
**Ubežne in razpršene emisije skupnega pomena za industrijske sektorje -
Standardna metoda za določevanje razpršenih emisij hlapnih organskih spojin v
ozračje**

Fugitive and diffuse emissions of common concern to industry sectors - Standard
method to determine diffuse emissions of volatile organic compounds into the
atmosphere

Fugitive und diffuse Emissionen von allgemeinem Interesse für Industriebereiche -
Verfahren zur Bestimmung diffuser Emissionen flüchtiger organischer Verbindungen in
die Atmosphäre

Émissions fugitives et diffuses concernant les secteurs industriels - Méthode normalisée
pour la détermination des émissions diffuses de composés organiques volatils dans
l'atmosphère

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organischer Verbindungen in die Atmosphäre

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European foreword

This document (EN 17628:2022) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2022, and conflicting national standards shall be withdrawn at the latest by October 2022.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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Introduction

0.1 Background

This document has been developed to provide a framework for the selection and use of monitoring methods to determine (detect, identify and/or quantify) the emission to the air of volatile organic compounds (VOC) from diffuse sources, in particular due to the storage, transfer and handling (loading/unloading) of such compounds, within certain industrial sectors. It has primarily been developed to meet the needs of the European Best Available Technique Reference (BREF) document for the refining of mineral oil and gas [1] including the Commission implementing decision [2] establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU [3] on industrial emissions, for the refining of mineral oil and gas.

Emissions of VOCs from anthropogenic, biogenic and other natural sources contribute to the formation of ozone and other pollutants in the atmosphere which are detrimental to human health and damaging to the environment. Better determination of the anthropogenic contribution can help reduce these impacts. A wide range of human activities can give rise to emissions (e.g. industrial processes, transport, the storage and handling of fuels and chemicals, end use of VOC containing products, etc.). Emission sources can be complex and diffuse sources are difficult to determine accurately. Their determination has hitherto required the use of specific measurement and estimation methods not subject to standardization. By setting out appropriate standardization criteria and demonstrating their use with certain techniques, the determination of diffuse VOC should be improved, assisting the management of emissions and consequential benefits.

0.2 European context

National reduction targets for VOC emissions to air in European countries are regulated through the Gothenburg Protocol [4] of the UN-ECE Convention on Long-range Trans-boundary Air Pollution (CLRTAP) and, additionally, for the EU Member States and the EU as a whole by the National Emission Ceilings Directive (2016/2284/EU [5]). Annual reporting of emissions is required under both instruments.

National emissions are the sum of sectoral emissions. Within the EU sectoral emissions are regulated to enable the national commitment to be met. For the largest industrial sectors, the principle instrument is the Industrial Emissions Directive (Directive 2010/75/EU [3]). The Industrial Emissions Directive (IED) sets minimum emission standards for certain pollutants in key sectors but, more importantly, sets out formal guidance to permitting authorities on the emissions, to both air and water and expressed as concentrations or loads that might be achieved through the application of Best Available Technology (BAT). Conclusions on BAT (BATC) are published in the Journal of the European Union and have legal status. The BATC are derived through a formal process (the Sevilla Process) of data collection and appraisal recorded in Best Available Techniques Reference documents (BREFs). BREFs provide context and guidance for the interpretation of the BATC. The IED sets out a requirement to review, and if necessary, revise, each sectoral BREF on an 8-year cycle.

This document supports BATCs that require diffuse VOC emissions to be assessed and reported. These are, at the time of writing, set out in:

- Mineral Oil and Gas Refineries [2] (BAT 6);
- Common Waste Water and Waste Gas in the Chemical Sector [6] (BAT 5);
- Common Waste Gas Management and Treatment Systems in the Chemical Sector (BAT 22) [7].

General information on Monitoring for Diffuse Emissions can be found in the JRC Reference Report on Monitoring of Emissions to Air and Water from IED Installations (EUR 29261 EN) [8].

