



D-NOSES

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**Map of odour issues
and priorities.
Multilevel
engagement plan for
stakeholders and
communities**

D4.1

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Deliverable

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Map of odour issues and priorities. Multilevel engagement plan for stakeholders and communities

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Summary

This document provides a preliminary mapping of communities affected by odour pollution in eight European countries and in Chile, and presents a conceptual framework for supporting stakeholders in planning and conducting citizen science interventions aimed at tackling odour problems.

The document is structured in 5 chapters:

Chapter 1. D-NOSES ENGAGEMENT MODEL (beta version): it presents a framework aimed to support the creation of citizen science interventions on odour pollution. The model is based on six main phases around which the intervention is structured. They include: 1) **framing the problem** to identify the community and understand the problem at stake; 2) **pilot design** to involve different stakeholders in the co-creation of the intervention and ensure that it will address their concerns; 3) **data collection** to gather odour observations through tools defined with participants and train them to use such tools; 4) **data analysis** to validate, classify and visualise the data gathered and draw conclusions; 5) **action** to propose new practices that can be adopted to mitigate the odour problem and 6) **outcomes** to reflect on the results of the intervention and how can be used to inform policies and future interventions.

The chapter also presents a preliminary version of the D-NOSES toolkit, a set of activities and tools that can be combined to design citizen science interventions. This first version of the toolkit is aimed to support consortium partners in the co-design (Task 4.3) and development (Tasks 5.3 - 5.11) of the pilot interventions. The toolkit is instrumental to enacting the conceptual framework and promoting the replicability of the interventions (Task 6.3).

Chapter 2. ODOUR ISSUES AT NATIONAL LEVEL: It presents the results of desk research (Task 4.1) on communities affected by odour problems in Austria, Bulgaria, Germany, Greece, Italy, Portugal, Spain, UK and Chile. It provides an overview of 1) how odour pollution affects different aspects of people' lives, such as daily annoyances, negative impacts on business activities and health concerns; 2) how odour problems are monitored in the different countries and who is involved in this task; and 3) what are the best practices in odour management put in place by various countries. Information and communities mapped through this process are made available through the community mapping tool (Task 3.2). Overall, this chapter contributes to build a knowledge base for reporting cases of odour pollution in a systematic way (Task 3.1).

Chapter 3. POTENTIAL PILOT CASE STUDIES: It presents potential cases for the D-NOSES pilot interventions. Over the duration of the project, at least 10 pilots will be developed to

tackle odour issues in different countries through a bottom-up citizen science approach. This chapter presents potential cases for the first 6 pilots that will start in 2019. For each pilot case, stakeholders and target groups to be engaged in the interventions and awareness raising actions have been identified, as well as possible motivations and barriers for engaging them (Task 4.1).

Chapter 4. CO-DESIGNING PILOT CASE STUDIES: It presents a preliminary plan for the implementation of the pilot interventions. It builds on the results of the co-creation workshop (Task 4.3) conducted during the consortium meeting in Zaragoza in September 2018. The proposed strategies and plans are meant to be validated with the stakeholders to be involved in the pilot interventions (continuation of Task 4.3).

Chapter 5. FINAL REMARKS: It summarizes the main contributions of this deliverable and discusses final reflections and remarks.

Overall, the work presented in this document paves the way for the tasks to be conducted in the following phases of the project. More specifically, it launches the implementation of the pilots (Tasks 5.3 - 5.11) by selecting the cases and proposing potential work plans. Also, it provides consortium partners and other stakeholders with the conceptual framework and tools that are necessary to successfully run the pilots. This is crucial to Task 6.3, which aims to create DIY guidelines for the replicability of the interventions.

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FINAL REMARKS

1

D-NOSES

ENGAGEMENT MODEL

(beta version)

One of the key goals of the D-NOSES project is to support and guide a collaborative journey to tackle odour pollution with the active involvement of key actors of the quadruple helix model (public authorities, industries, civil society and academia). To this end, D-NOSES will define, iterate and validate a methodology that aims to empower citizens, and the relevant stakeholders, to generate, access and use data related to odour pollution in areas affected by odour emitting activities. The collected data will be used to inform and co-design possible solutions to manage and mitigate the odour problems.

The proposed methodology will be tested and improved in at least 10 pilot case studies to be developed across Europe and other non-European countries. The resulting approach is aimed to be universally replicable in diverse regions and situations around the globe, to generate scientifically valid and actionable data through citizen science interventions that have the potential to improve people's lives. D-NOSES will leverage on the results for the pilots to run advocacy actions and propose standards for odour regulation at local, national and international levels.

One of the key challenges of the D-NOSES approach is how to orchestrate the engagement of different stakeholders - *citizens, CSO's and NGO's, industries, local & regional authorities, and odour experts, etc.* - as they can be affected in different ways by the problem and can have conflicting interests and goals. Thus, the objective is to identify a common agenda amongst them, balance expectations and interests, and encourage a bottom-up approach where affected communities take an active role in defining and monitoring the problem while engaging in dialogues with public authorities and emitting industries to co-design potential mitigation options and good practices to reduce the odour impact.

In this deliverable we present the first version of the proposed engagement model. It is largely based on previous engagement models by project partners Ideas for Change (**The Bristol Approach**¹) and Mapping for Change (**Extreme Citizen Science approach**²). These models have been previously tested and validated in a wide number of citizen science projects about different topics, ranging from air and noise pollution, damp problems in homes and accessibility barriers for mobility. D-NOSES will combine best practices of both models as well as expand them with new methods and tools specific to the domain of odour pollution and the quadruple helix approach. The D-NOSES engagement model will be developed, tested and iterated through the inputs from pilot case studies.

THE PHASES OF THE D-NOSES ENGAGEMENT MODEL

The D-NOSES engagement model is structured into six phases, starting from the identification of the problem and the affected communities, going through data collection and proposals for actions to reduce the problem and increase the quality of life. It culminates with a reflection on what was learned during the process and how it contributes to a commons -a set of community shared resources including data, social networks, and learning. In the following section, we summarise the goals and key activities of each phase.



Figure 1: D-NOSES Engagement strategy (version beta)

Phase 1 - FRAME THE PROBLEM

The first phase includes identifying areas affected by odour problems and choosing a potential area where to conduct the pilot intervention. Once the area is identified, the process starts with the problem definition – identifying matters of concern that communities care about and are prepared to give their time and energy to address. The odour problem should thus be expressed in terms of citizens’ concerns rather than from the lens of experts. For this reason, it is often useful to collect daily life stories on how the odour problem is affecting the everyday lives of people living or working in the polluted area.

An important step in this phase is to map out as many stakeholders involved in the case as possible, and to identify their motivations to participate as well as possible barriers and mitigations strategies. Ethnographic methods are generally used in this phase because they

¹ Balestrini, M., et al. (2017) "A city in common: a framework to orchestrate large-scale citizen engagement around urban issues." Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. ACM.

² Haklay, M., and Francis, L., (2018). Participatory GIS and community-based citizen science for environmental justice action, in Chakraborty, J., Walker, G. and Holifield, R.(eds.), The Routledge Handbook of Environmental Justice. Abingdon: Routledge, pp. 297-308

enable to gain a deep understanding of the living context and a first-hand experience of the problem at stake.

Finally, in the Framing phase we aim to investigate how technology and data can be utilised to help tackle the issue, and what existing resources (e.g. existing public information) can be drawn upon. In this process it is also important to identify if there are any gaps in resources or knowledge that need to be filled.

