



Guidance document for estimation and measurement of VOC emissions from activities covered by annex VI of the Gothenburg Protocol

Technical TFTEI meeting of 24 June 2015

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Agenda



- The demand,
- The context of the Gothenburg Protocol
- Organisation of the guidance and information available
- Next steps

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The demand



- ❑ Guidelines and practicalities of VOC emission calculation for EECCA (individual VOC conversion into organic carbon/VOC total quantity) under the Gothenburg protocol

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Context of the document



- ❑ Gothenburg Protocol:
 - ✓ Introduction of commitments for reduction of VOC emissions for Parties in 2020
 - ✓ Mandatory Emission Limit Values (ELVs) for different activities (for VOCs, annex VI and annex XI)
 - ✓ Establishment of solvent management plans for activities using solvents covered by annex VI

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Context of the document



Gothenburg Protocol :

Emissions shall be monitored in all cases via measurements or through calculations

Compliance with ELVs shall be verified through continuous or discontinuous measurements, type approval, or any other technically sound method.

*For the emissions in waste gases, in case of **continuous measurements**, compliance with the ELVs is achieved if the validated daily emission average does not exceed the ELVs.*

*In case of **discontinuous measurements** or other appropriate determination procedures, compliance with the ELVs is achieved if the average of all the readings or other procedures within one monitoring exercise does not exceed the limit values.*

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Context of the document



Gothenburg Protocol :

The inaccuracy of the measurement methods may be taken into account for verification purposes.

The fugitive and total ELVs apply as annual averages;

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Context of the document



☐ Gothenburg Protocol :

The concentrations of air pollutants in gas-carrying ducts shall be measured in a representative way.

*Monitoring of relevant polluting substances and measurements of process parameters, as well as the quality assurance of automated 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, national or international standards** which will ensure the provision of data of an equivalent scientific quality shall apply.*

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Organisation of the guidance developed



- ✓ Context and aim of the guidance
- ✓ Types of ELVs implemented in annex VI
- ✓ VOC measurement techniques
- ✓ Solvent management plan
- ✓ Control of VOC ELVs for some activities

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Types of ELVs implemented



- ✓ **EIVs expressed as total organic carbon (TOC)**, which is a concentration of carbon in the gas stream, usually expressed in mg C per cubic meter (**mg C/m³**), in the standard conditions (STP), methane can be include or not,
- ✓ **ELVs related to one or several substances** which are assigned to specific risk phrases expressed in mg substances per cubic meter (**mg VOC/m³**) in the standard conditions (Article 5 of annex VI),
- ✓ **ELVs expressed as a total VOC emission, expressed in % of solvent input, or g VOC/unit of activity (g VOC/m², g VOC/kg high solid, ...)** for some activities using solvents or % of petrol throughput for activities related to storage and handling of petrol,
- ✓ **Fugitive emission of VOC expressed in % of solvent input**

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VOC monitoring techniques available



- Total VOC concentration measurement techniques
- ✓ Flame ionisation detector (FID)
- ✓ Catalytic oxidation and non dispersive infrared absorption
- ✓ Photoionisation detection (PID)

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VOC monitoring techniques available



- ❑ CEN standards for total VOC concentration measurement techniques

FID considered in two CEN standards:

- ✓ EN 12619 of June 1999: Stationary sources — Determination of the mass concentration of total gaseous organic carbon at low concentrations in flue gases — Continuous flame ionisation detector method. range of 0 – 20 mg/Nm³.
- ✓ EN 13526 of November 2001: Stationary sources — Determination of the mass concentration of total gaseous organic carbon in flue gases from solvent using processes — continuous flame ionisation detector method. The standard has been validated as suitable for measuring emissions up to 500 mg/Nm³ although FIDs can be used to measure higher concentrations.

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VOC monitoring techniques available



- ❑ CEN standards for total VOC concentration measurement techniques

Another standard ISO 13199:2012 - Stationary source emissions — Determination of total volatile organic compounds (TVOCs) in waste gases from non-combustion processes — Non-dispersive infrared analyser equipped with catalytic converter.

This method is suitable for the measurement of TVOC emissions from non-combustion processes. This method allows continuous monitoring with permanently installed measuring systems, as well as intermittent measurements of TVOC emissions. The method has been tested on field operation for painting and printing processes, where TVOC concentrations in the waste gases were from about 70 mg/m³ to 600 mg/m³.

