

**EU provisional position** based on ECE/EB.AIR/WG.2009/18 and 18 corr. as amended by ECE/EB.AIR/WG.5/2011/2. Strikeout means provisions proposed to be deleted and bold underlined proposed amendment to text.

## Annex V

### LIMIT VALUES FOR EMISSIONS OF NITROGEN OXIDES FROM STATIONARY SOURCES

1. Section A applies to Parties other than Canada and the United States of America, section B applies to Canada and section C applies to the United States of America.

A. Parties other than Canada and the United States of America

2. For the purpose of ~~this section A~~, "**emission limit value" (ELV)** means the quantity of a ~~gaseous substance~~ **NOx (sum of NO and NO2, expressed as NO2)** contained in the waste gases from an installation that is not to be exceeded. Unless otherwise specified, it shall be calculated in terms of mass of ~~pollutant~~ **NOx** per volume of the waste gases (expressed as mg/m<sup>3</sup>), assuming standard conditions for temperature and pressure for dry gas (volume at 273.15 K, 101.3 kPa). With regard to the oxygen content of ~~exhaust~~ **waste** gas, the values given in the tables below for each source category shall apply. Dilution for the purpose of lowering concentrations of pollutants in waste gases is not permitted. ~~Limit values generally address NO together with NO2, commonly named NOx, expressed as NO2.~~ Start-up, shutdown and maintenance of equipment are excluded.

3. Emissions shall be monitored in all cases **via measurements or through calculations achieving at least the same accuracy**. Compliance with emission limit values shall be verified **through** ~~The methods of verification can include~~ continuous or discontinuous measurements, type approval, or any other technically sound method. In case of continuous measurements, compliance with the emission standard **limit values** is achieved if the validated ~~daily/monthly~~ emission average does not exceed the limit values. In case of discontinuous measurements or other appropriate determination procedures, compliance with the emission **limit values** is achieved if the mean value based on an appropriate number of measurements under representative conditions does not exceed the **emission limit** value ~~of the emission standard~~. The inaccuracy of the ~~continuous and discontinuous~~ measurement methods may be taken into account for verification purposes.

4. ~~Sampling and analysis~~ **Monitoring** of relevant polluting substances and measurements of process parameters, as well as the quality assurance of automated measuring systems and the reference measurement methods to calibrate those systems, shall be carried out in accordance with CEN standards. If CEN standards are not available, ISO standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall apply.

5. Special provisions for combustion plants **referred to in paragraph 7** ~~with a rated thermal input exceeding 50 MWth and for combustion plants when combined to a common stack with a total rated input exceeding 50 MWth~~:

5.1 The competent authority may grant derogation from the obligation to comply with the emission limit values provided for in paragraph ~~57~~ in the following cases:

a) for combustion plants ~~{only/mainly}~~ **normally** using gaseous fuel ~~who~~ **that** have to resort exceptionally to the use of other fuels because of a sudden interruption in the supply of gas and for this reason would need to be equipped with a waste gas purification facility

[b) for **existing** combustion plants not operated more than ~~XXX~~ **17 500** operating hours, starting from DATE **1 January 2016** and ending no later than **31 December 2023**DATE]

[c) for existing combustion plants **other than on shore gas turbines (covered by paragraph 8)** using solid or liquid fuels not operated more than 1500 operating hours per year as a rolling average over a period of five years; instead **the** following emission limit values apply:

for solid fuels: ~~{option 1 and 2 = 450 mg/Nm<sup>3</sup>; option 3 = 600 mg/Nm<sup>3</sup>}~~

for liquid fuels: ~~{option 1, 2 and 3 = 450 mg/Nm<sup>3</sup>}~~

5.2 Where a combustion plant is extended by at least 50MWth, the emission limit value specified in paragraph 7 for new installations shall apply to the extensional part ~~and to the part of the plant~~ affected by the change.

5.3 Parties shall ensure that provisions are made in the permits for procedures relating to malfunction or breakdown of the abatement equipment.

