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Ordinance
on Air Pollution Control (OAPC)

of 16 December 1985 (as at 28 March 2000)

Please note:

This translation is for your convenience;
it is not legally binding.

ORDINANCE ON AIR POLLUTION CONTROL (OAPC) 814.318.142.1

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The Swiss Federal Council,

on the basis of Articles 12, 13, 16 and 39 of the Federal Law of 7 October 1983[1] relating to the Protection of the Environment (Law),

hereby ordains:

Chapter 1: General provisions

Art. 1 Purpose and scope

1 The purpose of this Ordinance is to protect human beings, animals, plants, their biological communities and habitats and the soil against harmful effects or nuisances caused by air pollution.

2 It shall regulate:

a. preventive measures to limit emissions from installations which pollute the air, as defined in Article 7 of the Law;

a.bis[2] open air waste incineration;

b. requirements governing fuels;

c. maximum permitted air pollution load (ambient air quality standards);

d. procedure to be followed if ambient air pollution levels are excessive.

AS **1986** 208

1 SR **814**.01

2 Inserted by Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

Art. 2 Definitions

1 Stationary installations means:

a. buildings and other fixed structures;
b. site alterations;
c. devices and machinery;
d. ventilating installations which collect vehicle exhaust gases and discharge them into the environment as exhaust air.

2 Vehicles means motor vehicles, aircraft, ships and railways.

3 Transport infrastructure means roads, airfields, railway tracks and other installations where vehicle exhaust gases are discharged into the environment as exhaust air without being collected.

4 New installations also means installations which are altered, extended or repaired, if:

a. higher or different emissions are thereby expected or
b. the costs incurred amount to more than half those of a new installation.

5 Ambient air pollution levels shall be considered excessive if they exceed one or more of the ambient air quality standards laid down in Annex 7. If no ambient air quality standards are laid down for a pollutant, ambient air pollution levels shall be considered excessive, if

a. they endanger human beings, animals, plants, their biological communities and habitats;
b. a survey establishes that they seriously disturb the well-being of a large section of the population;
c. they damage buildings or
d. they harm soil fertility, vegetation or waters.

6 .... [3]

[3] Repealed in accordance with Fig. I of the Ordinance of 25 Aug. 1999 (AS **1999** 2498).

Chapter 2: Emissions

Section 1: Limitation of emissions from new stationary installations

Art. 3 Preventive limitation of emissions in accordance with Annexes 1-4

1 New stationary installations shall be equipped and operated in such a way that they meet the emission limit values laid down in Annex 1.

2 Additional or different requirements shall apply in the case of the following installations:

a. installations listed in Annex 2: the requirements laid down in this Annex;
b. combustion installations: the requirements laid down in Annex 3;
c.[4] combustion installations listed in Article 20: the test requirements laid down in Annex 4.

Art. 4 Preventive limitation of emissions laid down by the authorities

1 In the case of emissions for which no emission limit value is laid down in this Ordinance or for which a particular limit value is not applicable, the authorities shall take preventive measures to limit them as much as technology and operating conditions will allow, provided this is economically acceptable.

2 The following are measures to limit emissions which technology and operating conditions will allow:

a. those which have been successfully tested in comparable installations at home or abroad or
b. those which have been successfully applied in experiments and which are technologically possible to transfer to other installations.

4 Wording in accordance with Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

3 A medium-sized, financially sound firm in the relevant branch shall be used to assess the economic acceptability of emission limit values. If a particular branch contains very different classes of firms, a medium-sized firm in the relevant class shall be used.

Art. 5 Stricter emission limit values laid down by the authorities

1 If a single planned installation is expected to cause excessive ambient air pollution levels, even though the preventive emission limit values are met, the authorities shall order additional or stricter emission limit values for that installation.

2 The emission limit values shall be supplemented or tightened so that no excessive ambient air pollution levels can be caused.

Art. 6 Collection and discharge of emissions[5]

1 Emissions shall be collected as fully and as near the place of origin as possible and shall be discharged so that no excessive ambient air pollution levels occur.[6]

2 They shall generally be discharged above roof level by stacks or exit air ducts.

3 Annex 6 shall apply to tall stacks. If the required stack height H cannot be realised or if the parameter H_0 is more than 100 m, the authorities shall tighten the emission limit values laid down in Annexes 1-3 instead.

5 Wording in accordance with Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

6 Wording in accordance with Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

Section 2: Limitation of emissions from existing stationary installations

Art. 7 Preventive limitation of emissions

The provisions concerning preventive limitation of emissions for new stationary installations (Art. 3, 4 and 6) shall also apply to existing stationary installations.

Art. 8 Compulsory retrofitting

1 The authorities shall ensure that existing stationary installations, which do not comply with the requirements of this Ordinance, are retrofitted.

2 They shall issue the necessary orders and shall lay down the time limit for retrofitting in accordance with Article 10. If necessary, they shall order operating restrictions or the shut-down of the installation for the duration of the retrofitting work.[7]

3 The retrofitting may be waived, if the owner undertakes to shut down the installation within the time limit set for retrofitting.

Art. 9 Stricter emission limit values

1 If it is established that a single existing installation is causing excessive ambient air pollution levels, even though it complies with the preventive emission limit values, the authorities shall order additional or stricter emission limit values for that installation.

2 The emission limit values shall be supplemented or tightened so that excessive ambient air pollution levels are no longer caused.

3 The additional or stricter emission limit values shall be imposed by means of retrofitting orders to be implemented within the time limits laid down in Article 10, Paragraph 2. If necessary, the authorities shall order operating restrictions or the shut-down of the installation for the duration of the retrofitting work.

4 If excessive ambient air pollution levels are caused by more than one installation, the procedure laid down in Articles 31-34 shall be followed.

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7 Second sentence inserted by Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

Art. 10[8] Time limits for retrofitting

1 The standard time limit for retrofitting shall be five years.

2 Shorter time limits of at least 30 days shall be set if:

a. the retrofitting can be carried out without major investments;
b. the emissions are more than three times the value laid down for the preventive emission limit value, or
c. the ambient air pollution levels caused by the installation alone are excessive.

3 Longer time limits up to a maximum of ten years shall be set if:

a. the emissions are less than one and a half times the value laid down for the preventive emission limit value, or the provisions governing flue gas losses are not complied with and
b. neither Letter a nor Letter c of Paragraph 2 are met.

4 Subject to the ordering of shorter time limits for retrofitting under Article 32.

Art. 11 Concessions

1 The authorities shall grant concessions on request to an owner of an installation, if retrofitting under Article 8 and 10 would be disproportionate, in particular would prove to be technically or operationally impossible or economically unacceptable.

2 As a concession, the authorities may allow longer time limits in the first instance. If the granting of longer time limits is not sufficient, the authorities shall set less strict emission limit values.

Section 3: Control of stationary installations

Art. 12 Emission declaration

1 Anyone who wishes to operate or construct an installation which causes air pollution shall provide the authorities with the following information:

a. type and level of emissions;

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8 However, see the Final Provisions of the Amendments of 20 Nov. 1991 and 15 Dec. 1997 at the end of this text.

b. site, height and variation in time of the discharge of emissions;
c. other conditions pertaining to the discharge required to assess the emissions.

2 The emission declaration may be based on measurements or on a quantitative balance of the substances used.

Art. 13 Emission measurements and controls

1 The authorities shall ensure that the emission limit values are complied with. They shall carry out their own emission measurements or controls or shall have these carried out on their behalf.

2 If possible, the first measurements or controls shall be carried out within three months, but no later than twelve months after the new or retrofitted installation begins operation.

3 The measurements or controls shall generally be repeated every two years in the case of combustion installations or every three years in the case of other installations.[9] Subject to contrary provisions laid down in Annexes 2 and 3.[10]

4 In the case of installations which may have high levels of emissions, the authorities shall order continuous measurement and recording of the emissions or of another operating value which may be used to monitor emissions.

Art. 14 Measurement procedures

1 The measurements must relate to the operating stages which are important for assessment. If necessary, the authorities shall lay down the type and range of measurements to be taken and the operating stages to be covered.

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9 Wording in accordance with Fig. I of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998**).

10 Wording of the second sentence in accordance with Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

2 Emission measurements shall be taken according to the recognised rules of metrology. The Swiss Agency for the Environment, Forests and Landscape (Swiss Agency) shall recommend suitable measuring methods.[11]

3 Owners of installations to be checked shall set up and make accessible suitable measuring sites in accordance with instructions issued by the authorities.

4 The measured and calculated values, the measuring methods used and the operating conditions in the installation at the time the measurements were proceeded shall be recorded in a measurement report.

Art. 15 Assessment of emissions

1 The measured values shall be converted to the reference values laid down in Annex 1 Figure 23.

2 Unless Annexes 1-4 state otherwise, the values calculated in accordance with Paragraph 1 shall be converted to hourly averages for the assessment. If necessary, the authorities may lay down other suitable time periods for calculating averages.

3 In the case of approval and control measurements, the emission limit values shall be accepted to be met if none of the average values calculated in accordance with Paragraph 2 exceeds the limit value.

4 In the case of continuous measurement of emissions, the emission limit values shall be accepted to be met if over a period of one calendar year:

a. none of the daily average values exceeds the emission limit values;
b. 97 percent of all hourly average values are no more than 1.2 times the limit value;
c. none of the hourly average values are more than twice the limit value.

[11] Wording of the second sentence in accordance with Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

5 The authorities shall take account of the particular circumstances when assessing emissions during the start-up and shut-down phases of the installation.

Art. 16 By-passes and operational breakdowns

1 A by-pass to protect exhaust gas purification systems may only be used with the approval of the authorities.

2 If the use of a by-pass or an operational breakdown could cause high levels of emissions, the authorities shall lay down what measures are to be taken.

Section 4: Emissions from vehicles and transport infrastructures

Art. 17 Preventive limitation of emissions from vehicles

As a precautionary measure, emissions from vehicles shall be limited based on the legislations governing road traffic, air traffic, shipping and the railways as much as technology and operating conditions will allow, provided this is economically acceptable.

Art. 18 Preventive limitation of emissions from transport infrastructures

In the case of transport infrastructures, the authorities shall order as many measures as are technically and operationally possible and economically acceptable to limit emissions caused by traffic.

Art. 19 Measures against excessive ambient air pollution levels from traffic

If vehicles or transport infrastructures are proved or expected to cause excessive ambient air pollution levels, the procedure laid down in Articles 31-34 shall be followed.

Section 5: Type-approval of combustion installations[12]

Art. 20[13]

1 The following combustion installations shall only be put on the market if they have been granted type-approval:

a. forced draught burners run on "extra light" fuel oil (gas oil) or gas, with a heat input of less than 350 kW;
b. heating boilers for forced draught burners defined in Letter a, provided the heat carrier is water and the temperature of the water is no more than 110 °C;
c. heating boilers defined in Letter b fitted to fixed forced draught burners (unit);
d. heating boilers and circulation heaters with atmospheric gas burners, with a heat input of less than 350 kW, provided the heat carrier is water and the temperature of the water is no more than 110 °C;
e. heating boilers and circulation heaters defined in Letter d fitted with oil vaporisation burners run on "extra light" fuel oil (gas oil);
f. directly fired gas water storage heaters (boilers) containing more than 30 litres of water and with a heat input of less than 350 kW;
g. continuous flow gas heaters for heating drinking water and with a heat input of between 35 kW and 350 kW.[14]

2 Putting on the market shall be deemed to be the transfer of the installations against payment or free of charge. The initial putting into service by the end user shall be considered equivalent to putting on the market.[15]

3 The type-approval requirements are laid down in Annex 4.[16]

4 The type-approval procedure is laid down in Article 37.[17]

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11 Wording in accordance with Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).
12 See also the Final Provisions of the Amendment of 20 Nov. 1991 at the end of this text.
14 Wording in accordance with Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).
15 Inserted by Fig. I of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).
16 Originally paragraph 2.
17 Originally paragraph 3.

5 Contrary to Paragraph 1, the Cantons may allow practical testing of a limited number of installations which have not yet received type-approval, for a period of no more than two years. Installations which have not been granted type-approval in their existing form by the end of this period must be taken out of service.[18]

6 Manufacturers or importers of burners defined in Paragraph 1 Letter a and of heating boilers defined in Paragraph 1 Letter b shall publish recommendations stating which burner/boiler combinations meet the requirements laid down in Annex 3.[19]

Section 6: Fuels

Art. 21 Requirements

The requirements laid down in Annex 5 shall apply to fuels.

Art. 22 Declaration

Anyone who imports fuels or offers them for sale commercially must declare the quality of the fuel to the customer or consumer. In the case of imports, he must also declare the quality to the customs authorities.

Art. 23 Compulsory notification

1 Anyone who procures quality B fuels (Annex 5) to operate a combustion installation or who supplies such fuels to the operator of a combustion installation must notify the authorities of the Canton in which the installation is operated.

2 The following information must be supplied:

a. the quantity of fuel;
b. name and address of the supplier;
c. name and address of the recipient.

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18 Originally paragraph 4.Wording of the second sentence in accordance with Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

19 Originally paragraph 5. Inserted by Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

Section 7: Motor fuels

Art. 24 Requirements

The requirements laid down in Annex 5 shall apply to motor fuels.

Art. 25 Declaration

Anyone who imports motor fuels or offers them for sale commercially must declare the quality of the motor fuel to the customer or consumer. In the case of imports, he must also declare the quality to the customs authorities.

Art. 26 Installations for unleaded gasoline

1 Installations for unleaded gasoline such as storage and transport tanks, tankers and petrol pumps must be clearly marked "unleaded".

2 If an installation which previously contained leaded gasoline is to be used for unleaded gasoline, the owner of the installation must clean it thoroughly beforehand or take other measures to ensure that no excessive lead residues remain.

Section 8:[20] Open air waste incineration

Art. 26a

1 If waste is incinerated or decomposed by heat, this shall only be done in installations in accordance with Annex 2 Figure 7.

2 The following shall be exempted:

a. the incineration of waste in accordance with Annex 2 Figure 11;
b. dry, natural waste from forests, fields and gardens. These may be incinerated in the open air provided little smoke arises. The Cantons may restrict or prohibit open air incineration in certain areas if excessive ambient air pollution levels are expected.

[20] Inserted by Fig. I of the Ordinance of 20 Nov. 1991 (AS **1992** 124). Wording in accordance with Fig. I of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).

Chapter 3: Ambient air quality

Section 1: Determination and assessment

Art. 27 Determination of ambient air quality

1 The Cantons shall monitor the level and evolution of air pollution in their region; in particular, they shall determine the extent of ambient air pollution concentrations.

2 To this end, they shall carry out surveys, measurements and dispersion calculations. The Swiss Agency shall recommend suitable methods.

Art. 28 Ambient air quality forecast

1 Before a stationary installation or transport infrastructure which is expected to cause high levels of emissions is constructed or retrofitted, the authorities may require an ambient air quality forecast from the owner.

2 The forecast must state what air pollution is expected, in what areas, in what quantities and with what frequency.

3 The forecast shall state the type and level of emissions, the dispersion conditions and the calculation methods.

Art. 29 Monitoring individual installations

The owner of an installation which discharges high levels of emissions may be required by the authorities to monitor ambient air quality by means of measurements in the area affected.

Art. 30 Assessment of ambient air quality

The authorities shall assess whether the measured ambient air pollution levels are excessive (Art. 2 Para. 5).

Section 2: Measures against excessive ambient air pollution levels

Art. 31[21] Drawing up an action plan

1 The authorities shall draw up an action plan in accordance with Article 44a of the Law if, in spite of preventive emission limit values, excessive ambient air pollution levels are noted or expected due to:

a. a transport infrastructure
b. a number of stationary sources

Art. 32[22] Content of action plan

1 The action plan shall state:

a. the sources of emissions which are responsible for causing excessive ambient air pollution levels;
b. the importance of the emissions of individual sources for the total pollution load;
c. the measures for reducing and eliminating excessive ambient air pollution levels;
d. the effect of individual measures;
e. the existing or future legal basis for individual measures;
f. the timetable for enactment and implementation of the measures;
g. the authorities responsible for enforcing the measures.

2 Measures under paragraph 1c are:

a. for stationary installations: shorter time allowed for retrofitting or additional or stricter emission limit values;
b. for transport infrastructures: measures with regard to construction, operation, traffic management or traffic restrictions.

Art. 33[23] Implementation of the action plan

1 The measures contained in the action plan shall generally be implemented within five years.

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21 Wording in accordance with Fig. I of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).
22 Wording in accordance with Fig. I of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).
23 Wording in accordance with Fig. I of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).

2 As a matter of priority, the authorities shall order the measures for installations which cause more than 10 percent of the total pollution load.

3 The Cantons shall regularly check the effectiveness of the measures and shall amend the action plans if necessary. They shall keep the public informed.

Art. 34 Applications from the Cantons

1 If a cantonal action plan contains measures which come under the jurisdiction of the Confederation, the Canton shall submit the plan to the Federal Council and shall make relevant application.

2 If the action plan requires the co-operation of another Canton, the authorities shall submit the plan to the Canton in question and shall make relevant application. If necessary, the Federal Council shall co-ordinate the action plans of the Cantons.

Chapter 4: Final provisions

Section 1: Enforcement

Art. 35 Enforcement by the Cantons

Subject to Article 36, the Cantons shall be responsible for enforcing this Ordinance.

Art. 36 Enforcement by the Confederation

1 The Confederation shall enforce the provisions concerning the type-approval (Art. 37) and the controls for imported fuels (Art. 38). It shall carry out surveys regarding the state and evolution of air pollution throughout Switzerland (Art. 39).

