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Item 5 (e) of the provisional agenda

**Revision of the annexes to the 1999 Gothenburg Protocol
to Abate Acidification, Eutrophication and Ground-level
Ozone: draft revised annex V**

Draft revised annex V

Note by the secretariat

Summary

This document presents proposals for amendments to annex V to the Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone for consideration by the Executive Body for the Convention on Long-range Transboundary Air Pollution at its thirtieth session. It is based on document ECE/EB.AIR/WG.5/2011/10/Rev.1, as further revised at the twenty-ninth session of the Executive Body in December 2011. It also reflects modifications to section C, subsequently submitted by the delegation of the United States. Proposed new text to the draft revised annex is indicated in bold.

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 “**emission limit value**” (**ELV**) means the quantity of **NO_x (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 **NO_x** per volume of the waste gases (expressed as mg/m³), 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 the **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. Start-up, shutdown and maintenance of equipment are excluded.

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

4. **Monitoring** of relevant polluting substances and measurements of process parameters, as well as the quality assurance of automated measuring systems and the reference **measurements** to calibrate those systems, shall be carried out in accordance with CEN standards. If CEN standards are not available, ISO standards **or** 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 6**:

5.1 The competent authority may grant derogation from the obligation to comply with the **ELVs** provided for in paragraph **6** in the following cases:

(a) For combustion plants **normally** 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;

[(b) For **existing** combustion plants not operated more than **17,500** operating hours, starting from **1 January 2016** and ending no later than **31 December 2023** or

For existing combustion plants **other than onshore gas turbines (covered by paragraph 7)** using solid or liquid fuels not operated more than **1,500** operating hours per year as a rolling average over a period of five years, instead **the** following **ELVs** apply:

- (i) For solid fuels: **450 mg/m³**;
- (ii) For liquid fuels: **450 mg/m³**.]

5.2 Where a combustion plant is extended by at least 50 MWth, the **ELV** specified in paragraph 6 for new installations shall apply to the extensional part affected by the change. The ELV is calculated as an average weighted by the **actual thermal input** for both the existing and the new part of the **plant**.

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 ELV as the weighted average of the ELVs for the individual fuels, on the basis of the thermal input delivered by each fuel. Parties may apply rules by which combustion plants and process plants within a mineral oil refinery** may be exempted from compliance with the individual NO_x limit values **set out** in this annex, **provided that they are complying with a bubble NO_x limit value determined on the basis of the best available techniques.**

6. Combustion plants with a rated thermal input exceeding 50 MWth:¹

Table 1

Limit values for NO_x emissions released from **combustion plants**^{a/}

Fuel type	Thermal input [(MWth)]	ELV for NO _x (mg/m ³) ^{b/}	
		Option 2	Option 3
Solid fuels	50–100	New plants: 300 (coal, lignite and other solid fuels) (pulverized lignite: 450) 250 (biomass, peat)	
		Existing plants: 300 (coal, lignite and other solid fuels) (pulverized lignite: 450) 250 (biomass, peat)	[Existing plants: 600 (coal, lignite) 600 (biomass, peat – delete]
	100–300	New plants: 200 (coal, lignite and other solid fuels) 200 (biomass, peat)	
		Existing plants: 200 (coal, lignite and other solid fuels) 250 (biomass, peat)	[Existing plants: 600 (coal, lignite) 600 (biomass, peat – delete]

¹ 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 units below 15 MWth shall not be considered when calculating the total rated input.

Fuel type	Thermal input [(MWth)]	ELV for NO _x (mg/m ³) ^{b/}	
		Option 2	Option 3
Liquid fuels	>300	New plants: 150 (coal, lignite and other solid fuels) (general) 150 (biomass, peat) Existing plants: 200 (coal, lignite and other solid fuels) 200 (biomass, peat)	New plants: 200 (pulverized lignite)
	50–100	New plants: 300 Existing plants: 450	
	100–300	New plants: 150 Existing plants: 200 (general)	Existing plants within refineries and chemical installations: 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
	>300	New plants: 100 Existing plants: 150 (general) Existing plants within refineries and chemical installations: 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 (< 500 MWth)	[Existing plants: 400 – delete]

Fuel type	Thermal input [(MWth)]	ELV for NO _x (mg/m ³) ^{b/}	
		Option 2	Option 3
Natural gas	50–300	New plants: 100	
		Existing plants: 100	
	>300	New plants: 100	
		Existing plants: 100	
Other gaseous fuels	>50	New plants: 200	
		Existing plants: 300	

^{a/} In particular, the **ELVs** shall not apply to:

- Plants 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 within installations for the production of pulp;]
- Waste incinerators; and
- Plants powered by diesel, petrol or gas engines or by combustion turbines, irrespective of the fuel used.

