

D-NOSES

Distributed Network for Odour Sensing,
Empowerment and Sustainability

Analysis of existing regulations in odour pollution, odour impact criteria 1

D2.2

September 2019

Deliverable

PROJECT ACRONYM	GRANT AGREEMENT #	PROJECT TITLE
D-NOSES	789315	D-NOSES

DELIVERABLE REFERENCE NUMBER AND TITLE

D2.2
Analysis of existing regulation in odour pollution, odour impact criteria 1
Revision: <v.1>

AUTHORS

Cyntia Izquierdo
Carlos Diaz
(AMIGO)

Laura Capelli
(POLIMI)

Rosa Arias
Nora Salas Seoane
(Ibercivis)



Funded by the Horizon 2020 programme of the European Union

Grant Agreement No 789315

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Revision History

REVISION	DATE	AUTHOR	ORG...	DESCRIPTION
v1.0	26.08.2019	Carlos Diaz	(AMIGO)	First Draft
v2.0	04.09.2019	Cyntia Izquierdo	(AMIGO)	Add the section 3. Standards
v3.0	20.09.2019	Carlos Diaz	(AMIGO)	Add the section 4. Guidelines
v3.1	27.09.2019	Laura Capelli	POLIMI	Revision of Italian regulations, general revision, and minor corrections

STATEMENT OF ORIGINALITY

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.



HOW TO CITE THIS REPORT

Diaz C., Izquierdo C., Capelli L., Arias R., Salas Seoane N. (2019) Analysis of existing regulations in odour pollution, odour impact criteria 1, D-NOSES, H2020-SwafS23-2017-789315.

Summary

This document provides an overview of odour regulations in eight European countries and in Chile.

The document is structured in 5 chapters:

Chapter 1. Introduction : it presents the goal of the document and explains the difference between regulations/laws, standards and guidelines.

Chapter 2. Official odour regulation by Countries : it presents an update on the different regulatory approaches to deal with odour impact in several countries.

Chapter 3. Standards : it presents the developments being made on standardization of methodologies to assess odour impact.

Chapter 4. Guidelines: it presents some of the most important technical guidelines developed by organizations or governments of the countries of the consortium.

Chapter 5. How odours are regulated in each country: it presents the way these countries use the legislation available (if there is any), the standards or guidelines to deal with odour impact.

Chapter 6. References: it presents a list of regulations, standards, guidelines and scientific articles related to odours, as well as a set of scientific documents related to the subject.

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SUMMARY

FIRST SECTION

1.1 First subsection

EXTRA BITS

1

Introduction

Odour is regulated under different formats and at different levels. Regulations, standards and guidelines are the usual way to deal with odour impact.

Although there is a large set of guidelines and standards dealing with odours around the world, there are only a few specific regulations for odours. The focus of this document will only be the regulations or ways of managing odours in the countries of the consortium of the H2020 D-NOSES project, where the pilot case studies will be developed.

In order to have a better understanding of the way odours are regulated maybe it is useful to point out the difference between guideline, standard and regulation (laws, decrees, ordinances and other regulations)

Regulation: rules **published in an official journal** made by a government or other authority which compliance is mandatory. This includes laws, decrees, ordinances, etc. **In some cases, a guideline is published in an official journal**, in this case, this guideline becomes a regulation.

Standard: technical document **issued by any international Standardization body** (ISO, CEN, CENELEC, ASTM, AIEE, etc) or **National** ones. They are **not published in official journals** and they are **usually for sale** on the websites of these organizations.

Guideline: technical report, technical guidance, technical guide, etc **made by other organizations**, such as government bodies, associations, technical groups, etc or even the same ones aforementioned, but that have a different status.

In general, odour issues are treated in different ways by regulators in the countries studied in the present report. The situations found in the jurisdictions analysed may be categorized as follows:

- those which include odour in the legislation as an air pollutant or a nuisance but provide no limits to tackle the issue;
- those with an odour guideline that it is taken as “de-facto” reference in courts;
- those which include odour in the legislation as an air pollutant or a nuisance and have guidelines published in official journals describing a methodology, but avoiding the set of limits;

- those which have odour legislation just for some activities (e.g. Germany with odour limits in biofilters from waste management);
- those which have odour legislation for specific operations of an activity (such as concentrated animal feeding operations, swine operations, etc.);
- those which have legislation only for some odorants but not for odours;
- those which have legislation for odorants associated with activities (e.g. Chile with a legislation on TRS from pulp paper factories);
- those which seem to have no odour legislation at all;
- those which have no odour legislation but odour may be included based on definitions of air pollutant, contaminant, adverse effects or other terms.

Every year, the *Air quality in Europe* (AQE) Report presents an updated overview and analysis of air quality in Europe. In 2018, the AQE report edited by the [European Environment Agency \(EEA\)](#) presented the progress towards meeting the requirements of the air quality directives made in 2018. Unfortunately, the AQE report [does not mention odours as a pollutant with a key impact](#) on the air quality in Europe.

2

Official odour regulation by Countries

This section will focus on the existing regulation/laws about odours and odour pollution in the countries of the consortium. These texts include all the international, national, regional and local regulations, published in official journals.

There is a large set of environmental laws and regulations around the world, however, unfortunately there are only very few texts dealing with controlling and managing odours.

In this section, the regulations related to odours on the countries belonging to the H2020 D-NOSES project will be discussed. The list of countries includes Austria, Bulgaria, Chile, Germany, Greece, Italy, Portugal, Spain and the United Kingdom.

2.1 Austria

There are no odour regulations nor odour limits in the country.

There are no odour regulations in Austria and odour nuisance is regulated in qualitative terms (e.g. unacceptable odour is not permitted). The *Industrial Emission Directive* is applied to several industrial activities and within this context, the facilities susceptible of producing an odour impact may have specific odour limits based on olfactometric studies and modelling.

The legal system in Austria makes a difference between legal values and target values. There are no legal values related to odours in Austria, however there is a guideline setting target values for Spa areas.

It is also quite common in this country to have a look to what it is being done in Germany. To this effect, in some cases the known German guideline GOAA/GIRL is also applied.

Austria has also a guideline related to the livestock industry, setting a determined distance of separation of a plant from people affected by the odour impact, commonly known as setback distance. The *Preliminary Guideline to Assessment of Odour Pollution Caused by Livestock Husbandry in Livestock Buildings* estimates odour emissions from livestock facilities by using the following parameters: number and type of animals, ventilation system, manure removal and storage and animal feed type. From these parameters an odour number is calculated which is used in a dispersion model to calculate a setback distance for the facility. In addition, it is also possible to use a dispersion model to better tune this setback distance.