2 If a federal law makes a federal authority responsible for enforcement in a given field, this authority shall also enforce the relevant provisions of this Ordinance. The collaboration of the Federal Agency and the Cantons specified in Article 41 Paragraphs 2 and 4 of the Law, and is subject to the legislation regarding secrecy.[24]

3 The Federal Department of Environment, Transport, Energy and Communications[25] may order implementing and supplementary provisions, particularly concerning:

a. methods of testing, measurement and calculation;
b. type-approval;
c. stacks.

Art. 37[26] Type approval and control

1 Test centres for type approval in accordance with Article 20 are:

a. for oil combustion installations, the Federal Institute for Materials Testing and Research in Dübendorf (EMPA);
b. for gas combustion installations, the Swiss Gas and Water Industry Association (SVGW).

2 The test centres shall conduct the type approval tests themselves or shall adopt the test results of other appropriate centres. They shall draw up a report on each test for the attention of the Swiss Agency.

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24 Wording in accordance with Fig. II 13 of the Ordinance of 2 Feb. 2000 relating to the Federal Law of Coordination and Simplification of Decisive Procedures (AS **2000** 703).

25 The designation of the administration unit was adopted according with Fig. 4a of the the Ordinance on Official Publications of 15 June 1998 (SR **170.512.1**).

26 Wording in accordance with Fig. I of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).

3 The Swiss Agency shall decide whether or not to grant type approval on the basis of this report. It shall notify the manufacturer or importer of the decision and shall levy a charge of 500 Swiss francs.

4 The test centres shall check by means of random samples, whether the combustion installations intended for the market match the approved type. They shall take note of any reasons why an installation does not comply with the regulations. They shall inform the owner of the installation and the Swiss Agency of the test results.

5 If the checked installations do not match the approved type, the Swiss Agency shall order the necessary measures. In serious cases, it may prohibit further sales and marketing or require adjustment of installations put on the market.

Art. 38 Fuels

1 The customs authorities shall take samples of imported fuels or those supplied by national refineries. They shall either submit the samples to the EMPA or analyse them themselves.[27]

2 The customs authorities or the EMPA shall report the results of the tests to the Swiss Agency.[28]

3 If the Swiss Agency establishes that an importer is repeatedly importing fuels which fail to meet the quality requirements, it shall inform the customs authorities and the cantonal prosecution authorities accordingly.[29]

Art. 39 Ambient air pollution surveys

1 The Swiss Agency shall carry out surveys regarding the state and evolution of ambient air pollution throughout Switzerland.

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27 Wording in accordance with Fig. I of the Ordinance of 25 Aug. 1999, in force since 1 January 2000 (AS **1999** 2498).

28 Wording in accordance with Fig. I of the Ordinance of 25 Aug. 1999, in force since 1 January 2000 (AS **1999** 2498).

29 Wording in accordance with Fig. I of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124).

2 The EMPA shall operate the National Air Pollution Monitoring Network (NABEL) on behalf of the Swiss Agency.

Section 2: Amendment and repeal of existing legislation

Art. 40 Amendment of existing legislation

1 The Ordinance of 23 December 1971[30] relating to Prohibited Toxic Substances shall be amended as follows:

Art. 2a Para. 2 and 3

2 ...

3 *Repealed*

Art. 4 Para. 2 Let. a

...

Fig. II (Transitional provisions concerning the amendment of 10 December 1984[31]

Repealed

Art. 41 Repeal of existing legislation

The Ordinance of 10 December 1984[32] relating to Air Pollution Control Measures for combustion installations shall be repealed.

Section 3: Transitional provisions

Art. 42

1 Installations which require a construction permit or planning permission shall be rated as new installations if no decision has been taken regarding the construction permit or planning permission at the time this Ordinance enters into force.

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30 SR **814.839**. Text inserted in the aforementioned Ordinance.
31 [AS **1984** 1521]
32 [AS **1984** 1516]

2 Within two years of this Ordinance entering into force, the authorities shall issue retrofitting orders under Articles 8 and 9, if possible for all retrofitting cases, but at least for the most urgent.

3 In the case of existing excessive ambient air pollution levels, the action plans under Article 31 shall be drawn up within three years of this Ordinance entering into force.

Section 4: Entry into force

Art. 43

This Ordinance shall enter into force on 1 March 1986.

Final provisions of the amendment of 20 November 1991[33]

1 Installations which require a construction permit or planning permission and regarding which no decision has been taken at the time this amendment enters into force, must fulfil the requirements of the new Ordinance.

2 Contrary to Article 10, the authorities shall grant a time limit of between five and ten years to installations which require retrofitting under the amendment of 20 November 1991, but which already meet the emission limit values laid down in the Ordinance's[34] previous provisions. Subject to the provisions of Article 10 Paragraph 2 Letters a and c.

3 Installations listed in Article 20, which have been granted type-approval in accordance with the Ordinance's[35] previous provisions, may continue to be put on the market until 31 December 1992.

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33 AS **1992** 124
34 AS **1986** 208
35 AS **1986** 208

Final provisions of the amendment of 15 December 1997[36]

1 Installations which require a construction permit or planning permission and regarding which no decision has been taken at the time this amendment enters into force, must fulfil the requirements of the new ordinance.

2 Contrary to Article 10, the authorities shall grant a time limit of between five and ten years to installations which require retrofitting under the amendment of 15 December 1997, but which already meet the emission limit values laid down in the previous provisions of the Ordinance.[37] Subject to the provisions of Article 10 paragraph 2 letters a and c.

Final provisions of the amendment of 25 August 1999[38]

1 Gasoline that satisfies the previous requirements of the Ordinance relating to the benzene content may continue to be manufactured and marketed until 30 June 2000.

2 Diesel oil and unleaded gasoline that satisfy the previous requirements of the Ordinance may continue to be marketed from licensed storage stocks, compulsory stocks and army stocks until 31 December 2004.

36 AS **1998** 223
37 AS **1986** 208
38 AS **1999** 2498

Annex 1[39]
(Art. 3 Para. 1)

General preventive emission limit values

1 Scope

1 The provisions of this Annex shall apply to the preventive control of emissions from stationary sources.

2 Subject to additional or different provisions which apply to:

a. special installations listed in Annex 2;
b. combustion installations listed in Annex 3;
c. type-approval of combustion installations laid down in Annex 4.

2 Definitions

21 Exhaust gases

Exhaust gases means exhaust air, flue gases and other air pollutants discharged by installations.

Emissions are expressed as:

22 Emissions

a. Concentration:
   Mass of emitted substance per volume of the exhaust gas (e.g. in milligrams per cubic meter [mg/m^3]);
b. Mass flow:
   Mass of emitted substance per unit of time (e.g. in grams per hour [g/h]);
c. Emission factor:
   Ratio of the mass of emitted substance to the mass of the products generated or processed (e.g in kilograms per tonne [kg/t]);

[39] Corrected in accordance with Fig. II of the Ordinance of 20 Nov. 1991 (AS **1992** 124) and 15 December 1997, in force since 1 March 1998 (AS **1998** 223**)**.

d. Emission ratio:
Ratio of the mass of an air polluting substance emitted to the mass of that substance supplied with fuels and charge materials (in percent [% mass]);
e. Soot number:
The degree of blackening on a filter paper caused by flue gases. The comparative scale used to determine the soot number (according to the Bacharach method) has 10 degrees; the degrees are numbered 0 to 9.

23 Reference value for emission concentrations

1 The limit values indicated as concentrations and the oxygen contents indicated as reference values refer to the volume of exhaust gas under standard conditions (0 °C, 1013 mbar) after subtraction of the moisture content (dry).

2 The limit values indicated as emission concentrations refer to the volume of exhaust gas, which is diluted no more than technology and operating conditions require.

3 If an oxygen content is indicated as the reference value for an installation listed in Annexes 2-4, the measured emission concentrations shall be converted to this reference value.

24 Heat input

The heat input means the thermal energy supplied to an installation per unit of time. It is obtained by multiplying the fuel consumption of the installation by the lower calorific value of the fuel.

3 General provisions

31 Emission control

1 The following emission limit values shall apply:
a. for dust particles: Figure 4;
b. for inorganic substances mainly in dust particles: Figure 5;
c. for gaseous or vaporous inorganic substances: Figure 6;

d. for organic substances in the form of gas, vapour or particles: Figure 7;
e. for carcinogens: Figure 8.

2 Substances not listed in Figures 5-8 shall be assigned to the substance classes which have comparable effects on the environment. Account shall be taken of degradability and accumulability, toxicity, effects of decomposition and their transformation products as well as degree of odour.

32 Emission limit values which depend on the size of the installation

1 If there is more than one source of emissions and if the emission limit values depend on the size of an installation (e.g. capacity or mass flow), the authorities shall lay down which sources of emissions taken together shall be considered to form a single installation.

2 Emission sources are generally considered as a single installation if they are situated in close proximity to each other and if their emissions:

a. mainly contain the same or similar pollutants or
b. can be reduced using the same technology.

3 Parts of an installation which are only used to replace other parts of the installation in case of breakdown are not taken into account when determining the size of the installation.

4 Emission limit values which depend on a certain mass flow shall only apply if:

a. this mass flow is reached or exceeded for more than five hours per week, or
b. double this mass flow is reached or exceeded for a shorter time period.

4 Dust particles

41 Emission limit value for total dust

If the mass flow of dust particles is 0.5 kg/h or more, total dust emissions shall not exceed 50 mg/m^3.

42 Emission limit values for substances contained in dust particles

The requirements laid down in Figures 5, 7 and 8 shall apply for the control of individual substances contained in the dust.

43 Measures relating to treatment, storage, transshipment and transport

1 If high levels of dust emissions may occur in commercial or industrial installations due to processes such as the conveyancing, crushing, sizing or filling of dusty materials, the dust-containing exhaust gases must be collected and fed to a dust removal system.

2 In the case of the storage and transshipment of dusty materials in the open, measures must be taken to prevent high levels of dust emissions.

3 Transport equipment which prevents high levels of dust emissions must be used during the transport of dusty materials.

4 If works traffic on factory roads can cause high levels of dust emissions, the roads must be kept dust free.

5 Inorganic substances mainly as dust particles

51 Emission limit values

1 The emission concentration of substances listed in Figure 52 shall not exceed the following limit values:

a. Class 1 substances
   at a mass flow of 1 g/h or more: 0.2 mg/m^3
b. Class 2 substances
   at a mass flow of 5 g/h or more: 1 mg/m^3
c. Class 3 substances
   at a mass flow of 25 g/h or more: 5 mg/m^3

2 The limit values apply to the total mass of an emitted substance, including gaseous and vaporous components in the exhaust gas.

3 If the exhaust gas contains several substances belonging to the same class, the limit value shall apply to the sum of these substances.

52 Table of inorganic substances mainly as dust particles

Substance		Expressed as	Class
Antimony[1)]	and its compounds	Sb	3
Arsenic[1)]	and its compounds except arsine	As	2
Chromium[1)]	and its compounds	Cr	3
Cobalt[1)]	and its compounds	Co	2
Copper	and its compounds	Cu	3
Cyanides[2)]		CN	3
Fluorides[2)]	if dust	F	3
Lead	and its compounds	Pb	3
Manganese	and its compounds	Mn	3
Mercury	and its compounds	Hg	1
Nickel[1)]	and its compounds	Ni	2
Palladium	and its compounds	Pd	3
Platinum	and its compounds	Pt	3
Quartz dust	if crystalline fine dust	SiO_2	3
Rhodium	and its compounds	Rh	3
Selenium	and its compounds	Se	2
Tellurium	and its compounds	Te	2
Thallium	and its compounds	Tl	1
Tin	and its compounds	Sn	3
Vanadium	and its compounds	V	3

1) If not listed as a carcinogenic compound under Figure 8.

2) If easily soluble.

6 Gaseous or vaporous inorganic substances

61 Emission limit values

The emission concentration of substances listed in Figure 62 shall not exceed the following limit values:

a. Class 1 substances
   at a mass flow of 10 g/h or more: 1 mg/m^3
b. Class 2 substances
   at a mass flow of 50 g/h or more: 5 mg/m^3
c. Class 3 substances
   at a mass flow of 300 g/h or more: 30 mg/m^3
d. Class 4 substances
   at a mass flow of 2500 g/h or more: 250 mg/m^3

62 Table of gaseous or vaporous inorganic substances

Substance	Class
Ammonia and ammonium compounds, expressed as ammonia	3
Bromine and its gaseous or vaporous compounds, expressed as hydrogen bromide	2
Chlorine	2
Chlorine compounds, vaporous or gaseous inorganic chlorine compounds except cyanogen chloride and phosgene, indicated as hydrogen chloride	3
Cyanogen chloride	1
Fluorine and its vaporous or gaseous compounds, expressed as hydrogen fluoride	2
Hydrogen arsine	1
Hydrogen cyanide	2
Hydrogen phosphide	1
Hydrogen sulphide	2
Nitrogen oxides (nitrogen monoxide and nitrogen dioxide), expressed as nitrogen dioxide	4
Phosgene	1
Sulphur oxides (sulphur dioxide and sulphur trioxide), expressed as sulphur dioxide	4

7 Organic substances in the form of gas, vapor or particles

71 Emission limit values

1 The emission concentration of substances listed in Figure 72 shall not exceed the following limit values:

a. Class 1 substances
   at a mass flow of 0.1 kg/h or more: 20 mg/m^3
b. Class 2 substances
   at a mass flow of 2.0 kg/h or more: 100 mg/m^3
c. Class 3 substances
   at a mass flow of 3.0 kg/h or more: 150 mg/m^3

2 Notwithstanding Paragraph 1, the provisions governing dust limitation laid down in Figure 41 shall apply to Class 2 and Class 3 organic substances in particle form.

3 If the exhaust gas contains several substances belonging to the same class, the limit value shall apply to the sum of these substances.

4 If the exhaust gas contains substances of different classes, the sum of the substances at a total mass flow of 3.0 kg/h or more shall not exceed the limit value of 150 mg/m^3, in addition to fulfilling the requirements laid down in Paragraphs 1 and 2.

5 Emissions of substances with presumed carcinogenic potential[40], which are not listed in Figure 72 as Class 1 substances, must be controlled in accordance with Paragraph 1 Letter a.

6 Emissions of substances which in terms of Annex 3.4 of the Ordinance of 9 June 1986[41] relating to Environmentally Hazardous Substances are classed as ozone depleting substances, but which are not listed in Figure 72 as Class 1 substances, must be controlled in accordance with Paragraph 1 Letter a. Subject to the provisions of Figure 8.

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40 Substances with presumed carcinogenic potential means in particular substances contained in Section III B (Stoffe mit begründetem Verdacht auf krebserzeugendes Potential) of the List "Maximale Arbeitsplatzkonzentrationen und biologische Arbeitsstofftoleranzwerte" of the Deutsche Forschungsgemeinschaft. Source: VCH Verlags-AG, Postfach, CH-4020 Basel, Switzerland.

41 SR **814.013**

72 Table of organic substances in the form of gas, vapour or particles

Substance	Chemical formula	Class
Acetaldehyde	C_2H_4O	1
Acetone	C_3H_6O	3
Acetic ester (see Ethyl acetate)		
Acetic acid	$C_2H_4O_2$	2
Acetic-acid butyl ester (see Butyl acetate)		
Acetic-acid ethyl ester (see Ethyl acetate)		
Acetic acid methyl ester (see Methyl acetate)		
Acetic acid vinyl ester (see Vinyl acetate)		
Acrolein (see 2-Propenal)		
Acrylic acid	$C_3H_4O_2$	1
Acrylic acid ethyl ester (see Ethyl acrylate)		
Acrylic acid methyl ester (see Methyl acrylate)		
Alkanes, except methane		3
Alkenes, except 1,3-butadiene and ethene		3
Alkyl alcohols		3
Alkyl lead compounds		1
Aniline	C_6H_7N	1
Benzoic acid methyl ester (see Methyl benzoate)		
Biphenyl	$C_{12}H_{10}$	1
Bromomethane	CH_3Br	1
2-Butanone	C_4H_8O	3
2-Butoxyethanol	$C_6H_{14}O_2$	2
Butyl acetate	$C_6H_{12}O_2$	3
Butylglycol (see 2-Butoxyethanol)		
Butyric aldehyde	C_4H_8O	2
Carbon disulphide	CS2	2
Carbon tetrachloride (see Tetrachloromethane)		
CFCs, chlorofluorocarbons, fully halogenated, with up to 3 C-atoms		1
Chloroacetaldehyde	C_2H_3ClO	1
Chlorobenzene	C_6H_5Cl	2
2-Chloro-1,3-butadiene	C_4H_5Cl	2

Substance	Chemical formula	Class
Chloroacetic acid	$C_2H_3ClO_2$	1
Chloroethane	C_2H_5Cl	1
Chloromethane	CH_3Cl	1
Chloroform (see Trichloromethane)		
2-Chloroprene (see 2-Chloro-1,3-butadiene)		
2-Chloropropane	C_3H_7Cl	2
Cresols	C_7H_8O	1
Cumene (see Isopropylbenzene)		
Cyclohexanone	$C_6H_{10}O$	1
Diacetone alcohol (see 4-Hydroxy-4-methyl-2-pentanone)		
Dibutyl ether	$C_8H_{18}O$	3
1,2-Dichlorobenzene	$C_6H_4Cl_2$	1
1,4-Dichlorobenzene	$C_6H_4Cl_2$	2
1,1-Dichloroethane	$C_2H_4Cl_2$	2
1,1-Dichloroethene	$C_2H_2Cl_2$	1
1,2-Dichloroethene	$C_2H_2Cl_2$	3
Dichloromethane	CH_2Cl_2	1
Dichlorophenols	$C_6H_4Cl_2O$	1
Diethanolamine (see 2,2-Iminodiethanol)		
Diethylamine	$C_4H_{11}N$	1
Diethyl ether	$C_4H_{10}O$	3
Di-(2-ethylhexyl)-phthalate	$C_{24}H_{38}O_4$	2
Diisopropyl ether	$C_6H_{14}O$	3
Diisobutyl ketone (see 2,6-Dimethyl-4-heptanone)		
Diisocyanatotoluene (see 4-Methyl-m-phenylenediisocyanate)		
Dimethylamine	C_2H_7N	1
Dimethyl ether	C_2H_6O	3
N,N-Dimethylformamide	C_3H_7NO	2
2,6-Dimethyl-4-heptanone	$C_9H_{18}O$	2
Dioctylphthalate (see Di-(2-ethylhexyl)-phthalate)		
1,4 Dioxan	$C_4H_8O_2$	1

