Methanethiol (Methyl mercaptan)	Methanthiol (Methylmercaptan)	74-93-1
Methyl bromide	Brommethan	74-83-9
Methyl iodide	Methyljodid	74-88-4
4-Methyl-3-oxa-1-pentanol	Isopropoxy-ethanol,2-	109-59-1
2-Methyl-m-phenylenediamine	Methylphenylendiamin,2-	823-40-5
N-Methyl-N,2,4,6-tetranitroaniline (tetryl)	Methyl-2,4,6-N-tetranitroanilin,N-	479-45-8
Methylamine	Methylamin	74-89-5
Methylene chloride	Dichlormethan	75-09-2
4,4'-Methylenebis(2-methylcyclohexylamine)	Methylenbis(2-methylcyclohexylamin),4',4'-	6864-37-5
Montanic acid waxes, Zn-salts	Montanwachssäuren, Zn-Salze	73138-49-5
Morpholine	Morpholin	110-91-8
1-Naphthalenamine	Naphthylamin,1-	134-32-7
Naphthalene, 1,5-diisocyanato-	Naphthylen-1,5-diisocyanat	3173-72-6
1,5-Naphthalenediamine	Naphthylendiamin,1,5-	2243-62-1
2-Naphthyl phenyl amine	Phenyl-2-naphthylamin,N-	135-88-6
2-Nitro-p-phenylenediamine,2	Nitro-p-phenyldiamin,2-	5307-14-2
m-Nitroaniline	Nitroanilin,m-	99-09-2
o-Nitroaniline	Nitroanilin,2-	88-74-4
p-Nitroaniline	Nitroanilin,p-	100-01-6
Nitrocresols	Nitrokresole	

Substance (English terms)	Stoff (German terms)	CAS-Number
Nitrophenols	Nitrophenole	
Nitropyrenes	Nitropyrene	5522-43-0
Nitrotoluene (all isomers)	Nitrotoluole (alle Isomere)	1321-12-6
Oxalic acid	Oxalsäure	144-62-7
Pentachloronaphthalene	Pentachlornaphthalin	1321-64-8
N,N,N',N'',N'''- Pentamethyldiethylenetriamine	Dimethylamino-N,N',N'- trimethyl-1,2-diaminoethan,N-2-	3030-47-5
Phenol	Phenol	108-95-2
Phenol, 2,4,5-trichloro-	Trichlorphenol,2,4,5-	95-95-4
Phenol, p-tert-butyl	Butylphenol,4-tert-	98-54-4
Phenyl-1-(p-tolyl)-3- dimethylaminopropane,1-	Phenyl-1-(p-tolyl)-3- dimethylaminopropan,1-	5632-44-0
Phthalic anhydride	Phthalsäureanhydrid	85-44-9
Phthalonitrile	Phthalonitril	91-15-6
Piperazine	Piperazin	110-85-0
2-Propanamine, 2-methyl-	Dimethylethylamin,1,1	75-64-9
Propane, 1,2-dichloro-	Dichloropropan,1,2-	78-87-5
Propane, 1-bromo-	Bromopropan,1-	106-94-5
1,2-Propanediol, dinitrate	Propylenglycoldinitrat	6423-43-4
1,2,3-Propanetriol, trinitrate	Glycerintrinitrat	55-63-0
Propanoic acid, 2,2-dichloro-	Dichlorpropionsäure,2,2-	75-99-0
2-Propenal (Acrolein, Acrylaldehyde)	Propenal,2-(Acrolein, Acrylaldehyd)	107-02-8
1-Propene, 3-chloro-2-methyl-	Chlor-2-methylpropen,3-	563-47-3
2-Propenoic acid, butyl ester	Butylacrylat,n-	141-32-2
2-Propenoic acid, ethyl ester (Ethyl acrylate)	Ethylacrylat	140-88-5
2-Propenoic acid, methyl ester	Methylacrylat	96-33-3
2-Propyn-1-ol	Prop-2-in-1-ol	107-19-7
Pyridine	Pyridin	110-86-1
Sodium chloroacetate	Monochloressigsäure, Na-Salz	3926-62-3
Sodium Trichloroacetate	Natriumchloracetat	650-51-1
4-Tert-butyltoluene	Butyltoluol	98-51-1
1,1,2,2-Tetrabromoethane	Tetrabromethan,1,1,2,2-	79-27-6
Tetrachloroethylene	Tetrachlorethylen	127-18-4
Thioalcohols	Thioalkohole	
Thioethers	Thioether	