^{b/} The O₂ reference content is 6% for solid fuels and 3% for **liquid and gaseous fuels**.

7. Onshore combustion turbines with a rated thermal input exceeding 50 MWth: the NO_x ELVs expressed in mg/Nm³ (at a **reference** O₂ content of 15%) are to be applied to a single turbine. The **ELVs** in table 2 apply only above 70% load.

Table 2

Limit values for NO_x emissions released from onshore combustion turbines (including Combined Cycle Gas Turbine CCGT)

Fuel type	Thermal input [(MWth)]	ELV for NO _x (mg/m ³) ^{a/}	
		Option 1	Option 2
Liquid fuels (light and medium distillates)	> 50	New plants: 50	
		Existing plants: 90 200 in case of plants operating less than 1,500 hours a year	[Existing plants: 120- <u>delete</u>]

Fuel type	Thermal input [(MWh)]	ELV for NO _x (mg/m ³) ^{a/}	
		Option 1	Option 2
Natural gas ^{b/}	> 50	Existing plants: 50 (general) ^{c/, d/} 150 in case of plants operating less than 1,500 hours per year	New plants: 50 (in general) ^{d/}
Other gases	> 50		New plants: 50 Existing plants: 120 200 in case of plants operating less than 1,500 hours a year

^{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.

^{c/} **75 mg/Nm³ 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 c/, but having an efficiency greater than 35% — determined at ISO base load conditions — the ELV for NO_x shall be $50 \times \eta / 35$ where η is the gas-turbine efficiency at ISO base load conditions expressed as a percentage.

8. Cement production:

Table 3

Limit values for NO_x emissions released from cement **clinker** production^{a/}

Plant type	ELV for NO _x [(mg/Nm ³)]	
	Option 2	Option 3
General (existing and new installations)		500
Existing lepol and long rotary kilns in which no waste is co-incinerated	800	

^{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 O₂ reference content is 10%.

9. Stationary engines:

Table 4

Limit values for NO_x emissions released from new stationary engines

Engine type, power, fuel specification	ELV 1 ^{a/, b/, c/} [(mg/Nm ³)]	ELV 2 ^{a/, b/, c/} [(mg/Nm ³)]	ELV 3 ^{a/} [(mg/Nm ³)]
Gas engines > 1 MWth			
Spark ignited (=Otto) engines all gaseous fuels		95	190
		(enhanced lean burn)	Standard lean burn or rich burn [with catalyst]
Dual fuel engines > 1 MWth			
In gas mode (all gaseous fuels)		190	
In liquid mode (all liquid fuels)			
1–20 MWth	225		
>20 MWth	225 ^{c/}		
Diesel engines > 5 MWth (compression ignition)			
<i>Slow (< 300 rpm)/ Medium (300-1,200 rpm)/ speed</i>			
5–20 MWth			
Heavy Fuel Oil (HFO) and bio-oils	225		
Light Fuel Oil (LFO) and Natural Gas (NG)		190	
>20 MWth			
Heavy Fuel Oil (HFO) and bio-oils	190		
Light Fuel Oil LFO and NG		190	
<i>High speed (>1,200 rpm)</i>		190	

Note: The reference oxygen content is 15%.²

^{a/} These ELVs do not apply to engines running less than 500 hours a year.

^{b/} Where Selective Catalytic Reduction (SCR) cannot currently be applied for technical and logistical reasons [like on remote islands] or where the availability of sufficient amounts of high quality fuel cannot be guaranteed, a transition period of 10 years after the entry into force of the Protocol may be for diesel engines and dual fuel engines during which the following ELVs apply:

² 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 mgNm³ at 15 % O₂ corresponds to 500 mg/Nm³ at 5 % O₂,
- 95 mg/Nm³ at 15 % O₂ corresponds to 250 mg/Nm³ at 5 % O₂,
- 225 mg/Nm³ at 15 % O₂ corresponds to 600 mg/Nm³ at 5 % O₂.

