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Transboundary Air Pollution

### Working Group on Strategies and Review

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Item 3 (b) of the provisional agenda

**Options for revising the annexes to the Gothenburg Protocol to  
Abate Acidification, Eutrophication and Ground-level Ozone:  
technical annexes**

## Draft revised annex IV

### Note by the secretariat

#### *Summary*

This document presents proposals for amendments to annex IV to the Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone for consideration by the Working Group on Strategies and Review at its forty-ninth session. It is based on documents ECE/EB.AIR/WG.5/2009/17, ECE/EB.AIR/WG.5/2011/2, and further proposals made by the European Union and provisionally agreed at the forty-eighth session of the Working Group in April 2011.

Proposed new text is indicated in bold. Text in square brackets that is not marked for deletion has not been provisionally agreed by the Working Group.

## Limit values for emissions of sulphur 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, except tables 3, 4 and 5, – ~~delete~~] **“emission limit value” (ELV)** means the quantity of [a gaseous substance – ~~delete~~] **SO<sub>2</sub> (or SO<sub>x</sub>, where mentioned as such)** 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 – ~~delete~~] **SO<sub>2</sub> (SO<sub>x</sub>)** 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 the [exhaust – ~~delete~~] **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<sup>1/</sup> in all cases. – ~~delete~~] Compliance with **ELVs** [limit values – ~~delete~~], **minimum desulphurization rates, sulphur recovery rates and sulphur content limit values** shall be verified [. The methods of verification can include continuous or discontinuous measurements, type approval, or any other technically sound method. – ~~delete~~]:

(a) **Emissions shall be monitored through measurements or through calculations 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. In case of continuous measurements, compliance with the [emission standards – ~~delete~~] **ELV** is achieved if the validated [[daily/ – ~~delete~~] monthly] emission average does not exceed the limit **value** [values – ~~delete~~], **unless otherwise specified for the individual source category**. In case of discontinuous measurements or other appropriate determination procedures, compliance with the [emission standards – ~~delete~~] **ELV** 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 – ~~delete~~] **ELV**. The inaccuracy of the [continuous and discontinuous – ~~delete~~] measurement methods may be taken into account for verification purposes;

(b) **In case of combustion plants applying the minimum rates of desulphurization set out in paragraph 5.1 (b), the sulphur content of the fuel shall also be regularly monitored and the competent authorities shall be informed of substantial changes in the type of fuel used. The desulphurization rates shall apply as monthly average values;**

(c) **Compliance with the minimum sulphur recovery rate shall be verified through regular measurements or any other technically sound method;**

(d) **Compliance with the sulphur limit values for gas oil shall be verified through regular targeted measurements.**

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<sup>1</sup> [Monitoring is to be understood as an overall activity, comprising measuring or calculating of emissions, mass balancing, etc. It can be carried out continuously or discontinuously. – ~~delete~~]

4. [Sampling and analysis – ~~delete~~] **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 – ~~delete~~] **measurements** to calibrate those systems, shall be carried out in accordance with **European Committee for Standardization (CEN)** standards. If CEN standards are not available, **International Organization for Standardization (ISO)** standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall apply.

5. **The following subparagraphs set out** 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: – ~~delete~~]

5.1 The competent authority may grant derogation from the obligation to comply with the emission limit values provided for in paragraph 7 in the following cases:

[(a) For [SO<sub>2</sub> in respect of – ~~delete~~] a combustion plant which to this end normally uses low-sulphur fuel, in cases where the operator is unable to comply with those limit values because of an interruption in the supply of low-sulphur fuel resulting from a serious shortage;]

[(b) For [SO<sub>2</sub> in respect of – ~~delete~~] a combustion plant firing indigenous solid fuel, which cannot comply with the emission limit values [for SO<sub>2</sub> – ~~delete~~] provided for in paragraph 7[; – ~~delete~~], instead at least **the following limit values for the** rates of desulphurization have to be met:

[Existing plants: 50–300 MWth: 92 % – ~~delete~~]