5.4 In the case of a multi-fuel firing combustion plant involving the simultaneous use of two or more fuels, the competent authority shall **determine the emission limit value as the weighted average of the emission limit values for the individual fuels, on the basis of the thermal input delivered by each fuel.** ~~provide rules for setting the emission limit values.~~

6. — **Parties may apply rules by which combustion plants and process plants within a** ~~m~~Mineral oil refineries may be exempted from compliance with the individual NO<sub>x</sub> limit values **set out** in this annex, **provided that they are** complying with ~~a~~ **the overall bubble** NO<sub>x</sub> limit value; **determined on the basis of the best available techniques** ~~set in table 1. Following~~ ~~alternative bubble NO<sub>x</sub> limit value may be used, referring to the sum of the emissions from all~~ combustion plants and process installations expressed as an average concentration and at a reference oxygen content of ~~[3%]~~

7. Combustion plants (boilers and process heaters) with a rated thermal input exceeding 50 MWth or combustion plants when combined to a common stack with a total rated input exceeding 50 MWth<sup>1</sup>:

**Table 1. Suggested options for limit values for NO<sub>x</sub> emissions released from refineries using the bubble concept**

|                      | Suggested ELV for NO <sub>x</sub> [mg/Nm <sup>3</sup> ] |                        |                        |
|----------------------|---|------------------------|------------------------|
|                      | Option 1 <sup>1/</sup>                                  | Option 2 <sup>1/</sup> | Option 3 <sup>1/</sup> |
| Mineral oil refinery | 150   | 300                    | 400                    |

Oxygen reference: dry basis, 3% for combustion, 15 % for gas turbines

**Table 2. Suggested options for Limit values for NO<sub>x</sub> emissions released from boilers and process heaters - combustion plants <sup>a/</sup>**

| Fuel type   | Thermal input [MWth] | ELV for NO <sub>x</sub> [mg/Nm <sup>3</sup> ] <sup>b/</sup>    |   |   |
|-------------|----------------------|--|---|---|
|             |                      | Option 1 <sup>1/</sup>   | Option 2 <sup>1/</sup>  | Option 3 <sup>1/</sup>  |
| Solid fuels | 50-100               | New plants:<br>250 (coal, lignite)<br>200 (biomass, peat)      | New plants:<br>300 (coal, lignite and <b>other solid fuels</b> )<br>(pulverised lignite: 450)<br>250 (biomass, peat)      | New plants:<br>400 (coal, lignite)<br>(pulverised lignite 450)<br>400 (biomass, peat) |
|             |                      | Existing plants:<br>250 (coal, lignite)<br>250 (biomass, peat) | Existing plants:<br>300 (coal, lignite and <b>other solid fuels</b> )<br>(pulverised lignite: 450)<br>300 (biomass, peat) | Existing plants:<br>600 (coal, lignite)<br>600 (biomass, peat)                        |

<sup>1</sup> **The rated thermal input of the combustion plant is calculated as the sum of the input of all units connected to a common stack.** Individual combustion plants **units** below 15 MWth shall not be considered **when calculating** to calculate the total rated input.