Substance	Chemical formula	Class
Diphenyl (see Biphenyl)		
Ethanol (see Alkyl alcohols)		
Ethene	C_2H_4	1
Ether (see Diethyl ether)		
2-Ethoxyethanol	$C_4H_{10}O_2$	2
Ethyl acetate	$C_4H_8O_2$	3
Ethyl acrylate	$C_5H_8O_2$	1
Ethylamine	C_2H_7N	1
Ethylbenzene	C_8H_{10}	2
Ethyl chloride (see Chloroethane)		
Ethylene glycol	$C_2H_6O_2$	3
Ethylene glycol monobutyl ether (see 2-Butoxyethanol)		
Ethylene glycol monoethyl ether (see 2-Ethoxyethanol)		
Ethylene glycol monomethyl ether (see 2-Methoxyethanol)		
Ethyl glycol (see 2-Ethoxyethanol)		
Ethyl methyl ketone (see 2-Butanone)		
Formaldehyde	CH_2O	1
§Formic acid	CH_2O_2	1
Formic acid dimethyl amide (see N,N-Dimethyl-formamide)		
Formic acid methyl ester (see Methyl-formate)		
2-Furaldehyde	$C_5H_4O_2$	1
Furfural, Furfurol, 2-Furylmethanal (see 2-Furaldehyde)		
Furfuryl alcohol	$C_5H_6O_2$	2
Glycol (see Ethylene glycol)		
Halons, bromofluorocarbons, fully halogenated, with up to 3 C-atoms		1

Substance	Chemical formula	Class
HBFCs, bromofluorocarbons, partly halogenated, with up to 3 C-atoms		1
HCFCs, chlorofluorocarbons, partly halogenated, with up to 3 C-atoms		1
4-Hydroxy-4-methyl-2-pentanone	$C_6H_{12}O_2$	3
2,2'-Iminodiethanol	$C_4H_{11}NO_2$	2
Isopropenylbenzene	C_9H_{10}	2
Isopropylbenzene	C_9H_{12}	2
Maleic anhydride	$C_4H_2O_3$	1
Mercaptans (see Thiols)		
Methacrylic acid methyl ester (see Methyl meth-acrylate)		
Methanol (see Alkyl alcohols)		
2-Methoxyethanol	$C_3H_8O_2$	2
Methyl acetate	$C_3H_6O_2$	2
Methyl acrylate	$C_4H_6O_2$	1
Methylamine	CH_5N	1
Methyl benzoate	$C_8H_8O_2$	3
Methyl chloride (see Chloromethane)		
Methyl chloroform (see 1,1,1,-Trichloroethane)		
Methylcyclohexanone	$C_7H_{12}O$	2
Methylene chloride (see Dichloromethane)		
Methyl ethyl ketone (see 2-Butanone)		
Methyl formate	$C_2H_4O_2$	2
Methyl glycol (see 2-Methoxyethanol)		
Methyl isobutyl ketone (see 4-Methyl-2-pentanone)		
Methyl methacrylate	$C_5H_8O_2$	2
4-Methyl-2-pentanone	$C_6H_{12}O$	3
4-Methyl-m-phenylenediisocyanate	$C_9H_6N_2O_2$	1
N-Methyl pyrrolidone	C_5H_9NO	3
Naphthalene	$C_{10}H_8$	1
Nitrobenzene	$C_6H_5NO_2$	1
Nitrocresols	$C_7H_7NO_3$	1

Substance	Chemical formula	Class
Nitrophenols	$C_6H_5NO_3$	1
Nitrotoluenes, except 2-nitrotoluene	$C_7H_7NO_2$	1
Olefin hydrocarbons (see Alkenes)		3
Paraffin hydrocarbons (see Alkanes)		3
Perchloroethylene (see Tetrachloroethene)		
Phenol	C_6H_6O	1
Phthalic acid-(2-ethylhexyl)-ester (see Di-(2-ethyl-hexyl)-phthalate)		
Phthalic acid dioctyl ester (see Di-(2-ethylhexyl)-phthalate)		
Pinenes	$C_{10}H_{16}$	3
2-Propenal	C_3H_4O	1
Propionaldehyde	C_3H_6O	2
Propionic acid	$C_3H_6O_2$	2
Pyridine	C_5H_5N	1
Styrol	C_8H_8	2
1,1,2,2-Tetrachloroethane	$C_2H_2Cl_4$	1
Tetrachloroethene	C_2Cl_4	1
Tetrachloromethane	CCl_4	1
Tetrahydrofuran	C_4H_8O	2
Thiols		1
Thioether		1
Toluene	C_7H_8	2
Tolylene-2,4-diisocyanate (see 4-Methyl-m-phenylenediisocyanate)		
1,1,1-Trichloroethane	$C_2H_3Cl_3$	1
1,1,2-Trichloroethane	$C_2H_3Cl_3$	1
Trichloromethane	$CHCl_3$	1
Trichlorophenols	$C_6H_3OCl_3$	1
Triethylamine	$C_6H_{15}N$	1
Trimethylbenzenes	C_9H_{12}	2
Vinyl acetate	$C_4H_6O_2$	1
Respirable wood particles (except beech and oak		

Substance	Chemical formula	Class
wood particles)		
Xylenols, except 2,4-Xylenol	$C_8H_{10}O$	1
2,4-Xylenol	$C_8H_{10}O$	2
Xylenes	C_8H_{10}	2

8 Carcinogens

81 Definition

Carcinogens means those substances which are marked carcinogenic (K) in the list of limit values for exposure at the workplace[42] published by the Swiss Institute for Accident Insurance (SUVA).

82 Emission control

1 Irrespective of their contribution to the carcinogenic risk, emissions of carcinogens shall be limited as much as technology and operating conditions will allow, provided this is economically acceptable.

2 Emissions of the carcinogens listed in Figure 83 shall at least be limited so that emission concentrations do not exceed the following limit values:

a. Class 1 substances
   at a mass flow of 0.5 g/h or more 0.1 mg/m^3
b. Class 2 substances
   at a mass flow of 5 g/h or more 1 mg/m^3
c. Class 3 substances
   at a mass flow of 25 g/h or more 5 mg/m^3

3 If the exhaust gas contains several substances belonging to the same class, the limit values laid down in Paragraph 2 shall apply to the sum of these substances.

42 Source: Schweizerische Unfallversicherungsanstalt SUVA, Postfach, CH-6002 Luzern, Switzerland.

83 Table of carcinogens

Substance	Chemical formula	Class
Acrylonitrile	C_3H_3N	3
Antimony trioxide (in respirable form), expressed as Sb	Sb	2
Arsenic trioxide and arsenic pentoxide, arsenious acid and its salts, arsenic acid and its salts (in respirable form) expressed as As	As	2
Asbestos (chrysotile, crocidolite, amosite, anthophyllite, actinolite, tremolite) as fine dust		1
Benzo(a)pyrene	$C_{20}H_{12}$	1
Benzene	C_6H_6	3
Beryllium and its compounds in respirable form, expressed as Be	Be	1
Bromomethane	C_2H_7Br	3
1,3 Butadiene	C_4H_6	3
Cadmium and its compounds cadmium chloride, cadmium oxide, cadmium sulphate, cadmium sulphide, and other biological available compounds (in respirable form), expressed as Cd	Cd	1
1-Chloro-2,3-epoxypropane	C_3H_5ClO	3
α-Chlortoluene	C_7H_7Cl	3
α-Chlorotoluenes; mixtures of chlorotoluene, α, α-Drichlorotoluene, α, α, α-Trichlorotoluene and benzoyl chloride		3
Chromium(VI) compounds (in respirable form) as far as calcium chromate, chromium(III) chromate, strontium chromate and zinc chromate, expressed as Cr	Cr	2
Cobalt (in form of respirable dusts or aerosols of cobalt metal and cobalt salts of low solubility), expressed as Co	Co	2
Dibenzo(a,h)anthracene	$C_{22}H_{14}$	1
1,2-Dibromethane	$C_2H_4Br_2$	3
1,2 Dichloroethane	$C_2H_4Cl_2$	3
3,3-Dichlorobenzidine	$C_{12}H_{10}N_2Cl_2$	2
Diesel soot		3

Substance	Chemical formula	Class
Diethyl sulphate	$C_4H_{10}O_4S$	2
Dimethyl sulphate	$C_2H_6O_4S$	2
Epichlorohydrin (s. 1-Chloro-2,3-epoxy-propane)		
1,2-Epoxypropane	C_3H_6O	3
Ethyleneimine	C_2H_5N	2
Ethylene oxide	C_2H_4O	3
Hydrazine	H_4N_2	3
2-Naphthylamine	$C_{10}H_9N$	1
Nickel (in form of respirable dusts or aerosols of nickel metal, nickel sulphide and pyritiferous ores, nickel oxide and nickel carbonate, nickel tetracarbonyl), expressed as Ni	Ni	2
2-Nitrotoluene	$C_7H_7NO_2$	3
o-Toluidine	C_7H_9N	3
Trichloroethene	C_2HCl_3	3
Respirable wood particles from beech and oak		3
Vinyl chloride	C_2H_3Cl	3
N-Vinyl-2-pyrrolidone	C_6H_9NO	3

Annex 2[43]
Art. 3 Para. 2 Let. a)

Additional or different emission limit values for specific installations

Contents

43 Corrected in accordance with Fig. II of the Ordinance of 20 Nov. 1991 (AS **1992** 124), 15 Dec. 1997 (AS **1998** 223) and in accordance with Annex 2 Fig. 5 of the Ordinance on phytosanitary products of 23 June 1999, in force since 1 August 1999 (SR **916.161**).

32	Large storage tank installations
33	Installations for loading gasoline
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42	Cupolas
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44	Installations for refining non-ferrous metals
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61	Installations for coating and printing with organic substances
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71	Installations for incinerating municipal and special waste
72	Installations for incinerating waste timber, paper and similar waste

73 Installations for incinerating sulphite liquor from pulp manufacture

8 Other installations

81 Installations in which goods are treated by direct contact with furnace flue gases

82 Stationary internal combustion engines

83 Gas turbines

84 Installations for the production of particle board

85 Dry cleaning (clothes)

86 Crematoria

87 Surface treatment plants

88 Building sites

89 Tools with internal combustion engines

1 Nonmetallic minerals

11 Cement kilns and lime clinker kilns

111 Fuels and waste

1 Figure 81 shall not apply to cement kilns.

2 Waste shall only be used or treated in cement kilns if it is suitable based on the type, amount and composition of the waste. The Swiss Agency shall issue guidelines.

112 Nitrogen oxides

Emissions of nitrogen oxides (nitrogen monoxide and nitrogen dioxide), indicated as nitrogen dioxide, shall be limited as much as technology and operating conditions will allow, provided this is economically acceptable, but to at least 800 mg/m^3.

113 Sulphur oxides

Emissions of sulphur oxides, indicated as sulphur dioxide, shall not exceed 500 mg/m^3.

12 Installations for firing ceramic products using clay

121 Reference value

Emission limit values refer to an oxygen content in exhaust gas of 18 percent (%vol).

122 Fluorine compounds

1 The emission limit values for fluorine compounds laid down in Annex 1 Figure 5 and 6 shall not apply.

2 Emissions of fluorine compounds, indicated as hydrogen fluoride, shall not exceed 250 g/h.

123 Nitrogen oxides

Emissions of nitrogen oxides (nitrogen monoxide and nitrogen dioxide), indicated as nitrogen dioxide, shall be limited as much as technology and operating conditions will allow, provided this is economically acceptable, at a mass flow of 2000 g/h or more, but at least to 150 mg/m^3.

124 Organic substances

1 The emission limit values laid down in Annex 1 Figure 7 shall not apply.

2 Emissions of gaseous and vaporous organic substances shall be indicated as total carbon and shall not exceed 100 mg/m^3.

125 Relation to Figure 81

The provisions of Figure 81 shall apply.

13 Installations for the production of glass

131 Scope

The provisions of this Figure shall apply to installations which produce more than 2 tonnes of glass per year.

132 Reference value

Emission limit values refer to the following oxygen contents in the flue gas:

a. for flame-heated glass melting furnaces: 8 percent (%vol)
b. for flame-heated pot furnaces: 13 percent (%vol)

133 Nitrogen oxides

1 The emission limit values for nitrogen oxides laid down in Annex 1 Figure 6 shall not apply.

2 Emissions of nitrogen oxides (nitrogen monoxide and nitrogen dioxide), indicated as nitrogen dioxide, shall be limited as much as technology and operating conditions will allow, provided this is economically acceptable, but at least so that they do not exceed the following limit values:

a. container glassware: 2.5 kg per tonne of glass produced
b. other glass: 6.5 kg per tonne of glass produced

134 Dust

1 The emission limit values for total dust laid down in Annex 1 Figure 41 shall not apply.

2 Dust emissions shall not exceed a total of 0.4 kg per tonne of glass produced.

135 Sulphur oxides

Emissions of sulphur oxides from the raw material, indicated as sulphur dioxide, shall not exceed 500 mg/m^3.

136 Relation to Figure 81

The provisions of Figure 81 shall apply.

2 Chemistry

21 Installations for the production of sulphuric acid

211 Scope

The provisions of this Figure shall apply to installations for the production of sulphur dioxide, sulphur trioxide, sulphuric acid and oleum.

212 Sulphur dioxide

1 The emission limit values for sulphur dioxide laid down in Annex 1 Figure 6 shall not apply.

2 Emissions of sulphur dioxide shall not exceed 2.6 kg per tonne of 100 percent sulphuric acid.

213 Sulphur trioxide

Emissions of sulphur trioxide shall not exceed 60 mg/m^3 under constant gas conditions, or 120 mg/m^3 in all other cases.

22 Installations using the Claus method

221 Sulphur

The sulphur emission factor shall not exceed the following limit values:

For installations with a production capacity of	limit value as percent (% mass)
less than 20 t/day	3.0
20-50 t/day	2.0
more than 50 t/day	0.5

222 Hydrogen sulphide

1 The flue gases shall be fed through an afterburning system.

2 Emissions of hydrogen sulphide shall not exceed 10 mg/m^3.

23 Installations for the production of chlorine

231 Chlorine

1 Emissions of chlorine shall not exceed 3 mg/m^3.

2 In the case of installations for the production of chlorine with complete liquefaction, emissions of chlorine shall not exceed 6 mg/m^3.

232 Mercury

If the alkali chloride electrolysis of the mercury-cell method is used, mercury emissions shall not exceed an annual average of 1.5 g per tonne of installed chlorine capacity.

24 Installations for the production of 1,2-dichloroethane and vinyl chloride

1 The exhaust gas shall be fed to an exhaust gas purification system.

2 The emission limit values for 1,2-dichloroethane and vinyl chloride laid down in Annex 1 shall apply irrespective of the mass flows prescribed there.

25 ...

26 Production and packing of phytosanitary products

1 Anyone who produces or packs phytosanitary products must inform the cantonal environmental protection agency.

2 The authorities shall lay down the preventive emission limit values for total dust in accordance with Article 4; Annex 1 Figure 41 shall not apply.

27 Installations for producing carbon-black

Particles emissions shall not exceed a total of 20 mg/m^3.

28 Installations for producing carbon (hard-burnt carbon) or electrographite

281 Organic substances

1 Emissions of organic substances, expressed as total carbon, shall not exceed the emission limit values laid down in Figures 282-284.

2 The emission limit values laid down in Annex 1 Figure 7 shall not apply.

282 Mixing and shaping

Emissions of organic substances in the exhaust gas of mixing and shaping installations in which pitch, tar or other volatile binding agents or flow promoters are processed at increased temperature shall not exceed 100 mg/m^3.

283 Burning

1 Emissions of organic substances in the exhaust gas of single chamber furnaces, compound chamber furnaces and tunnel furnaces shall not exceed 50 mg/m^3.

2 Emissions of gaseous organic substances in the exhaust gas of ring furnaces for graphite electrodes, carbon electrodes and carbon bricks shall not exceed 200 mg/m^3.

284 Impregnating

Emissions of organic substances in the exhaust gas of impregnating installations which use tar-based impregnating agents shall not exceed 50 mg/m^3.

285 Relation to Figure 81

The provisions laid down in Figure 81 shall also apply in the case of installations in which goods are treated by direct contact with furnace flue gases.

3 Mineral oil industry

31 Refineries

311 Definition and scope

The provisions of this Figure shall apply to installations for the destillation or refining of mineral oil and mineral oil products and to other installations for producing hydrocarbons.

312 Refinery furnaces

312.1 Reference values

1 The emission limit values refer to an oxygen content in the flue gas of 3 percent (%vol).

2 The requirements for the emission limitation of refinery furnaces shall be determined by the total heat input of the refinery.

312.2 Sulphur oxides

Emissions of sulphur oxides, indicated as sulphur dioxide, shall not exceed the following emission concentrations:

a. with a heat input up to 300 MW: 350 mg/m^3

b. with a heat input of more than 300 MW: 100 mg/m^3

312.3 Nitrogen oxides

Emissions of nitrogen oxides (nitrogen monoxide and nitrogen dioxide), indicated as nitrogen dioxide, shall not exceed 300 mg/m^3.