1 Scope

This document specifies the framework for determining emissions to the atmosphere of Volatile Organic Compounds (VOCs). It specifies a system of methods to detect and/or identify and/or quantify VOC emissions from industrial sources. These methods include Optical Gas Imaging (OGI), Differential Absorption Lidar (DIAL), Solar Occultation Flux (SOF), Tracer Correlation (TC), and Reverse Dispersion Modelling (RDM). It specifies the methodologies for carrying out all the above, and also the performance requirements and capabilities of the direct monitoring methods, the requirements for the results and their measurement uncertainties.

This document specifically addresses, but is not restricted to, the petrochemicals, oil refining, and chemical industries receiving, processing, storing, and/or exporting of VOCs, and includes the emissions of VOCs from the natural gas processing/conditioning industry and the storage of natural gas and similar fuels. The methods specified in this document have been validated at onshore facilities.

This document is applicable to diffuse VOC emissions to atmosphere but not to the emissions of VOCs into water and into solid materials such as soils. It is complementary to EN 15446 [9], the standardized method for the detection, localization of sources (individual leaks from equipment and piping), and quantification of fugitive VOC emissions within the scope of a Leak Detection and Repair Programme (LDAR).

This document has been validated for non-methane VOCs, but the methodology is in principle applicable to methane and other gases.

This document specifies methods to determine (detect, identify and/or quantify) VOC emissions during the periods of monitoring. It does not address the extrapolation of emissions to time periods beyond the monitoring period.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15259, *Air quality - Measurement of stationary source emissions - Requirements for measurement sections and sites and for the measurement objective, plan and report*

EN 60825-1:2014, *Safety of laser products – Part 1: Equipment classification and requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp/ui>

3.1

detection

recognition of the presence of an emission source in a certain area

3.2

localisation

determination with a certain degree of precision of the position of an emission

EN 17628:2022 (E)**3.3****quantification**

determination of an emission rate

3.4**site**

area within a defined perimeter where emissions might take place

3.5**section**

delimited area within a site usually having a specific function

3.6**main equipment**

delimited piece of equipment

Note 1 to entry: Examples are compressor, distillation tower, individual basin, individual storage tank and water separator.

3.7**component**

assembly or mechanical part of an item of main equipment

Note 1 to entry: Examples are fitting, flange, pump, seal, valve.

3.8**volatile organic compound****VOC**

organic compound having a vapour pressure of 0,01 kPa or more at 293,15 K or having the corresponding volatility under the conditions of use

[SOURCE: Directive 2010/75/EC [3], modified]

Note 1 to entry: Care is necessary in the use of the term VOC, as there are many different definitions in common use. In some contexts, VOC excludes methane or methane and ethane. It is recommended to clearly state which range of compounds is reported as VOC.

3.9**organic compound**

compound containing at least the element carbon and one or more hydrogen, halogens, oxygen, sulphur, phosphorous, silicon or nitrogen, with the exception of carbon oxides and inorganic carbonates and bicarbonates

[SOURCE: Directive 2010/75/EC [3]]

3.10**emission**

discharge of substances into the atmosphere

Note 1 to entry: This term comprises four types of emission sources:

- Accounted channelled emissions (from monitored stacks);
- Unaccounted channelled emissions (from, e.g. vents, flares);
- Fugitive emissions (leaks from, e.g. valves, seals);
- Area emissions (from, e.g. water treatment basins, coke storage).

3.11**fugitive emission**

emission to the atmosphere caused by loss of tightness of an item which is designed to be tight

[SOURCE: EN 15446:2008 [9]]

3.12**diffuse emission**

emission to the atmosphere from an identified site or facility, not specifically directed to identified stack emission points

Note 1 to entry: This term comprises the sum of various unaccounted channelled emissions, fugitive emissions and area emissions.

3.13**expanded uncertainty**

quantity defining an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand

Note 1 to entry: The fraction may be viewed as the coverage probability or level of confidence of the interval.

Note 2 to entry: To associate a specific level of confidence with the interval defined by the expanded uncertainty requires explicit or implicit assumptions regarding the probability distribution characterized by the measurement result and its combined standard uncertainty. The level of confidence that may be attributed to this interval can be known only to the extent to which such assumptions may be justified.

Note 3 to entry: Expanded uncertainty is termed overall uncertainty in paragraph 5 of Recommendation INC-1 (1980).