Guiding questions: *Where do odour issues occur in your country/area? Which stakeholders are involved? What are their concerns and motivations? What is the common agenda among them?*

Key Activities:

- Identification of affected communities and characterisation of the odour problem.
- Pre-select, for each country, the most suitable case study to test and validate the D-NOSES methodology, involving quadruple helix stakeholders.
- Stakeholder mapping: issues, motivations, barriers and mitigation strategies.
- Meetings, interviews and conversations with local stakeholders in order to understand the context and the issue at stake.

Expected outcomes:

- Identification of the pilot case and the key stakeholders to be involved
- Understanding of the problem and identification of a matter of concern

Phase 2 - PILOT DESIGN

This phase aims to co-design with stakeholders the data collection strategy to monitor the odour problem that affects their area. This starts with reaching a consensus on what specific aspect of the problem participants want to inquire into, and which data are needed to this end.

In this phase, a decision is taken regarding which data gathering tools (e.g. apps, data sensing diaries, etc.) will be used to collect odour observations and what skills participants need to develop to use such tools. Training sessions in community places are carried out to develop such skills. Videos and educational materials can also be created to support participation during data collection.

Guiding questions: *What aspect of the problem do participants want to understand? Which data are needed to uncover it? How could data be gathered?*

Key Activities:

- Co-define a common research question.
- Co-design a data collection strategy and data gathering tools
- Training sessions and educational materials to support the data collection phase

Expected outcomes:

- Data collection protocol and data gathering tools to be deployed in the next phase.

Phase 3 - DATA COLLECTION

This phase includes the deployment of the data collection strategy that is defined collaboratively with the stakeholders during Phase 2. Ideally, the data collection period will last approximately one year in order to ensure that the odour observations are gathered during different weather conditions (ideally, during the four seasons of the year), since the dispersion conditions is one of the main factors influencing the perception of odours and its corresponding impact, together with the emitting conditions at the odour sources.

We acknowledge that it can be difficult to sustain the engagement of participants for such a long period or time. In order to address this problem, the use of different strategies will be applied, such as creating a group of community champions, engaging a broader group of participants by organising events (e.g. data jams, co-creation workshops, training sessions, etc.), and conducting data analysis sessions to allow participants to explore preliminary results.

Guiding questions: *Which kind of support do participants need during the data collection process? How can the engagement be sustained throughout the campaign?*

Key Activities:

- Deploy the data collection protocol and data gathering tools
- Regular feedback to engaged citizens and organization of different participatory activities for a sustainable engagement during pilot execution

Expected outcomes:

- Citizens' generated data to monitor the perceived odours in the pilot area
- Data shared by other stakeholders (e.g. operational data from emitting industries, weather data, data of environmental stations owned by public authorities, etc.)
- Continuous monitoring of the level of engagement (considering all RRI dimensions) and the impact generated by each pilot

Phase 4 - DATA ANALYSIS

This phase involves the analysis of the data collected by pilot participants, including their validation, classification and visualisation. This is done with the help of the odour experts within the D-NOSES consortium, but also with the support and insights of pilot participants who can help to interpret the results, adding value with their situated knowledge and experience. Data visualisation will be a key point in this matter because of its role in helping people making sense of the data.

Guiding questions: *What does the data tell us? How can we correlated the observed data on odour perception with the daily operations at the odour emitting industries or the weather conditions at the time of perception? What are the main criteria to validate the collected data?*

Key Activities:

- Validate, classify, visualise and analyse the data with the support of the odour experts and pilot's participants.
- Correlation of observed data with daily operations at the emitting activities and the weather conditions.

Expected outcomes:

- New insights and understanding of the odour problem under investigation.
- Identification of situations for improvement (changes in daily operations, good practices, etc.).

Phase 5 - ACTION

This phase includes the co-design of possible actions that can be adopted by quadruple helix stakeholders to mitigate the odour problem, on the basis of the results drawn from the collected data. It might be that large corrective measures are difficult to implement in the short term, such as actions that may require investments from the odour emitting industries to confine and treat the odour emissions. This type of actions are out of the scope of D-NOSES and will be conveniently explained to all engaged stakeholders from the start of the pilots in order to avoid raising false expectations (see D8.3 on Ethics for more details). However, reflections will be made with all participants to co-design actions that they could be readily implemented in order to improve the local air quality in the shorter term.

Guiding questions: *What corrective measures or good practices could be put in place in the short term to mitigate/reduce the problem? Could the outcomes of the pilot inform a community regulation to control odour pollution and protect affected citizens?*

Key Activities:

- Co-design of Odour Management Plans with quadruple helix stakeholders in the short to medium term to mitigate the problem and increase the quality of life of the affected community.
- Inform new local regulations to control odor pollution in the medium term.

Phase 6 - OUTCOMES

The last phase includes reflection on what has been learnt, what can be done in the medium term, both in terms of odour mitigation and monitoring, and on regulation and control, and how to ensure that the resulting data and tools are accessible to third parties as a commons.

Moreover, since the results of the pilots are aimed to contribute to define standard criteria for future odour regulations at different levels, in this phase participants are invited to reflect on lessons learnt during the pilot and how it can be translated into policy recommendations.

Guiding questions: *What are the lessons learnt during the process? How can they inform policies and odour regulations at different levels? What tools and data remain available to the community and can be used in future projects (i.e. data commons)?*

Key Activities:

- Feedback survey
- Society-policy dialogues
- Scientific guidelines and policy recommendations
- Scientific and non-scientific publications

Expected outcomes:

- *Commons*, in terms of data, tools, best practices, scientific guidelines, regulations, etc.

TOOLS TO ENACT THE ENGAGEMENT MODEL

The engagement model presented above should not be seen as a strict process to be followed step by step. Instead, it is aimed to help communities and orchestrators to galvanise around a shared issue and work collaboratively towards the design of a citizen science intervention.

While the phases are useful to guide a cohesive process, enacting a theoretical framework requires that certain tools are deployed. In order to facilitate this process, D-NOSES offers a set of resources aimed to help designing, implementing and supporting citizen science interventions on odour pollution. These resources are presented in the form of a toolkit.

There is not a silver bullet to conduct a citizen science intervention. Every intervention must be tailored to a unique context (socio-cultural context, type of problem, stakeholders involved, past interventions). In this regard, the D-NOSES toolkit is meant to function as an inspirational guide for planning pilot interventions.

The D-NOSES toolkit provides pilot organisers with a list of possible activities to be conducted during the pilot, as well as a list of tools to develop such activities. Anyone who wants to organise a pilot interventions on odour pollution can browse among the list of proposed activities and select the ones that best fit with the pilot goals and its cultural context.

An initial version of the toolkit has been prepared by consortium partners Ideas for Change and Mapping for Change. It combines consolidated methods and tools already used by them in previous citizens science projects. The toolkit contains 32 cards organised into two main categories:

- **MEC cards (Method cards):** in the MEC, the pilot organisers can find some basic methods for designing the overall pilot strategy. Examples of MEC are conversations, field activities, surveys and workshops. Most of the methods comprised in the MEC can be applied in different phases of the pilot. For each phase, the method can be performed through different types of activities, which are presented in the TAC cards.
- **TAC cards (Tools cards):** once the organisers decide which method they want to use (i.e. co-creation workshop), it might not be so obvious how to put it into practice. The TAC cards aim to fill this gap. They provide some ideas or concrete tools that could be used during the activity (e.g. co-creation canvas). For instance, if the pilot organisers

decide to do interviews with different stakeholders, in the TAC he/she can find an example of questions to ask during the interviews.