313 Storage

1 Floating-roof tanks, fixed-roof tanks with floating cover, fixed-roof tanks with connections to the refinery gas line or equivalent measures shall be provided for the storage of crude oils and refining products which have a vapour pressure of more than 13 mbar at a temperature of 20 °C. Floating-roof tanks shall be equipped with an effective seal.

2 Fixed-roof tanks shall be equipped with forced ventilation and the gases produced shall be fed to the gas collecting or afterburning system if:

a. liquids are stored which may emit Class 1 substances as laid down in Annex 1 Figure 7 or substances laid down in Annex 1 Figure 8 under storage conditions, and
b. the expected emissions exceed the mass flows given in Annex 1.

314 Other emission sources

1 Organic gases and vapours which are emitted shall be collected using a gas collecting system. They shall be reused, fed to a gas purification system or afterburning or burnt off. This provision shall apply in particular to:

a. pressure relief fittings and blow-down systems;
b. process plants;
c. regeneration of catalysts;
d. inspection and cleaning;
e. start up and shut down processes;
f. decanting of raw materials, intermediate products and finished products which have a vapour pressure of more than 13 mbar at a temperature of 20 °C.

2 Relief fittings in case of disaster and fire must not be fed into a gas collecting system.

315 Hydrogen sulphide

1 Gases produced by desulphurisation installations and other sources shall be further processed if they also fulfil the following conditions:

a. volume content of hydrogen sulphide: over 0.4 percent
b. mass flow of hydrogen sulphide: over 2 t/day

2 Emissions of hydrogen sulphide in gases which are not further processed shall not exceed 10 mg/m^3.

316 Processing water and ballast water

1 Processing water or excess ballast water must be degassed before it is fed into an open system.

2 The exhaust gases produced shall be purified by scrubbing or combustion.

32 Large storage tank installations

321 Definition and scope

The provisions of this Figure shall apply to large storage tank installations with a capacity of more than 500 m^3 per tank, which are intended for the storage of products with a vapour pressure of more than 1 mbar at a temperature of 20 °C.

322 Storage

Fixed-roof tanks with floating cover, floating-roof tanks equipped with effective seals or other equivalent measures to reduce emissions shall be provided for storage.

33 Installations for loading gasoline

1 The filling of road tankers, tank wagons or similar transport containers with motor or aircraft fuel must be carried out from below or by equivalent measures to reduce emissions.

2 The emission limit values laid down in Annex 1 Figure 7 and 8 shall not apply to petrol stations.

3 Petrol stations shall be equipped and operated in such a way that:

a. the organic gases and vapours displaced during delivery at the petrol station are collected and fed back into the transport container (vapour recovery); the vapour recovery system and the connected installations shall not have any opening to the air during vapour recovery under normal operating conditions;
b. when filling vehicles with standardised tank filler pipes[44] no more than 10 percent of the organic substances contained in the displacement air shall be emitted; this requirement shall be deemed to be fulfilled if an official specialist agency has appropriate measuring results and if the vapour recovery system is properly installed and operated.

4 The provisions of Paragraph 3 Letter b shall not apply when using small filling devices.

4 Metals

41 Foundries

411 Amines

Emissions of amines arising during core making shall not exceed 5 mg/m^3.

412 Relation to Figure 81

The provisions laid down in Figure 81 shall also apply in the case of installations in which goods are treated by direct contact with furnace flue gases.

42 Cupolas

421 Particles

1 The emission limit values for total dust laid down in Annex 1 Figure 41 shall not apply.

2 Total particles emissions shall not exceed the following limit values per tonne of molten iron:

---

[44] US Standard SAE 1140
Source: SAE European Office, 27-29 Knowl Piece, Wilbury Way, Hitchin, Herts SG4 OSX, England.

For installations with a smelting power of	Limit values
less than 4 t/h	150 g/t
4-8 t/h	120 g/t
more than 8 t/h	90 g/t

422 Carbon monoxide

Emissions of carbon monoxide in the flue gas shall not exceed 1000 mg/m^3 for hot-blast furnaces with secondary self-heated recuperator.

423 Relation to Figure 81

The provisions laid down in Figure 81 shall apply.

43 Aluminium smelters

431 Fluorine compounds

1 The emission limit valuess for fluorine compounds laid down in Annex 1 Figures 5 and 6 shall not apply.

2 Emissions of fluorine compounds, indicated as hydrogen fluoride, shall not exceed a total of 700 g per tonne of aluminium produced.

3 Emissions of gaseous fluorine compounds, indicated as hydrogen fluoride, shall not exceed 250 g per tonne of aluminium produced.

432 Assessment of emissions

For comparison with the emission limit values the measured emissions shall be averaged over an operating period of one month.

44 Installations for refining non-ferrous metals

441 Organic substances

1 The emission limit values laid down in Annex 1 Figure 7 shall not apply.

2 Emissions of organic substances, indicated as total carbon, shall not exceed 50 mg/m^3.

442 Relation to Figure 81

The provisions laid down in Figure 81 shall also apply in the case of installations in which goods are treated by direct contact with furnace flue gases.

45 Galvanising installations

451 Particles

Particles emissions shall not exceed a total of 10 mg/m^3.

452 Additional provisions for hot-galvanising installations

1 The emission limit values refer to a volume of exhaust air of 3000 m^3 per square metre of zinc bath surface area and per hour.

2 At least 80 percent of emissions from the zinc bath shall be collected by a housing, hood, side suction system or by similar measures.

3 Emissions shall only be measured during dipping. The dipping period begins with the first and ends with the last contact of the product to be galvanised with the galvanising bath.

46 Installations for the production of lead accumulators

461 Lead

1 The exhaust gases from the installations shall be collected and fed to a dust separation system.

2 Emissions of lead shall not exceed 1 mg/m^3.

462 Sulphuric acid fumes

1 Sulphuric acid fumes, which arise during forming, shall be collected and fed to a exhaust gas purification system.

2 Emissions of sulphuric acid, indicated as H_2SO_4, shall not exceed 1 mg/m^3.

463 Relation to Figure 81

The provisions laid down in Figure 81 shall also apply in the case of installations in which goods are treated by direct contact with furnace flue gases.

47 Heating furnaces and heat treatment furnaces

471 Scope

The provisions of this Figure shall apply to heating furnaces and heat treatment furnaces with a heat input of more than 100 kW, which are heated by means of gas fuels as laid down in Annex 5 Figure 4 Letters a-c.

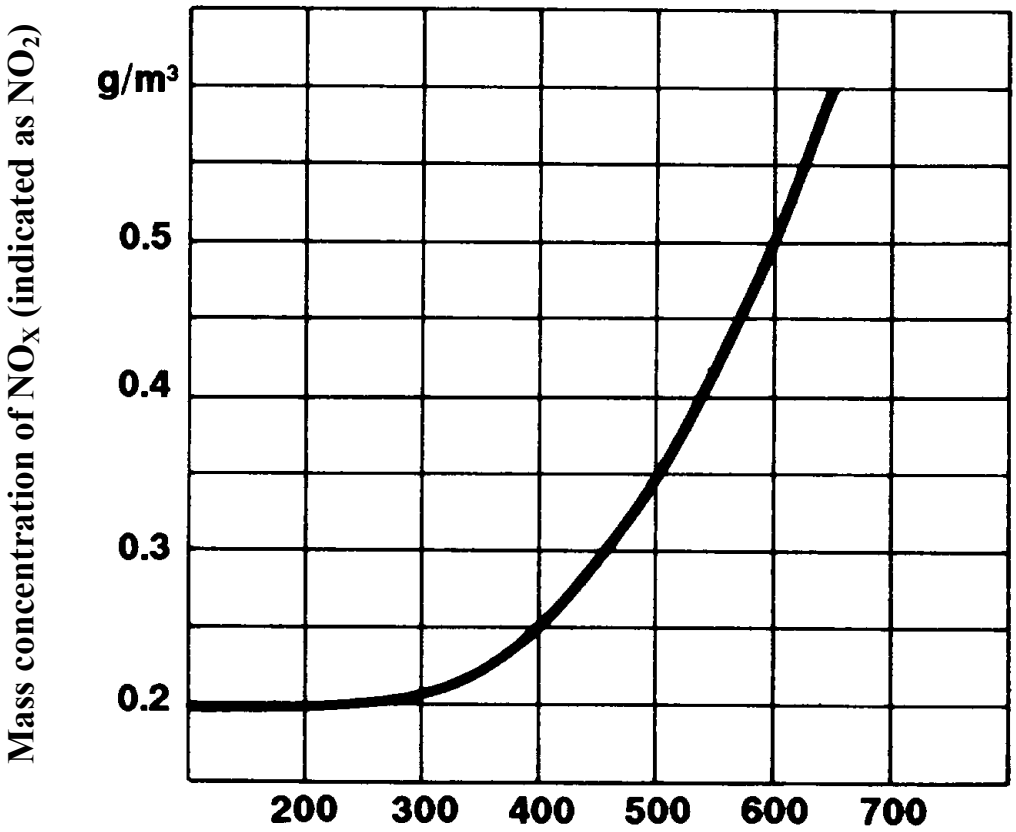
472 Reference value

The emission limit values refer to an oxygen content in the flue gas of 5 percent (%vol).

473 Nitrogen oxides

Emissions of nitrogen oxides, indicated as nitrogen dioxide, shall not exceed the limit values laid down in the diagram below.

Diagram:



474 Measurements

Emissions shall be measured with a rated load of at least 80 percent and at the highest operating temperature.

475 Relation to Figure 81

The provisions of Figure 81 shall apply.

5 Agriculture and foodstuffs

51 Stock rearing

511 Scope

The provisions of this Figure shall apply to installations for traditional stock rearing and intensive stock rearing.

512 Minimum distance

1 With construction of installations the required minimum distances to residential areas laid down according to the recognised rules of stock rearing shall be observed. These include, in particular, the recommendations of the Federal Research Station for Farm Management and Agricultural Engineering.[45]

2 The minimum distances may be reduced if the strong-smelling waste air is purified.

513 Ventilating systems

Ventilating systems must conform to the recognised rules of ventilating technology. These include, in particular, the recommendations of the Swiss Standard on Livestock Housing Conditions.[46]

52 Smoking installations

521 Scope

The provisions of this Figure shall apply to installations for smoking meat, sausages and fish.

522 Smoke production

Figure 81 shall not apply.

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45 Source: Eidg. Forschungsanstalt für Agrarwirtschaft und Landtechnik, CH-8355 Tänikon, Switzerland.

46 Source: Institut für Nutztierwissenschaften, ETH-Zentrum, CH-8092 Zürich, Switzerland.

523 Organic substances

1 The emission limit values laid down in Annex 1 Figure 7 shall not apply.

2 Emissions of organic substances shall be indicated as total carbon. They shall not exceed the following limit values:

a. during hot smoking
   at a mass flow of 50 g/h or more: 50 mg/m^3
b. during cold smoking
   at a mass flow of 50 g/h to 300 g/h: 120 mg/m^3
c. during cold smoking
   at a mass flow of over 300 g/h: 50 mg/m^3

53 Installations for processing animal carcasses and drying manure

531 Definition and scope

The provisions of this Figure shall apply to:

a. animal carcass processing installations.
b. installations where animal carcasses, parts of animal carcasses, and products of animal origin are collected and stored for use or disposal in animal carcass processing installations;
c. installations for melting animal fats;
d. installations for producing gelatine, haemoglobin and animal fodder;
e. installations for drying manure.

532 Constructional and operational requirements

1 Processing installations and storage sites where odours may develop shall be accomodated in closed rooms.

2 Strong-smelling exhaust gases shall be collected and fed to an exhaust gas purification system.

3 Raw and intermediate products shall be stored in sealed containers.

533 Relation to Figure 81

The provisions laid down in Figure 81 shall also apply in the case of installations in which goods are treated by direct contact with furnace flue gases.

54 Installations for drying green fodder

541 Scope

The provisions of this Figure shall apply to installations in which grass, maize and similar green fodder, rape, potatoes and sugar-beet chips are dried.

542 Particles

Particles emissions shall be limited as much as technology and operating conditions will allow, provided this is economically acceptable, but to at least 150 mg/m^3.

543 Relation to Figure 81

The provisions laid down in Figure 81 shall also apply in the case of installations in which goods are treated by direct contact with furnace flue gases.

55 ...

56 Installations for roasting coffee and cocoa

561 Organic substances

1 The emission limit values laid down in Annex 1 Figure 7 shall not apply.

2 Emissions of gaseous and vaporous organic substances shall be indicated as total carbon. In the case of installations with a roasting capacity of more than 100 kg of raw product per hour, they shall not exceed the following limit values:

a. installations with a roasting capacity up to 750 kg/h: 150 mg/m^3
b. installations with a roasting capacity of more than 750 kg/h: 50 mg/m^3

562 Relation to Figure 81

The provisions laid down in Figure 81 shall also apply in the case of installations in which goods are treated by direct contact with furnace flue gases.

6 Coating and printing

61 Installations for coating and printing with organic substances

611 Scope

1 The provisions of this Figure shall apply to:

a. installations for coating and printing surfaces with organic substances such as paints, varnishes or plastics;
b. installations for impregnating.

2 They shall apply both to the application and evaporation areas and to the attached drying and stoving installations.

612 Particles

Total particles emissions shall not exceed the following limit values:

a. during spray painting: 5 mg/m^3
b. during powder coating: 15 mg/m^3

613 Solvent emissions

1 The emission limit values laid down in Annex 1 Figure 71 shall not apply to gaseous and vaporous organic emissions of Class 2 and Class 3 substances as laid down in Annex 1 Figure 72.

2 These emissions shall be indicated as total carbon and at a mass flow of 3 kg/h or more shall not exceed a total of 150 mg/m^3.

3 If paints are used which, in addition to water, exclusively contain less than 15 percent ethanol (%mass) as solvent, emissions of ethanol shall not exceed 300 mg/m^3 at a mass flow of 3 kg/h or more.

614 Exhaust gases from drying and stoving installations

1 The emission limit values laid down in Annex 1 Figure 7 shall not apply to drying and stoving installations in which drying or stoving is carried out at temperatures of more than 120 °C.

2 Emissions of gaseous and vaporous organic substances shall be indicated as total carbon and at a mass flow of more than 250 g/h shall not exceed the following limit values:

a. rotary offset printing installation: 20 mg/m^3
b. all other installations: 50 mg/m^3

615 Relation to Figure 81

The provisions laid down in Figure 81 shall also apply in the case of installations in which goods are treated by direct contact with furnace flue gases.

7 Waste

71 Installations for incinerating municipal and special waste

711 Scope and definitions

1 The provisions of this Figure shall apply to installations in which municipal or special waste is incinerated or decomposed by heat. Excepted are installations for incinerating waste timber, paper and similar waste (Fig. 72) and sulphite liquor from pulp manufacture (Fig. 73) and cement kilns (Fig. 11).

2 Municipal waste means waste from households and other waste of similar composition. It includes in particular:

a. garden rubbish;
b. market waste;
c. road sweepings;
d. office waste, packaging and kitchen waste from the catering industry;
e. treated municipal waste;
f. animal carcasses and meat waste;
g. sludge from municipal sewage treatment plants;
h. gases from waste as defined in Annex 5 Figure 41 Paragraph 2;
i. waste as defined in Annex 5 Figure 3 Paragraph 2 Letter b.

3 Special waste means waste listed in the Ordinance of 12 November 1986[47] on the Movement of Special Waste (OMSS).

712 Relation to Annex 1

1 The emission limit values laid down in Annex 1 Figure 7 shall not apply.

2 Where emission limit values laid down in Annex 1 are valid, they shall apply irrespective of the prescribed mass flows.

713 Reference value and assessment of emissions

1 The emission limit values refer to the following oxygen contents in the flue gas:

a. plants for incinerating liquid waste: 3 percent (%vol)
b. plants for incinerating gases from waste alone or together with liquid waste: 3 percent (%vol)
c. plants for incinerating solid waste alone or together with liquid waste or gases from waste: 11 percent (%vol)

2 The levels obtained shall be averaged over an operating period of several hours for the assessment of emissions.

714 Emission limit values

1 Emissions shall not exceed the following limit values:

a. particles: 10 mg/m^3
b. lead and zinc and their compounds, indicated as metals, as sum total: 1 mg/m^3
c. mercury and cadmium and their compounds, indicated as metals, each one: 0.1 mg/m^3
d. sulphur oxides, indicated as sulphur dioxide: 50 mg/m^3
e. nitrogen oxides (nitrogen monoxide and nitrogen dioxide), indicated as nitrogen dioxide, at a mass flow of 2.5 kg/h and more: 80 mg/m^3
f. gaseous inorganic chlorine compounds, indicated as hydrogen chloride: 20 mg/m^3

47 SR **814.610**

g. gaseous inorganic fluorine compounds, indicated as hydrogen fluoride: 2 mg/m^3
h. ammonia and ammonium compounds, indicated as ammonia: 5 mg/m^3
i. gaseous organic substances, indicated as total carbon: 20 mg/m^3
k. carbon monoxide: 50 mg/m^3

2 In the case of installations with 1000 mg/m^3 of nitrogen oxides (nitrogen monoxide and nitrogen dioxide) or more in the crude gas, the authorities may lay down a less strict emission limit value for ammonia and ammonium compounds, notwithstanding Paragraph 1 Letter h.

715 ...

716 Monitoring

1 The following shall be continuously measured and recorded:

a. the temperature of the flue gases around the incineration zone and in the stack;
b. the oxygen content of the flue gases after they leave the incineration zone;
c. the carbon monoxide content of the flue gases.

2 Operation of the flue gas purification system shall be continuously monitored by measuring an emission character or an appropriate operating character such as temperature of flue gas, pressure drop or water flow rate of the flue gas scrubber.