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VOC monitoring techniques available



- Individual VOC substance concentration measurement techniques
- ✓ Sampling, gas chromatography and analysis by FID
- ✓ Non Dispersive Infrared Spectrometry (NDIR)
- ✓ Fourier Transform Infrared absorption (FTIR)

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VOC monitoring techniques available



- CEN standards for individual VOC concentration measurement techniques

EN 13649 of 2014 (replacing the 2002 version): Stationary source Determination of the mass concentration of individual gaseous organic compounds: activated carbon and solvent desorption method. Sampling occurs by adsorption on sorbents, preparation by solvent extraction or thermodesorption and analysis by gas chromatography. The results obtained are expressed as the mass concentration (mg/m^3) of the individual gaseous organic compounds. This document is suitable for measuring individual VOCs whose ranges vary depending on compound and test method. This Technical Specification may be used to meet the monitoring requirements of the Industrial Emission Directive (IED) and associated supporting documents.

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Translation of concentrations of single VOC
expressed in mass of VOC in total VOC
concentrations expressed in mass of carbon



The formula is as follows for a mixture of organic compound i:

(12 x number of carbon).

$$\text{CONC}_{\text{VOC}}(\text{mass of C eq}) = \sum_i \text{CONC}_i (\text{mass of VOC}) \times \frac{12n_i}{M_i} \times P_i$$

Concentration of organic compound i expressed in mass of carbon

Concentration of organic compound i expressed in mass of the chemical substance

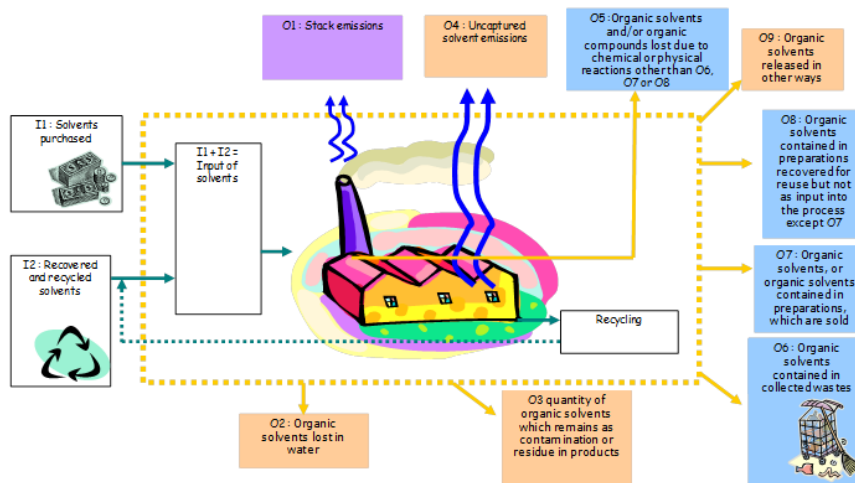
M_i : Molar mass of organic compound i.

P_i : proportion of organic compound i in the mixture

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Solvent balance



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Other activities



Loading /unloading of mobile containers at terminals (excluding load of sea going ships)

Emissions from loading and unloading of mobile containers at terminals can be estimated through equations developed by API and translated in several guides such as CONCAWE [4] and US EPA [5].

The ELV implemented requires measurement in the vent of the loading and unloading platform. If equipped with a recovery unit, the measurement devices have to be installed on the vent to the atmosphere of this recovery unit.

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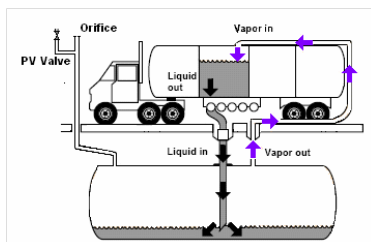
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Other activities



Storage of petrol at service-stations (Stage I)

In order to be in compliance with the ELV implemented by annex VI, measurement of emissions is not required if a vapour balancing unit is present. The VOC vapours exit the tank through a return line to the mobile container.



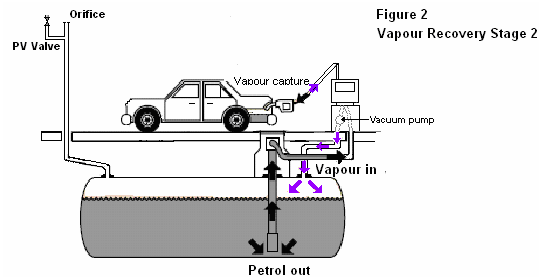
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Other activities

Car refueling at service stations (stage II)



- 2 CEN standards to establish the petrol vapour recovery efficiency of new Stage II petrol vapour recovery equipment and the in-use performance of such equipment once installed at service stations are available
- The first standard specifies the measurement and test methods for the efficiency assessment of petrol vapour recovery systems for service stations (Stage II). The second one specifies the test methods for verification of vapour recovery systems at service stations (Stage II).

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Conclusions

A draft document available

Is the document answering the question?

Obtain exact information on measurement techniques used in Belarus (other ECCA countries) and types of current ELVs existing for the activities covered by annex VI.

Next steps



Information expected by Belarus: Obtain exact information on measurement techniques used in Belarus (or other EECCA countries) and types of current ELVs existing for the activities covered by annex VI.