- (i) **Existing plants: 50–100 MWth: 80%;**
- (ii) **Existing plants: 100–300 MWth: 90%;**
- (iii) **New plants: 50–300 MWth: 93%;**
- (iv) **Existing plants: > 300 MWth: [96 % – ~~delete~~] 95\_%;**
- (v) **New plants: > 300 MW: 97%;]**

[(c) For combustion plants **normally** using [only / mainly – ~~delete~~] 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;]

[(d) 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;**]

[(e) For existing combustion plants 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,[-~~delete~~] instead **the following** [emission limit values – ~~delete~~] **ELVs** apply:

- (i) For solid fuels: **800 mg/m<sup>3</sup>**; [option 1 = 800 mg/Nm<sup>3</sup>; option 2 = 800 mg/Nm<sup>3</sup>; option 3 = 2000 mg/Nm<sup>3</sup> – ~~delete~~]

(ii) For liquid fuels: **850 mg/m<sup>3</sup>** [option 1 = 850 mg/Nm<sup>3</sup>; option 2 = 850 mg/Nm<sup>3</sup>; option 3 = 1700 mg/Nm<sup>3</sup>] – ~~delete~~ **for plants with a rated thermal input not exceeding 300 MWth and 400 mg/m<sup>3</sup> for plants with a rated thermal input greater than 300 MWth.**]

5.2 Where a combustion plant is extended by at least 50MWth, the [emission limit value – ~~delete~~] **ELV** specified in paragraph 7 for new installations shall apply to the extensional part [and to the part of the plant – ~~delete~~] 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 ELV as the weighted average of the ELVs for the individual fuels, on the basis of the thermal input delivered by each fuel** [provide rules for setting the emission limit values – ~~delete~~].

6. **Parties may apply rules by which combustion plants and process plants within a mineral** [Mineral – ~~delete~~] **oil refinery** [refineries – ~~delete~~] may be exempted from compliance with the individual SO<sub>2</sub> limit values **set out** in this annex, **provided that they are** complying with a [the overall – ~~delete~~] **bubble SO<sub>2</sub> limit value** [,- ~~delete~~] **determined on the basis of the best available techniques** [set in table 1. Following alternative bubble SO<sub>2</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%] – ~~delete~~].

*[Table 1. Suggested options for limit values for SO<sub>2</sub> emissions released from refineries using the bubble concept:*

| Plant type           | ELV for SO <sub>2</sub> [(mg/Nm <sup>3</sup> )] |          |          |
|----------------------|---|----------|----------|
|                      | Option 1  | Option 2 | Option 3 |
| Mineral oil refinery | 200   | 600      | 1000     |

– ~~delete~~]

7. Combustion plants [(boilers and process heaters) – ~~delete~~] 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 – ~~delete~~]:<sup>2</sup>

<sup>2</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 – ~~delete~~] **units** below 15 MWth shall not be considered **when calculating** [to calculate – ~~delete~~] the total rated **thermal** input.

Table I. [2. Suggested options for – ~~delete~~] Limit values for SO<sub>2</sub> emissions [released – ~~delete~~] from [boilers and process heaters – ~~delete~~] **combustion plants**<sup>a/</sup>