717 Storage

Strong-smelling waste and waste which develops dangerous fumes shall be stored in closed bunkers, rooms or tank installations. The exhaust air shall be extracted and purified.

718 Prohibition to incinerate waste in small installations

1 Municipal and special waste shall not be incinerated in installations with a heat input of less than 350 kW.

2 The prohibition shall not apply to special waste from hospitals which, due to its composition, cannot be disposed of as municipal waste.

719 Incineration of waste which is especially hazardous to the environment

1 Owners of installations which may give off emissions which are especially hazardous to the environment shall determine the expected emissions by preliminary tests using small amounts of waste and shall inform the authorities of the result before waste is incinerated.

2 Emissions which are especially hazardous to the environment means emissions which are both highly toxic and not readily degradable such as polyhalogenated aromatic hydrocarbons.

72 Installations for incinerating waste timber, paper and similar waste

721 Scope

1 The provisions of this Figure shall apply to installations in which waste made up of the following types of substances alone or together with wood fuels as described in Annex 5 is incinerated or decomposed by heat:

a. waste timber as described in Annex 5 Figure 3 Paragraph 2 Letter a;
b. paper and cardboard;
c. other waste which when incinerated gives off similar emissions as waste listed under Letters a and b.

2 The provisions laid down in Figure 71 shall apply if such wastes as defined in Figure 721 Paragraph 1 are incinerated together with wastes as defined in Figure 711.

3 The provisions of this Figure shall not apply to cement kilns (Fig. 11).

722 Reference value

The emission limit values refer to an oxygen content in the flue gas of 11 percent (%vol).

723 Particles

Particles emissions shall not exceed 50 mg/m^3.

724 Lead and zinc

Emissions of lead and zinc together shall not exceed 5 mg/m^3.

725 Organic substances

1 The emission limit values laid down in Annex 1 Figure 7 shall not apply.

2 Emissions of gaseous organic substances, indicated as total carbon, shall not exceed 50 mg/m^3.

726 Carbon monoxide

Emissions of carbon monoxide shall not exceed 250 mg/m^3.

727 Incineration control

The installation shall be operated with an automatic control for the furnace.

728 Prohibition to incinerate waste in small installations

Waste as described in Figure 721 shall not be incinerated in installations with a heat input of less than 350 kW.

73 Installations for incinerating sulphite liquor from pulp manufacture

731 Sulphur oxides

1 The emission limit values for sulphur oxides laid down in Annex 1 Figure 6 shall not apply.

2 Emissions of sulphur oxides, indicated as sulphur dioxide, shall not exceed 4.0 kg per tonne of liquor incinerated.

732 Assessment of emissions

For comparison with the emission limit values, the measured emissions shall be averaged over an operating period of 24 hours.

8 Other installations

81 Installations in which goods are treated by direct contact with furnace flue gases

1 Only fuels described in Annex 5 shall be used.

2 Annex 1 Figure 6 shall not apply to emissions of sulphur oxides from the fuel. If quality B fuels are used, emissions of sulphur oxides indicated as sulphur dioxide, shall be limited to such an extent that they are no higher than the unreduced emissions from the use of corresponding quality A fuels.

3 Annex 1 Figure 6 shall apply to emissions of sulphur oxides from the treated goods.

82 Stationary internal combustion engines

821 Reference value

The emission limit values refer to an oxygen content in the exhaust gas of 5 percent (%vol).

822 Fuels

Stationary internal combustion engines shall only be run on fuels described in Annex 5.

823 Particles

Particles emissions shall not exceed 50 mg/m^3.

824 Nitrogen oxides and carbon monoxide

1 Emissions from stationary internal combustion engines with a fuel input of more than 100 kW shall not exceed the following limit values:

a. carbon monoxide: 650 mg/m^3

b. nitrogen oxides (nitrogen monoxide and nitrogen dioxide), indicated as nitrogen dioxide:

   1. when running on gas fuels as described in Annex 5 Figure 41 Letter d and e and when running on these fuels at least 80% of the yearly operation time: 400 mg/m^3
   2. when running on other fuels: 250 mg/m^3

2 For internal combustion engines of emergency power-generating sets, which are operated for no more than 50 hours during the year, the authorities shall take preventive measures to limit the emissions according to Art. 4; Paragraph 1 and Annex 1 shall not apply.

825 Test benches

For test benches used to test internal combustion engines, the authorities shall take preventive measures to limit the emissions according to Art. 4; Annex 1 and Annex 2 Figures 821 - 824 shall not apply.

83 Gas turbines

831 Reference value

The emission limit values refer to nominal heat input and an oxygen content in the exhaust gas of 15 percent (%vol).

832 Fuels

Gas turbines shall only be run on fuels described in Annex 5.

833 Soot number

Emissions of soot shall not exceed the following soot numbers (Annex 1 Fig. 22):

a. with a heat input up to 20 MW: soot number 4
b. with a heat input over 20 MW: soot number 2

834 Carbon monoxide

Emissions of carbon monoxide shall not exceed the following limit values:

a. with a heat input up to 40 MW: 240 mg/m^3
b. with a heat input over 40 MW: 120 mg/m^3

835 Sulphur oxides

Emissions of sulphur oxides, indicated as sulphur dioxide, shall not exceed 120 mg/m^3 at a mass flow of 2.5 kg/h or more.

836 Nitrogen oxides

Emissions of nitrogen oxides (nitrogen monoxide and nitrogen dioxide), indicated as nitrogen dioxide, shall not exceed the following limit values:

a. with a heat input up to 40 MW:
   1. when running on gas fuels as described in Annex 5 Figure 41 Letter d and e and when running on these fuels at least 80% of the yearly operation time: 150 mg/m^3
   2. when running on other fuels: 120 mg/m^3

b. with a heat input over 40 MW:
   1. when running on gas fuels as described in Annex 5 Figure 41: 50 mg/m^3
   2. when running on other fuels: 120 mg/m^3

837 Test benches and emergency power-generating sets

1 For test benches used to test gas turbines, the authorities shall take preventive measures to limit the emissions according to Art. 4; Annex 1 and Annex 2 Figures 831 - 836 shall not apply.

2 For gas turbines of emergency power-generating sets, which are operated for no more than 50 hours during the year, the authorities shall take preventive measures to limit the emissions according to Art. 4; Annex 1 and Annex 2 Figures 833, 834 and 836 shall not apply.

84 Installations for the production of particle board

841 Scope

The provisions of this Figure shall apply to installations in which particle board is produced using the dry method.

842 Particles

Particles emissions shall not exceed the following limit values:

a. in the flue gas of chip driers: 50 mg/m^3
b. in flue gases of grinding machines: 10 mg/m^3

843 Organic substances

1 The emission limit values laid down in Annex 1 Figure 7 shall not apply.

2 Emissions of gaseous and vaporous organic substances, measured at a temperature of 150 °C, shall be indicated as total carbon.

3 These emissions shall be limited as much as technology and operating conditions will allow, provided this is economically acceptable, but to at least 350 g per tonne of wood used (absolutely dry).

844 Relation to Figure 81

The provisions of Figure 81 shall also apply in the case of installations in which goods are treated by direct contact with furnace flue gases.

85 Dry cleaning (clothes)

1 The provisions of this Figure shall apply to dry cleaning installations which are operated using halogenated hydrocarbons.

2 The loading door of a dry cleaning machine shall remain locked by means of an automatic safety system until the concentration of gaseous and vaporous organic substances in the machine air falls below 2 g/m^3.

3 The concentration laid down in Paragraph 1 which determines the locking shall be continuously measured inside the machine around the loading door.

4 The items for cleaning shall reach a minimum temperature of 35 °C before being taken out of the machine.

5 If the exhaust gas is extracted from the machine, it shall be purified by means of an activated carbon filter or by equivalent measures.

6 The air in the room shall be extracted so that the operating areas are always kept below atmospheric pressure.

86 Crematoria

861 Organic substances

1 The emission limit values laid down in Annex 1 Figure 7 shall not apply.

2 Emissions of gaseous and vaporous organic substances, indicated as total carbon, shall not exceed 20 mg/m^3.

862 Carbon monoxide

Emissions of carbon monoxide shall not exceed 50 mg/m^3.

87 Surface treatment plants

1 The provisions of this Figure shall apply to installations in which the surface of articles and products made of metal, glass, ceramics, plastic, rubber or other substances are treated with halogenated hydrocarbons, which at a pressure of 1013 mbar have a boiling point lower than 150 °C.

2 Surface treatment plants shall be equipped and operated as follows:

a. Articles and products must be treated in a chamber which is closed except for openings used to extract exhaust gases.
b. An automatic locking system must ensure that articles and products cannot be removed until the concentration of halogenated hydrocarbons reaches 1 g/m^3 or less in the removal area.
c. Extracted exhaust gases must be cleaned in an separator. During the process, emissions of halogenated hydrocarbons laid down in Annex 1 Figure 72 shall not exceed a mass flow of 100 g/h and emissions of halogenated hydrocarbons laid down in Annex 1 Figure 83 shall not exceed a mass flow of 25 g/h. The emission limit values laid down in Annex 1 Figure 7 and 8 shall not apply.
d. If halogenated hydrocarbons are put into or taken out of the plant, emissions must be reduced with a vapour recovery system or equivalent measures.

3 If a plant is unable to meet the requirements laid down in paragraph 2, letters a and b because the treated articles and products are bulky, emissions shall be reduced as much as technology and operational conditions will allow provided this is economically acceptable, by measures such as encapsulation, sealing, separation from the plant exhaust gas, airlocks or extraction.

88 Building sites

1 Emissions from building sites shall be limited as much as technology and operational conditions will allow, provided this is economically acceptable, particularly by means of emission limit values for the machines and equipment used and appropriate working methods. Account shall be taken of the type, size and location of the building site and the time of building work . The Swiss Agency shall issue guidelines.

2 The emission limit values laid down in Annex 1 shall not apply to construction plant and building sites.

89 Tools with internal combustion engines

1 Emissions from tools such as chain saws and lawn mowers shall be limited as much as technology and operational conditions will allow, provided this is economically acceptable, particularly by means of engine design measures, the use of appropriate motor fuels and exhaust gas treatment measures. The Swiss Agency shall issue guidelines.

2 The emission limit values laid down in Annex 1 shall not apply.

Annex 3[48]
(Art. 3 Para. 2 Let. b)

Additional or different emission limit values for combustion installations

1 Scope

1 The provisions of this Annex shall apply to combustion installations which are used for the following purposes:

a. to heat buildings;
b. to produce industrial heat;
c. to produce warm or hot water;
d. to produce steam.

2 They shall not apply to combustion installations in which goods are treated by direct contact with furnace flue gases.

2 General provisions

21 Fuels

The combustion installations listed in Figure 1 shall only be run on fuels as defined in Annex 5.

22 Control of combustion installations

1 The following combustion installations must not be controlled periodically in accordance with Article 13 Paragraph 3:

a. combustion installations which are operated for less than 100 hours in a calendar year;
b. combustion installations with a heat input of less than 12 kW, which are used solely to heat individual rooms;
c. continuous flow heaters for heating drinking water with a heat input of less than 35 kW;

48 Wording in accordance with Fig. II of the Ordinance of 20 Nov. 1991 (AS **1992** 124) and 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).

d. directly fired water storage heaters containing less than 30 litres of water, which are used solely to heat water;
e. coal combustion installations with a heat input of less than 70 kW;
f. wood combustion installations with a heat input of less than 70 kW, provided they are run solely on pure wood in its natural state in accordance with Annex 5 Figure 3 Paragraph 1 Letter a or b.

2 Nitrogen oxide emissions from installations with a heat input of 350 kW or less need not be measured periodically.

23 Measurement and assessment of emissions

1 Emissions from each combustion installation shall be measured in the stationary state and in the heat input ranges which are significant for assessment. These shall generally be at least the highest and lowest heat input point at which the installation is operated under normal operating conditions.

2 Particles emissions shall be measured and assessed over half an hour in the case of installations which are operated with soot blowers or similar cleaning processes. The measurement must include the cleaning phase.

24 Marking

Installations which are subject to type-approval as laid down in Article 20 must be fitted with a type-approval plate in a clearly visible place which contains at least the information laid down in Annex 4 Figure 8.

3 Special provisions for combustion installations made up of several individual installations

1 If several individual installations form a single operating unit, then the heat input (Ann. 1 Fig. 24) of the whole operating unit (total heat input) shall determine the emission limit values for each individual installation.

2 The total heat input means the sum of the heat inputs of all the individual installations which make up the operating unit.

3 The following shall be exceptions to Paragraphs 1 and 2:

a. individual installations with a heat input of up to 1 MW, provided one or several other individual installations which make up the operating unit are run on the same fuels;
b. individual installations with a heat input of up to 5 MW, provided no other individual installations which make up the operating unit are run on the same fuel.

4 Oil combustion installations

41 Combustion installations run on "extra light" fuel oil

411 Emission limit values

1 Emissions from combustion installations which are run on "extra light" fuel oil shall not exceed the following limit values:

Combustion installations run on "extra light" fuel oil	
Reference value: The limit values for the gaseous pollutants refer to an oxygen content in the flue gas of	3 %vol
Soot number a. installations with forced draught burners b. installations with vaporisation burners	 1 2
Carbon monoxide (CO) a. installations with forced draught burners b. installations with vaporisation burners fitted with a ventilator	 80 mg/m^3 150 mg/m^3
Nitrogen oxides (NO_X), indicated as nitrogen dioxide (NO_2) a. for installations listed in Article 20 b. for installations with a heat input of over 350 kW: with a temperature of the heat carrier fluid of up to 110 °C with a temperature of the heat carrier fluid of over 110 °C	 120 mg/m^3 120 mg/m^3 150 mg/m^3
Ammonia and ammonium compounds, indicated as ammonia[1)]	30 mg/m^3

[1)] *Note:* This emission limit value is only important for combustion installations fitted with a denitrification system.

2 Emissions of sulphur oxides shall be limited by the sulphur content limit value laid down in Annex 5 Figure 11. The emission limit values laid down in Annex 1 Figure 6 for sulphur oxides shall not apply.

412 Additional provisions for nitrogen oxide emissions

1 The limit values for nitrogen oxides shall only apply to the following installations if they were marketed after 31 December 1992:

a. installations listed in Article 20;
b. installations with a heat input of between 350 kW and 1 MW.

2 The authorities may lay down less stringent limit values in the case of com- bustion installations where the temperature of the heat carrier fluid is over 150 °C and where the limit value for nitrogen oxides of 150 mg/m^3 laid down in Figure 411 cannot be complied with because technology and operating conditions do not allow or because it is economically unacceptable. However, emissions of nitrogen oxides, given as nitrogen dioxide, shall not exceed 250 mg/m^3.

3 The emission limit values for nitrogen oxides refer to a content of organically-bound nitrogen in the fuel of 140 mg/kg. In the case of a higher nitrogen content, emissions of nitrogen oxides, indicated as nitrogen dioxide, may be 0.2 mg/m^3 higher per 1 mg nitrogen in the fuel; in the case of a lower nitrogen content, emissions of nitrogen oxides, indicated as nitrogen dioxide, must be 0.2 mg/m^3 lower per 1 mg nitrogen in the fuel.

413 Partially burned oil fractions

1 No partially burned oil fractions shall occur in the flue gases of combustion installations run on "extra light" fuel oil.

2 The flue gases shall generally be deemed to be free of partially burned oil fractions if the limit values for carbon monoxide laid down in Figure 411 are complied with during the periodic control. In the case of odour emissions, the authorities may carry out an additional oil test with solvents.

414 Energy requirements

1 The flue gas losses from heating boilers with forced draught burners shall not exceed the following limit values:

a.	with single stage burner operation:	7 percent
b.	with two-stage burner operation	
	1. during operation of first burner stage:	6 percent
	2. during operation of second burner stage:	8 percent

2 In the case of heating boilers with oil vaporisation burners, the limit value indicated on the type-approval plate for the permitted flue gas losses shall not be exceeded.

3 The limit values for flue gas losses laid down in Paragraphs 1 and 2 shall apply to installations which are marketed after 31 December 1992.

4 The authorities may lay down less stringent limit values in the case of heating boilers where the temperature of the heat carrier fluid is over 110 °C and where the requirements laid down in Paragraph 1 cannot be complied with because technology and operating conditions do not allow or because it is economically unacceptable.

5 In the case of heating boilers with forced draught burners where the temperature of the water is no more than 110 °C and which are marketed before 1 January 1993, the flue gas losses shall not exceed the following limit values:

a. installations with a heat input of up to 70 kW: 10 percent
b. installations with a heat input of over 70 kW: 9 percent

42 Combustion installations run on "medium" and "heavy" fuel oil

421 Emission limit values

1 Emissions from combustion installations which are run on "medium" or "heavy" fuel oil shall not exceed the following limit values:

"Medium" and "heavy" fuel oil	Heat input		
	over 5 MW up to 50 MW	over 50 MW up to 100 MW	over 100 MW
Reference value: the limit values refer to an oxygen content in the flue gas of %vol	3	3	3
Total dust particles:			
Quality A fuel oils mg/m³	80	50	50
Quality B fuel oils mg/m³	50	50	50
Carbon monoxide (CO) mg/m³	170	170	170
Sulphur oxides (SO_X) indicated as sulphur dioxide (SO_2) mg/m³	1700	1700	400
Nitrogen oxides (NO_X) indicated as nitrogen dioxide (NO_2) mg/m³	450	300	150
Ammonia and ammonium compounds indicated as ammonia[1)] mg/m³	30	30	30

[1)] *Note:* This emission limit value is only important for combustion installations fitted with a denitrification system.

2 The emission limit value for sulphur oxides of 1700 mg/m³ shall be deemed to be met if fuel oil with a sulphur content of no more than 1 percent (% mass) is used.