Substance (English terms)	Stoff (German terms)	CAS-Number
Thiourea	Thioharnstoff	62-56-6
Toluene-2,4-diisocyanate-	Diisocyanattoluol,2,4-	584-84-9
Toluene-2,6-diisocyanate-	Diisocyanattoluol,2,6-	91-08-7
p-Toluidine	Toluidin,p-	106-49-0
Trichlorobenzenes (all isomers)	Trichlorbenzole (alle Isomere)	12002-48-1
Trichloroethylene	Trichlorethen	79-01-6
Trichloronaphtalene	Trichlornaphthalin	1321-65-9
Trichlorophenols	Trichlorphenole	
Tricresyl phosphate (ooo,oom,oop,omm,omp,opp)	Trikresylphosphat,(ooo,oom,oop, omm,omp,opp)	78-30-8
Triethylamine	Triethylamin	121-44-8
Trimellitic anhydride	Benzoltricarbonsäureanhydrid,1, 2,4-	552-30-7
Tri-n-butylphosphate	Tri-N-butylphosphat	126-73-8
2,4,7-Trinitrofluorenone	Trinitrofluoren-9-on,2,4,7-	129-79-3
Trinitrotoluene (TNT)	Trinitrotoluol,2,4,6-(TNT)	118-96-7
N-Vinylpyrrolidone	Vinyl-2-pyrrolidon,N-	88-12-0
Xylenols (except for 2,4- Xylenol)	Xylenole (ausgenommen 2,4- Xylenol)	1300-71-6

Annex 5 Equivalence Factors for Dioxins and Furans

The concentrations of the following dioxins and furans determined in the waste gas shall be multiplied and totalled by the given equivalence factors in order to receive the totals required under 5.2.7.2 or the relevant requirements pursuant to 5.3 or 5.4.

Table 20: Equivalence Factors for Dioxins and Furans

Substance	Equivalence Factors
2,3,7,8 – Tetrachlorodibenzodioxin (TCDD)	1
1,2,3,7,8 – Pentachlorodibenzodioxin (PeCDD)	0.5
1,2,3,4,7,8 – Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,7,8,9 – Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,6,7,8 – Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,4,6,7,8 – Heptachlorodibenzodioxin (HpCDD)	0.01
Octachlorodibenzodioxin (OCDD)	0.001
2,3,7,8 – Tetrachlorodibenzofuran (TCDF)	0.1
2,3,4,7,8 – Pentachlorodibenzofuran (PeCDF)	0.5
1,2,3,7,8 – Pentachlorodibenzofuran (PeCDF)	0.05
1,2,3,4,7,8 – Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,7,8,9 – Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,6,7,8 – Hexachlorodibenzofuran (HxCDF)	0.1
2,3,4,6,7,8 – Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,4,6,7,8 – Heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,7,8,9 – Heptachlorodibenzofuran (HpCDF)	0.01
Octachlorodibenzofuran (OCDF)	0.001

Annex 6 VDI Guidelines and Standards in Relation to Emission Measurement Technique

Table 21: VDI Guidelines and Standards in Relation to Emission Measurement Technique

Test Object	Method		VDI Guideline		DIN/EN Standards	
	Continuous	Inter-mittent	Guideline/Standard	Version	Guideline/Standard	Version
General Guidelines						
Calibration			3950 P. 1	Jul. 94		
Measurement planning			2448 P. 1	Apr. 92		
Emission measuring			4200	Dec. 00		
Requirements for testing bodies			4220	Sep. 99		
Dust						
Dust (general)		X	2066 P. 1	Oct. 75		
Dust	X		2066 P. 4	Jan. 89		
	X		2066 P. 6	Jan. 89		
Dust (lower concentrations)		X	2066 P. 7	Aug. 93	EN 13284-1	Nov. 01
Dust (higher concentrations)		X	2066 P. 2	Aug. 93		
Fractionating dust measurement		X	2066 P. 5	Nov. 94		
Soot level		X	2066 P. 8	Sep. 95		
Dust Components						
Heavy metals (sampling)		X	3868 P. 1	Dec. 94		
Heavy metals (analysis)		X	2268 P. 1	Apr. 87		
		X	2268 P. 2	Feb. 90		
		X	2268 P. 3	Dec. 88		
		X	2268 P. 4	May 90		
Mercury		X			13211	Jun. 01
Asbestos		X	3861 P. 2	Sep. 96		

