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ECONOMIC COMMISSION FOR EUROPE

EXECUTIVE BODY FOR THE CONVENTION ON  
LONG-RANGE TRANSBOUNDARY AIR POLLUTION

Working Group on Abatement Techniques

**DRAFT ANNEX ON LIMIT VALUES (LVs) FOR NQ  
EMISSIONS FROM STATIONARY SOURCES**

Prepared by the Task Force on the Assessment  
of Control Options/Techniques for NQ, led by Germany <sup>\*</sup>/

**Introduction**

1. This draft annex covers the stationary sources of nitrogen oxides (NQ) emissions listed in table 1. Installations or parts of installations for research, development and testing of new products and processes are not covered

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<sup>\*</sup>/ At the fifth meeting of the Task Force held in Karlsruhe (Germany) from 21 to 22 October 1998.

**Table 1:** Considered stationary source categories for NQ emissions according to their emission relevance<sup>a/</sup>

1.	Boilers with a rated thermal input exceeding 10 MW <sup>b/</sup> .
2.	Gas turbines with a rated thermal input exceeding 1 MW
3.	Stationary engines with a rated thermal input exceeding 1 MW
4.	Mineral oil refineries (process furnaces)
5.	Production and processing of metals: <ul style="list-style-type: none"> <li>- Metal ore roasting or sintering installations</li> <li>- Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2.5 Mg/hour</li> <li>- Installations for the processing of ferrous metals (hot rolling mills) with a capacity exceeding 20 Mg/hour of crude steel)</li> </ul>
6.	Installations for the production of cement clinker in rotary kilns (production capacity > 500 Mg/d) or in other furnaces (production capacity > 50 Mg/d)
7.	Installations for the manufacture of glass, including glass fibre, with a melting capacity > 20 Mg/d
8.	Installations for the production of nitric acid

<sup>a/</sup> The given threshold values refer to production capacities or output, except for boilers, gas turbines and stationary engines. Where one operator carries out several activities falling under the same subheading at the same installation or the same site, the capacities of such activities are added together. If new capacities are added to existing installations, they must be taken into account in the calculation of the overall capacity, but may be treated separately. If no threshold value is indicated, the given limit value applies to all respective installations.

<sup>b/</sup> The rated thermal input is based on the lower heating value of the respective fuel (LHV).

## 2. Further definitions for this draft annex are:

(a) NO<sub>x</sub> emission means any discharge of NQ, usually calculated as NO<sub>2</sub>, from an installation or process into the environment;

(b) Standard conditions means a temperature of 273.15 K and a pressure of 101.3 kPa;

(c) Waste gas means the final gaseous discharge of NQ into the atmosphere. The volumetric flow rates shall be expressed in m<sup>3</sup>/h at standard conditions;

(d) Limit value means the maximum quantity of a gaseous substance contained in the waste gases from an installation which is not to be exceeded under normal operating conditions. If not otherwise specified it shall be calculated in terms of mass of pollutant per volume of the waste gases (expressed as mg/m<sup>3</sup>), assuming standard conditions for temperature and

pressure for dry gas. With regard to the oxygen content of the exhaust gas, the values given in the tables below for each source category shall apply. Any dilution for the purpose of lowering concentrations of pollutants in waste gases is not permitted. Limit values generally address NO together with NO<sub>2</sub>, commonly named NO<sub>x</sub>, expressed as NO<sub>2</sub>. Unless otherwise specified by the competent authorities, start-up, shutdown, and exceptional operating conditions are excluded;

(e) New installations can comprise existing installations that undergo essential modification (rebuilt), as is often the case, for instance, in the glass manufacturing industry.

3. Emissions shall be monitored<sup>4/</sup> in all cases. Compliance with limit values shall be verified in all cases. The methods of verification could include continuous, discontinuous measurements, type approval, or any other technically sound method. Furthermore, they shall be economically viable.

4. The concentrations of air pollutants in gas-carrying ducts have to be measured in a representative way. Sampling and analysis of all pollutants, as well as reference measurement methods to calibrate any measurement system, shall be carried out according to the standards laid down by the Comité Européen de Normalisation (CEN). If no CEN standards are given, the standards set by the International Organization for Standardization (ISO) shall apply. While awaiting the development of CEN or ISO standards, national standards shall apply. Emissions can be detected as NO only, if NO<sub>x</sub> contributes less than 5% to total NO<sub>x</sub> emissions.