- (i) **Dual fuel engines: 1,850 mg/Nm³ in liquid mode; 380 mg/Nm³ in gas mode;**
 (ii) **Diesel engines — Slow (< 300 rpm) and Medium (300–1,200 rpm)/speed: 1,300 mg/Nm³ for engines between 5 and 20 MWth and 1,850 mg/Nm³ for engines > 20 MWth;**
 (iii) **Diesel engines — High speed (> 1200 rpm): 750 mg/Nm³.**

^{c/} Engines **running** between 500 and 1,500 operational hours per year **may be exempted from compliance with these ELVs in case they are applying** [is to apply [the upper values of ELV3] primary measures **to limit NO_x emissions and meet the ELVs set out in footnote b/**];

[^{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. – ~~delete~~]

[[Since engines running with higher energy efficiency consume less fuel and emit therefore less CO₂ and since higher efficiency of the engines can lead to higher temperatures and therefore to higher NO_x concentrations in the flue gases, a NO_x bonus using the formula [ELV x actual efficiency / reference efficiency] could be justified .] – ~~delete~~]

10. **Iron ore sinter plants:**

Table 5

Limit values for NO_x emissions released from iron ore sinter plants

<i>Plant type</i>	<i>ELV for NO_x [(mg/Nm³)]</i>
	<i>Option 2</i>
Sinter plants: New installation	400
Sinter plants: Existing installation	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.]

11. **Nitric acid production:**

Table 6

Limit values for NO_x emissions from nitric acid production excluding acid concentration units

<i>Type of installations</i>	<i>ELV for NO_x [(mg/Nm³)]</i>
	<i>Option 2</i>
New installations	160
Existing installations	190

B. Canada

12. **Limit values for controlling emissions of NO_x will be determined for stationary sources, as appropriate, taking into account information on available control technologies, limit values applied in other jurisdictions, and the documents below:**

- (a) **New Source Emission Guidelines for Thermal Electricity Generation;**
- (b) **National Emission Guidelines for Stationary Combustion Turbines. PN1072;**
- (c) National Emission Guidelines for Cement Kilns. PN1284;
- (d) **National Emission Guidelines for Industrial/Commercial Boilers and Heaters. PN1286;**
- (e) **Operating and Emission Guidelines for Municipal Solid Waste Incinerators. PN1085;**
- (f) **Management Plan for Nitrogen Oxides (NO_x) and Volatile Organic Compounds (VOCs) — Phase I. PN1066; and**
- (g) **Operating and Emission Guidelines for Municipal Solid Waste Incinerators. PN1085.**

C. United States of America

13. Limit values for controlling emissions of NO_x from new stationary sources in the following stationary source categories are specified in the following documents:

- (a) Coal-fired Utility Units — 40 Code of Federal Regulations (C.F.R.) Part 76;
- (b) Electric Utility Steam Generating Units — 40 C.F.R. Part 60, Subpart D, and Subpart Da;
- (c) Industrial-Commercial-Institutional Steam Generating Units — 40 C.F.R. Part 60, Subpart Db;
- (d) Nitric Acid Plants — 40 C.F.R. Part 60, Subpart G;
- (e) Stationary Gas Turbines — 40 C.F.R. Part 60, Subpart GG;
- (f) Municipal Waste Combustors — 40 C.F.R. Part 60, Subpart Ea, and Subpart Eb;
- (g) Hospital/Medical/Infectious Waste Incinerators — 40 C.F.R. Part 60, Subpart Ec;
- (h) **Petroleum Refineries — 40 C.F.R. Part 60, Subpart J, and Subpart Ja;**
- (i) **Stationary Internal Combustion Engines — Spark Ignition, 40 C.F.R. Part 60, Subpart JJJJ;**
- (j) **Stationary Internal Combustion Engines — Compression Ignition, 40 C.F.R. Part 60, Subpart IIII;**
- (k) **Stationary Combustion Turbines — 40 C.F.R. Part 60, Subpart KKKK;**
- (l) **Small Municipal Waste Combustors — 40 C.F.R. Part 60, Subpart AAAA;**
- (m) **Portland Cement — 40 C.F.R. Part 60, Subpart F;**
- (n) **Commercial and Industrial Solid Waste Combustors — 40 C.F.R. Part 60, Subpart CCCC; and**
- (o) **Other Solid Waste Combustors — 40 C.F.R. Part 60, Subpart EEEE.**