Table 1 presents the index of all the cards and how they are organised into the two categories and figure 2 shows an example of the kind of information presented in a MEC and a TAC card .

<p> MEC: Conversation</p> <p> TACS:</p> <ul style="list-style-type: none"> - Exploratory conversation guide (with citizens) - Exploratory conversation guide (with public authorities) - Exploratory conversation guide (with emitting industries) - Round Table Talks
<p> MEC: Survey</p> <p> TACS:</p> <ul style="list-style-type: none"> - Odour problem survey - Feedback survey
<p> MEC: Field activity</p> <p> TACS:</p> <ul style="list-style-type: none"> - Sensory walks - Vox Pops -Rapid Appraisal Participatory GIS
<p> MEC: Policy dialogue</p> <ul style="list-style-type: none"> - TAC in process of creation, including Policy briefs and more
<p> MEC: Co-creation workshop</p> <p> TACS:</p> <ul style="list-style-type: none"> - Participatory Mapping - Mapping the commons - Empathy timeline - Sensing Strategy Canvas - Collaborative pilot schedule -Future newspaper -Storyline -Pilot Appraisal -Contrast Matrix
<p> MEC: Participatory Data Collection</p> <p> TACS:</p> <ul style="list-style-type: none"> - Sensory walks - Sensing diaries -Physical installations -OdourCollect App
<p> MEC: Training session</p> <p> TACS:</p> <ul style="list-style-type: none"> - Skills programme -Certificate of Odour Experts

Table 1. The list of MEC and TAC of the first version of the D-NOSES toolkit.



Figure 2. Example of MEC and TAC cards

This *beta*³ version of the toolkit was first tested by project partners during the consortium meeting in Zaragoza (18-19th September, 2018). During a dedicated workshop, the pilot leaders used the toolkit to design an initial engagement strategy for their pilot interventions.

A second version of the toolkit will be prepared in the coming months and will incorporate insights gathered during the Zaragoza workshop, as well as initial inputs from the pilots that will start in 2019. Throughout the course of the project the toolkit will be expanded and re-organised accordingly, including more data collection methods specific for odours (inspired by traditional monitoring techniques) and cross-cutting issues, such as all the RRI dimensions, like gender, and inclusiveness. The final version will be delivered by the end of the project.

³ A version that is made available for testing.

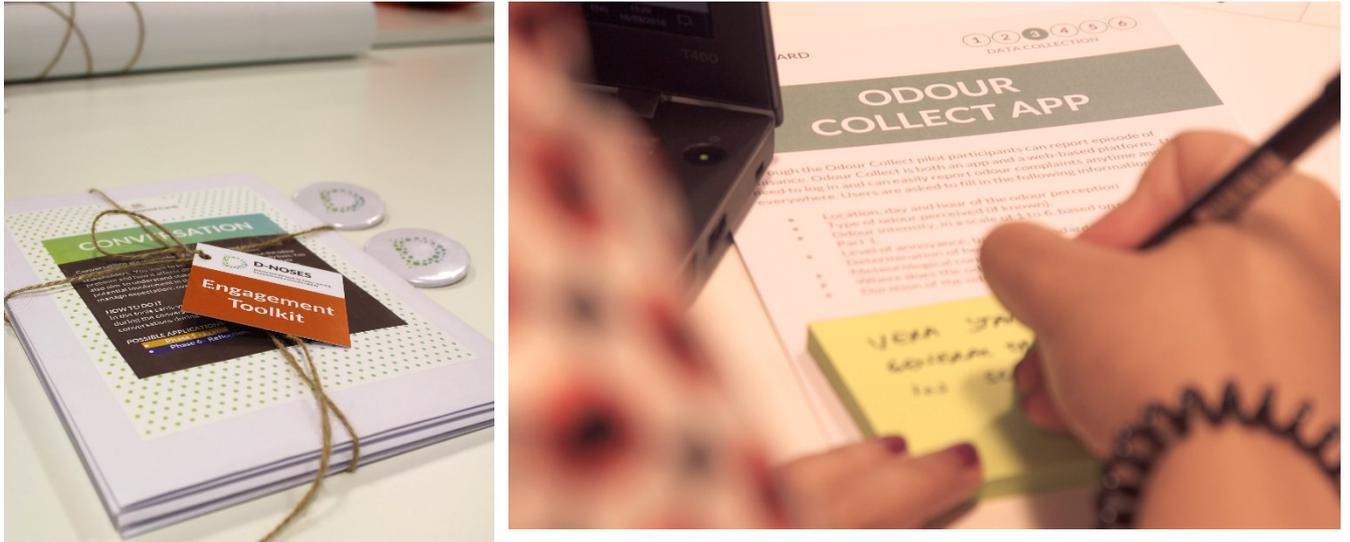


Figure 3: D-NOSES Engagement Toolkit (Beta Version)

INITIAL RESULTS FROM THE MODEL IN ACTION

In the following chapters we present initial results drawn from the activities carried out by project partners during the first phase of the pilot: **Phase 1 - Frame the problem.**

- **Chapter 2** presents the results of the desk research conducted to identify communities affected by odour pollution in 8 different countries (*Task 4.1*)
- **Chapter 3** presents potential pilot case studies and the mapping of stakeholders for the selected case (*Task 4.4*).
- **Chapter 4** presents the results of the consortium meeting in Zaragoza where partners have designed pilot strategies by using the current version of the D-NOSES toolkit. It presents the overall approach and a tentative calendar for the six pilot case studies that will start in the next months. It shows how the engagement framework can be adapted and tailored to the different needs and contexts of each pilot (*Task 4.3*).

2

ODOUR ISSUES AT NATIONAL LEVEL

This section presents an overview of cases of odour pollution in eight countries in Europe and in Chile. The identification of affected communities is an ongoing task during project execution. Over 450 cases have been already identified and documented. This chapter provides a summary and discussion of the cases in each country.

2.1 Focus and identification process

This chapter presents the results of a desk research conducted to identify cases of odour pollution in Austria, Greece, Spain, Chile, Portugal, UK, Bulgaria, Italy and Germany. The aim of this investigation was two-fold. On the one hand, it aims to contribute to the D-NOSES goal of systematically mapping cases of odour pollution across Europe and beyond in order to feed into the International Odour Observatory (IOO). On the other hand, this investigation supports the identification of potential case studies for conducting situated citizen science interventions (pilots).

An important aspect to consider when conducting citizen science interventions is the need to sustain the engagement of participants over a long period of time. For this, it is critical to tackle issues that citizens are already concerned about, and therefore more likely to devote time and energy to the project activities⁴. By drawing on this understanding, the mapping of the cases of odour pollution has mainly focused on identifying communities affected by the problem, in order to understand what worries them the most and how the problem impacts their everyday activities.

⁴ Balestrini, Mara, et al. "A city in common: a framework to orchestrate large-scale citizen engagement around urban issues." Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. ACM, 2017.

To do so, we have conducted news scraping, which entails reviewing news from national and local media where cases of odour complaints from the past eight years have been reported⁵. A protocol for documenting each case was prepared and shared among partners in order to homogenise criteria. The protocol includes a shared spreadsheet to report information and a set of questions to guide the analysis of each case (see Table 2).

