



D-NOSES

Distributed Network for Odour Sensing,
Empowerment and Sustainability

ODOUR POLLUTION A GROWING SOCIETAL CONCERN



HIGHLIGHTS

- Odour nuisances, being the second cause of environmental complaints after noise, lead to a significant decline in our quality of life and must be urgently addressed.
- Odour regulations across Europe and within countries differ significantly from each other. In many places they are even completely lacking. There is a need for bottom-up, multi-level governance in Europe in order to protect its citizens.
- Odorous gases are commonly measured at the source (emission). The level of the odours in surrounding residential areas (immission) is more complex to determine, but also much more relevant to measuring the impact on residents.
- The Distributed Network for Odour Sensing, Empowerment and Sustainability (D-NOSES) project will reverse the way in which odour pollution is commonly tackled, through a co-creative citizen science approach.

MAIN ODOUR ISSUES IN EUROPE

The sources that generate odours in European communities are numerous and diverse; in many cases the same community is exposed to more than one odour source. Industrial activities, waste management and agriculture/livestock represent the main challenges regarding odour emissions within Europe.

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IDEAS
FOR
CHANGE



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ODOUR POLLUTION IS...

... the second reason for citizens' environmental complaints after noise across Europe¹

Increased and prolonged exposure to odour pollution is having a **significant impact** on affected communities. The need for action is becoming more urgent with the growing recognition at all levels of the **harmful effects of bad air quality** on people's health and lives. Reducing the impact and improving the affected citizens' quality of life will require a **collaborative approach** by all stakeholders; a reliable measure of the real nuisance will be central to this initiative and crucial to its success.

"Almost 60% of complaints in the field of air pollution concern odour nuisance" (Poland, 2016, Information from the Polish delegation to the Council of the EU).

In Chile, 14.7% of all official complaints received by the Ministry of the Environment were related to odours (data from 2016). In addition, many affected residents took to the streets in, often violent, mass protests to express their concerns about the odour nuisances.



... an indicator of environmental impact

In addition, odour pollution is often a **symptom of broader environmental issues** caused by population growth, urbanisation and industrialisation. Frequently associated with air pollution, odours can also often be correlated with soil and water contamination, and sanitary problems (poor waste management). Furthermore, gases emitted in landfills and livestock facilities are mixtures of methane (greenhouse gas) and toxic odorous gases (e.g. hydrogen sulphide), and thus contribute to climate change. Therefore, odour manifestations should be considered as an **alert signal** and a potential **call for an environmental impact assessment**.



Odour nuisance from Rio Tinto river (a small affluent of the Douro river, North Portugal), alerting to illegal discharges as serious environmental problem along its course.



... not just a nuisance

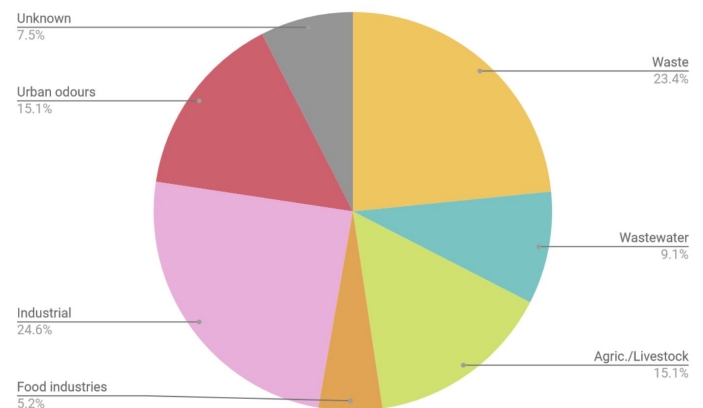
Odours have generally been assumed to be annoying, but harmless. There is, however, evidence that persistent exposure to odours can have **adverse effects that go beyond mere inconvenience**². People in affected communities can suffer from headaches, throat and eye irritation, nausea, sleeplessness, anxiety, stress, or even respiratory problems. In addition, odours affect the quality of life (social effects) and have **possible economic impacts**³ (e.g. tourism or loss of property value).

"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." (WHO)⁴

Odour issues can therefore generate **conflicts between the residents and the emitters** which have to coexist in increasingly limited space, and lead to possible obstacles to the continuation or expansion of odour-emitting activities.

HEALTH IMPACTS

A study in Finland⁵ surveyed over 1,000 residents living at varying distances to major waste treatment centres. Those closer to the centres, and thus exposed to odour nuisance, reported more physical symptoms, such as shortness of breath, eye irritation, fever / shivering and even muscular pains. This study shows a direct link between odour nuisance and effects on human health.



Overview of the general distribution of odour sources in all European D-NOSES partner countries (source: D-NOSES deliverable D4.1⁶, based on over 220 cases of odour complaints reported in the local and national press from the past 8 years).

[1] ADEME, 2005. Pollutions olfactives: origine, législation, analyse, traitement, Dunod, Paris, XII-388p.

[2] Schillman & Williams 2005. 'Science of Odor as a Potential Health Issue'. Journal of Environmental Quality 34(1): 129-138.