2.2 Bulgaria

There is no regulation that regulates odour pollution

There is no law that regulates odour pollution at national level. However, the Ordinance related to air pollution published the 10th September 2012 included provisions for the imposition of a sanction for industries releasing odoriferous substances into the air (such as hydrogen sulphide, etc.), but this regulation is not specific about odours.

The *Industrial Emission Directive* is applied to several industrial activities and within this context, the facilities susceptible of producing an odour impact may have specific odour limits based on olfactometric studies and modelling or other type of studies.

In Bulgaria, at the moment, there is no specific law regulation on odour pollution in general. However, the Ordinance, related to air pollution includes provisions for the imposition of some sanctions for industries releasing excessive odours into air. The authority, which has the obligation and the legal right to impose such sanctions are the *Regional Inspectorates for Environment and Water* (RIEW). The so mentioned *Regional Inspectorates for Environment and Water* (RIEW) are in total 16 and they are part of the control system of the *Ministry of Environment and Water* (MOEW).

2.3 Chile

No odour regulations at this moment in Chile

There are no odour regulations for the moment in Chile, but there has been quite a work from the Environmental Ministry of Chile on odours over the last two decades in this country. The environmental Ministry has a specific department on odours, as it happens in some regions of Germany or the Netherlands. There are not many more countries in the world with such a department in an Environmental Ministry.

In 2012, Chile started the elaboration of a Strategy for Odour Management in Chile (2014-2017), whose objective is to strengthen the regulatory framework through measures in the short, medium and long term to quantify, control and prevent the generation of odours, approaching the management of the issue with an integrated approach. In 2017, the strategy was updated.

In April 2019, the deputies of the Chamber of Chile approved the introduction of some amendments on the current text of the Chilean general Environmental regulation. The core of the amendment is focused on the [introduction of "odour" as an environmental pollutant](#) within this regulation.

Also the Ministry of Environment [announced](#) that by 2020 the first regulation to manage odours from the pig industry will be published. This announcement also informed that in the next few years other odour regulations will be published concerning: Wastewater treatment plants, landfills and paper mills.

2.4 Germany

Some odour regulations in Germany, dealing with odours from waste management activities. Big changes to come in the new Federal regulation of Air.

Germany published in 1964 an air pollution control regulation titled "Technical Instructions on Air Quality Control" (*Technische Anleitung zur Reinhaltung der Luft*) and commonly known as the **TA Luft**. This federal regulation has been amended several times since then, being the last one in 2002 (TA-Luft, 2002).

There are many provisions in the TA Luft related to odour management, for example, for livestock activities there is a fixed setback distance (that is, the distance between a plant and a population) related to the number of animals that the plant has.

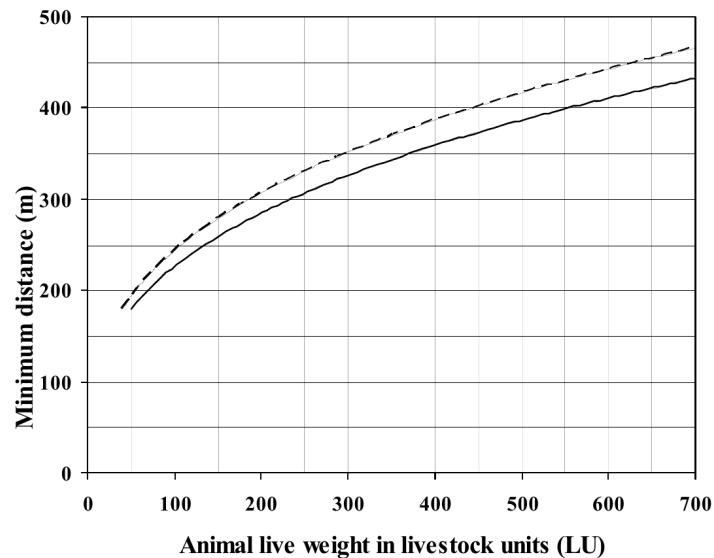


Figure 1: Separation distances from livestock activities from the TA Luft.

For Installations of Biological Treatment of Waste, odorous gases from the curing phase of ventilated windrows should be directed to a biofilter or an equivalent waste gas purification facility. There is a fixed limit of 500 ou/m^3 in the emission from these biofilters and this limit has to be checked at least once a year. This limit of 500 ou/m^3 is also set in some other industrial activities.

Unfortunately, there are no general odour limits in the TA Luft, but this is going to change in the next revision of the the "TA Luft" as [the GOAA/GIRL guideline will be included into the text](#). This way this guideline will become finally a law in Germany and odour will officially be included in the regulatory body of this country. Section 4.4 of the present document will describe a bit more about the GOAA/GIRL and why it has been important in German permitting process of potentially odour-emitting industrial plants.

The *Industrial Emission Directive* is applied to several industrial activities and within this context, the facilities susceptible of producing an odour impact may have specific odour limits based on olfactometric studies and modelling or other type of studies.

2.5 Greece

There is currently no specific odour legislation.

Currently there is no legislation in Greece concerning odor emitted from industrial sources. Research in national legislation confirmed that provisions about odour exist only for urban activities where no specific limits are in place.

Nevertheless, as part of Europe, it has some tools (standards like EN 13725, EN 16841) for odour measurement.

The *Industrial Emission Directive* (IED) is applied to several industrial activities and within this context, the facilities susceptible of producing an odour impact may have specific odour limits based on olfactometric studies and modelling or other type of studies.

2.6 Italy

In Italy there is not a national regulation, but several regional laws have been published.

In Italy there is not a national regulation, The former Italian Government did a small modification in the [Italian national regulation on environment](#), adding the article 272-bis, giving the regions of Italy the power to regulate an odour impact. This was an important step towards regulation on odours in the Italian regions. However, [according to some experts](#), this article 272 -bis excludes the activities under the IED.

The *Industrial Emission Directive* is applied to several industrial activities and within this context, the facilities susceptible of producing an odour impact may have specific odour limits based on olfactometric studies and modelling or other type of studies.

As previously mentioned, in Italy there is not a national regulation, but some regions and provinces have implemented their own regulations in order to define how odour emissions and odour pollution issues shall be managed. The most recent one was published last year in Puglia (Legge Regionale Puglia 32/2018).

There are other regions (or provinces) such the region of Lombardia, the region of Piemonte, and the province of Trento, where there are regional laws relating with odours.