 Location			
In which COUNTRY is the case taking place?	In which CITY? Please specify also the NEIGHBOURHOOD	Provide the GEOGRAPHICAL COORDINATES of the area where the problem is occurring. Or you can add a LINK TO GOOGLE MAPS	
 About the odour			
What is the EMITTING ACTIVITY that is causing the odour problem?	What kind of PROBLEMS is the odour causing in the living area? You can choose more than one.	Provide more information about EACH of the problems you mentioned. For instance, what kind of nuisance (e.g. odour, health concern, noise...)? What type of businesses are being affected (e.g. tourism, agriculture...)? What kind of environmental pollution is causing (e.g. water pollution, air pollution, etc)?	For HOW LONG has the problem been going on? Since...
 Data collected & Best practises			
Have any DATA been collected to monitor the problem? E.g. research study, olfactory study, citizens' data gathering..... Please describe. Also, add links to the study, if any.		Have any practices for ODOUR MANAGEMENT been tested and implemented to address the problem? Please explain.	Have any innovative TOOLS OR METHODS been used to monitor the problem?
 Stakeholders involved			
Who are the stakeholders involved?	For each of the stakeholders, select the corresponding category. It is a public body (e.g. City Council, Regional government, National government); SMEs, business, industry, academy, NGOs, CSOs, local associations, policy makers, non-constituted citizen organizations.		Please select if the stakeholder is LOCAL, REGIONAL, NATIONAL OR INTERNATIONAL?
 Source of information			
Please, add the link of the INFORMATION SOURCE (e.g. newspapers, reports, etc.)		Please, add the PUBLICATION DATA of the case (for newspapers and articles the data published and for other sources, the year)	
 Others			

⁵ To map the cases in Chile, project partner ECOTEC build on the findings of a previous study developed for the environmental Ministry. The study is based on information (complaints) provided by governmental sources (environmental and health Ministry).

Please add any other COMMENT OR OBSERVATION that will help to better understand the case.	Is there any ODOUR REGULATION at national or local level?
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Table 2. Guiding questions for analysing and reporting cases of odour pollution

For each affected community the main odour emitting activities and odour sources that generate the odour nuisance have been identified. This allowed to build an extended list of odour sources. To the best of our knowledge, there is not yet a complete (and standardised) list of activities that generate odour nuisance. D-NOSES aims to fill this gap by building a knowledge library about odour sources; a useful contribution to the field of odour monitoring.

D-NOSES odour experts have proposed an initial categorisation of odour emitting activities (table 3), which has been used to classify the odour sources of the affected communities identified during the desk research. It proposes six categories of odour sources, each of which is composed by several different odour emitting activities.

The six categories exemplify activities concerning urban, industrial or productive life, such as waste management (either solid or liquid waste), production activities (agricultural or industrial production) and activities related to human habits.

WASTE MANAGEMENT

Odour generated by activities related to the management of solid waste, such as:

- Biomethanisation plant
- Integral waste treatment facility
- Waste incinerator
- Transfer station
- Recycling plant
- Pneumatic collection
- Other

WASTEWATER TREATMENT

Odour generated by management, treatment or lack of treatment of wastewater:

- Urban waste water treatment plant
- Industrial wastewater treatment plant
- Sludge treatment facilities
- Collection deposit
- Stormwater tanks
- River or alike with stagnant water
- Other

AGRICULTURE / LIVESTOCK

Odour generated by agricultural and livestock related activities, such as:

- Animal slaughtering
- Animal by-product rendering
- Farm (intensive, unknown type)
- Chicken barn
- Pig farm
- Cattle/dairy farm
- Manure or slurry application in the field
- Livestock/animal feed compounders
- Other

FOOD INDUSTRIES

Odour generated by food processing industries, such as:

- Gelatine industry
- Coffee industry
- Cocoa bean/Chocolate industry
- Dairy products factory
- Sugar processing
- Breweries
- Manufacture of alcoholic and non-alcoholic beverages
- Animal feed industry
- Meat industry
- Fish, mollusc and crustacean processing and preservation
- Large bakeries, rusk and pastry bakeries
- Potato processing industry
- Manufacture of vegetable oils and fats
- Aroma and flavours manufacturers

INDUSTRIAL

Odour generated by industrial production, such as:

- Pulp and Paper mills
- Oil refinery processes
- Energy production (gas, coal, other)
- Natural gas and petroleum extraction
- Asphalt mixing plants
- Chemical industry
- Ammonia plants
- Leathery and tanning of skins
- Tyre industry
- Pharmaceutical industry
- Production and processing of metals
- Mineral industry
- Construction site
- Production of polymeric/ plastic materials
- Other

URBAN ODOURS

Odour generated in urban context specially related with human habits or mismanagement of public infrastructure

- Urine
- Sewage system
- Traffic
- Waste bin
- Waste truck

UNKNOWN

The odour source is unclear or not known.

Table 3. Categorisation of odour emitting activities

It is worth noting that the results should not be considered as an accurate representation of the situation at national level, since the dataset was mainly based on media reports and therefore only cases that received media coverage are reported. Nevertheless, this approach allowed us to identify communities that are playing an active role in denouncing the problem and, therefore, may be more willing to participate in pilot interventions.

The identification of affected communities will continue throughout the project duration as part of the awareness and dissemination activities of the International Odour Observatory that will be launched in the upcoming months (*Task 3.1*).

2.2 Overview of results across countries

According to our preliminary results, over 450 communities are affected by odour problems in the nine countries under study, 222 of them are located in Europe⁶.

The sources that generate odours in these communities are numerous and diverse, and in many cases, more than one odour source affects the same community. Table 4 provides an overview of the number of communities identified in each country and the different odour sources that affect them. Figure 4 shows the distribution across all countries, figure 5 focuses on European countries only. While in Chile the main odour source is related with agricultural and livestock activities, Europe faces important challenges with odours generated by industrial activities and waste management.

	Austria	Bulgaria	Chile	Germany	Greece	Italy	Portugal	Spain	UK	Total
Affected communities	26	21	253	31	12	38	21	36	37	476
Odour sources										
Waste Management	4	3	30	9	2	18	4	4	15	89
Wastewater Treatment	2	-	45	2	1	6	3	4	5	68
Agriculture/Livestock	4	1	81	7	3	4	3	7	9	119
Food industries	1	-	36	-	2	0	3	4	3	49
Industrial	8	4	22	5	3	22	9	10	1	84
Urban odours	6	12	-	2	1	-	-	15	2	38
Unknown	1	1	39	12	-	-	-	3	2	58
Total odour sources	26	21	253	37	12	50	22	47	37	492

Table 4: Number of affected communities and odour source identified in each country.

⁶ The results of the Chile mapping build on a previous extensive study conducted by ECOTEC for the Ministry of Environment, by drawing on information provided by governments. This explains why the number of cases mapped in Chile is much larger than the rest of the countries.