| Fuel type | Thermal input<br>[MWth] | ELV for NO <sub>x</sub> [mg/Nm <sup>3</sup> ] <sup>b/</sup>    |   |   |                         |
|-----------|-------------------------|--|---|---|-------------------------|
|           |                         | Option 1 <sup>1/</sup>   | Option 2 <sup>1/</sup>  | Option 3 <sup>1/</sup>  |                         |
|           | 100-300                 | New plants:<br>150 (coal, lignite)<br>150 (biomass, peat)      | New plants:<br><u>200 (coal, lignite and other solid fuels)</u><br><u>200 (biomass, peat)</u>           | New plants:<br>200 (coal, lignite)<br>300 (biomass, peat)             |                         |
|           |                         | Existing plants:<br>200 (coal, lignite)<br>200 (biomass, peat) | Existing plants:<br><u>200 (coal, lignite and other solid fuels)</u><br><u>250 (biomass, peat)</u>      | Existing plants:<br>600 (coal, lignite)<br>600 (biomass, peat)        |                         |
|           | >300                    | New plants:<br>100 (coal, lignite)<br>100 (biomass, peat)      | New plants:<br><u>150 (coal, lignite and other solid fuels) (general)</u><br><u>150 (biomass, peat)</u> | New plants:<br><u>200 (pulverised lignite)</u><br>200 (biomass, peat) |                         |
|           |                         | Existing plants:<br>100 (coal, lignite)<br>100 (biomass, peat) | Existing plants:<br><u>200 (coal, lignite and other solid fuels)</u><br><u>200 (biomass, peat)</u>      | Existing plants:<br>200 (coal, lignite)<br>200 (biomass, peat)        |                         |
|           | Liquid fuels            | 50-100   | New plants:<br>250  | New plants:<br>300  | New plants:<br>400      |
|           |                         |  | Existing plants:<br>300   | Existing plants:<br>450   | Existing plants:<br>450 |
| 100-300   |                         | New plants:<br>100   | New plants:<br>150  | New plants:<br>200  |                         |

| Fuel type   | Thermal input<br>[MWth] | ELV for NO <sub>x</sub> [mg/Nm <sup>3</sup> ] <sup>b/</sup> |   |                                   |
|-------------|-------------------------|---|---|-----------------------------------|
|             |                         | Option 1 <sup>1/</sup>                                      | Option 2 <sup>1/</sup>  | Option 3 <sup>1/</sup>            |
|             |                         |   | Existing plants:<br>450   | Existing plants:<br>200 (general) |
|             | New plants:<br>80       | New plants:<br>100  | New plants:<br>200  |                                   |
|             | >300                    | Existing plants:<br>400                                     | Existing plants:<br>150 (general)<br><u>450 for firing of distillation and conversion residues from crude oil refining for own consumption in combustion plants and for firing liquid production residue as non-commercial fuel (&lt; 500 MW)</u> | Existing plants:<br>400           |
| Natural gas | 50-300                  | New plants:<br>80   | New plants:<br>100  | New plants:<br>150                |
|             |                         | Existing plants:<br>80                                      | Existing plants:<br>100   | Existing plants:<br>300           |
|             | >300                    | New plants:<br>60   | New plants:<br>100  | New plants:<br>100                |

| Fuel type                         | Thermal input<br>[MWth] | ELV for NO <sub>x</sub> [mg/Nm <sup>3</sup> ] <sup>b/</sup> |                        |                        |
|-----------------------------------|-------------------------|---|------------------------|------------------------|
|                                   |                         | Option 1 <sup>1/</sup>                                      | Option 2 <sup>1/</sup> | Option 3 <sup>1/</sup> |
|                                   |                         | Existing plants:  | Existing plants:       | Existing plants:       |
| Other gaseous fuels <sup>e/</sup> | >50                     | 80  | <u>100</u>             | 200                    |
|                                   |                         | New plants:   | New plants:            | New plants:            |
|                                   |                         | 200   | <u>200</u>             | 200                    |
| Existing plants:                  | Existing plants:        | Existing plants:  | Existing plants:       |                        |
|                                   |                         | 300   | <u>300</u>             | 300                    |

a/ In particular, the **emission** limit values shall not apply to:

- ~~Plant where the combustion process is an integrated part of a specific production, for example the coke oven used in the Iron and Steel industry and glass and ceramics production plants;~~
- Plant in which the products of combustion are used for direct heating, drying, or any other treatment of objects or materials;
- Post-combustion plants designed to purify the waste gases by combustion which are not operated as independent combustion plants;
- Facilities for the regeneration of catalytic cracking catalysts;
- Facilities for the conversion of hydrogen sulphide into sulphur;
- Reactors used in the chemical industry;
- Coke battery furnaces;
- Cowpers;
- ~~{Recovery boilers for black liquor within installations for the production of pulp}~~
- Waste incinerators; and
- Plant powered by diesel, petrol or gas engines or by combustion turbines, irrespective of the fuel used.