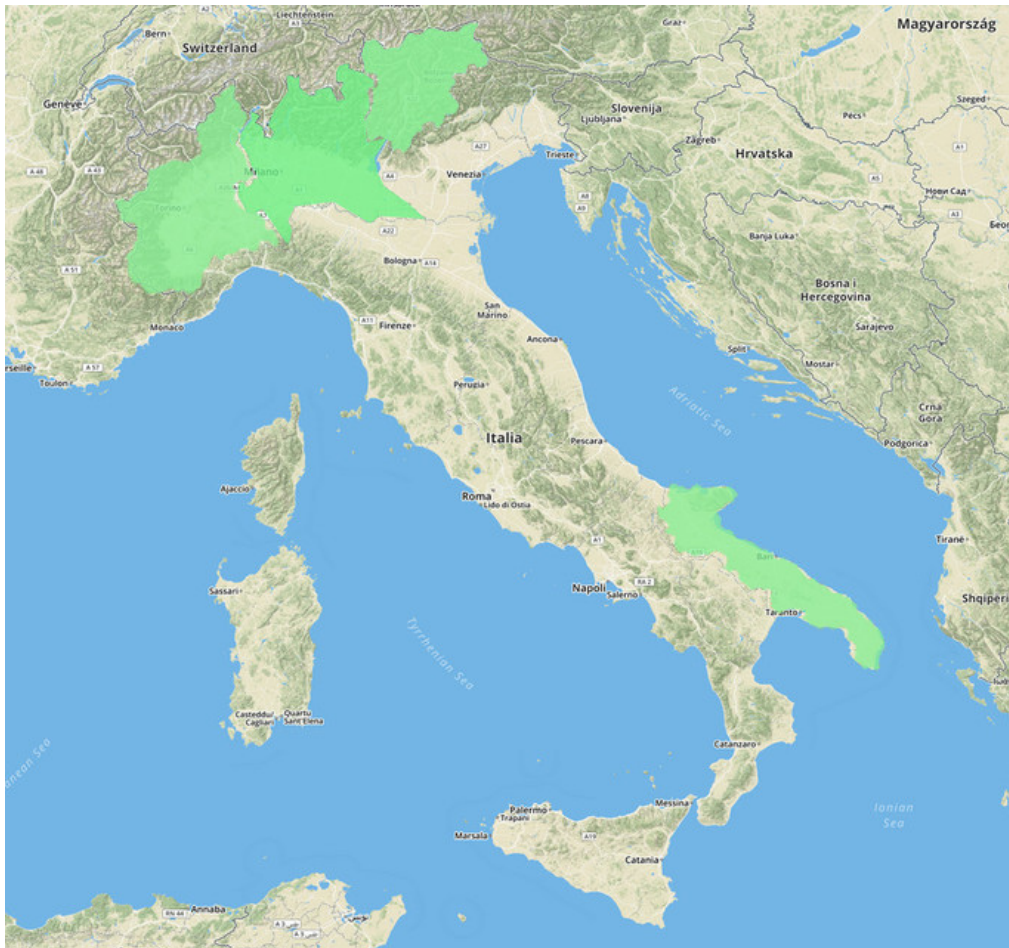


Figure 2: Regional regulations in Italy.

Lombardia

The Region of Lombardy published the first Italian regional regulation mentioning odour in 2003 for composting plants (D.g.r. 16 April 2003– n. 7/12764). This regulation is no longer valid, but, 10 years later, this region again acted as a pioneer in Italy by publishing a Regional Guideline specifically on odour emissions ('General determinations regarding the characterization of atmospheric emissions from activities with a high odour impact', D.g.r. 15 February 2012 – n. IX/3018). Similar to other European regulations, this guideline is based on dynamic olfactometry and dispersion modeling.

It is important to highlight that this guideline defines the requirements of the odour impact studies by emission dispersion simulation, but it doesn't set any acceptability criteria. The choice to avoid fixing acceptability criteria was due to the idea of leaving some time for the guideline to be applied and thus verify, based on the first studies conducted according to it, what a reasonable acceptance criteria would be.

This Guideline settles an example due to all the technical aspects described in it, so it is currently used as a regulatory reference in other Italian regions.

This Guideline was published in the Official Bulletin of the Lombardy Region, so it is officially in force.

Trento

In 2016, the "Guidelines for the characterization, analysis and definition of technical and management criteria for the mitigation of emissions from odorous -impact activities" were approved and published in the Deliberation of the Provincial Council (Deliberazione Giunta Provinciale n. 1087 di data 24 giugno 2016). This guideline is very similar to the Regional Guideline of Lombardy.

The most important novelty is that this guideline is the first one that defines acceptability criteria; these are fixed in terms of 98th percentile peak odour concentration limit values

Piemonte

On January 2017, the Piemonte Region approved the Guidelines for the characterization and mitigation of atmospheric emissions from odorous impact activities (DGR n. 13554 9 January 2017). It applies to plants subjected to Integrated Environmental Authorisation or to territories where the odour problem has not been solved by other ways. Lombardy Regional Guidelines were used as a base for this one.

Puglia

The new Regional Law of Puglia published in 2018 (Legge Regionale Puglia 32/2018) replaced the previous one (Legge Regionale Puglia 23/2015). This new Law has a characteristic that differentiates it from other laws of the world: it defines different odour impact criteria (OIC) according to the sensitivity of the people affected by the odour impact. In other words, the sensitivity of receptors is classified into 8 different groups: from areas where hospitals are located (OIC restrictive level), to areas of industrial or agricultural use.

2.7 Portugal

There are no odour regulations in Portugal.

As other similar European countries, there is no specific regulations for managing odour pollution in the country. In Portugal, diffuse emission of pollutants (but not odours) is regulated by Article 9, Obligations of operators for the purpose of minimizing diffuse emissions, DL No. 39/2018 of June 11, which establishes the legal regime for the prevention and control of emissions of pollutants into the air.

As it happens in the rest of European countries, the *Industrial Emission Directive* (IED) is applied to several industrial activities and within this context, the facilities susceptible of producing an odour impact may have specific odour limits based on olfactometric studies and modelling or other type of studies.

2.8 Spain

There is not a national law regulating odour.

As it happens in the rest of European countries, the *Industrial Emission Directive* (IED) is applied to several industrial activities and within this context, the facilities susceptible of producing an odour impact may have specific odour limits based on olfactometric studies and modelling or other type of studies.

Some years ago, the Catalonia Government presented a draft “Against Odorous Pollution”, inspired by the first H4 Horizontal Guideline of UK. Although this project of legislation was never ratified, the odour limits set in this regulation has been used as a reference on many studies/industrial permits. In addition, this draft was taken as a basis for ordinances in municipalities in Spain affected by odour impact.

Currently there is no legislation on odours in the regions of Spain, even though these regions have a wide competency on air quality matters. Some regions mention odours as a pollutant and set [methodologies](#) to measure it. In the region of the Canary Island the environment authorities are taking a step further and they are setting limits of 3, 6 and 9 European odour units per cubic meter for ambient air depending on the [odour emitted by an activity](#).

Due to this lack of regulations at national and regional levels, some municipalities have taken the decision of developing their own ordinances for odour control. This is usually made in a very specific context during long term unresolved conflicts with an odour -emitting activity. That is why these ordinances are usually focused on some type of plant. In addition, it is common to set regulations for odours at a local level, e.g. from bars and restaurants.