| Fuel type   | Thermal input [(MWth)] | ELV for SO <sub>2</sub> mg/m <sup>3</sup> [mg/Nm <sup>3</sup> – <del>delete</del> ] <sup>b/</sup>                      |   |  |
|-------------|------------------------|--|---|--|
|             |                        | [Option 1– <del>delete</del> ]   | Option 2  | Option 3   |
| Solid fuels | 50–100                 | [New plants:<br>300 (coal, lignite)<br>250 (peat)<br>100 (biomass) –<br><del>delete</del> ]                            | New plants:<br>400 (coal, lignite <b>and<br/>other solid fuels</b> )<br>300 (peat)<br>[150 (biomass) –<br><del>delete</del> ]                 | New plants:<br>[850 (coal,<br>lignite)<br>850 (peat) –<br><del>delete</del> ]<br>200 (biomass)         |
|             |                        | [Existing plants:<br>300 (coal, lignite)<br>250 (peat)<br>100 (biomass) –<br><del>delete</del> ]                       | Existing plants:<br>400 (coal, lignite <b>and<br/>other solid fuels</b> )<br>300 (peat)<br>[150 – <del>delete</del> ] <b>200</b><br>(biomass) | [Existing plants:<br>2000 (coal,<br>lignite)<br>2000 (peat)<br>2000 biomass) –<br><del>delete</del> ]  |
|             | 100–300                | [New plants:<br>150 (coal, lignite)<br>300 (peat)<br>100 (biomass) –<br><del>delete</del> ]                            | New plants:<br>200 (coal, lignite <b>and<br/>other solid fuels</b> )<br>300 (peat)<br>[150 (biomass) –<br><del>delete</del> ]                 | [New plants:<br>200 (coal, lignite)<br>300 (peat) –<br><del>delete</del> ]<br>200 (biomass)            |
|             |                        | [Existing plants:<br>150 (coal, lignite)<br>250 (peat)<br>100 (biomass) –<br><del>delete</del> ]                       | Existing plants:<br>250 (coal, lignite <b>and<br/>other solid fuels</b> )<br>300 (peat)<br>[150 – <del>delete</del> ] <b>200</b><br>(biomass) | [Existing plants:<br>2000 (coal,<br>lignite)<br>2000 (peat)<br>2000 (biomass) –<br><del>delete</del> ] |
|             | >300                   | [New plants:<br>100 (coal, lignite)<br>(FBC: 150)<br>100 (peat)<br>(FBC:100)<br>100 (biomass) –<br><del>delete</del> ] | New plants:<br>150 (coal, lignite <b>and<br/>other solid fuels</b> )<br>(FBC: 200)<br>150 (peat)<br>(FBC: 200)<br>150 (biomass)               | [New plants:<br>200 (coal, lignite)<br>200 (peat)<br>200 (biomass) –<br><del>delete</del> ]            |
|             |                        | [Existing plants:<br>100 (coal, lignite)<br>(FBC: 150)<br>100 (peat)<br>100 (biomass) –<br><del>delete</del> ]         | Existing plants:<br>200 (coal, lignite <b>and<br/>other solid fuels</b> )<br>200 (peat)<br>[150 – <del>delete</del> ] <b>200</b><br>(biomass) | [Existing plants:<br>1200 (coal,<br>lignite)<br>1200 (peat)<br>1200 (biomass) –<br><del>delete</del> ] |

| Fuel type   | Thermal input [(MWth)]     | ELV for SO <sub>2</sub> mg/m <sup>3</sup> [mg/Nm <sup>3</sup> – <del>delete</del> ] <sup>b/</sup> |  |  |
|---|----------------------------|---|--|--|
|   |                            | [Option 1 – <del>delete</del> ]   | Option 2   | Option 3                                     |
| Liquid fuels  | 50–100                     | [New plants: 200 – <del>delete</del> ]  | New plants: 350  | [New plants: 850 – <del>delete</del> ]       |
|   |                            | [Existing plants: 200 – <del>delete</del> ]   | Existing plants: 350   | [Existing plants: 1700 – <del>delete</del> ] |
|   | 100–300                    | [New plants: 150 – <del>delete</del> ]  | New plants: 200  | [New plants: 400 – <del>delete</del> ]       |
|   |                            | [Existing plants: 150 – <del>delete</del> ]   | Existing plants: 250   | [Existing plants: 1700 – <del>delete</del> ] |
|   | >300                       | [New plants: 100 – <del>delete</del> ]  | New plants: 150  | New plants: 200                              |
|   |                            | [Existing plants: 100 – <del>delete</del> ]   | Existing plants: 200   | Existing plants: 1,700                       |
| Gaseous fuels in general  | >50                        | [New plants: 10 – <del>delete</del> ]   | [New plants: 20 – <del>delete</del> ]  | New plants: 35                               |
|   |                            | [Existing plants: 10 – <del>delete</del> ]  | [Existing plants: 30 – <del>delete</del> ]   | Existing plants: 35                          |
| Liquefied gas   | >50                        | [New plants: 5 – <del>delete</del> ]  | New plants: 5  | [New plants: 5 – <del>delete</del> ]         |
|   |                            | [Existing plants: 5 – <del>delete</del> ]   | Existing plants: 5   | [Existing plants: 5 – <del>delete</del> ]    |
| [Low-calorific-value gases <sup>c/</sup> – <del>delete</del> ]<br><b>Coke oven gas or blast furnace gas</b> | >50                        | [New plants: 200 – <del>delete</del> ]  | New plants: 200 for<br><b>blast furnace gas</b><br>400 for coke oven gas                                 | [New plants: 400 – <del>delete</del> ]       |
|   |                            | [Existing plants: 200 – <del>delete</del> ]   | Existing plants: [250 – <del>delete</del> ] 200 for<br><b>blast furnace gas</b><br>400 for coke oven gas | [Existing plants: 800 – <del>delete</del> ]  |
| <b>Gasified refinery residues</b>   | > 50                       |   | <b>New plants: 35</b>  | <b>Existing plants: 800</b>                  |
| [Low calorific gases from blast furnace and BOF – <del>delete</del> ]                                       | [>50 – <del>delete</del> ] | [New plants: 200 – <del>delete</del> ]  | [New plants: 200 – <del>delete</del> ]   | [New plants: 200 – <del>delete</del> ]       |
|   |                            | [Existing plants: 200 – <del>delete</del> ]   | [Existing plants: 400 – <del>delete</del> ]  | [Existing plants: 800 – <del>delete</del> ]  |
| <b>FBC</b> fluidized bed combustion (circulating, pressurized, bubbling)                                    |                            |   |  |  |