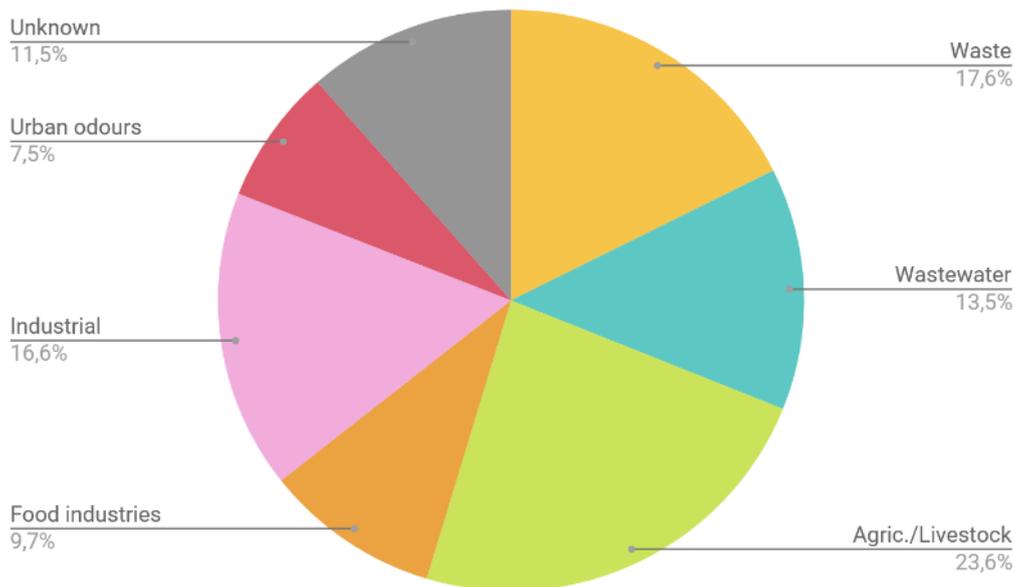


Figure 4: General distribution of odour sources across all countries, including Chile

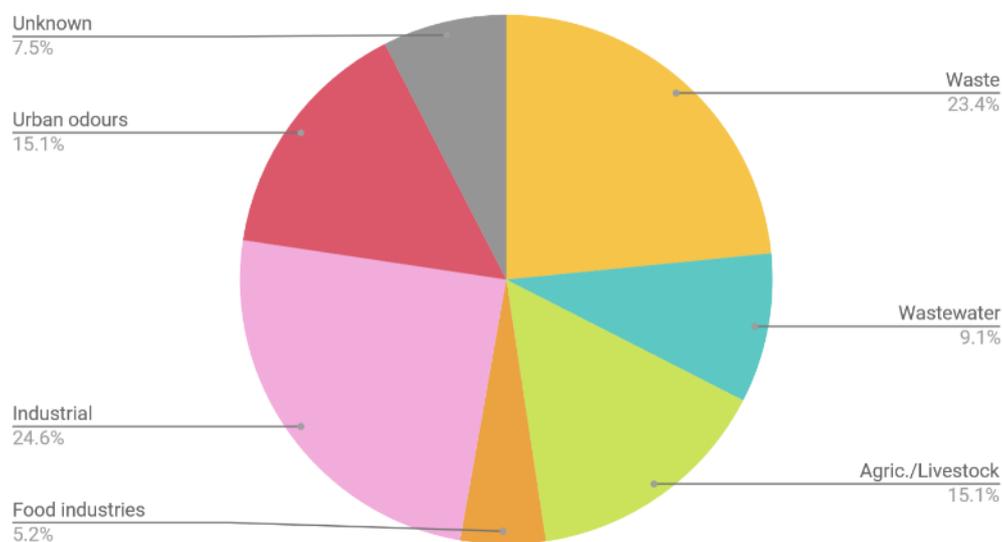


Figure 5: General distribution of odour sources across European countries

In the following sections, we present the results per country, categorising relevant aspects such as geographical spread of the problem, main sources of odour, issues caused to local communities, data that has already been collected to monitor the problem, and management practices.

Odours affecting communities in the International Odour Observatory

Based on this preliminary study the first **Map of the International Odour Observatory** has been developed and the affected communities identified mapped, which is accessible via this [link](https://dnoses.communitymaps.org.uk/project/odours-affecting-communities?layer=1)⁷. This resource will provide an interactive living documentary throughout the duration of

⁷ <https://dnoses.communitymaps.org.uk/project/odours-affecting-communities?layer=1>

the project and beyond and will enable communities across the world to share their experiences in relation to odour issues in their respective localities and co-create the map.

The map has been developed using Community Maps⁸, a web based application that visualises data. It offers an intuitive, multilingual interface with data filtering and modern clustering capabilities for large data sets. The map interface provides users with a way in which to add new data as well as edit, delete and comment on existing data. The application further provides a search feature to find contributions matching a given keyword and filtering according to different categories of interest.

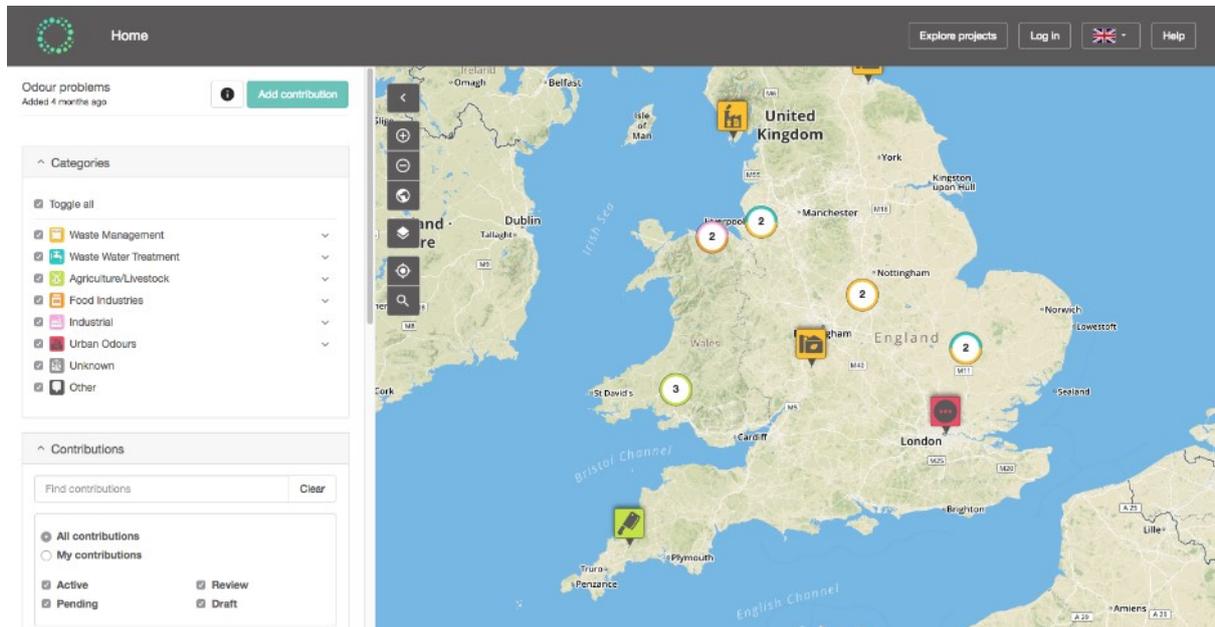


Figure 6: Odours affecting communities in the UK mapped in the International Odour Observatory.

2.3 Odour issues in Austria

#26 cases identified

GEOGRAPHICAL SPREAD

Most of the identified cases are located in the Eastern part of the country, in particular around Vienna, Austria's capital. Most of them are thus located in areas with a higher population density, as well as industrial and agricultural activity. The following map shows the geographical spread of the identified cases.