Here there is a non-exclusive list of ordinances dealing with odours in Spain.



Figure 3: local regulations in Spain

(Source: <https://dnoses.communitymaps.org.uk/project/oderegulations>)

Lliça del Vall, Barcelona

Ordinance of "Lliça de Vall" for regulating the release of odours into the atmosphere approved in 2006. This ordinance applies to industrial processes or operations which, in their normal operation, or due to certain disturbances, may release odorous substances into the indoor environment of industrial installations.

In annex 1 of the ordinance, odour limits are set depending on the odour threshold of the substances.

Banyoles, Girona

This City Council approved a Specific Plan against Odours in January 2004. This plan contemplated a series of actions, such as the creation of a map of odours, the modification of urban planning to avoid the installation of disruptive activities a few meters from residential areas, etc. In the same plan, it was determined to draw up an Ordinance on Odours that established the maximum tolerable, control systems, obligations of companies that cause nuisance and the regime of sanctions.

People affected by odour nuisance should make their complaint by complying with the annex 6 of this ordinance, where a "Sample questionnaire justifying odour episodes" is displayed.

San Vicente del Raspeig, Alicante

On 26th January 1994, the city council approved an Atmospheric Protection Ordinance, including odours. This regulation is based on an 'odour perception index' (IP). The IP is based on a mathematical formula that takes into account several factors:

$$IP = \text{Log. } 10(UO) * FC * FD * FI * FP \forall F$$

Alcantarilla, Murcia

On 11th June 2016, this local ordinance about odour regulation defined the areas with an 'odour' saturation. This way they limit the areas where an industrial facility potentially causing annoyance cannot be located or where the urban expansion has to be halted in order to avoid an odour impact. According to the Ordinance, it is the duty of the municipality to create and maintain a standardized register of citizen complaints.

According to this ordinance, the City Council may request a specific environmental assessment of a certain activity after receiving odour complaints from a community. This assessment must include a chapter about how to deal with the odour impact.

San Pedro del Pinatar, Murcia

An Ordinance regulating the measures to prevent and correct odour nuisance arising from certain activities affecting urban or residential areas was published on April 2011. It established odour limits in ambient air (dynamic olfactometry+dispersion modelling or VDI 3490).

Las Palmas de Gran Canaria, Canary Islands

In June 1999, this municipality has developed an 'odour perception index' (IP) in its regulation. The IP is based on a mathematical formula that takes into account: odour concentration, hedonic tone, duration of the odour, intermittency, wind direction, etc.

Riudellots de la Selva, Girona

The objective of this ordinance was to protect residents and odour-sensitive sites from odour nuisance caused by odour-producing activities. It was approved in 2009. In this case, it is the duty of the City Council to establish an infrastructure for the recording of odour-related complaints and their notification to the responsible activities potentially associated with the complaint. Each complaint will be communicated to the management of the facilities most likely to have caused the incident, protecting the identity of the complainant. In Annex F of the ordinance, there is a "Sample form for odour episodes justification".

Sarria de Tèr, Girona

This new regulation (Municipal Ordinance in odours) entered into force in October 2018 after the complaints of 50% of the residents in this small municipality in Catalonia. The cause of

concern is a paper mill. Complaints are related to noise and odours, although odours are the main concern and also reach some neighbour populations such as Sant Julia de Ramis and the north of the city of Girona. The regulation sets odour limits in ambient air based on olfactometry measurements ($3 \text{ ou}_E/\text{m}^3$ for paper mills) and also uses the field inspection method based on EN16841:2016.

Sant Pere de Vilamajor, Barcelona

In 2010, the city council of Sant Pere de Vilamajor, announced in the official journal of the province of Barcelona that it was initially approved the Municipal Ordinance regulating odours of Sant Pere de Vilamajor and it was submitted to public information. No news has been published since then, so it ~~was~~*never approved*.

2.9 United Kingdom

There are no official regulations about odours. Usually odour conflicts are taken to the court.

There are no official regulations about odours in the UK. Numerous individual local authorities and four environment agencies are responsible for regulating the impact of odorous emissions from industrial and commercial premises in England, Wales, Scotland and Northern Ireland and usually this regulation is made through guidelines that will be commented in section 4.9 of this report.

As it happens in the rest of European countries, the *Industrial Emission Directive* (IED) is applied to several industrial activities and within this context, the facilities susceptible of producing an odour impact may have specific odour limits based on olfactometric studies and modelling or other type of studies.

The case of the Foston Pig Unit and Anaerobic Digestion Plant illustrates the typical process of [rejecting a permit due to odour impact](#). In this case the developers of the project decided [to withdraw](#) the development, but in other cases, the case has been brought to court.

Standards

At European level, there are only 2 Standards related directly to odours: EN-13725 and EN-16841. Chile has 3 Standards based on European and German Standards.

Official standards are sanctioned by an accredited standardization body (CEN, ISO, etc.) and they describe methods or procedures adopted by mutual agreement.

The Netherlands and Germany were the [first European countries that started developing odour related Standards](#). These standards have been transposed and adapted in other countries e.g Chile

Dynamic Olfactometry: EN 13725 and NCh3190

The EN 13725- Air quality - Determination of odour concentration by dynamic olfactometry- is the most used methodology in the world to measure odour concentration. This Standard was so successful that many other countries such as Australia, Chile or Colombia adopted it in their national standards. This standard was published in 2003, however it is being reviewed recently and a new version is expected to be published in 2020.

In 2010, the Chilean Government approved the NCh3190, which is basically a transposition of the European EN 13725.

The odour concentration is defined within the European Standard EN 13725 as the number of *European odour units* in a cubic metre of gas at standard conditions. Therefore, the odour concentration is measured in "European Odour Units per cubic metre" and its symbol is "ou_E/m³".

In short, the odour concentration has similar characteristics than decibels in the sense that they are both properties linked to the human senses. The odour concentration is calculated from the number of times that an odorous gas has to be diluted in order to reach the odour threshold of a group of people or panel specially trained and selected, but with a normal sense of smell. In fact, the geometric mean of the individual odour threshold of each person is calculated.

The odour threshold of any odorant is the minimum concentration at which anybody with a normal sense of smell is able to detect it.

The process of measuring the odour concentration from an odorous sample using the EN 13725 standard can be better explained with a simple example. Let's suppose that there is an odorous

gas that it is diluted with odourless air 10 million times. Probably, when this gas is smelled by a member of a panel, she (or he) will not detect anything. If we dilute the odorant less and less, there will be a moment in which this person will be able to detect the diluted mix. This way, if the gas has been diluted, let's say 20 times with odourless gas in order to reach the detection threshold, it is estimated that the initial odour concentration of the gas was $20 \text{ ou}_E/\text{m}^3$... for this person, of course.