<sup>a/</sup> In particular, the [limit values – ~~delete~~] ELVs shall not apply to:

[- Plants 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; – ~~delete~~]

- 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[for black liquor – ~~delete~~] 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.
- [ - Combustion plants running less than 500 hours a year. - ~~delete~~]
- <sup>b/</sup> The O<sub>2</sub> reference content is 6% for solid fuels and 3% for [others – ~~delete~~] **liquid and gaseous fuels.**
- <sup>c/</sup> e.g. gasification of refinery residues or coke oven gas – ~~delete~~
8. Gas oil:

Table 2. [3. Suggested options for – ~~delete~~] Limit values for the sulphur content of gas oil <sup>a/</sup>

|         | Sulphur content (per cent by weight) |
|---------|--------------------------------------|
| Gas oil | < 0.10                               |

<sup>a/</sup>“Gas oil” means any petroleum-derived liquid fuel, excluding marine fuel, falling within CN code 2710 19 25, 2710 19 29, 2710 19 45 or 2710 19 49, or any petroleum-derived liquid fuel, excluding marine fuel, of which less than 65% by volume (including losses) distils at 250° C and of which at least 85% by volume (including losses) distils at 350° C by the ASTM D86 method. Diesel fuels, i.e., gas oils falling within CN code 2710 19 41 and used for self-propelling vehicles, are excluded from this definition[product within HS 2710, or any petroleum product which, by reason of its distillation limits, falls within the category of middle distillates intended for use as fuel and of which at least 85 per cent by volume, including distillation losses, distils at 350°C – ~~delete~~]. Fuels used in [on-road and – ~~delete~~] non-road **mobile machinery** [vehicles – ~~delete~~] and agricultural tractors are **also** excluded from this definition. [Gas oil intended for marine use is included in the definition if it meets the description above or it has a viscosity or density falling within the ranges of viscosity or density defined for marine distillates in table I of ISO 8217 (1996) – ~~delete~~].

9. Mineral oil and gas refineries:

[Claus plant - ~~delete~~] **Sulphur recovery units:** for plants that produces more than 50 Mg of sulphur a day:

Table 3. [4. Suggested options for Limit values for SO<sub>2</sub> emissions released from – ~~delete~~] Limit value expressed as a minimum sulphur recovery rate of sulphur recovery units

| Plant type     | [Efficiency for sulphur recovery– <del>delete</del> ] Minimum sulphur recovery rate <sup>a/</sup> |                             |                           |
|----------------|---|-----------------------------|---------------------------|
|                | [Option 1– <del>delete</del> ]  | Option 2                    | Option 3                  |
| New plant      | [99.9 – <del>delete</del> ]   | [99.8 – <del>delete</del> ] | <b>99.5</b>               |
| Existing plant | [99.5 – <del>delete</del> ]   | <b>98.5</b>                 | [97 – <del>delete</del> ] |

<sup>a/</sup> The sulphur recovery rate is the percentage of the imported H<sub>2</sub>S converted to elemental sulphur as a yearly average.