⁸ Community Maps is a participatory mapping platform owned by Mapping for Change from University College London (UCL): <https://communitymaps.org.uk/welcome>

MAIN SOURCES OF ODOUR IN AUSTRIA

Waste Management	Wastewater Treatment	Agriculture/Livestock	Industrial	Food industry	Urban odours	Unknown
15%	7%	15%	31%	4%	23%	4%

There are a variety of sources that cause odour pollution in Austria. According to the identified cases, the main sources are wastewater treatment and waste treatment in urban areas, as well as industrial activities such as refineries and chemical industries. In more remote areas, several incidents of odour pollution were identified due to agriculture and livestock farming.

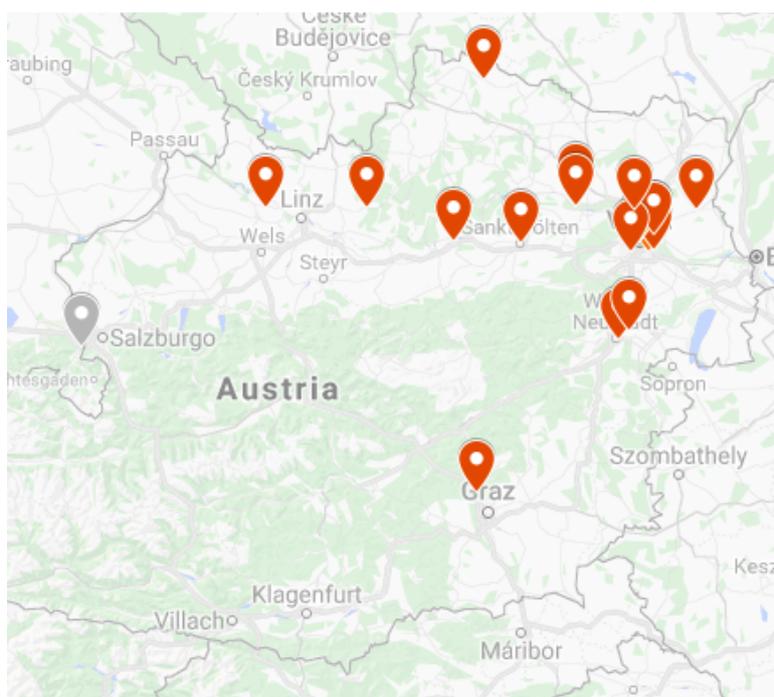


Figure 7: Geographical spread of reported odour issues in Austria

PROBLEMS CAUSED

- **Nuisances:** bad smell, e.g. like varnish and solvents, oil and gasoline, waste, sewage, ammonia-like, like rotten eggs (wastewater related, H₂S)
- **Health:** respiratory problems, cough, watery eyes, headache, sleeplessness
- **Environmental:** H₂S, CO₂.

The most common problem caused by odour is nuisance. Local residents reach out to the authorities in order to report the problem. In most cases, the authorities conduct measurements to determine whether there is a health or environmental risk. In a few cases, health problems could be determined, such as headaches and respiratory problems.

DATA COLLECTED TO MONITOR THE PROBLEM

In most cases, citizens report odour nuisances to the authorities. It is not known whether these authorities keep track of the quantity and quality of the complaints. The City of Vienna, for instance, keeps track by running a telephone hotline, which residents can call to report odour nuisances. The responsible municipal department (“Wien Kanal”) collects data on these complaints.

In some cases, measurements are conducted by the authorities to determine whether there is a risk to health or to the environment. In other cases, the emitting industry (chemical industry) refers to the report of their environmental impact assessment, saying that their emissions are in compliance with legal regulations.

In Austria, there is no federal law which regulates odour pollution in general. However, the federal Ministry for Sustainability and Tourism recommends to apply the “Directive for the Assessment of Emissions from Livestock Farming” (Richtlinie zur Beurteilung von Immissionen aus der Nutztierhaltung) in diverse regulations and permit procedures (building law, directive on industrial emissions, environmental impact assessments).

ODOUR MANAGEMENT PRACTICES

Citizens generally file complaints and local authorities look into each specific case. Depending on the case, different actions might follow. There are several cases where complaints of residents led to actions which solved odour issues, for instance:

- upgrade of wastewater treatment plants
- upgrade of a glass recycling facility to mitigate emissions, with the side effect to reduce odour pollution
- closing of a pig farm
- prevention of planned farms (livestock)
- organisation of a public meeting in order to start a communication between citizens, the authority and the emitting industry (chemical industry)
- obligation to operate with closed doors (non-hazardous plastic waste treatment plant)
- installation of a odour hotline, where residents can call

2.4 Odour issues in Greece

#12 cases identified

GEOGRAPHICAL SPREAD

The odour incidents are located in several areas of Greece: three cases are in northern Greece, four cases in southern Greece and five cases in central. Most of the cases are close to cities or towns with increased agricultural activity. Below is the map that shows the cases identified:

MAIN SOURCES OF ODOUR IN GREECE

Waste Management	Wastewater Treatment	Agriculture/Livestock	Industrial	Food industry	Urban odours
17%	8%	25%	17%	25%	8%

There is a wide variety of issues that cause odour problems in Greece. Out of three cases of urban activities, two of them are reportedly waste treatment facilities and one of them wastewater treatment facility. Industrial activities include a refinery and a cement production company. The agricultural activities include one large fertilizer company in Northern Greece, two cases of olive pomace mills and cases of animal product and by-product processing.

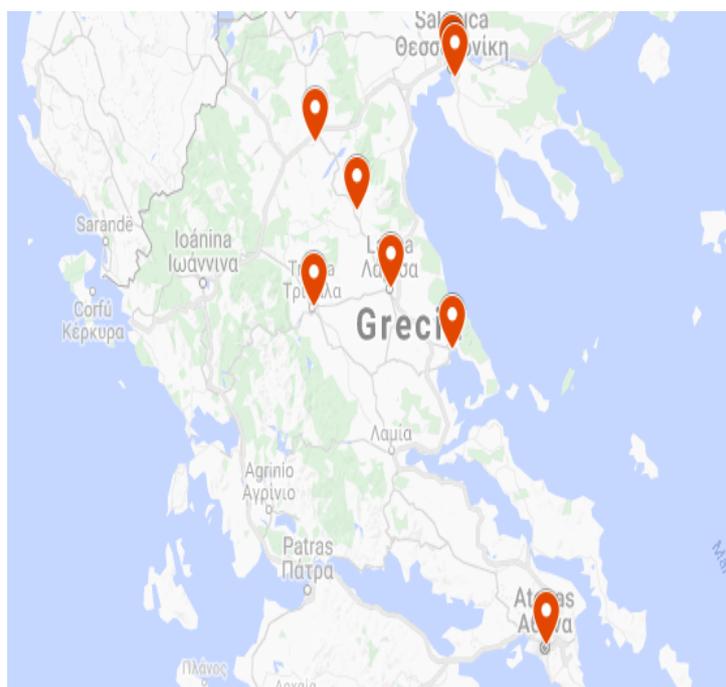


Figure 8: Geographical spread of reported odour issues in Greece

PROBLEMS CAUSED

The most common problem caused by odour issues is nuisance. Local resident initiatives that reach the authorities office are complaints and often lawsuits against the activities causing the odour pollution. The second most common complaint comes from the business activities surrounding the source of odour. In particular, tourist services such as accommodation (hotels, resorts) and restaurants are affected. Therefore they complained to local authorities to take measures either to relocate or to ban the production activities. Health issues are the next most common problem.