5. For all installations defined in table 1, measurements of emissions [should, shall] be carried out continuously, when emissions exceed [30] kg NO<sub>x</sub>/h for a new plant or [135] kg NO<sub>x</sub>/h for an existing plant. For combustion installations of category 1, table 1, measurements of emissions should be carried out continuously, when the capacity of the plant exceeds [100; 300] MW<sub>th</sub> for a new plant or [300] MW<sub>th</sub> for an existing plant.

6. In the case of continuous measurements, as a minimum requirement, compliance with the emission standards is achieved if [95]% of the [calculated 48-hour average] values do not exceed [110]% of the limit value for combustion installations exceeding [100; 300] MW<sub>th</sub>; for all other installations where continuous measurement is required, the [daily mean] shall not exceed the limit value. [For new plants, the limit values are regarded as complied with if

- The daily average value does not exceed the given limit value, and
- The hourly average value does not exceed 200% of the given limit value.]

7. In the case of discontinuous measurements, as a minimum requirement, compliance with the emission standards is achieved if the mean value [based on an appropriate number of measurements under representative conditions] does not exceed the value of the emission standard [average value of one-hour measurements, appropriate number of hours of operation, as a rule 24 hours, at least three readings per check].

8. In the case of oxycombustion and electric furnaces for glass production, waste gas concentrations have to be converted into total emissions per product output due to the lower volume flows in the exhaust ducts.

9. Parties may use their own approaches to monitoring requirements provided that they result in equal stringency.

#### **SPECIFIC EMISSION STANDARDS FOR SELECTED MAJOR STATIONARY SOURCES**

##### **A. Boilers and process heaters with a rated thermal input exceeding 10 MW**

10. Limit values for NO<sub>x</sub> emissions released from boilers (as defined in table 1, category 1) are:

**Table 2:** NO<sub>x</sub> limit values for boilers > 10 MW<sub>th</sub>

<b>Capacity, technique, fuel specification</b>	<b>Limit value (mg/Nm<sup>3</sup>)<sup>a/</sup></b>
Solid fuels, new installations:	
- Boilers [10 - 50 MW <sub>th</sub> ]	[400; 500; 550]
- Boilers [50 - 100 MW <sub>th</sub> ]	[400]
- Boilers [100 - 300 MW <sub>th</sub> ]	[200; 300; 400]
- Boilers [> 300 MW <sub>th</sub> ]	[200; 400]
Solid fuels, existing installations:	
- Boilers [10 - 50 MW <sub>th</sub> ]	[400; 650]
- Boilers [50 - 100 MW <sub>th</sub> ]	[400; 650]
- Boilers [100 - 300 MW <sub>th</sub> ]	[200; 300; 400; 500; 650]
- Boilers [> 300 MW <sub>th</sub> ]	[200; 300; 400; 500; 650]
Liquid fuels, new installations:	
- Boilers [10 - 50 MW <sub>th</sub> ]	[300; 350; 400; 450]
- Boilers [50 - 100 MW <sub>th</sub> ]	[300; 400]
- Boilers [100 - 300 MW <sub>th</sub> ]	[150; 300]
- Boilers [> 300 MW <sub>th</sub> ]	[150; 200; 300]
Liquid fuels, existing installations:	
- Boilers [10 - 50 MW <sub>th</sub> ]	[400; 450; 600]
- Boilers [50 - 100 MW <sub>th</sub> ]	[400; 450]
- Boilers [100 - 300 MW <sub>th</sub> ]	[150; 250; 300; 350; 450; 650]
- Boilers [> 300 MW <sub>th</sub> ]	[150; 250; 450]
Gaseous fuels, new installations:	
- Boilers; fuel: natural gas	[100; 200]
- Boilers; fuel: all other gas	[200]