b/ ~~These values do not apply to combustion plants running less than 500 hours a year.~~  
The O<sub>2</sub> reference content is 6% for solid fuels and 3% for **others liquid and gaseous fuels.**

e/ ~~inter alia refinery gases, coke oven gases, blast furnace gases, BOF gases~~

8. Onshore combustion turbines with a rated thermal input exceeding 50MWth: the NO<sub>x</sub> **emission** limit values expressed in mg/Nm<sup>3</sup> (at a **reference** O<sub>2</sub> content of 15%) are to be applied to a single turbine. The **emission** limit values in table 3 apply only above 70% load.

**Table 3. Suggested options for Limit values for NO<sub>x</sub> emissions released from onshore combustion turbines (including CCGT)**

| Fuel type                                      | Thermal input<br>[MWth] | ELV for NO <sub>x</sub> [mg/Nm <sup>3</sup> ] <sup>a/</sup>  |   |                                |
|--|-------------------------|--|---|--------------------------------|
|  |                         | Option 1 <sup>1/</sup>   | Option 2 <sup>1/</sup>  | Option 3 <sup>1/</sup>         |
| Liquid fuels<br>(light and medium distillates) | >50                     | <u>New plants:</u><br>50   | <u>New plants:</u><br>100   | <u>New plants:</u><br>120      |
|  |                         | <u>Existing plants:</u><br>90<br><b><u>200 in case of plants operating less than 1500 hours per year</u></b>                               | <u>Existing plants:</u><br>120  | <u>Existing plants:</u><br>120 |
| Natural gas <sup>b/</sup>                      | >50                     | <u>New plants:</u><br>50   | <u>New plants:</u><br>50 (in general) <sup>d/</sup>   | <u>New plants:</u><br>50       |
|  |                         | <u>Existing plants:</u><br><b><u>50 (general) c/ d/</u></b><br><b><u>150 in case of plants operating less than 1500 hours per year</u></b> | <u>Existing plants:</u><br>90   | <u>Existing plants:</u><br>120 |
| Other gases <sup>e/</sup>                      | >50                     | <u>New plants:</u><br>50   | <u>New plants:</u><br>50  | <u>New plants:</u><br>50       |
|  |                         | <u>Existing plants:</u><br>75  | <u>Existing plants:</u><br>120<br><b><u>200 in case of plants operating less than 1500 hours per year</u></b> | <u>Existing plants:</u><br>120 |

a/ Gas turbines for emergency use that operate less than 500 hours per year are not covered.

b/ Natural gas is naturally occurring methane with not more than 20% (by volume) of inert gases and other constituents.

e/ ~~[e.g. for supplementary firing with other gases]~~

c/ 75 mg/Nm<sup>3</sup> in the following cases, where the efficiency of the gas turbine is determined at ISO base load conditions:

- (i) gas turbines, used in combined heat and power systems having an overall efficiency greater than 75 %;
  - (ii) gas turbines used in combined cycle plants having an annual average overall electrical efficiency greater than 55 %;
  - (iii) gas turbines for mechanical drives.)
- d/ for single gas turbines not falling into any of the categories mentioned under footnote d/, but having an efficiency greater than 35 % - determined at ISO base load conditions – the ELV for NO<sub>x</sub> shall be 50 x η / 35 where η is the gas-turbine efficiency at ISO base load conditions expressed as a percentage.