[3] Batalhone et al, 2002. Economics of Air Pollutions. Hedonic Price Model and Smell Consequences of Sewage Treatment Plants in Urban Areas, Working Paper 234, University of Brasília, 25p.

[4] Constitution of the World Health Organization: Principles: <https://www.who.int/about/mission/en/>

[5] Aatamila et al, 2011. 'Odour annoyance and physical symptoms among residents living near waste treatment centres', Environmental Research 111 (1k 164-170).

[6] Balestrini et al, 2018. Map of odour issues and priorities. Multilevel engagement plan for stakeholders and communities D-NOSES deliverable D4.1 v5.1, 100p. (<https://dnoses.eu/wp-content/uploads/2019/01/D4.1-Map-of-Odour-Issues.pdf>)

European environmental regulations largely ignore odour issues

Odour pollution has repeatedly been ignored in environmental regulations **leaving citizens defenceless**.

According to the Directive 2010/75/EU⁷ on Industrial Emissions, European countries must prevent and limit air, soil and water pollution, as well as negative environmental effects such as odours. A European standard defines how to sample and measure odours in the laboratory (EN 13725:2003⁸) (see next page), thereby quantifying odour emissions. However, no standard regulates the need for an odour risk analysis at the planning stage or the requirement for odour control management to be included in permits. Ultimately, there are still **no common criteria to establish impact odour thresholds**. We advocate that odour thresholds need to be established in cases where residents are impacted and odour nuisance is present.

DISPARATE ODOUR REGULATIONS IN EUROPE

Some efforts have been made to regulate odours throughout Europe at the national, regional and even municipal levels⁹. However, it has not led to the drawing up of clear, Europe-wide definitions, terms and criteria and there are **still many European areas that have no odour regulations** at all.

Due to the lack of regulations, situated technical studies are rarely conducted, data on odour pollution are scarce or not accessible, and the implementation of effective odour control strategies is usually disregarded. It is often the citizens who build up the pressure for local authorities and odour emitting industries to monitor and control odour emissions.

WHEN CITIZENS GET INVOLVED

Inhabitants of a southern German district have been complaining about nightly odour nuisance since 2015. The centralisation of residents' observations by the municipality, although late, was crucial in advancing the search for odorous sources. The collection and cross-referencing of spatiotemporal and weather data made it possible to delimit the area concerned and identify a potential emitter. Empowering citizens to collect data through the use of innovative tools could have enabled the authorities to act more quickly to prevent and reduce odour emissions.

Odour regulation in eight European countries and in Chile (D-NOSES partners)

EU

Directive 2010/75/EU on Industrial Emissions (applies to all European partner countries)

AUSTRIA

- No national regulation on odours
- Recommendation to apply the "Directive for the Assessment of Emissions from Livestock Farming" (2017, replacing the previous one from 1995) in diverse regulations and permit procedures

BULGARIA

- Under the Environmental Protection Act, certain permits include conditions for monitoring and strict control of odour emissions
- Some odour issues are addressed in single regulations (ordinances) related to waste management, air pollution, wastewater treatment, etc.
- An ordinance related to air pollution includes sanctions for industries releasing odorous substances

GERMANY

- Federal Immission Control Act (BImSchG) regulates the licensing of potential odour emitters and defines significant odour nuisance
- Technical Directive on Air Pollution Control (TA Luft) describes the use of BImSchG in practice and sets specific emission limits
- Directive on Odour Immissions (GIRL) sets limit values for odour exposure in habituated and industrial zones

GREECE

- No national regulation on odours

ITALY

- No national regulation on odours
- Local guidelines on odour emissions, primarily based on a modellistic approach (Region of Lombardy, Region of Piemonte, Region of Puglia, Province of Trento)

PORTUGAL

- No national regulation on odours
- Diffuse emission of pollutants is regulated by Article 9, DL No. 39/2018 of June 11
- Some environmental licences present conditions to minimise odours

SPAIN

- No regulation on odours at national or regional level, but in some municipalities (Lliçà de Vall, Banyoles, Alcantarilla, Las Palmas, etc.), although there is no coherence between ordinances
- In Catalonia, a specific regulation to control odour pollution was drafted in 2005, not adopted, but used as reference to set odour limits from different emitting activities elsewhere in Spain

UK

- Environmental Protection Act 1990 assigns a duty to the local councils to investigate all odour complaints
- Several guidelines on odour management, Pollution Prevention and Control in Scotland

CHILE

- Since 20 years there is an emission standard for total reduced sulphur compounds (TRS) associated with the manufacture of sulphated pulp
- During the last 5 years, there have been several actions alongside a national odour management strategy that includes adoption of international technical standards, odour evaluation within the environmental licensing scheme (guideline on odours published in December 2017 providing standards) and ongoing efforts on odour emission standards for selected activities (e.g. piggeries).