Capacity, technique, fuel specification	Limit value (mg/Nm <sup>3</sup> ) <sup>a/</sup>
Gaseous fuels, existing installations:	
- Fuel: natural gas	[100; 150; 200; 350]
- Boilers [10 - 50 MW <sub>th</sub> ]	[100; 150; 200; 350]
- Boilers [50 - 100 MW <sub>th</sub> ]	[100; 150; 200; 350]
- Boilers [100 - 300 MW <sub>th</sub> ]	[100; 150; 200; 350]
- Boilers [> 300 MW <sub>th</sub> ]	[100; 150; 200]
Fuel: all other gas	
- Boilers [10 - 50 MW <sub>th</sub> ]	1
- Boilers [50 - 100 MW <sub>th</sub> ]	[200; 250; 350]
- Boilers [100 - 300 MW <sub>th</sub> ]	[200; 250; 350]
- Boilers [> 300 MW <sub>th</sub> ]	[200; 250; 350]
	[100; 200; 250]
* These values do not apply to boilers running less than 500 hours a year.	
O <sub>2</sub> reference content 6% for solid fuels, 3% for others.	

#### B. Gas turbines with a rated thermal input exceeding [1; 10] MW

11. Limit values for NO<sub>x</sub> emissions released from gas turbines (as defined in table 1, category 2) are:

**Table 3:** NO<sub>x</sub> limit values for on-shore gas turbines

Capacity, technique, fuel specification	Limit value <sup>a/</sup> (mg/Nm <sup>3</sup> )
<b>Simple cycle</b>	
- [Existing installations < [30;40;50;100] MW <sub>th</sub> , natural gas]	[50; 75; 225; 350]
- [Existing installations < [30;40;50;100] MW <sub>th</sub> , all other gaseous and liquid fuels]	[100; 120; 300; 350]
- [Existing installations \$ [30;40;50;100] MW <sub>th</sub> , natural gas]	[50; 75; 225; 400]
- [Existing installations \$ [30;40;50;100] MW <sub>th</sub> , all other gaseous and liquid fuels]	[150; 300; 350; 600]
- New installations < [30;40;50;100] MW <sub>th</sub> , natural gas	[50; 75; 100; 150]
- New installations < [30;40;50;100] MW <sub>th</sub> , all other gaseous and liquid fuels	[100; 120; 150; 200]
- New installations \$ [30;40;50;100] MW <sub>th</sub> , natural gas	[50; 75; 100; 150]
- New installations \$ [30;40;50;100] MW <sub>th</sub> , all other gaseous and liquid fuels	[100; 120; 150]
<b>Combined cycle, cogeneration with post-combustion</b>	
- Fuel:natural gas [new and existing installations]	[50; 75; 100]
- Fuel:all other gaseous and liquid fuels [new and existing installations]	[100]
<sup>a/</sup> These values do not apply to gas turbines running less than 500 hours a year. O <sub>2</sub> reference content 15%.	

**C. Stationary engines with a rated thermal input exceeding 1 MW**

12. Limit values for NO<sub>x</sub> emissions released from stationary engines (as defined in table 1, category 3) are:

**Table 4:** NO<sub>x</sub> limit values for stationary engines

Capacity, technique, fuel specification	Limit value <sup>a/</sup> (mg/Nm <sup>3</sup> )
<b>Spark ignition (= Otto) engines, 4-stroke</b>	
- Lean burn engine	[100; 150; 250; 400; 500]
- All other engines	[100; 150; 350; 500]
<b>Compression ignition (= Diesel) engines</b>	
- Fuel: natural gas (jet ignition engines)	[500; 600]
- Fuel: heavy fuel oil	[600; 1,000; 1,500; 2,000]
- Fuel: diesel oil	[600; 800; 1,000; 2,000]
<sup>a/</sup> These values do not apply to engines running less than 500 hours a year. O <sub>2</sub> reference content 5%.	

**D. Mineral oil refineries**

13. Limit values for NO<sub>x</sub> emissions released from mineral oil refineries (as defined in table 1, category 4) are (steam and power generation are covered in sect.A):

**Table 5.** NO<sub>x</sub> limit values for mineral oil refineries (steam and power generation are covered in sect. A)

Capacity, technique, fuel specification	Limit value (mg/Nm <sup>3</sup> )
Existing combustion installations (73% Q)	
- Liquid fuels	[250; 300; 350; 450; 500]
- Gaseous fuels	[; 200; 350; 450; 500]
New combustion installations (73% Q)	
- Liquid fuels	[150; 250; 350; 400]
- Gaseous fuels	[150]
Existing and new installations Fluid catalytic cracker (FCC)	[200; 250; 500]