9. Cement production:

**Table 4. Suggested options for Limit values for NO<sub>x</sub> emissions released from cement clinker production<sup>a/</sup>**

|   | ELV for NO <sub>x</sub> [mg/Nm <sup>3</sup> ] |                        |                        |
|---|---|------------------------|------------------------|
|   | Option 1 <sup>1/</sup>                        | Option 2 <sup>1/</sup> | Option 3 <sup>1/</sup> |
| New installations   |   |                        |                        |
| - <del>preheater kilns</del> <b>General (existing and new installations)</b><br>- other kilns | 300   | 400                    | <u>500</u>             |
| - <b>Existing</b> lepol and long rotary kilns <b>in which no waste is co-incinerated</b>      | 400   | <u>800</u>             | 800                    |
| <del>Existing installations</del>   | 400   | 800                    | 1200                   |

a/ Installations for the production of cement clinker in rotary kilns with a capacity >500 Mg/day or in other furnaces with a capacity >50 Mg/day. The O<sub>2</sub> reference content is 10%.

10. Stationary engines:

**Table 5. Suggested options for Limit values for NO<sub>x</sub> emissions released from new stationary engines**

| ENGINE TYPE, POWER, FUEL SPECIFICATION | ELV 1                 |                       | ELV 2                 | ELV 3                 |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
|  | (a)                   | (b)                   | (a)                   | (a)                   |
|  | (c)                   | (c)                   | (c)                   | (a)                   |
|  | [mg/Nm <sup>3</sup> ] | [mg/Nm <sup>3</sup> ] | [mg/Nm <sup>3</sup> ] | [mg/Nm <sup>3</sup> ] |



|  |   |  |   |
|--|---|--|---|
| <b>GAS ENGINES &gt; 1 MW<sub>th</sub></b><br>Spark ignited (=Otto) engines<br>all gaseous fuels  | 35  | <u>95</u><br><b>(enhanced lean burn)</b>   | <u>190</u><br><b>Standard lean burn or rich burn with catalyst</b>  |
| <b>DUAL FUEL ENGINES &gt; 1 MW<sub>th</sub></b><br>In gas mode (all gaseous fuels)<br>In liquid mode (all liquid fuels)<br>1-20 MW<br>>20 MW   | 35 <sup>(e)</sup><br><br><u>225</u><br><u>225(e)</u>                  | <u>190(e)</u><br><br>750<br>450  | 380(e)<br><br>{1850} {2000}<br>{1850} {2000}  |
| <b>DIESEL ENGINES &gt; 5 MW<sub>th</sub></b><br><b>(compression ignition)</b><br><i>Slow (&lt; 300 rpm)/ Medium (300-1200 rpm)/ speed</i><br>5-20 MW<br>HFO and bio-oils<br>LFO and NG<br>>20 MW<br>HFO and bio-oils<br>LFO and NG<br><i>High speed (&gt;1200 rpm)</i> | <br><br><u>225</u><br>450<br><br><u>190</u><br>450<br><br>{130} {150} | <br><br>{450} {750}<br><u>190</u><br><br>{225} {450}<br><u>190</u><br><br><u>190</u> | <br><br>{1300} (d) {1600}<br>{1300} (d) {1600}<br><br><br>{750} {1850}<br>{750} {1850}<br><br>{750} {900} |

The reference oxygen content is 15% <sup>2</sup>

(a) These **emission limit** values do not apply to engines running less than 500 hours a year.

(b) Where SCR cannot currently be applied **for technical and logistical reasons** ~~{for certain geographical areas, like on remote islands}~~ or **where** the unavailability of **sufficient amounts of good high quality fuel or raw material quality cannot be** guaranteed, a transition period of ~~{x}~~ **10 years after the entry into force of the Protocol can may be applied granted for diesel engines and dual fuel engines during which the following emission limit values apply: -** *{During this transition period the upper value of ELV3 can be applied.}*

**- dual fuel engines: 380 mg/Nm<sup>3</sup> in gas mode and 1850 mg/Nm<sup>3</sup> in liquid mode:**

**- diesel engines - Slow (< 300 rpm) and Medium (300-1200 rpm)/ speed: 1300 mg/Nm<sup>3</sup> for engines between 5 and 20 MW and 1850 mg/Nm<sup>3</sup> for engines > 20 MW**

<sup>2</sup> The conversion factor from the limit values in the current Protocol (at 5% oxygen content) is 2,66 (16/6).