422 Use of "medium" and "heavy" fuel oil

"Medium" and "heavy" fuel oil shall not be used in installations or operating units which have a heat input of less than 5 MW for these fuels.

5 Coal and wood combustion installations

51 Coal combustion installations

511 Emission limit values

1 Emissions from combustion installations which are run on coal, coal briquettes or coke shall not exceed the following limit values:

Coal, coal briquettes, coke	Heat input					
	over 20 kW up to 70 kW	over 70 kW up to 1 MW	over 1 MW up to 5 MW	over 5 MW up to 50 MW	over 50 MW up to 100 MW	over 100 MW
Reference value: the limit values refer to an oxygen content in the flue gas of %vol	7	7	7	7	7	7
Total dust particles mg/m³	-	150	150	50	50	50
Carbon monoxide (CO) mg/m³	4000	1000	250[1)]	250	250	250
Sulphur oxides (SO_x) indicated as sulphur dioxide (SO_2) mg/m³	-	-	2000	2000	2000	400
Sulphur emission ratio - grate/pulverised coal installations % - fluidised bed installations %	- -	- -	- 25	- 25	- 25	15 15
Ammonia and ammonium compounds indicated as ammonia[2)] mg/m³	30	30	30	30	30	30

Notes:
- A dash in the table means that no limit value is laid down either in Annex 3 or Annex 1.
- Installations for which a limit value is laid down for the sulphur emission ratio must meet both the emission limit value for sulphur oxides and the limit value for the sulphur emission ratio.

1) For installations up to 2.5 MW, this limit value only applies to operation at full load.

2) This emission limit value is only important for combustion installations fitted with a denitrification system

2 The authorities shall lay down preventive emission limit values for inorganic substances primarily in dust form and for chlorine and fluorine compounds in accordance with Article 4; Annex 1 Figure 5 and the emission limit values for chlorine and fluorine compounds laid down in Annex 1 Figure 6 shall not apply.

3 The emission limit value for sulphur oxides of 2000 mg/m^3 shall be deemed to be met if the combustion installations is run on quality A coal, coal briquettes or coke as defined in Annex 5.

512 Measurement and control

In the case of combustion installations with a heat input of up to 70 kW, the emission limit value for carbon monoxide shall generally be deemed to be met if it is established that the installation is operated in accordance with the manufacturer's instruction regarding fuel and operation. If excessive smoke or odour pollution levels are suspected, the authorities may also take carbon monoxide measurements.

513 Use of Quality B coal

Quality B coal, coal briquettes and coke shall not be used in installations or operating units which have a heat input of less than 5 MW with these fuels.

52 Wood combustion installations

521 Type of installation and wood

1 Wood fuels as defined in Annex 5 Figure 3 Paragraph 1 shall only be used in installations which are suitable for the type of wood fuel in question.

2 In addition, only pieces of wood in the natural state, brushwood and cones as defined in Annex 5 Figure 3 Paragraph 1 Letter a shall be used in hand-charged installations with a heat input of up to 40 kW and in fireplaces.

522 Emission limit values

1 Emissions from combustion installations run on wood fuels as defined in Annex 5 Figure 3 Paragraph 1 shall not exceed the following limit values:

Wood fuels	Heat input					
	over 20 kW up to 70 kW	over 70 kW up to 200 kW	over 200 kW up to 500 kW	over 500 kW up to 1 MW	over 1 MW up to 5 MW	over 5 MW
Reference value: the limit values refer to an oxygen content in the flue gas of %vol	13	13	13	13	11	11
Total dust particles, mg/m³	-	150	150	150	150	50
Carbon monoxide (CO): - for wood fuels as defined in Ann. 5 Fig. 3 Para.1 Let. a and b mg/m³	4000[1)]	2000	1000	500	250	250
- for wood fuels as defined in Ann. 5 Fig. 3 Para. 1 Let. C mg/m³	1000	1000	800	500	250	250
Nitrogen oxides (NOx) indicated as nitrogen dioxide (NO_2) mg/m³	2)	2)	2)	2)	2)	2)
Gaseous organic substances indicated as total carbon (C) mg/m³	-	-	-	-	50	50
Ammonia and ammonium compounds indicated as ammonia[3)] mg/m³	-	-	-	-	30	30

Notes:

- A dash in the table means that no limit value is laid down either in Annex 3 or Annex 1.

1) Does not apply to central heating stoves.

2) See limit value for nitrogen oxides in Annex 1 Figure 6.

3) This emission limit value is only important for combustion installations fitted with a denitrification system.

2 Subject to the special requirements for new hand-charged installations laid down in Figure 523.

3 The authorities shall lay down preventive emission limit values for chlorine compounds and organic substances in gas, vapour or particle form in accordance with Article 4; the emission limit values for chlorine compounds laid down in Annex 1 Figure 6 and those for organic substances laid down in Annex 1 Figure 7 shall not apply.

523 Special requirements for hand-charged installations

New hand-charged heating boilers, which are unable to meet the emission limit values laid down in Figure 522 at 30 percent nominal heat input, must be fitted with a heat accumulator which can store at least half the thermal energy produced per fuel load at nominal heat input.

524 Measurement and control

1 In the case of combustion installations with a heat input of up to 70 kW, the emission limit value for carbon monoxide shall generally be deemed to be met if it is established that the installation is being properly operated and only wood in the natural state as defined in Annex 5 Figure 3 Paragraph 1 Letters a and b is being used. If excessive smoke or odour pollution levels are suspected, the authorities may also take carbon monoxide measurements.

2 In the case of combustion installations with a heat input of between 70 kW and 1 MW, the dust particles emission limit values shall generally be deemed to be met during the periodic control of the installation, if it is established that the limit value for carbon monoxide is complied with and the operating conditions are comparable with these of the time of the first measurement and the limit values for both dust particles and carbon monoxide are met when the first measurement was taken.

3 Emissions must be measured when the installation has reached its operating temperature. Measurement generally begins as soon as the fuel is released.

4 In the case of hand-charged installations with through or top burning, contrary to Paragraph 3, the measurement must begin five minutes after the largest amount of fuel specified by the manufacturer in the operating instructions has been laid on a layer of glowing embers sufficient to set it alight.

5 The average emissions over a period of half an hour shall be decisive for the assessment.

6 Gas combustion installations

61 Emission limit values

Emissions from combustion installations run on gas fuels shall not exceed the following limit values:

Combustion installations run on gas fuels	
Reference value: The limit values refer to an oxygen content in the flue gas of	3 %vol
Carbon monoxide (CO)	100 mg/m^3
Nitrogen oxides (NO_X) indicated as nitrogen dioxide (NO_2): a. for installations listed in Article 20 Paragraph 1 Letters a-d - atmospheric burners with a heat input of up to 12 kW - other installations b. for combustion installations with a heat input of over 350 kW - temperature of heat carrier fluid up to 110 °C - temperature of heat carrier fluid over 110 °C	 120 mg/m^3 80 mg/m^3 80 mg/m^3 110 mg/m^3
Ammonia and ammonium compounds indicated as ammonia[1)]	30 mg/m^3
1) *Note:* This emission limit value is only important for combustion installations fitted with a denitrification system.	

62 Additional provisions for nitrogen oxide emissions

1 The limit values for nitrogen oxides shall only apply to the following installations if they are marketed after 31 December 1992:

a. the installations listed in Article 20;
b. installations with a heat input of between 350 kW and 1 MW.

2 The authorities may lay down less stringent limit values for combustion installations where the temperature of the heat carrier fluid is over 150 °C and where the limit values for nitrogen oxides of 110 mg/m^3 laid down in Figure 61 cannot be complied with because technology and operating conditions do not allow or because it is economically unacceptable. However, emissions of nitrogen oxides, indicated as nitrogen dioxide, shall not exceed 200 mg/m^3.

3 Contrary to Figure 61, limit values for nitrogen oxides which are 10 mg/m^3 higher shall apply to gas combustion installations which are run on gas fuels as defined in Annex 5 Figure 41 Letters b, d and e.

4 The emission limit values for nitrogen oxides laid down in Annex 1 Figure 6 and Annex 3 Figure 61 shall not apply to installations listed in Article 20 Paragraph 1 letters f and g; preventive emission limit values in accordance with Article 4 shall not be ordered.

63 Energy requirements

631 Heating boilers with forced draught burners

1 In the case of heating boilers with forced draught burners run on gas fuels, the flue gas losses shall not exceed the following limit values:

a. with single stage burner operation: 7 percent
b. with two-stage burner operation
   1. during operation of first burner stage: 6 percent
   2. during operation of second burner stage: 8 percent

2 The limit values for flue gas losses laid down in Paragraph 1 shall apply to installations which were marketed before 31 December 1992.

3 The authorities may lay down less stringent limit values in the case of heating boilers where the temperature of the heat carrier fluid is over 110 °C and where the requirements laid down in Paragraph 1 cannot be complied with because technology and operating conditions do not allow or because it is economically unacceptable.

4 In the case of heating boilers with forced draught burners run on gas fuels where the temperature of the water is no more than 110 °C and which are marketed before 1 January 1993, the flue gas losses shall not exceed the following limit values:

a. installations with a heat input of up to 70 kW: 10 percent
b. installations with a heat input of over 70 kW: 9 percent

632 Heating boilers with atmospheric burners

1 In the case of heating boilers and circulation heaters with atmospheric gas burners and with a heat input of up to 350 kW, where water is used as the heat carrier and the temperature of the water is no more than 110 °C, the flue gas losses shall not exceed the following limit values:

a. for installations marketed after 31 December 1992, the q_A limit value indicated on the type-approval plate;
b. for all other installations, the limit value $q_A = 14.5 - 2 \log Q_{Nmax}$, but no more than 12.5 percent.

Where:

q_A = limit value for the maximum permitted flue gas losses in percent
$\log Q_{nmax}$ = logarithmic value of the maximum boiler nominal output in kW

2 The requirements laid down in Figure 631 shall apply to heating boilers and circulation heaters with atmospheric gas burners with a heat input of over 350 kW.

7 Combustion installations for liquid fuels as defined in Annex 5 Figure 15

1 The requirements laid down in Figure 41 shall apply to combustion installations which are run on liquid fuels as defined in Annex 5 Figure 15.

2 Fuels defined in Annex 5 Figure 15 shall not be used in installations with a heat input of less than 350 kW.

8 Multiple- and mixed-fuel combustion installations

81 Multiple-fuel combustion installations

If a single installation is run alternately on different kinds of fuel, the emission limit values set for each of the fuels used shall apply.

82 Mixed-fuel combustion installations

1 If a single installation is run simultaneously on different kinds of fuel, the emission concentrations of the mixed fuel limit value shall not be exceeded.

2 The mixed fuel limit value shall be calculated according to the following formula:

$$G_M = G_1 \times \frac{E_1}{E_{tot}} + G_2 \times \frac{E_2(21-B_1)}{E_{tot}(21-B_2)} + \ldots + G_n \times \frac{E_n(21-B_1)}{E_{tot}(21-B_n)}$$

Where:

G_M	=	mixed fuel limit value relating to an oxygen content B_1
$G_1, G_2 \ldots G_n$	=	emission limit value for the different fuels[49]
$E_1, E_2 \ldots E_n$	=	energy supplied per hour by each fuel
E_{tot}	=	$E_1 + E_2 + \ldots E_n$
$B_1, B_2 \ldots B_n$	=	reference value (oxygen content to which the emission limit value refers for the first, second and subsequent fuels)

3 To calculate the determining sulphur emission ratio, proceed by analogy according to Paragraph 2.

49 *Note:* Use the following as emission limits for sulphur oxides:

a. for "extra light" fuel oil:
G = 330 mg/m^3 relating to an oxygen content in the flue gas of 3 percent (%vol);

b. for gas:
G = 38 mg/m^3 relating to an oxygen content in the flue gas of 3 percent (%vol).

Annex 4[50]
(Art. 3 Para. 2 Let. c)

Test requirements for the type-approval of combustion installations

1 Scope

The provisions of this Annex shall apply to the type-approval of installations defined in Article 20, Paragraph 1, Letters a-g, tested after 30 June 1992.

2 Definitions

21 Forced draught burners

1 Forced draught burners means burners in which the air required for combustion is sucked in by means of a ventilator, and in which the relationship between the fuel and air may be varied to a substantial extent.

2 In the case of forced draught burners run on fuel oil, atomisation may take place mechanically (e.g. atomisation by means of an atomising nozzle through pressure release or by means of a rotary cup) or may be by auxiliary fluid (e.g. air, steam or liquid).

22 Oil vaporisation burners

1 Oil vaporisation burners means burners in which the fuel oil is evaporated by the effect of heat.

2 Flue gas evacuation may take place either with or without the help of a ventilator.

50 Wording in accordance with Fig. II of the Ordinance of 20 Nov. 1991 (AS **1992** 124) and corrected in accordance with Fig. II of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).

23 Atmospheric gas burners

1 Atmospheric gas burners means burners in which the air required for combustion is sucked in either through the impetus of the fuel gas jet or by natural draught.

2 Draught-assisted atmospheric burners in which flue gas evacuation is aided by a ventilator are also rated as atmospheric gas burners.

24 Heat input range

1 The heat input range means the range laid down by the manufacturer within which a type-approved burner, boiler, circulation heater or water heater fulfils the requirements in terms of air pollution control and energy and within which it is to be used.

2 The range is given in terms of heat input as defined in Annex 1 Figure 24.

25 Reference value for emission concentrations

The emission limit values indicated as concentrations refer to the volume of the flue gas under normal conditions (0 °C, 1013 mbar) after subtraction of the moisture content (dry) and to an oxygen content in the flue gas of 3 percent (%vol).

3 Requirements for forced draught burners

31 Emission limit values

1 Within the heat input range of the forced draught burner, emissions shall not exceed the following limit values:

a. soot number
   1. when used with "extra light" fuel oil: 0.5
   2. when used with test gas G20 or G31 (methane or propane): none

b. nitrogen oxides (NO_X), indicated as nitrogen dioxide (NO_2):
   1. when used with "extra light" fuel oil: 120 mg/m^3
   2. when used with test gas G20 (methane): 80 mg/m^3
   3. when used with test gas G31 (propane): 90 mg/m^3

c. carbon monoxide (CO): 60 mg/m^3

d. gaseous organic substances, indicated as propane:
   1. when used with "extra light" fuel oil: 30 mg/m^3
   2. when used with test gas G20 or G31 (methane or propane): none

2 In the case of installations with bicombustion burners, the oil and gas limit values laid down in Paragraph 1 for oil burners and gas burners respectively shall not be exceeded.

3 For oil burners, the emission limit values for nitrogen oxides refer to a content of organically-bound nitrogen in the "extra light" fuel oil of 140 mg/kg. In the case of a higher nitrogen content, emissions of nitrogen oxides, indicated as nitrogen dioxide, may be 0.2 mg/m^3 higher per 1 mg of nitrogen in the fuel; in the case of a lower nitrogen content, emissions of nitrogen oxides, indicated as nitrogen dioxide, must be 0.2 mg/m^3 lower per 1 mg of nitrogen in the fuel.

32 Start-up performance of oil burners

321 Soot number

During the burner's start-up phase, the soot number shall not exceed level 3.

322 Further requirements

1 Before the fuel is released, ventilation of the combustion chamber shall be ensured.

2 During testing of the start-up performance, pressure oscillation in the combustion chamber must be seen to subside at the end of the start-up phase to normal operating conditions.

4 Requirements for heating boilers for forced draught burners

41 Emission limit values

1 Emissions from a heating boiler with a forced draught burner, tested according to Figure 3, shall not exceed the emission limit values laid down in Figure 31 within the heat input range of the boiler.

2 Start-up performance must fulfil the requirements laid down in Figure 32.

42 Energy requirements

421 Flue gas losses

Within the heat input range of the heating boiler, flue gas losses at a flow temperature of 80 °C shall not exceed the following limit values:

a. with single stage burner operation: 7.0 percent
b. with multiple stage or modulated burner operation:
   1. with minimum boiler heat input: 6.0 percent
   2. with maximum boiler heat input: 7.5 percent

422 Standby losses

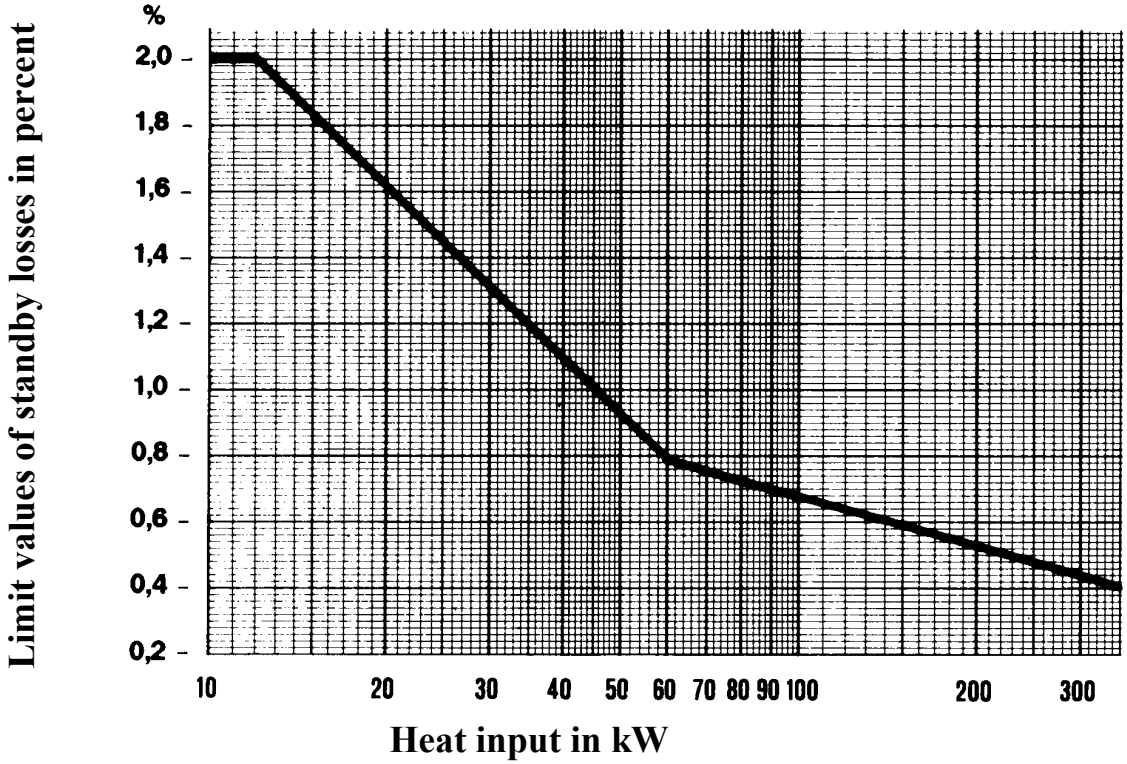
1 Standby losses shall not exceed the following limit values:

Maximum heat input	up to 12 kW	over 12 kW and up to 60 kW	over 60 kW and up to 350 kW
Limit values of standby losses as percentage of maximum heat input	2.0	$3.853-(1.717 \log Q_F)$	$1.729 -(0.522 \log Q_F)$

Where:

Q_F = maximum heat input in kW

Diagram 1:
Limit values of standby losses for heating boilers with forced draught burners



2 The limit values refer to a temperature difference between the water contained in the boiler and the surrounding air of 50 °C at maximum heat input.