In some areas people affected are reportedly suffering from headache and breathing issues. Studies are underway to link potential health problem patterns with the specific activities of interest. Last but not least, environmental issues arise. Especially in areas of heavy industrial activity such as refinery, fertilizer or cement production, local authorities undertake measurements and audits in order to ascertain the situation in terms of environmental effects.

DATA COLLECTED TO MONITOR THE PROBLEM

In most cases, data gathered refers to the environmental permit of each company. There is currently no odour legislation in Greece. Therefore, in the vast majority of the cases only a correlation between the concentration of several parameters and odour issues can take place. There is one case where a local university has undertaken studies on air quality in the surrounding area. The odour studies in this case were promoted by the industry itself, in close cooperation with local authorities. Citizens are generally not involved in organized movements. There are a few cases that have generated activity on social media and on local newspapers but people engage in odour issues by filing individual complaints to the local authorities and issuing lawsuits.

ODOUR MANAGEMENT PRACTICES

In general, most of the identified industrial activities involved in the odour problem proceed either with the refurbishment of the industrial process or the upgrade of the abatement techniques used, in compliance with the best management practices proposed by the European Commission. More specifically, the olive oil mills have renovated their cyclonic systems and the bag filters that retain dust and pieces of olive pomace. The waste treatment plants are implementing techniques such as wet scrubbing and biofilters for the reduction of odour due to the compost. The larger industrial plants are implementing constant refurbishment of their processes that allows for lower emissions.

One more technique that is applied is the operation according to the weather pattern. This implies that the installation is ceasing operations when the local wind direction is affecting a specific area of concern, and re-initiating the activity as soon as the weather is not affecting it. By applying such a simple solution, the installation avoids numerous complaints from the neighbouring community. This of course implies that the process is such that there is no high cost during the start and end of operations in accordance with the change in wind direction. This proved to be quite effective for the olive pomace mills in several areas around Greece. The complaints ceased in some cases, whereas in others the complaints were reduced. This practice is not possible to be applied in continuous industrial processes (e.g. waste or wastewater treatment, which usually runs for 24h, 7 days a week). However, even in continuous processes there is still room for improvement by modifying the schedule of certain discontinuous odour emitting operations according to the specific dispersion conditions at the time of the operation.

2.5 Odour issues in Spain

#36 cases identified

GEOGRAPHICAL SPREAD

Thirty four active cases of odour pollution have been identified across the whole country. About 50% of them are located close to big and mid-sized cities such as Madrid, Barcelona, Valencia, Zaragoza or Bilbao, some of the main industrial areas in the country. The following map shows cases across the national area.



Figure 9: Geographical spread of reported odour issues in Spain

MAIN SOURCES OF ODOUR IN SPAIN

Waste Management	Wastewater Treatment	Agriculture/Livestock	Food industry	Industrial	Urban odours	Unknown
9%	9%	15%	9%	21%	32%	6%

Industry and agricultural activities

According to the identified cases, production activities - from either industries or agriculture - account for over 45% of the cases of odour pollution in Spain. The industrial activities identified as the source of odour are located in the north of the country and include mainly chemical industries, tanneries and paper mills. The cases related with agricultural activities are centralized in Bilbao, Vizcaya and Castilla la Mancha, involved in controversial intensive pig farms.

Urban sources: habits, incivism and mismanagement

Over 30% of the cases identified in Spain are related to widespread bad human habits and incivism acts that are the cause of frequent odour nuisances. For example, cities like Madrid, Barcelona, San Sebastian or Barakaldo are being pointed by their citizens as smelly cities due to the smell of urine that is perceived in the streets. In some cases (e.g. San Sebastian and Vizcaya), these complaints are reported in correspondence with local festivals, during which large numbers of people flocked to the streets and consume beverages and alcohol. However, in big cities such as Madrid and Barcelona such episodes of urine smell are more systematic. They generally occur in neighborhoods marked by nightlife (e.g. Malasaña in Madrid, and Gothic and Raval in Barcelona) or in some specific areas (e.g. tiny streets, under bridges, light poles) used both by human and dogs to urinate.

Another cause of odour issue in urban contexts is the bad habit to throw garbage bags to the containers outside of the established times resulting in an accumulation of garbage that produce bad smells, especially in summer due to the high temperatures. This has become a problem of coexistence in different cities (e.g. Cartagena, Reus). Most of the affected neighborhoods are in favour of undertaking awareness campaigns to encourage good practices and avoid discomfort. However, in some cases, it is the poor maintenance of public infrastructures that causes odour problems. For instance, in many cases, citizens complain about the odour generated by garbage containers that are not properly and regularly cleaned by city councils. Another example in this regard is the case of Santa Cruz de Tenerife in the Canary Islands, where a public fountain - tourist attraction - is generating bad smells due to the lack of adequate cleaning, causing stagnation of water and therefore bad smells.

Waste and wastewater treatment sources

According to the cases identified, over 18% of odour pollution in Spain is caused by activities related to the processing and treatment of various types of urban waste (e.g. garbage, sewage waters). Common sources of odour are sewage handling facilities, waste treatment plants, and landfill sites.

In some cases, the issues with sewage systems are caused by bad human habits. This is the case for instance of Valencia where the massive use of wet wipes thrown down the lavatory has caused serious problems to the sewage system plants. Wet wipes accumulate into an enormous mass that creates blockages in pipes and causes huge problems in the sewage systems, thus the smell. Wet wipes are known to be one of the main problem faced by sewage system plants and a large amount of money is spent every year to fix obstructions in the system. Valencia is a city that has long suffered from this issue. In 2017, a process of extraction of compacted wipes that approached 600 tons was carried out. That was considered to be a

Spanish record. In 2015 the city council announced that throwing wet wipes to the toilet was forbidden to avoid blockages in the pipes. The sanctions can reach 3,000 euros if there is serious damage to the network.

PROBLEMS CAUSED

In Spain, the main problem caused by odour issues is nuisance. Citizens report industrial activities causing odour nuisance to the local authorities. Sometimes, these reports are filed by nearby businesses, such as hotels or restaurants. Health problems are less common, but occasionally, respiratory or stomach problems have been reported.

Odour pollution is often correlated with other sanitary issues, such as mosquito or rats plagues that approach the areas where bad odours appear. Odours are also often associated with air pollution, because of the chemicals pollutants emitted by the odour causing activity and which get controlled by the emitting industry and public authorities.



Figure 10: Affected communities by odour pollution in local newspapers and social media (Spain, 2018)

DATA COLLECTED TO MONITOR THE PROBLEM

Data collected by industries and public authorities

Spain, as other European countries, has an overall odour regulation based on the Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control or IED) for any activity included in this regulation. The competences on the IED lie on the Autonomous Communities (AC), which can set ambient air odour limits for industrial activities. However, there are not specific Autonomous regulations to control odours and only some small municipalities with ongoing odour problems have ordinances to control odours (usually, the ordinances follow different criteria to establish emission or immission limits and, in some cases, they are not even based in the European standards on odour measurement due to the lack of knowledge of the local authorities).