Thus, the limit value of:

- 190 mg/Nm<sup>3</sup> at 15 % O<sub>2</sub> corresponds to 500 mg/Nm<sup>3</sup> at 5 % O<sub>2</sub>,
- 95 mg/Nm<sup>3</sup> at 15 % O<sub>2</sub> corresponds to 250 mg/Nm<sup>3</sup> at 5 % O<sub>2</sub>,
- 225 mg/Nm<sup>3</sup> at 15 % O<sub>2</sub> corresponds to 600 mg/Nm<sup>3</sup> at 5 % O<sub>2</sub>.

**- diesel engines – High speed (> 1200 rpm): 750 mg/Nm<sup>3</sup>**

(c) ~~A flexibility option for Engines running between 500 to and 1500 operational hours per year~~ **may be exempted from compliance with these emission limit values in case they are applying** is to apply ~~[the upper values of ELV3] [achievable with primary measures~~ **to limit NO<sub>x</sub> emissions and meet the emission limit values set out in footnote (b)]**.

(d) ~~Limit of primary measures under development (Currently only first laboratory tests done on some engine type.)~~

(e) ~~A derogation from the obligation to comply with the emission limit values can be granted to combustion plants using gaseous fuel which have to resort exceptionally to the use of other fuels because of a sudden interruption in the supply of gas and for this reason would need to be equipped with a waste gas purification facility. The exception time period shall not exceed 10 days except where there it is an overriding need to maintain energy supplies.~~

~~[Since engines running with higher energy efficiency consume less fuel and emit therefore less CO<sub>2</sub> and since higher efficiency of the engines can lead to higher temperatures and therefore to higher NO<sub>x</sub> concentrations in the flue gases, a NO<sub>x</sub> bonus using the formula [ELV x actual efficiency / reference efficiency] could be justified.]~~

11. ~~Production and processing of metals~~ **Iron ore sinter plants:**

**Table 6. ~~Suggested options for~~ Limit values for NO<sub>x</sub> emissions released from ~~primary iron and steel~~<sup>a/</sup> **production iron ore sinter plants****

| Plant type                           | Suggested ELV for NO <sub>x</sub> [mg/Nm <sup>3</sup> ] <sup>b/</sup> |                        |                        |
|--------------------------------------|---|------------------------|------------------------|
|                                      | Option 1 <sup>1/</sup>  | Option 2 <sup>1/</sup> | Option 3 <sup>1/</sup> |
| Sinter plants: New installation      | [... <sup>c/</sup> ]  | <u>400</u>             | 400                    |
| Sinter plants: Existing installation | [... <sup>e/</sup> ]  | <u>400</u>             | 400                    |

~~a/ — Production and processing of metals: metal ore roasting or sintering installations, installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting with a capacity exceeding 2.5 Mg/hour, installations for the processing of ferrous metals (hot rolling mills > 20 Mg/hour of crude steel).~~

~~b/ — As an exemption to paragraph 3, these ELVs should be considered as averaged over a substantial period of time~~

~~e/ — SCR is considered as part of the BAT in the European Reference document but no BAT-AEL is reported.~~

12. Nitric acid production:

**Table 7. Suggested options for Limit values for NO<sub>x</sub> emissions from nitric acid production excluding acid concentration units**

| Type of installations  | ELV for NO <sub>x</sub> [mg/Nm <sup>3</sup> ] |                                  |                        |
|------------------------|---|----------------------------------|------------------------|
|                        | Option 1 <sup>1/</sup>                        | Option 2 <sup>1/</sup>           | Option 3 <sup>1/</sup> |
| New installations      | 40  | <del>154</del> <b><u>160</u></b> | 200                    |
| Existing installations | <del>100</del>                                | <del>185</del> <b><u>190</u></b> | 200                    |