10. Titanium dioxide production:

Table 4. [5. Suggested options for – ~~delete~~] Limit values for SO<sub>x</sub> emissions released from titanium dioxide production (annual average)

| Plant type                       | ELV for SO <sub>x</sub> (expressed as SO <sub>2</sub> ) [(kg/t of TiO <sub>2</sub> )] |          |                                 |
|----------------------------------|---|----------|---------------------------------|
|                                  | [Option 1 – <del>delete</del> ]   | Option 2 | [Option 3 – <del>delete</del> ] |
| Sulphate process, total emission | [3 – <del>delete</del> ]  | 6        | [10 – <del>delete</del> ]       |
| Chloride process, total emission | [1.5 – <del>delete</del> ]  | 1.7      | [3 – <del>delete</del> ]        |

## B. Canada

11. [13. Limit values for controlling emissions of sulphur dioxide from new stationary sources in the following stationary source category will be determined on the basis of available information on control technology and levels, including limit values applied in other countries and the following document: Canada Gazette, Part I. Department of the Environment. Thermal Power Generation Emissions – National Guidelines for New Stationary Sources. May 15, 1993. pp. 1633-1638. – ~~delete~~] **[Limit values for controlling emissions of sulphur oxides 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. These documents vary in the degree to which they are mandatory, and in some cases the authority for implementation is not at the federal level, but rests with sub-national jurisdictions. The inclusion of a particular document should not be understood to imply that Canada agrees to be bound by it under the Gothenburg Protocol:**

(a) **Order Adding Toxic Substances to Schedule 1 to the Canadian Environmental Act, 1999. SOR/2011-34;**

(b) **Proposed Regulation, Order Adding Toxic Substances to Schedule 1 to the Canadian Environmental Protection Act, 1999;**

(c) **New Source Emission Guidelines for Thermal Electricity Generation;**

(d) **National Emission Guidelines for Stationary Combustion Turbines. PN1072; and**

(e) **Operating and Emission Guidelines for Municipal Solid Waste Incinerators. PN1085.]**

## C. United States of America

12. [14. – ~~delete~~] Limit values for controlling emissions of sulphur dioxide from new stationary sources in the following stationary source categories are specified in the following documents:

(a) **Electric Utility Steam Generating Units — 40 Code of Federal Regulations (C.F.R.) Part 60, Subpart D, and Subpart Da;**

(b) **Industrial-Commercial-Institutional Steam Generating Units — 40 C.F.R. Part 60, Subpart Db, and Subpart Dc;**



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- (c) Sulphuric Acid Plants — 40 C.F.R. Part 60, Subpart H;
  - (d) Petroleum Refineries — 40 C.F.R. Part 60, **Subpart J and Subpart Ja**;
  - (e) Primary Copper Smelters — 40 C.F.R. Part 60, Subpart P;
  - (f) Primary Zinc Smelters — 40 C.F.R. Part 60, Subpart Q;
  - (g) Primary Lead Smelters — 40 C.F.R. Part 60, Subpart R;
  - (h) Stationary Gas Turbines — 40 C.F.R. Part 60, Subpart GG;
  - (i) Onshore Natural Gas Processing — 40 C.F.R. Part 60, Subpart LLL;
  - (j) Municipal Waste Combustors — 40 C.F.R. Part 60, Subpart Ea, and Subpart Eb;[ and – delete]
  - (k) Hospital/Medical/Infectious Waste Incinerators — 40 C.F.R. Part 60, Subpart Ec;
  - (l) **Stationary Combustion Turbines — 40 C.F.R. Part 60, Subpart KKKK;**
  - (m) **Small Municipal Waste Combustors — 40 C.F.R. Part 60, Subpart AAAA; and**
  - (n) **Kraft Pulp Mills — 40 C.F.R. Part 60, Subpart BB.**
-