5 Requirements for fixed combinations of heating boilers with forced draught burners (units)

Within the heat input range of the installation, fixed combinations must fulfil the requirements of Figures 3 and 4.

6 Requirements for heating boilers with oil vaporisation burners

61 Emission limit values

1 For heating boilers with heat input of up to 30 kW, emissions within their heat input ranges shall not exceed the following limit values:

a. soot number:
   1. for burners without draught: 2.0
   2. for burners with draught: 1.0
b. nitrogen oxides (NO_X), indicated as nitrogen dioxide (NO_2): 120 mg/m^3
c. carbon monoxide (CO): 150 mg/m^3

2 Heating boilers with heat input of over 30 kW must fulfil the requirements laid down in Figure 5.

3 The emission limit values for nitrogen oxides refer to a content of organically-bound nitrogen in the "extra light" fuel oil of 140 mg/kg. In the case of a higher nitrogen content, emissions of nitrogen oxides, indicated as nitrogen dioxide, may be 0.2 mg/m^3 higher per 1 mg of nitrogen in the fuel; in the case of a lower nitrogen content, emissions of nitrogen oxides, indicated as nitrogen dioxide, must be 0.2 mg/m^3 lower per 1 mg of nitrogen in the fuel.

62 Energy requirements

The requirements laid down in Figure 712 shall apply to flue gas losses and standby losses.

7 Requirements for heaters with atmospheric gas burners

71 Heating boilers and circulation heaters

711 Emission limit values

Emissions from heating boilers and circulation heaters and from combined installations for domestic hot water preparation shall not exceed the following limit values in their respective heat input ranges:

a. soot number: none
b. nitrogen oxides (NO_X), indicated as nitrogen dioxide (NO_2):
   1. installations with a heat input of up to 12 kW
      - when used with test gas G20 or G31 (methane or propane): 120 mg/m^3
   2. installations with a heat input of over 12 kW
      - when used with test gas G20 (methane): 80 mg/m^3
      - when used with test gas G31 (propane): 90 mg/m^3
c. carbon monoxide: 100 mg/m^3

712 Energy requirements

1 In the case of heating boilers and circulation heaters and of combined installations for domestic hot water preparation, the quantity g, calculated from the flue gas losses and standby losses, shall not exceed the following limit values in their respective heat input range:

Maximum heat input	up to 12 kW	over 12 kW and up to 60 kW	over 60 kW and up to 350 kW
Limit values of the quantity g	12	16.632-(4.292 log Q_F)	11.322-(1.306 log Q_F)

2 The quantity is calculated as follows:

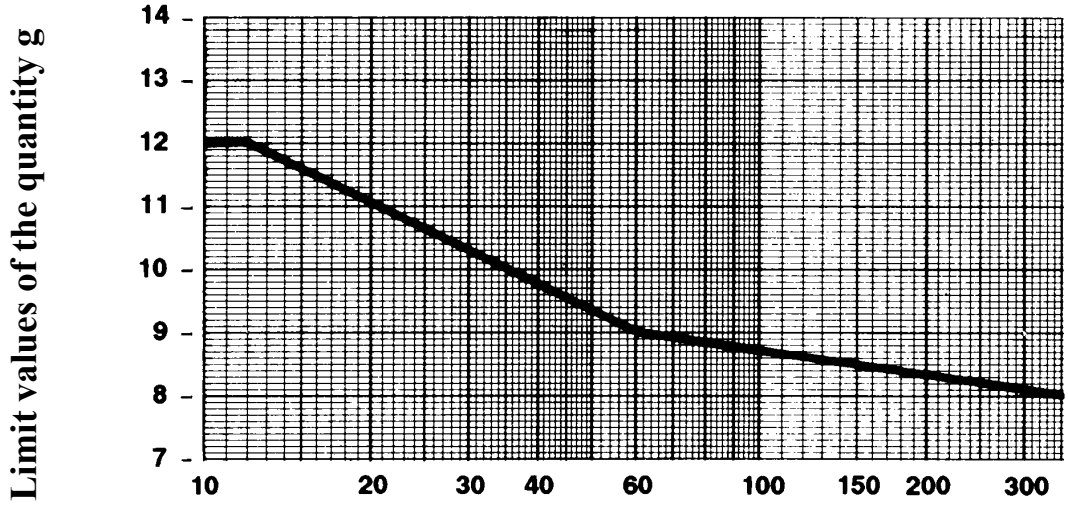
$$g = q_A + (2.5 \times q_B) - f$$

Where:

Q_F = maximum heat input in kW
q_A = flue gas losses in percentage of heat input
q_B = standby losses in percentage of maximum heat input
f = correction factor
f = 0 for heaters with constant boiler water temperature
f = 4 for heaters with sliding boiler water temperature

3 Heaters with sliding boiler water temperature means those installations whose flow temperature can be reduced to at least 40 °C in partial load operation and are equipped with a built-in regulator used for variable operation only which is integrated or included in the minimum basic options.

Diagram 2:
Limit values of the quantity g for heating boilers and circulation heaters with atmospheric gas burners



72 Directly fired water storage heaters

721 Emission limit values

Carbon monoxide emissions from directly fired water storage heaters shall not exceed 100 mg/m^3 in their heat input range.

722 Energy requirements

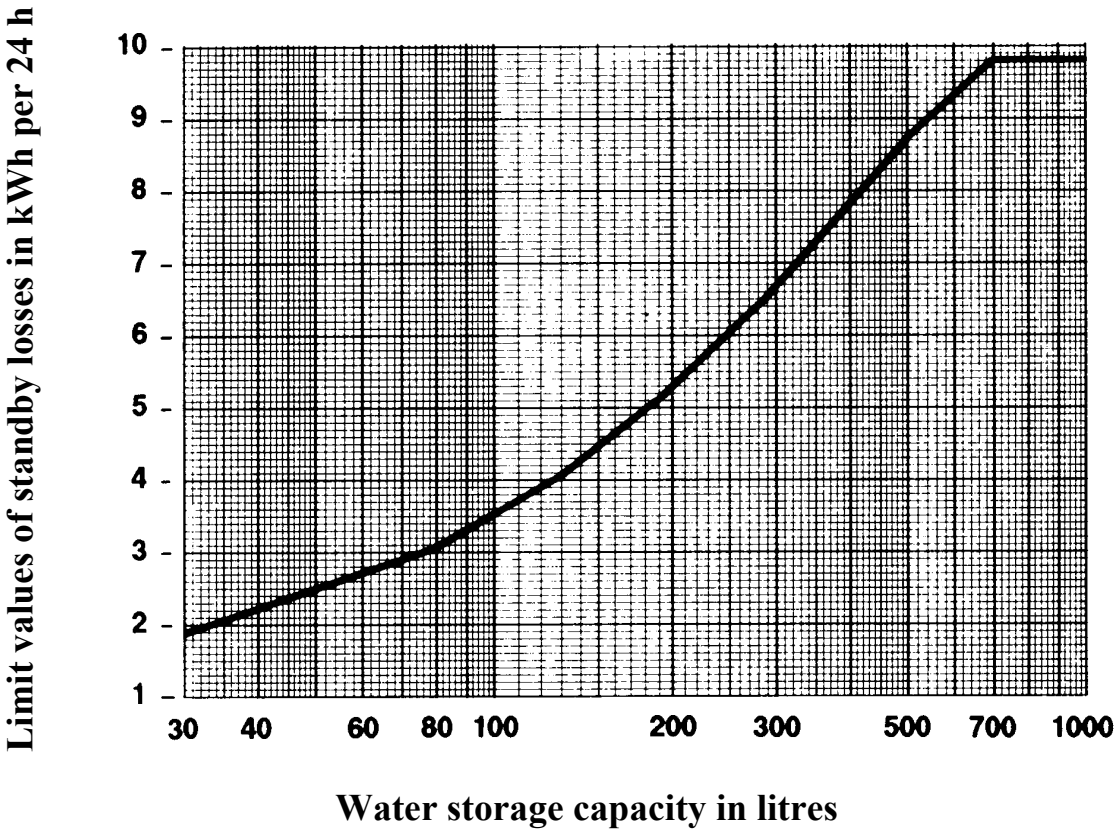
1 In the case of directly fired water storage heaters, flue gas losses and standby losses shall not exceed the following limit values in their heat input range:

a. flue gas losses:
   1. installations with a water storage capacity of up to 400 litres: 12.0 percent
   2. installations with a water storage capacity of more than 400 litres: 6.0 percent

b. standby losses in 24 hours:

Water storage capacity of the installation in litres	30	80	130	190	280	340	400	500	600	700 and over
Limit values of standby losses in kW per 24 hours	1.90	3.04	4.04	5.12	6.46	7.19	7.90	8.75	9.36	9.81

Diagram 3:
Limit values of standby losses for directly fired water storage heaters with atmospheric gas burners



2 In order to calculate the standby losses for installations with a water storage capacity between two of the values appearing in the table, the logarithmic values for the water storage capacity in the corresponding area should be interpolated in linear form (see Diagram 3).

73 Continuous flow water heaters for drinking water

731 Emission limit values

In the case of continuous flow water heaters for drinking water, carbon monoxide emissions shall not exceed 100 mg/m^3 in the heat input range of the installation.

732 Energy requirements

1 In the case of continuous flow water heaters for drinking water, flue gas losses and standby losses shall not exceed the following limit values:

$q_A = 12.5 - 2 \log Q_F$

Where:

q_A = flue gas losses in percentage of maximum heat input
$\log Q_F$ = logarithmic value of heat input in kW

2 Such installations must be equipped with an automatic ignition system.

8 Marking of type-approved installations

1 Every type-approved installation must be fitted with a type-approval plate in a clearly visible place. It should include the following information:

a. name of manufacturer and type of installation;
b. approval number in accordance with type-approval;
c. the permitted heat input range laid down in the type-approval and
d. for oil combustion installations with oil vaporisation burners and gas combustion installations with atmospheric burners, the q_A limit value for the maximum permitted flue gas losses in accordance with value g defined in Figure 712, Paragraph 1.

2 The limit value q_A for the maximum permitted flue gas losses for installations, according to Paragraph 1, Letter d above, shall be calculated as follows:

$$q_A = G - (2.5 \times q_B) + f$$

Where:

q_A = the limit value for the maximum permitted flue gas losses expressed as percentage of heat input

q_B = the value laid down in the type-approval for the standby losses expressed as percentage of maximum heat input

G = limit value for the quantity as defined in Figure 712 Paragraph 1

f = correction factor as defined in Figure 712

9 Technical implementation of type-approval

91 Principle

The testing shall take place according to the recognised rules of testing technology. The Swiss Agency shall lay down the appropriate testing procedures.

92 Assessment of the test results

1 For comparison with the limit values the values measured shall be converted to the reference values and then rounded as follows:

a. soot number: to 1 decimal point

b. emission concentrations (mg/m^3): to nearest round number

c. flue gas losses (%): to 1 decimal point

d. standby losses (% or kW): to 2 decimal points

e. quantity g: to 1 decimal point

2 The requirements contained in this Annex shall be deemed to be fulfilled if none of the values calculated according to the above procedure exceeds the respective limit value.

Annex 5[51]
(Art. 21 and 24)

Requirements for fuels

1 Fuel oils and other liquid fuels

11 Sulphur content of fuel oil

1 The sulphur content of "extra light" fuel oil (gas oil) shall not exceed 0.20 percent (% mass).

2 The sulphur content of "medium" and "heavy" fuel oil (gas oil) of A quality shall not exceed 1.0 percent (% mass).

3 The sulphur content of "medium" and "heavy" fuel oil (gas oil) of B quality shall not exceed 2.8 percent (% mass).

12 Additional requirements for fuel oils

1 Additives which contain compounds of halogen or heavy metals (except iron compounds) shall not be added to fuel oils.

2 In addition, additives containing substances such as magnesium compounds, which distort the results of the soot number measurement when controlling oil combustion installations, shall not be added to "extra light" fuel oil.

3 Fuel oils shall not be mixed with waste oil.

13 Other liquid fuels

131 Definition

Other liquid fuels means liquid organic compounds which can be burnt as "extra light" fuel oil and meet the requirements laid down in Figure 152.

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[51] Corrected in accordance with Fig. II of the Ordinance of 20 Nov. 1991, in force since 1 Feb. 1992 (AS **1992** 124) and Fig. I of the Ordinance of 25 Aug. 1999, in force since 1 Jan. 2000 (AS **1999** 2498).

132 Requirements

1 During combustion, other liquid fuels shall not produce any higher or other pollutant emissions than is the case with "extra light" fuel oil.

2 The content of pollutants in the fuel shall not exceed the following limit values:

Ash	50 mg/kg
Chlorine	50 mg/kg
Barium	5 mg/kg
Lead	5 mg/kg
Nickel	5 mg/kg
Vanadium	10 mg/kg
Zinc	5 mg/kg
Phosphorus	5 mg/kg
Polychlorinated aromatic hydrocarbons (e.g. PCB)	1 mg/kg

133 Relation to Annex 2 Figure 71

Other liquid organic compounds which do not meet the requirements laid down in Figure 152 shall be rated as special waste.

2 Coal, coal briquettes and coke

1 The sulphur content of A quality coal, coal briquettes and coke shall not exceed 1.0 percent (% mass).

2 The sulphur content of B quality coal, coal briquettes and coke shall not exceed 3.0 percent (% mass).

3 Wood fuels

1 Wood fuels means:

a. pieces of wood in the natural state including attached bark e.g. in the form of logs or wood briquettes without binding agent, brushwood and cones;
b. wood in the natural state not in pieces, for example in the form of wood chippings, shavings, sawdust, sander dust or bark;
c. wood residues from the wood-working industry, wood craftsmen and building sites, provided the wood is not pressure impregnated

and does not contain any coating made from halogenated organic compounds.

2 Wood fuels do not include:

a. waste timber from the demolition, conversion, or renovation of buildings, waste timber from packaging or old wooden furniture and waste timber mixed with wood fuels listed in Paragraph 1;
b. all other substances made of wood, such as:
   1. waste timber or wood waste, which has been impregnated with wood preservatives using the pressure method or painted with coatings made from halogenated organic compounds;
   2. waste timber or wood waste intensively treated with wood preservatives such as pentachlorophenol;
   3. such waste mixed with wood fuels listed in Paragraph 1 or with waste timber described in Letter a.

4 Gas fuels

41 Definition

1 Gas fuels means:

a. natural gas, petroleum gas or local gas which is supplied through the public gas utilities;
b. liquid gas consisting of propane and/or butane;
c. hydrogen;
d. gases similar to natural gas, petroleum gas or local gas, such as biogas from agriculture or sewage gases;
e. waste disposal site gases provided they do not contain more than a total of 50 mg/m^3 of inorganic and organic chlorine and fluorine compounds, indicated as hydrogen chloride and hydrogen fluoride.

2 All other gases shall be rated as gases from waste, which must meet the requirements laid down in Annex 2 Figure 71 during combustion. This shall apply in particular to waste disposal site gases, which do not meet the requirements laid down in Paragraph 1 Letter e.

42 Requirements

The sulphur content of gases laid down in Figure 41 Letters a and b shall not exceed 190 mg/kg.