Statistically that is a bit weak, so the same procedure is made for a group of minimum 4 people. Moreover, the people that perform the measurement are selected specifically as to prove that they have an "average" sensitivity to odours. People with too high or too low sensitivity are not considered for the measurement. This way, the geometric mean of the individual odour thresholds is calculated and this way, the odour concentration of an odorant is calculated.

The important fact to take into account of the EN 13725 is that it does not matter the people that participates in the measurement, it does not matter if they are male or female, young or not so young, if they are from Chile or from Belgium, the result will be repeatable and reproducible within an uncertainty range. International Interlaboratory testing is every year performed to evaluate the performance of olfactometric labs in the world under ISO 17025.

Olfactometry – Static Sampling: NCh3386 and VDI 3880

The German VDI 3880 "Olfactometry - Static sampling", which has been adapted by Chilean environmental ministry as the Standard NCh 3386:2015, published in 2011, describes the general requirements for measurement planning actual sampling (considering different source types) and quality assurance for comparable measurements.

Determination of odour in ambient air by using field inspection: EN 16841: part 1 and part 2

Based on the German VDI standard 3940 part 1 and implemented in Europe in 2016, the EN 16841 regulates the odour field inspection, a method of analysis of the odour impact in a defined area, through the characterization of odours by human panel members.

Two approaches are defined in the standard: Part 1: Grid method and Part 2: Plume method. Basically, the grid method can be used to determine the exposure to ambient odours in a defined area of study, using direct observation of recognisable odours. The plume method consists on the determination of the extent of recognisable odours from a specific source using direct observations (Guillot, J-M et al. 2012).

Questionnaires: NCh3387 and VDI 3883 Part 1

The German VDI 3883 -1 “Effects And Assessment Of Odours - Assessment Of Odour Annoyance- Questionnaires”, which has been adapted in Chile as the Standard NCh 3387:2015, was first published in 1995, but nowadays a new version is active, published in 2015.

The Standard describes a method for recording odour nuisance using questionnaires/surveys. The questionnaires can be used for several purposes: to examine complaints from the public, to examine the need for odour emission reduction measures, to examine the effectiveness of the installed reduction measures and to weight the odour nuisance from one source against the nuisance caused by noise, for example.

Repeated questioning of neighbour panellists: VDI 3883 Part 2

The German VDI 3883 -2 “Effects and assessment of odours; determination of annoyance parameters by questioning; repeated brief questioning of neighbour panellists” was published in March 1993.

The document describes a survey procedure to determine the existing odour nuisance by asking repeatedly to local test persons about their current odour perception and their nuisance assessment.

Conflict management in odour pollution: VDI 3883 Part 3

The German VDI 3883 -3 “Effects and assessment of odours - Conflict management in air pollution abatement - Fundamentals and application to ambient odour” was published on June 2014.

The guideline describes basic principles and application examples of communication methods and procedures for avoiding and resolving conflicts created in the immediate vicinity of odours activities where odour complaints are frequent.

Processing odour complaints: VDI 3883 Part 4

The German VDI 38834 “Effects and assessment of odours Processing odour complaints” was published quite recently, on June 2017.

There are no other similar standards, describing how to deal with the systematic recording and processing of odour complaints by the responsible authorities. The procedure of the method is divided into the following steps: a) Recording of the complaint (data collection), b) Determination of causes, c) Evaluation and d) Measures.

Supplementary instructions for application of EN 13725: VDI 3884 part 1

The German VDI 3884-1 “Olfactometry - Determination of odour concentration by dynamic olfactometry - Supplementary instructions for application of EN 13725” was published on February 2015.

This guideline supplements and specifies EN 13725, which describes further requirements for the application of the standard in practice, whenever deemed necessary for the quality of the measurement results. The guideline makes it possible to ensure uniform application of EN 13725 both in the performance of olfactometric measurements and in the notification and accreditation procedures of laboratories in accordance with ISO/IEC 17025. The VDI guideline applies to all laboratories that perform olfactometric measurements in accordance with EN 13725 in Germany and sets new criteria to ensure that the sampling and measurement is representative. For example, this standard sets the compulsory use of 30 minutes triplicates in order to have a representative sample of the odour released from a source (Diaz C.)

Determination of odour intensity and hedonic odour tone: VDI 3940 part 3

The German VDI 3940-3 “Measurement of odour impact by field inspection- Determination of odour intensity and hedonic odour tone” was published in January 2010.

This is a guideline for determining the odour intensity and hedonic tone effect in the ambient air. The method described here can only be used for grid or plume measurements. The general measurement specifications for grid and plume measurements, including the performance of an individual measurement, are described in detail in the guidelines VDI 3940 Part 1 and Part 2 (EN 16841). The method described here enables a) the investigation of odours in ambient air for a plant license, monitoring procedure or complaint procedure and b) the planning and testing of the effectiveness of emission reduction measures.

Determination of the hedonic odour tone - Polarity profiles: VDI 3940 part 4

The German VDI 3940-4 “Determination of the hedonic odour tone - Polarity profiles” was published in June 2010.

The guideline allows the hedonic classification of an odor using the method of polarity profiles. The testers describe an odour stimulus with the help of pairs of adjectives (cold - warm, stimulating - relaxing, pleasant - unpleasant, etc.). The odour emitted by a plant can be evaluated as hedonically clearly pleasant, if the evaluation delivers the result that the plant odour can be

assigned to the concept "odour". The guideline can be used, for example, to test the effectiveness of odour emission-reducing measures or to distinguish odours in the search for the odour source.

Determination of odour intensity and hedonic odour tone - Instructions and examples of use: VDI 3940 part 5

The German VDI 3940-5 "Measurement of odour impact by field inspection- Determination of odour intensity and hedonic odour tone - Instructions and examples of use" was published in November 2013.

The determination of odour intensity and hedonic tone can provide important information for the planning of emission reduction measures, especially in the case of exceedances of immission values. When comparing before-and-after determinations, it is possible to determine whether and to what extent a change has been achieved in the environment of an installation. The guideline provides orientation on the appropriate use of the available possibilities for determining and assessing odour intensity and hedonic odour tone effects in the field and lists references and application examples to the methods presented in the guidelines VDI 3940 Part 3 and Part 4.

Determination of hedonic odour tone: VDI 3882 part 2

The German VDI 3882-2 "Olfactometry - Determination of hedonic odour tone: VDI 3882 part 2 was published on September 1994.

The Directive describes an olfactometric method of analysis by which olfactory samples with odour concentrations above the odour threshold (supra-threshold concentrations) are assessed for their position on the sensitivity scale "pleasant - unpleasant". The hedonic odour effect should not be misunderstood with odour quality.