[SOURCE: ISO/IEC Guide 98-3:2008 [10]]

3.14**detection limit**

minimum concentration of a substance which produces an observable response, which is two times the standard deviation at zero

[SOURCE: EN 12619:2013 [11]]

4 Symbols and abbreviations

API	American Petroleum Institute
ATEX	ATmosphères EXplosibles
DIAL	Differential Absorption Lidar
DQO	Data Quality Objective
FID	Flame Ionization Detector
FTIR	Fourier Transform Infrared
HITRAN	High Resolution TRANsmission
IR	Infrared
LDAR	Leak Detection and Repair
LIDAR	Light Detection and Ranging
OGI	Optical Gas Imaging
PID	Photo Ionization Detector
PPE	Personal Protective Equipment
RDM	Reverse Dispersion Modelling
SOF	Solar Occultation Flux
TC	Tracer Correlation
VOC	Volatile Organic Compound
WMO	World Meteorological Organization

5 Principle

This document provides a framework for a number of complementary methods (DIAL, SOF, OGI, TC, and RDM) used to determine diffuse VOC emissions. It provides performance requirements and quality assurance procedures to ensure the correct application of each method. Common issues are identified and addressed within the main body of this document, method specific procedures and requirements are given in the relevant Annexes.

Methods are described as complementary because each has a potential role to play within an efficient VOC emission monitoring programme. For example, whereas periodic surveys of equipment can be undertaken using a leak detection and repair programme (LDAR) as described in EN 15446 [9], surveys of equipment and other potential emission sources (tanks, loading operations etc.) can be undertaken using OGI as described in this document. Periodic surveys of the whole site, or targeted areas therein, can be undertaken using DIAL and/or SOF. Where specific sources are identified TC and RDM techniques can be used for quantification.

6 Measurement objectives

6.1 General

A VOC monitoring program focussed on diffuse emissions has three main objectives: the detection of emission sources, their localization, and the quantification of emissions. Diffuse emissions can arise from leaks in which case detection and localization of the specific source is needed. Diffuse emissions also arise from normal operations in which case quantification can inform on the magnitude of emissions and indicate whether detection and localization of contributing sources is needed.

There are a number of different monitoring approaches that can be taken to meet these objectives. These range from a bottom-up investigation of potential emission source points, to a top-down investigation using remote sensing to first survey all or part of a site. Unexpected emissions can then be more closely investigated.

A baseline for expected emission sources is set from a site emission inventory and results from previous monitoring studies. Many diffuse sources are time-varying, and this document requires operational events that might contribute to emissions during the time of a survey to be documented. Determining the temporal variation of specific emission sources can be a measurement objective.

The broad nature of diffuse emissions and the many options for their determination makes it essential to set clear and specific measurement objectives for the monitoring campaign. This particularly affects the choice of methods to be used and expectations for data quality. It should be noted that all the methods covered by this document are dependent on external circumstances (meteorology, site operational constraints etc.) specific to the monitoring period and measurement objectives should, in their detail, be tolerant of such.

When measurement objectives are specified the following elements shall be considered:

- The purpose of the monitoring campaign shall be clearly stated. This specifies the scope and key deliverables of the campaign.
- The site or section(s) to be monitored shall be specified. For a section this will require information on the main equipment therein and components thereof, to be gathered. This information to be complemented by information on process streams and their thermodynamic state according to the measurement to be made.
- The type of monitoring for each section shall be specified. Examples might include detection, detection and localization of individual sources, detection and quantification of emissions.
- The spatial resolution of the monitoring shall be specified. This will reflect the type of monitoring to be conducted. Consideration shall be given to the techniques involved. For example, objectives shall be consistent with the spatial resolution of the techniques.
- For localization objectives should address the spatial resolution required. For example, to main equipment or, if repair is mandated, to the scale of the emission source.
- For quantification, objectives should explicitly address how emissions from different sources are separated. At a site-scale external (off-site) sources are to be accounted. At section scale, emissions from neighbouring sections need to be accounted, and so forth.
- For quantification measurement objectives for meteorological measurement should ensure necessary and appropriate data are gathered.