**E. Production and processing of metals**

14. Limit values for NO<sub>x</sub> emissions released from primary iron and steel production (as defined in table 1, category 5) are:

**Table 6.** NO<sub>x</sub> limit values for primary iron and steel production

Capacity, technique, fuel specification	Limit value (mg/Nm <sup>3</sup> )
Solid, liquid and gaseous fuels	
[- Existing installations, reheating and heat treatment only, excluding coke oven gas (5% Q)]	[500]
- New installations, reheating and heat treatment only, excluding coke oven gas (5% Q)	[200; 500]
- Existing installations, sinter plants (16% Q)	[250; 400]
- New installations, sinter plants (16% Q)]	[100; 400]

**F. Cement production**

15. Limit values for NO<sub>x</sub> emissions released from cement production (as defined in table 1, category 6) are:

**Table 7.** NO<sub>x</sub> limit values for cement production

Capacity, technique, fuel specification	Limit value (mg/Nm <sup>3</sup> )
New installations, general	[200; 300; 500, 800]
Existing installations, general	[400; 500; 800; 1,000; 1,200]
O <sub>2</sub> reference content 10%.	

**G. Glass production**

16. Limit values for NO<sub>x</sub> emissions released from glass production (as defined in table 1, category 7) are:

**Table 8.** NO<sub>x</sub> limit values for glass production

Capacity, technique, fuel specification	Limit value (mg/Nm <sup>3</sup> )	Limit value (kg/Mg glass)
Solid, liquid and gaseous fuels (at 8% Q), oxycombustion <sup>a/</sup>		
New installations <sup>b/</sup>		
- Regenerative furnaces, end-fired	[500; 800]	
- Regenerative furnaces, cross-fired	[500; 1,000]	
- Recuperative furnaces	[500]	
Existing installations		
- Regenerative furnaces, end-fired	[800; 1,000]	
- Regenerative furnaces, cross-fired	[800; 1,400]	
- Recuperative furnaces	[800]	
Electric furnaces		[0.75; 1]
<sup>a/</sup> Related to mass flow for comparison		
<sup>b/</sup> For the distinction between new and existing installations, see para. 2 (e)		

If nitrate refining is required for reasons of product quality, and in the case of special glass, emissions shall not exceed more than twice the above values.

#### H. Nitric acid production

17. Limit values for NO<sub>x</sub> emissions released from nitric acid production (as defined in table 1, category 8) are:

**Table 9.** NO<sub>x</sub> limit values for nitric acid production

Capacity, technique, fuel specification	Limit value (mg/Nm <sup>3</sup> )
All capacities	
- New installations	[250; 450]
- Existing installations	[450; 500]
The given limit value refers to an oxygen content of 3%.	

#### Endnote

1/ Monitoring is to be understood as an overall entity, comprising measuring of emissions, mass balancing, etc. It can be carried out continuously or discontinuously.



## ADDITIONAL PROPOSALS

### ITALY

#### Table 1

Section 1. "Boilers ... exceeding 50 MW."

#### Paragraph 4

**"When required** the concentrations ..."

Without the modification, the sentence obliges everybody to determine concentration by measurement, also if not required.

#### Paragraph 5

"... when emissions exceed [30] kg NQ/h on average during day a of operation for a new plant ..."

Otherwise even a very small installation that operates very little has to install a continuous measurement system.

### NETHERLANDS

#### Paragraph 7

Change the wording as follows:

"In cases other than those mentioned in paragraph 5, discontinuous measurements shall at least be applied, in which case compliance .. (based on six consecutive measurements of 15 minutes under representative conditions, allowing one reading only to be higher than the limit value) does not exceed the value of the emission standard".

#### Paragraph 9

Insert "at least" before the word "in".

#### Table 8:

For oxyfuel, we support the figure of 0.75 kg/Mg for new and existing plants; however, for the purpose of LVs, this figure should be expressed as a concentration tied to a reference CO<sub>2</sub> concentration instead of an oxygen concentration (air is introduced for cooling, thus giving practical metering problems with regard to fixing the proper oxygen content in the flue gas). In view of the above, we would suggest deleting paragraph 8.