Odour survey - Determination of necessity and references for preparation: VDI 3886 part 1

The German VDI 3886 -1 "Determination and assessment of odours - Odour survey - Determination of necessity and references for preparation" was published very recently, on September 2019.

An odour survey can be required in connection with the assessment of the protection against adverse environmental impacts according to § 5 of the German Federal Immission Control Act and the Ambient Odour Directive (GIRL). This standard represents a decision support for the necessity and (if required) the extent of an odour survey. Therefore, the standard primarily

addresses policy-makers, i.e. public authorities responsible for immission control, applicants for installation licences according to the German Federal Immission Control Act, operators of installations subject to licencing, and authorised persons for odour surveys. The reason for an odour assessment can be either a legal immission control or building permit procedure for a plant as well as a monitoring procedure e.g. triggered by neighbour complaints or also a land-use planning procedure.

The standard unifies and systematises the approach to the decision on the need for an odour assessment. First of all, test steps are clarified, the answer of which should be possible without measurements. As a rule, the required effort increases with each test step. For individual industries, it may be useful to choose different approaches.

Measurement of the odorant emission capacity of liquids: VDI 3885 part 1

The German VDI 3885-1 “Olfactometry - Measurement of the odorant emission capacity of liquids” was published in June 2017.

Odour emissions are often caused by liquids. The measurement of odour emission potential makes it possible to quantify the total amount of odours contained in a liquid that can escape from the liquid phase into the gas phase. The principle of the odour emission potential measurement of this guideline is based on aerating a sample of the liquid to be tested with neutral air. At certain intervals, the air leaving the reactor is filled into sample bags. The air samples obtained in this way are then measured by olfactometry according to EN 13725.

Emissions from and impacts of livestock operations - Method to determine separation distances - Odour: VDI 3894 part 2

The German VDI 3894 -2 “Emissions from and impacts of livestock operations - Method to determine separation distances– Odour” was published in November 2012.

The Directive provides for a simplified method for assessing odour from livestock facilities on ambient air by means of a setback distance. The Directive is aimed not only at farmers operating livestock facilities, but also at experts, public authorities and other experts in the field of livestock farming. The Directive allows the evaluation of odours from livestock facilities and their frequency of occurrence by simple means and without complex simulation calculations. It is used in the assessment of the keeping of livestock in stables under immission control law.

Odour-related measurements with electronic noses and their testing: VDI/VDE 3518 part 3

The German VDI/VDE-3518-3 “Multigas sensors - Odour-related measurements with electronic noses and their testing” was published on December 2018.

The guideline deals with odour-related measurements with multi-gas sensors. These measurements are carried out in relation to human sensory perception, based on olfactometric testing and measurement methods and instrumental analysis. The guideline requires the application of the guidelines VDI 3518 part 1 and part 2.

Emissions of gases, odours and dusts from diffuse sources Fundamentals: VDI 3790 Part 1

The German VDI 3790-1 “Environmental meteorology - Emissions of gases, odours and dusts from diffuse sources– Fundamentals” was published on July 2015.

The Directive provides an overview of the origin, characteristic properties and possibilities for quantifying emissions of gases, odours and dusts from diffuse sources. In contrast to captured sources, diffuse emissions usually occur over a large area without defined exhaust gas flows. As a rule, it is not possible to define limits on mass concentrations in waste gas for these. Therefore, in deviation from the usual procedure, the emission limiting requirements are generally defined by structural and operational measures. The guideline is addressed to both experts and operators of plants and representatives of the legislative authorities.

Emissions of gases, odours and dusts from diffuse sources Landfills: VDI 3790 Part 2

The German VDI 3790-2 “Environmental meteorology - Emissions of gases, odours and dusts from diffuse sources– Landfills” was published on June 2017.

The Directive addresses fugitive emissions from landfills for mineral and/or biodegradable waste and describes requirements and defines measurement and calculation methods to determine the source strength and emission factors of fugitive dust, odour and landfill gas emissions for landfills already closed or still in operation. The calculation and measurement methods described in this Directive allow the determination of fugitive emissions with sufficient accuracy, taking into account the relevant boundary conditions. The Directive therefore specifies the most important influencing variables and application criteria. The Directive applies both to landfills which are regulated under waste law and to those which existed before these regulations (old landfills). It does not deal with landfills for predominantly hazardous waste and underground landfills. The influence of mechanical/biological pre-treatment prior to disposal is taken into account. In addition, recommendations are given on how emissions can be prevented or reduced. The Directive is addressed to both experts and operators of landfills and representatives of public authorities.

Emissions of gases, odours and dusts from diffuse sources Storage, transshipment and transportation of bulk materials: VDI 3790 Part 3

The German VDI 3790-3 “Environmental meteorology - Emissions of gases, odours and dusts from diffuse sources – Storage, transshipment and transportation of bulk materials” was published on January 2010. An update is expected to be published on April 2020.

Diffuse dust emissions occur to a significant extent during the storage, handling and transport of bulk materials. This Directive applies to such diffuse dust emissions. The aim of the Directive is to estimate emission factors for this purpose. The directive does not allow emission limits to be set. Diffuse dust emissions from the operation of landfills are dealt with in Guideline VDI 3790 Part 2.

Emission of gases, odours and dust from diffusive sources Dust emissions due to vehicle movements on roads not open to the public: VDI 3790 Part 4

The German VDI 3790-4 “Environmental meteorology - Emissions of gases, odours and dust from diffuse sources – Dust emissions due to vehicle movements on roads not open to the public” was published on September 2018.

This Directive describes a calculation method for quantifying diffuse dust emissions due to vehicle-induced swirling caused by movements on paved and unpaved, commercial or industrial roadways. The use of the method described is limited to paved infrastructure with fleet masses of up to 38 tonnes averaged over the period under consideration and thus covers the majority of typical applications. There are no restrictions on fleet mass for unpaved roads. The guideline is addressed to experts as well as operators of quarries etc. and representatives of authorities.

Dispersion of odorants in the atmosphere - Fundamentals: VDI 3788 part 1

The German VDI 3788 -1 “Environmental meteorology - Dispersion of odorants in the atmosphere – Fundamentals” was published on July 2000.

The document describes requirements, concepts and application areas of analytical and numerical models, the required input variables as well as the result variables for dispersion calculations for odorous substances. Furthermore, the criteria for verification and validation that are indispensable for the quality assurance of models are explained. The physical modelling

of the propagation of odorous substances by means of the wind tunnel is not part of this series of guidelines.

Dispersion of odorants in the atmosphere – Reverse modelling: VDI 3788 part 2

The German VDI 3788 -2 “Environmental meteorology - Dispersion of odorants in the atmosphere – Reverse modelling” is expected to be published on October 2020.

According to the Odour Immission Directive (GIRL), the calculation of odour emissions on the basis of plume measurements is explicitly permitted in special cases (i.e. in the presence of complex source structures, diffuse sources).