Test Object	Method		VDI Guideline		DIN/EN Standards	
	Continuous	Inter-mittent	Guideline/Standard	Version	Guideline/Standard	Version
Sulphur Compounds						
Sulphur dioxide		X	2462 P. 8	Mar. 85		
Sulphur trioxide		X	2462 P. 7	Mar. 85		
Hydrogen sulphide		X	3486 P. 1	Apr. 79		
		X	3486 P. 2	Apr. 79		
Carbon disulphide		X	3487 P. 1	Nov. 78		
Nitrogen Compounds						
Nitrogen monoxide/-dioxide		X	2456 P. 8	Jan. 86		
Basic nitrogen compounds		X	3496 P. 1	Apr. 82		
Carbon Monoxide						
		X	2459 P. 1	Dec. 00		
		X	2459 P. 7	Feb. 94		
Chlorine Compounds						
Hydrogen chloride		X			1911-1 1911-2 1911-3	Jul. 98
Chlorine		X	3488 P. 1	Dec. 79		
		X	3488 P. 2	Nov. 80		
Fluoride Compounds						
Hydrogen fluoride		X	2470 P. 1	Oct. 75		
Organic Substances						
Hydrocarbons (general)			3481 P. 6	Dec. 94		
Hydrocarbons		X	3481 P. 2	Sep. 98		
Hydrocarbons (FID)	X		3481 P. 1	Aug. 75	12619	Sept. 99
	X		3481 P. 3	Oct. 95		
Hydrocarbons (IR)			2460 P. 1	Jul. 96		
		X	2460 P. 2	Jul. 74		
		X	2460 P. 3	Jun. 81		

Test Object	Method		VDI Guideline		DIN/EN Standards	
	Continuous	Inter-mittent	Guideline/Standard	Version	Guideline/Standard	Version
Determination of organic compounds by gas chromatography		X	2457 P. 1	Nov. 97	13649 (prEN)	
		X	2457 P. 2	Dec. 96		
		X	2457 P. 3	Dec. 96		
		X	2457 P. 4	Dec. 00		
		X	2457 P. 6	Jun. 81		
		X	2457 P. 7	Jun. 81		
Aliphatic aldehydes (C ₁ to C ₃)		X	3862 P. 1	Dec. 90		
		X	3862 P. 2	Dec. 00		
		X	3862 P. 3	Dec. 00		
		X	3862 P. 4	May 01		
Acrylonitrile		X	3863 P. 1	Apr. 87		
		X	3863 P. 2	Febr. 91		
PAH (general)		X	3873 P. 1	Nov. 92		
PAH in relation to facilities in carbon industry		X	3467	Mar. 98		
Vinyl chloride		X	3493 P. 1	Nov. 82		
Dioxins and furans		X			1948-1 1948-2 1948-3	May 97
Odorous substances		X	3881 P. 1	May 86		
		X	3881 P. 2	Jun. 87		
		X	3881 P. 3	Nov. 86		

Annex 7 S-Values

Table 22: S-Values

Substance	S-Value
Suspended particulate matter	0.08
Lead and its inorganic compounds, indicated as Pb	0.0025
Cadmium and its inorganic compounds, indicated as Cd	0.00013
Mercury and its inorganic compounds, indicated as Hg	0.00013
Chlorine	0.09
Inorganic gaseous chlorine compounds, indicated as hydrogen chlorine	0.1
Fluoride and its inorganic gaseous compounds, indicated as hydrogen fluoride	0.0018
Carbon monoxide	7.5
Sulphur oxides (sulphur dioxide and sulphur trioxide), indicated as sulphur dioxide	0.14
Hydrogen sulphide	0.003
Nitrogen oxides, indicated as nitrogen dioxides	0.1
For substances pursuant to 5.2.2	
• Class I	0.005
• Class II	0.05
• Class III	0.1
For substances pursuant to 5.2.5	
• Total Carbon	0.1
• Class I	0.05
• Class II	0.1
For substances pursuant to 5.2.7	
• 5.2.7.1.1 Class I	0.00005
• 5.2.7.1.1 Class II	0.0005
• 5.2.7.1.1 Class III	0.005