THE NEED FOR A BOTTOM-UP, MULTI-LEVEL GOVERNANCE MODEL



Odour pollution has generally a local impact and therefore **local regulations are often the most effective management strategy**. Regulations on national and international levels, however, are crucial to provide a fundamental framework and are even required in some countries (e.g. Portugal).

Citizens, as the producers of many odorous products (e.g. waste and wastewater), **are co-responsible** for odour emissions. Their inclusion in local decision-making and management processes enables them to increase their awareness of environmental challenges, adjust their behaviour and co-create local regulations for sustainable communities.



Through the inclusion of citizens, **industries can improve their relationships with communities**, and local authorities can increase transparency and **confidence in public institutions**.



[7] Directive 2010/75 of the European Parliament and of the Council of the 24 November 2010 on industrial emissions (integrated pollution prevention and control), OJL 334, 17.12.2010, p17-119.

[8] CEN, 2003. EN 13725:2003. Air quality. Determination of odour concentration by dynamic olfactometry.

[9] Brancher et al., 2017. 'A Review of Odour Impact Criteria in Selected Countries around the World'. Chemosphere 168:1531-1570.

Measuring odours and impacts

COMMON METHODS USED

An odour is commonly characterised by its concentration, rather than by its chemical composition. Expressed in odour units per cubic metre ($\text{ou}_\text{E}/\text{m}^3$), odour concentration is determined in a laboratory by **dynamic olfactometry**, a sensorial technique based on the participation of a panel of people with confirmed average sensitivity (method standardised at European level EN 13725:2003⁸, under revision). The **quantification of odour emissions at the source** based on this technique serves as input data to **odour dispersion models**. Such models provide easily understandable averaged results that are not only descriptive, but also predictive (useful for new plant under construction)¹⁰.

However, the results of this technique have high uncertainty levels, do **not report citizens' discomfort or real-time annoyance** and therefore do not provide accurate estimates of their exposure to odours.

Methods to evaluate odour impact at the receptors (citizens) include the recent European standard EN 16841:2016¹¹ on **field inspection of odours** (grid and plume methods) through human assessors, which are used increasingly for environmental odour assessment. However, these field inspections are **time-consuming and often induce high costs**, and still do not provide real-time information on the discomfort of the impacted citizens.

There is a need for a **cost-effective technique to assess the perceived nuisance** directly within the community. Citizens own the most precise and cost-effective sensor to measure odours - their own noses - and have a clear motivation for engagement: recovering their quality of life.

The involvement of citizens helps the industry and local authorities to obtain **real-time data at lower economic costs**. These data inform the optimisation of industrial processes and reduce the impact of odour pollution on the communities, while advancing the state of the art of odour management.

The **intervention of citizen science** in odour pollution is therefore of great interest. Citizen science has recently been experiencing an increase in support from the European commission, mainly in the fields of environmental monitoring and regulations. In addition, the open science movement has gained a lot of awareness. As a result, open science and citizen science project numbers have been steadily increasing throughout Europe and beyond.

"Informed opinion and active co-operation on the part of the public are of the utmost importance in the improvement of the health of the people."

(WHO)⁴



Our approach in D-NOSES: empowerment of citizens to co-design local solutions

The Distributed Network for Odour Sensing, Empowerment and Sustainability (D-NOSES) project is an EU H2020-SwafS (Science with and for Society) funded project that aims to provide an **inclusive, bottom-up approach** to tackle odour pollution issues at all levels in a cost-effective way.

Our approach is to **empower citizens to become a driving force for change through citizen science**. Odour problems can be mapped using the free **collaborative mapping app OdourCollect** (<https://odourcollect.eu>), which will allow industries to optimise their processes and to check the effects of newly implemented good practices and corrective measures at a lower cost. This methodology takes citizens' annoyance into account through **first-hand observations** and enables citizens to **co-design solutions** with all stakeholders, such as environmental NGOs, local authorities, odour-emitting industries and odour experts.

THROUGH THE IMPLEMENTATION OF THE PRINCIPLE 10 OF THE RIO DECLARATION (1992), D-NOSES WILL STRENGTHEN:

- **Not only access to information, but also generation of new data in odour pollution** through the International Odour Observatory (<https://dnoses.communitymaps.org.uk>)
- **Public participation in local decision-making** (multi-level engagement strategies of stakeholders and communities, co-creation and citizen science approaches)
- **Access to justice** through advocacy actions to introduce odour pollution to the policy agendas.

TAKE HOME MESSAGES

- Odour pollution is linked to environmental and health issues and therefore needs to be more closely regulated in Europe.
- The inclusion of citizens in odour regulation and management processes is beneficial for all stakeholders, as it promotes scientific education, improves relationships and increases confidence in public authorities.
- Be part of the solution! Get involved in our co-creation process: Find out more on the D-NOSES website (www.dnoses.eu)

[10] Capelli et al. 2013. 'Measuring Odours in the Environment vs. Dispersion Modelling: A Review'. Atmospheric Environment 79: 731-743.

[11] CEN, 2016. EN 16841:2016. Ambient air - Determination of odour in ambient air by using field inspection, Brussels.