While there is a guideline for the performance of plume measurements, there is no standardized procedure for the recalculation of odour emissions which is comparable with the guidelines VDI 3945 Part 3 and VDI 3782 Part 1.

The present guideline serves to standardize the procedure and quality assurance in the retroactive calculation according to GIRL.

4

Guidelines

Although the jurisdictions analyzed do not have regulations to manage and prevent odour impact, that does not mean that nothing can be done.

One of the first approaches to tackle odour impacts is by setting a clear methodology to deal with them. The most usual way to do so is by setting specific methodologies that deepen in aspects not dealt in standards or directly not treated in the regulations.

Guidelines usually deal with the way an odour is measured or how a dispersion modelling has to be done. Other guidelines deal with methodologies to abate odour, for example by use of *Best Available Technique* (BATs) or how to deal with odour incidents.

The most known environmental guidelines in Europe are the *Best Reference documents on BAT* (named as BREF). There are over 30 BREF documents published, which are related to different sectors. As of 2019, the [only BREF in Europe that set and odour limit](#) is the recently published Waste Treatment BREF that sets a limit of 200 to 1000 ou/m^3 as the maximum allowed odour concentration for some BATs related to the biological treatment of waste.

Guidelines may or may not be published in official journals. In the case that they are published in official journals they do not set odour limits, but methodologies. In some cases, reference odour limits might be included, such as in the H4 UK horizontal guideline on odours.

4.1 Austria

3 specific guidelines related to odour measurement.

There are 3 guidelines much used in Austria when dealing with odour issues.

ÖAW (1994)

The *Austrian Academy of Sciences* published in 1994 the “Environmental science basics and objectives within the framework of the National Environmental Plan for the fields climate, air,

noise and odour”. This guideline sets two specific limits depending on the odour intensity. Basically, this guideline sets that strong odours should occur less often than weak odours, that is, weak odours can be perceived by a population not more than 700 hours per year, whilst strong odours are not allowed to be perceived more than around 263 hours.

BMLFUW (2014)

“Leitfaden Gerüche in Innenräumen – Sensorische Bestimmung und Bewertung.” In 2014, the Federal Ministry of Agriculture and Forestry, Environment and Water Management published the *Indoor Odours Guide Sensory Identification and Evaluation*

BMLFUW (2017)

The *Directive on Evaluation of Ambient air concentration of odours from livestock* (2017) replaces the 1995 "Provisional guideline for the assessment of odour impact of livestock farming in stables". This guideline provides a way to forestall and prevent the odour impact of new facilities by the use of setback distances.



Figure 4: Directive on Evaluation of Ambient air concentration of odours from livestock (2017)

4.2 Bulgaria

No guidance published.

To date, no guidance directly related to odour management was found in Bulgaria.

4.3 Chile

In the last few years, Chile has become a country highly active in this area

The Chilean Government has been very active with odour issues in the last few years. Chilean Ministry of the Environment has even launched a new website exclusively to inform about odour pollution: what the odours are, how they are measured, what laws and/or regulations exist, etc.

GUIDANCE FOR PREDICTION AND EVALUATION OF ODOUR IMPACTS ON THE SEIA

The SEIA is the Environmental Impact Evaluation System, an instrument to introduce the environmental topic in the design and execution of projects and activities carried out in the country. It published a couple of years ago the "Guide for prediction and evaluation of odour impacts in the SEIA", whose objective is to provide tools for the estimation of odour emissions and the prediction and evaluation of the environmental impacts they generate.

4.4 Germany

The GOAA/GIRL guideline is the guideline for odour management in Germany

The *Guideline on Odour in Ambient Air* (GOAA), GIRL for its acronym in Germany has been the reference for setting odour impact criteria in Germany. The impact of this guideline in several permit procedures is so important, that the *Federal Ministry of Environment of Germany* is going to upgrade this guideline to a legislation status by incorporating the text in the *German regulation on air* (TA Luft).

This regulation sets clear limits for odour concentration in ambient air depending on the classification of the area where the odours are perceived. **The GOAA uses the concept of odour hour**, which in short is the recognition threshold of an odour in a given percentage of times within one hour. The *odour hour* does not distinguish between strong or weak odours, or between offensive and less offensive odours.

Any **odour-emitting industrial activity in Germany** should not produce **more than 876 odour hours every year in residential areas nearby**. For **commercial and industrial areas**, the odour hours produced by a factory are allowed to be **less than 1314 hours every year**.

4.5 Greece

No odour guidance for odour management.

To date, no guidance directly related to odour management was found in Greece.

4.6 Italy

Some Italian regions have developed several Guidelines, which some of them have become law.

As previously mentioned in the section of regulations, Italy has no national odour regulation, but some of their regions have developed several laws based on guidelines as the Italian Regions have the permission to establish regional regulations about odour emissions or to introduce requirements in permits (permit conditions) about odour emissions.

Metodologie per la valutazione delle emissioni odorigene - documento di sintesi

First in 2003, the *Agenzia per la protezione dell'ambiente e per i servizi tecnici* (APAT), part of the *Higher Institute for Environmental Protection and Research* (ISPRA) and controlled by the *Italian Ministry of the Environment*, published a technical guideline about odours, odour measurement methods, dispersion modeling, control, monitoring, etc. ("Metodi di misura delle emissioni

olfattive”). This guideline has been used as a reference in many cases when no other guideline is available in Italy.

More recently, in 2018, the *Sistema Nazionale per la Protezione dell’Ambiente* (SNPA - former APAT) published a technical and detailed document providing an overview of the available methods for odour emission evaluation. This document was approved with Resolution n. 38 of 2018, and represents the national reference on the state of the art of the available techniques for odour impact assessment.

4.7 Portugal

No odour guidance for odour management.

To date, no guidance directly related to odour management was found in Portugal.

4.8 Spain

No odour guidance for odour management.

To date, no guidance directly related to odour management was found in Spain.

In June 2005 the environmental administration of the Region of Catalonia presented the **Draft bill “Against Odorous Pollution”**. This Draft was inspired by the first *H4 Horizontal Guideline* of UK. This Draft received a lot of pressure from the pig farming sector in Catalonia and could not be finally approved. However, the text and the limits set in it are used as a reference by many odour consultants in Spain, so **it became a sort of guideline on odour management**

4.9 United Kingdom

The national Government, the Scottish Environmental Protection Agency (SEPA) and the Environment Agency (EA) have published guidelines on odour assessment.

The different *Environmental Protection Agencies* in UK (England, Scotland, Wales and Northern Ireland) have developed several Guidelines to assist practitioners involved in odour assessment for planning.

One of the first guidelines published in UK was the H4 Odour Guidance which focused on activities under the *Pollution and Prevention Control*(PPC) Regulations. This guideline was revised in 2009 and in 2011 and now the *H4 Odour Management- how to comply with your environmental permits* being used widely

There are a few more interesting guidelines in the UK that deal with odour management.