5 Gasoline

1 From 1 January 2000 onwards, gasoline shall be imported or supplied for commercial purposes only if it accords with the following requirements:

Item	Unit	Minimum value[1)]	Maximum value[1)]	Measurement method[2)]
Gasoline				
research octane number (R.O.N.)		95[3)]	--	EN 25164
motor octane number (M.O.N.)		85[3)]	--	EN 25163
vapour pressure (according to Reid): - six summer months	kPa	--	60.0[4)]	EN 12
vaporisation characteristics: - vaporised at 100 °C - vaporised at 150 °C	% (vol)	46.0 75.0	-- --	EN-ISO 3405
analysis of hydrocarbons: - olefins - aromatic compounds - benzene	% (vol)	-- -- --	18.0 42.0 1.0	ASTM D1319
oxygen content	% (mass)	--	2.7	EN 1601
oxygen containing constituents: - methanol to which stabilisers must be added - ethanol; stabilisers are necessary in some cases - isopropyl alcohol - tertiary butyl alcohol - isobutyl alcohol - ethers containing 5 or more carbon atoms per molecule	 % (vol) % (vol) % (vol) % (vol) % (vol) % (vol)	 -- -- -- -- -- --	 3 5 10 7 10 15	EN 1601
other oxygen containing components[5)]	% (vol)	--	10	EN 1601
sulphur content	mg/kg	--	150	EN-ISO 14596
lead content	g/l	--	0.005	EN 237

Notes:
1) The measurement results shall be assessed according to standard no. 4259: "Petroleum products – determination and application of precision data in relation to methods of test" of the International Standards Organisation ISO.
2) The following standards shall apply (jointly) to the measurements:
- EN: standard of the European Standards Committee CEN
- ISO: standard of the International Standards Organisation ISO
- ASTM: standard of the American Society for Testing and Materials
Standards obtainable from: Swiss Association for Standardisation SNV, Mühlebachstr. 54, 8008 Zurich.
3) For standard gasoline, the values differ from the table as follows: R.O.N. 91 (minimum) and M.O.N. 81(minimum).
4) Applies to qualities of gasoline used between 1 May and 30 September
5) Other monoalcohols whose boiling point does not exceed the final boiling point (F.B.P.) according to standard EN 228.

2 From 1 January 2005 onwards, gasoline shall be imported or supplied for commercial purposes only if it accords with the following additional requirements:

Item	Unit	Minimum value	Maximum value[1)]	Measurement method[2)]
Gasoline				
analysis of hydrocarbons: - aromatic compounds	% (vol)	--	35.0	ASTM D1319
sulphur content	mg/kg	--	50	EN-ISO 14596

Notes:
1) The measurement results shall be assessed according to standard no. 4295 "Petroleum products – determination and application of precision data in relation to methods of test" of the International Standards Organisation ISO.
2) The following standards shall apply (jointly) to the measurements:
- EN: standard of the European Standards Committee CEN
- ISO: standard of the International Standards Organisation ISO
- ASTM: standard of the American Society for Testing and Materials
Standards obtainable from: Swiss Association for Standardisation SNV, Mühlebachstr. 54, 8008 Zurich.

3 Aviation fuel shall be imported or supplied for commercial purposes only if the lead content does not exceed 0.56 g/l and the benzene content does not exceed 1 percent (% vol). Aviation fuel that is to be marketed shall be tinted blue.

6 Diesel oil

1 From 1 January 2000, diesel oil shall be imported or supplied for commercial purposes only if it accords with the following requirements:

Item	Unit	Minimum value[1)]	Maximum value[1)]	Measurement method[2)]
Diesel oil				
cetane number		51.0[3)]	--	EN-ISO 5165
density at 15 °C	kg/m^3	--	845	EN-ISO 3675
Vaporisation characteristics: 95 %	°C	--	360	EN-ISO 3405
Polycyclic aromatic hydrocarbons	% (mass)	--	11	IP 391
sulphur content	mg/kg	--	350	EN-ISO 14596

Notes:

1) The measurement results shall be assessed according to standard no. 4259 "Petroleum products – determination and application of precision data in relation to methods of test" of the International Standards Organisation ISO

2) The following standards shall apply (jointly) to the measurements:
- IP: standard of the Institute of Petroleum, London
- EN: standard of the European Standards Committee CEN
- ISO: standard of the International Standards Organisation ISO
- ASTM: standard of the American Society for Testing and Materials

Standards obtainable from: Swiss Association for Standardisation SNV, Mühlebachstr. 54, 8008 Zurich.

3) For winter qualities, the cetane number differs from the value shown in the table and shall satisfy the minimum requirements of EN 590 and SN 181 160-1.

2 From 1 January 2005, diesel oil shall only be imported or supplied for commercial purposes if it accords with the following additional requirements:

Item	Unit	Minimum value	Maximum value[1)]	Measurement method[2)]
Diesel oil				
sulphur content	mg/kg	--	50	EN-ISO 14596

Notes:

[1)] The measurement results shall be assessed according to standard no. 4259 "Petroleum products – determination and application of precision data in relation to methods of test".

[2)] The following standards shall apply (jointly) to the measurements:
- EN: standard of the European Standards Committee CEN
- ISO: standard of the International Standards Organisation ISO

Standards obtainable from: Swiss Association for Standardisation SNV, Mühlebachstr. 54, 8008 Zurich.

Annex 6[52]
(Art. 6 Para. 3)

Minimum height of tall stacks

1 Scope

The provisions of this Annex shall apply to installations where the quantity Q/S exceeds the value 5, where:

Q = mass flow of the emitted air pollutant in gram per hour;
S = characteristic value as laid down in Figure 9.

2 Calculation method

1 The required construction height of the stack shall be calculated step by step in accordance with Figures 3 to 6.

2 If more than one air pollutant is emitted, the construction height of the stack shall be calculated on the basis of the pollutant for which the quantity Q/S has the highest value.

3 Parameter H_0

31 Calculation of H_0 according to Diagram 1

1 The parameter H_0 takes account of the short-term effects of the air pollutants emitted from a single installation. It is determined with the help of Diagram 1.

2 The quantities Q and F are dependent upon the emission conditions of the installation. The values with full load operation and the most unfavourable fuel and emission conditions for air pollution are used to calculate H_0.

[52] Corrected in accordance with Fig. II of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).

3 The quantity S is used to limit the maximum short-term air pollution levels caused by the installation to a specific value (S-value). The S-values laid down in Figure 9 are used to calculate H_0.

32 Calculation of H_0 in each case

1 The parameter H_0 shall be determined in each case according to the recognised rules for calculating the stack height and the dispersion of flue gases, if:

a. the Q/S or F values lie outside Diagram 1 or
b. the temperature of the flue gas is less than 55 °C.

2 However, where flue gas temperatures are less than 55 °C, the parameter H_0 shall not be lower than the value which is obtained according to Diagram 1 for a temperature of 55 °C.

4 Minimum height for flat land with no obstacles

1 The stack height for flat land with no obstacles shall be

$H_1 = f \times H_0$

The correction factor f shall take account of the long-term effects due to channelled winds.

2 Values between 1.0 and 1.5 shall be used for f as follows:

f = 1.00 for sites with no prevailing wind direction;
f = 1.25 for sites with average conditions;
f = 1.50 for valleys where winds are channelled.

3 Intermediate values are also possible for f depending upon the site conditions.

5 Additional height for buildings and vegetation

High obstacles (buildings and vegetation) around the tall stack shall be taken into account by an additional height I_1:

$I_1 = g \times I$

Where:

I = height of the highest determining obstacles in the area affecting the installation. Values between 0 (no obstacles) and 30 m (e.g. forest) shall be used for I.
g = correction factor with values between 0 and 1 according to Diagram 2.

6 Construction height of stack

The stack construction height H shall be calculated according to the following formula:

$H = H_1 + I_1$

7 Further requirements

In reasoned cases, the authorities shall require taller stacks, for example, in the case of:

a. particular shaped buildings;
b sites with particularly poor meteorological dispersion conditions;
c. particular topographical configurations such as narrow valleys, hillsides or hollows.

8 Symbols

H	(m)	=	construction height of stack
H_0	(m)	=	parameter for determining H_1
H_1	(m)	=	minimum stack height for flat land with no obstacles
I	(m)	=	height of the highest determining obstacle
I_1	(m)	=	additional height for buildings and vegetation
f	(-)	=	correction factor for long-term effects due to channelled winds
g	(-)	=	correction factor for buildings and vegetation
Q	(g/h)	=	mass flow of the emitted air pollutants; emissions of nitrogen oxides (nitrogen monoxide and nitrogen dioxide) shall be converted to nitrogen dioxide
R_n	(m^3/h)	=	volume flow of the exhaust gas under normal conditions (0 °C, 1013 mbar)
t	(°C)	=	temperature of the exhaust gas at the stack outlet

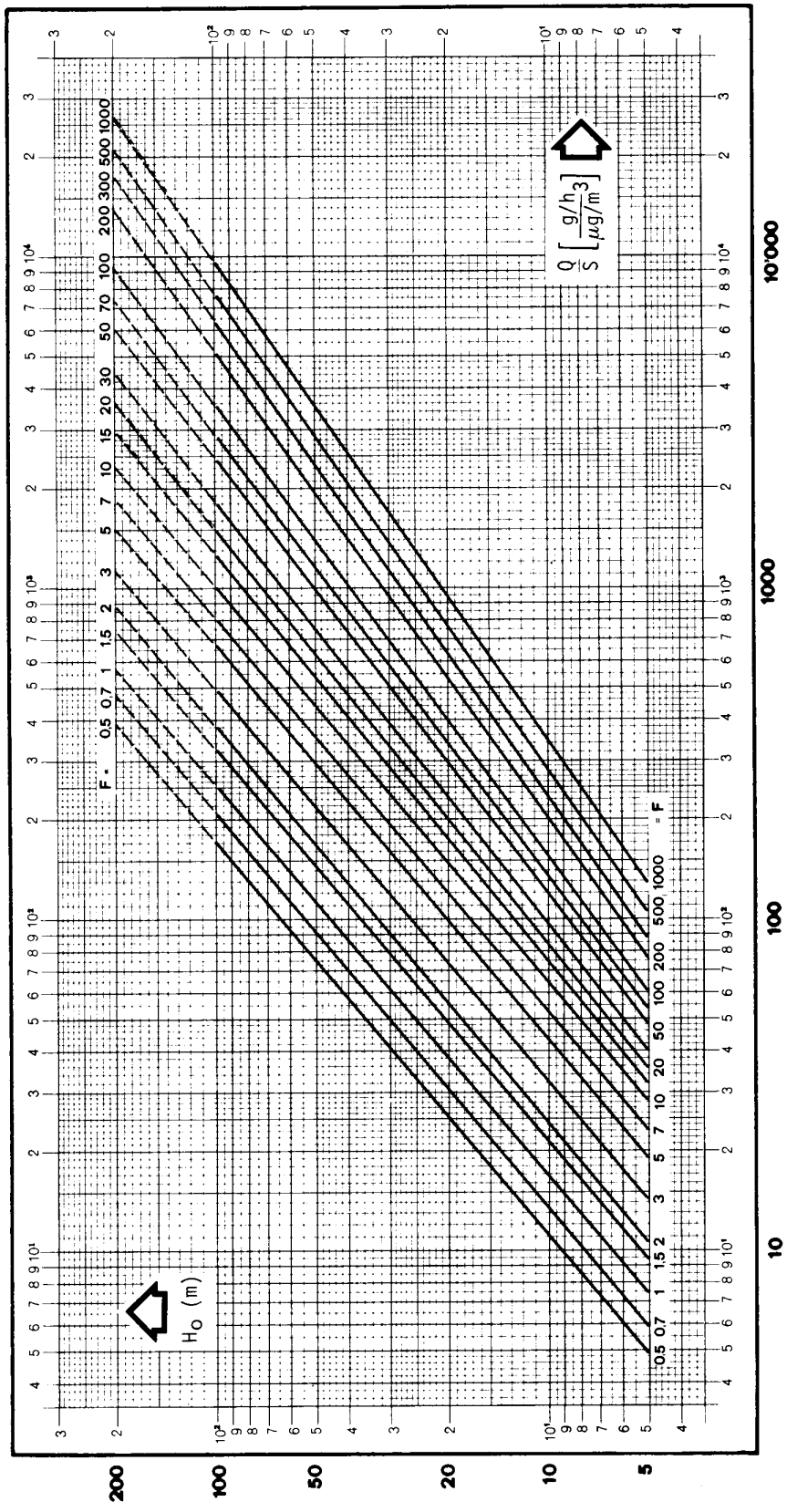
Δt (°C) = t-10 °C
F (m^4/s^3) = lift flux; $F = 3.18 \times 10^{-6} \times R_n \times \Delta t$
S ($\mu g/m^3$) = S-value (see Fig. 3 and 9)

9 S-values

Pollutant	S($\mu g/m^3$)
Suspended particles (PM10) [1)]	50
Hydrogen chloride, indicated as HCl	100
Chlorine	150
Hydrogen fluoride and inorganic gaseous fluorine compounds, indicated as HF	1
Carbon monoxide	8000
Sulphur oxides, indicated as sulphur dioxide	100
Hydrogen sulphide	5
Nitrogen oxides, indicated as nitrogen dioxide	100
Substances listed in Annex 1 Figure 5:	
- Class 1	0.5
- Class 2	2
- Class 3	5
Substances listed in Annex 1 Figure 7:	
- Class 1	50
- Class 2	200
- Class 3	1000
Substances listed in Annex 1 Figure 8:	
- Class 1	0.1
- Class 2	1
- Class 3	10

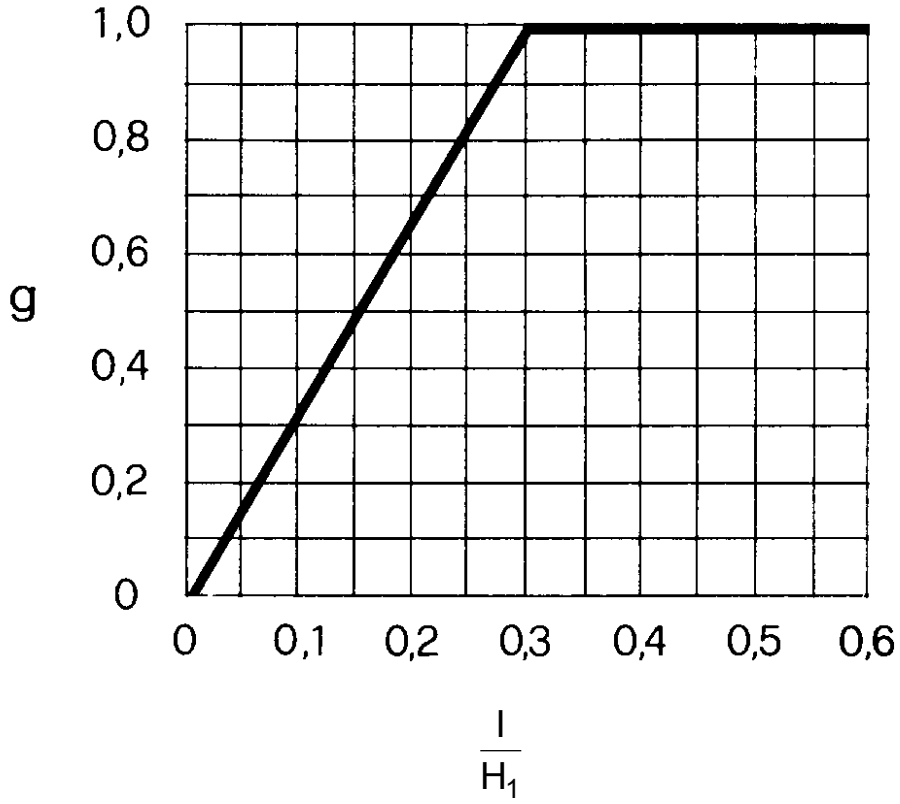
[1)] Fine particulate matter with an aerodynamic diameter of less than 10 µm.

Diagram 1: Calculation for the parameter H_O for tall stacks



$F = 3{,}18 \times 10^{-6} \times R_n \times \Delta t \qquad \Delta t = t - 10\,^{\circ}C$

Diagram 2:
Calculation of the correction factor for buildings and vegetation



I = height of the highest determining obstacle (Fig. 5)
H_1 = minimum stack height for flat land with no obstacles (Fig. 4)

Annex 7[53]
(Art. 2 Para. 5)

Ambient air quality standards

Pollutant	Ambient air quality standard	Statistical definition
Sulphur dioxide (SO_2)	30 µg/m³	Annual average level (arithmetical average)
	100 µg/m³	95% of the ½-hr-average levels of a year □ 100 µg/m³
	100 µg/m³	24-hr-average level; may be exceeded only once per year
Nitrogen dioxide (NO_2)	30 µg/m³	Annual average level (arithmetical average)
	100 µg/m³	95% of the ½-hr-average levels of a year □ 100 µg/m³
	80 µg/m³	24-hr-average level; may be exceeded only once per year
Carbon monoxide (CO)	8 mg/m³	24-hr-average level; may be exceeded only once per year
Ozone (O_3)	100 µg/m³	98% of the ½-hr-average levels of a month □ 100 µg/m³
	120 µg/m³	1-hr-average level; may be exceeded only once per year

Key:
mg = milligram; 1 mg = 0.001 g
µg = microgram; 1 µg = 0.001 mg
ng = nanogram; 1 ng = 0.001 µg
The sign " □ " means "equal to or less than"

[53] Corrected in accordance with Fig. II of the Ordinance of 15 Dec. 1997, in force since 1 March 1998 (AS **1998** 223).

Pollutant	Ambient air quality standard	Statistical definition
Suspended particulate matter (PM10) [1)]	20 µg/m³	Annual average level (arithmetical average)
	50 µg/m³	24-hr-average level; may be exceeded only once per year
Airborne Lead (Pb in PM10)	500 ng/m³	Annual average level (arithmetical average)
Airborne Cadmium (Cd in PM10)	1,5 ng/m³	Annual average level (arithmetical average)
Total dust fall out	200 mg/m² × day	Annual average level (arithmetical average)
Lead (Pb) in dust fall out	100 µg/m² × day	Annual average level (arithmetical average)
Cadmium (Cd) in dust fall out	2 µg/m² × day	Annual average level (arithmetical average)
Zinc (Zn) in dust fall out	400 µg/m² × day	Annual average level (arithmetical average)
Thallium (Tl) in dust fall out	2 µg/m² × day	Annual average level (arithmetical average)

Key:
mg = milligram; 1 mg = 0.001 g
µg = microgram; 1 µg = 0.001 mg
ng = nanogram; 1 ng = 0.001 µg
The sign " □ " means "equal to or less than"

1) Fine particulate matter with an aerodynamic diameter of less than 10 µg/m³.