H4 Odour Management - How to comply with your environmental permit

The *UK Environment Agency* developed this Guidance to help both holders and potential holders of environmental permits understand how to comply with their permits. The guideline contains information on:

- Odour as an issue, its perception, impact and acceptability
- Regulatory approach, including enforcement of permit conditions
- The proposed changes to odour conditions in the UK.
- The importance of odour management plans and their scope
- Risk assessments and monitoring of odour
- Measures for the control of odour
- Forms for recording levels of odour

It also describes some basic principles to be taken into account when dealing with odour impacts.



Criterion, $C_{98 \text{ ou}_\text{E}}/\text{m}^3$	Offensiveness	Odour Emission Sources
1.5	Most Offensive	Processes involving decaying animal or fish remains Processes involving septic effluent or sludge Biological landfill odours
3.0	Moderately Offensive	Intensive livestock rearing Fat frying (food processing) Sugar beet processing Well aerated green waste composting
6.0	Less Offensive	Brewery Confectionery Coffee

Figure 5: H4 guidance and benchmarks.

This guidance, also known as H4, has served as the basis for multiple regulations, other guidelines, environmental permits and even odour impact studies, as it establishes benchmark levels for odours based on the 98th percentile of hourly average concentrations of odour modelled over a year as follows:

- 1.5 odour units for most offensive odours;
- 3 odour units for moderately offensive odours;
- 6 odour units for less offensive odours.

Nuisance smells: how councils deal with complaints

This guide was published in 2015, and the previous “Odour guidance for local authorities” was withdrawn. This guide is applied not only to industrial odours, but also from trade and business premises. This guideline can help councils to look into complaints about odours that could be a ‘statutory nuisance’ in order to assess and deal with odour nuisance.

Odour guidance 2010: SEPA

The *Scottish Environment Protection Agency* (SEPA), Scotland’s environmental regulators, published this guidance in 2010 with the aim of providing practical guidance on how and why odours occur, how they can be investigated, how they can be mitigated and the roles and responsibilities of SEPA.

NIEA: Odour impact assessment guidance for permitted and licensed sites

The *Department of Agriculture, Environment and Rural Affairs* (DAERA) of the *Northern Ireland Environment Agency* published in 2012 the “Odour impact assessment guidance for permitted and licensed sites”, but it only covers very few basic procedures for carrying out an odour investigation.

IAQM Guidance on the assessment of odour for planning

The *British Institute of Air Quality Management* (IAQM) reviewed a previous guideline in 2018 to address the specific topic odour assessment applicable for planning purposes to assist practitioners involved in this area.

5

How odours are regulated

Although many countries do not have regulations to manage and prevent odour impact in populations, that doesn't mean that nothing can be done.

Countries with no specific odour regulation have other ways of controlling and regulating odour pollution.

At European level, the *European Environment Agency* (EEA) has a common framework related to environmental permitting, known as the *Industrial Emission Directive* (IED). This Directive 2010/75/EU of the *European Parliament* and of the *Council* of 24 November 2010 on industrial emissions (*Integrated Pollution Prevention and Control*) establishes a general framework for determining limits (including odour limits) for many industrial activities/processes in order to control odour emissions.

At present, the *European Union* (EU) has **28 member states**: **Austria**, Belgium, **Bulgaria**, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, **Germany**, **Greece**, Hungary, **Italy**, Ireland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, **Portugal**, Romania, **Spain**, Slovakia, Slovenia, Sweden and the **United Kingdom (UK)**.

This European Directive rules that installations should operate only if they hold a written permit or, in certain cases, if they are just registered. The permit conditions are defined to achieve a high level of protection for the environment and society, and each regional government has the authority to give or deny these permits.

These conditions are commonly based on the use of the Reference documents for Best Available Technique (named as BREF). There are more than 30 BREFs in Europe, covering several industrial sectors.

In 2018, the first European odour limit was published in the *Decision of the European Commission establishing the best available techniques (BAT) conclusions* **Waste Treatment (WT)**, so this implies that all the industries (of this sector) in Europe that use a biological treatment in waste sector have a range of **200 to 1000 ou_E/Nm³ as the maximum allowed odour concentration**.

In the case of activities like restaurants, garages, painting facilities or small farms, it is common to use simple criteria, such as extracting air from odorous areas, such as kitchens and painting tunnels and setting stacks at a certain height, or filtering the odours with activated carbon cartridges.

However, little is usually done at a planning level in towns and cities to prevent the odour impact of small activities, nor odours are taken into account in environmental impact assessment during territory planning, as it happens for example with noise.

In a few cases, the courts have to deal with odour impacts. One of the most important sentences in court cited in many court cases is the well known [Lopez Ostra v Spain](#).

In 1994, the *European Court of Human Rights* recognised the failure of a local authority to protect the residential intimacy of a resident, Ms *Lopez Óstra*, from intruding odours from a *Waste Water Treatment Plant* recently built, as an infraction of her human right of protection of intimacy in the private residence. The court considered that the government had failed to protect the citizen and hence her rights under art. 8 of the Convention of Rome, 1950:

Art 8. Everyone has the right to respect for his private and family life, his home and his correspondence.

There shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and is necessary in a democratic society in the interests of national security, public safety or the economic well-being of the country, for the prevention of disorder or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others.

As a result the Spanish state was fined for infringing on the human rights of its citizen Lopez Ostra by not adequately protecting her from offending odours penetrating her residence.

As seen before, court cases are usually complicated as there are no regulations on odours. There are two common approaches in court cases when there are no odour regulations:

1. Bringing into account in the court the health impact of odours in a population.
2. Considering the loss of value of properties affected by odours.

- 1. Bringing into account in the court the health impact of odours in a population.**

Reports of adverse human health effects associated with odors from industrial plants have been recorded by [numerous scientific studies](#). The most frequently reported problems include eye, nose, and throat irritation, headache, nausea, diarrhea, cough, chest tightness, palpitations, shortness of breath, stress and drowsiness. It is not easy to calculate the impact on health of an odour-emitting activity. Normally this is done by dose-response studies. It is also difficult to estimate the cost of this impact on a population.

- 2. Taking into account the decrease in the value of the properties.**

How much is the odour impact costing to a community? it is well known that properties situated in areas impacted by odours have a [lower value as compared with properties in odour-free areas](#). **Houses subject to moderate and severe odour nuisance sell at a discount of 5% and 12% respectively**, compared to houses without nuisance. In this case, it is possible to estimate the total cost of the odour impact in an area by simply estimating the number of households involved. [This is an example of a calculation of the loss of value of properties](#). The number of households involved might be calculated on the basis of the number of communities affected.

Appendix

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