Catalonia was the only region that attempted to publish a specific regulation to control odour pollution⁹ back in 2005. The regulation was carefully prepared and scientifically sound, but its adoption encountered a big opposition from the industrial sector, which saw the draft of the new Law as a new reason for more investments, and it was finally not approved. However, it has been used as reference for establishing limits to control odours from different industrial activities in other communities in Spain and other countries such as Chile, and the Catalan regional authorities has set some odour limits on the environmental permits of waste management activities as a result.

As there is no regulation (limits), local authorities usually don't really know how to manage or solve these problems. However, this situation is slowly changing. Until now, authorities did not carry out any odour study, monitoring or control, unless several odour complaints by citizens were received. When it is clear that there is an odour problem, a traditional odour study (odour sampling and olfactometry analysis - according to the European standard EN 13725:2003 on odour quantification by dynamic olfactometry - and dispersion modelling) is requested to the responsible industry. If these studies show that there is an odour problem, the public authority will order the industry to implement an odour control system to manage the problem.

In the last 2 years, a new European standard was published to measure ambient odours by field inspections (EN 16841:2016), adapted from a German standard (VDI 3940:2006) that has been traditionally used in Spain and other countries across Europe. Some other types of studies have been carried out, but they are not very common for now. As local/public authorities are the ones that can establish odour limits to each activity, they can also oblige the emitting industries to keep a record of odour complaints. These complaints are usually made to the local authority through the emergency number (112) or the police. The validation of such complaints is a difficult task, as odours are not permanent. Some industries or local authorities set a telephone number or apps/websites to collect these complaints, although the key to understand and validate the complaints will be to have a real time monitoring system such as the one proposed in D-NOSES through OdourCollect, with as many people as possible properly trained involved in gathering odour observations.

Data collected by citizens

In addition to data collected by the emitting industries or public authorities, we have identified a few cases where affected communities got organized to monitor the problem collecting observations on odour episodes. Citizens have opened blogs and Facebook groups to report complaints and share daily concerns and worries.

⁹ https://www.olores.org/images/pdfs/borrador_anteproyecto_ley_contaminacion_odorifera.pdf



Figure 11: Facebook group created by citizens to raise awareness about episodes of odour pollution.

In Villena, a village close to Alicante where several waste treatment industries and landfills are placed, citizens, with the support of an NGO, have set up the platform *Respira Villena* (Breathe Villena) where they collect data on odour episodes through Whatsapp messages. Thanks to this initiative, they were able to start a conversation with the industries and the public authority.

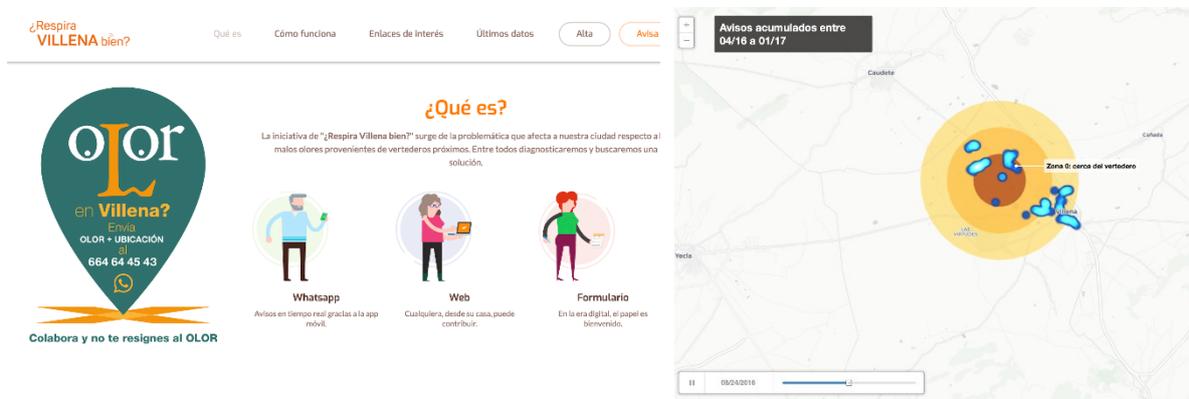


Figure 12: The citizen initiative *¿Respira Villena bien?*, a platform for collecting and mapping odour complaints

ODOUR MANAGEMENT PRACTICES

When the problem is caused by acts of incivility or bad habits, a recurrent action taken is to encourage new practices among the population through awareness campaigns or prohibitions and fines.

When the problem is caused by an emitting industry, an odour study is sometimes conducted, and corrective measures are usually taken up to some extent. These are considered to be best practices on odour management in Spain associated to the identified cases:

- **Confine, capture and treat:** If the activity has no odour control, a complete odour control system could be designed to enclose the odour, vacuum the air of the enclosure and send it to a control system, that should be different depending on the industry. However, this will be a expensive solution that sometimes it is not undertaken by the industry if the local authority is not obliging them through the environmental permit or other means.
- **Re-design of a ventilation system:** If the activity has an odour system control, but the vacuum system is not optimized.
- **Changing of the existing odour control system:** Sometimes the activities are in a hurry to solve an odour problem, so they install the first odour control system offered, without having been informed about other options available in the market, more suitable for their activity. A change of this equipment can be the best solution.
- **Improving the dispersion:** not always odours must be treated due to the operating cost, etc. Simply by improving the dispersion of the odour (if all the pollutants are controlled), through higher stacks or by adding special fans (such as the Eolage system), the associated nuisance can be reduced.
- **Good practices in management:** In other cases, there is no need to invest huge amounts of money, and with some management improvements the odour emission can be reduced. For instance, keeping doors and windows from the industry closed, increasing the equipments' maintenance, planning odour emitting operations at night or with favourable dispersion conditions, etc.
- **Odour Management Plan:** all the activities should be aware of the problem odours caused in the surroundings, so they could draft an Odour Management Plan to know how to proceed when an odour problem is generated or an odour complaint is received.

Before the implementation of an activity, an environmental impact study is made. However, the section on odour is often omitted in such studies, or it is said that there will be no impact, without making a thorough study of the case. The ideal case would be to conduct a theoretical odour study as a part of the environmental impact assessment of a future odour emitting activity. The same could be done for improved urban or industrial planning.

2.6 Odour issues in Chile

#253 cases identified

GEOGRAPHICAL SPREAD

Odour issues in Chile are related to economic activities and human settlements. Therefore geographical spread can generally be expected at villages and cities throughout the whole country. In contrast to European countries, in Chile is quite common to live in rural areas outside of a village, town or city limits, so even odour sources located in rural areas will still cause an impact on citizens living there. Common odour sources such as wastewater treatment plants or sanitary landfills can be found in nearly every municipality so the geographical spread of odour issues covers the whole country.

Chile's economy is characterized by the exploitation and export of commodities such as copper, fruit, fish products, pulp and paper, chemicals, and wine. Regional factors play an important role as climate and natural resources vary throughout the country's 4,200 km extension that stretches from North to South. The main affected areas cover coastal communities where port activities, petroleum refineries, fishing and fish processing and also power generation with fossil fuels concentrate. Important zones to be mentioned (North to South) are Iquique, Huascar, Quintero, Concepción-Talcahuano and Coronel.

Livestock farming takes place in middle Chile, around the metropolitan area and south of Santiago. Waste landfilling and wastewater treatment plants are usually located outside of towns and cities, but sparse regional planning and extension of living space toward rural areas reduced distances to this kind of sources.

Altogether, nearly 2,000 potential sources were identified by 2013. 253 facilities (about 13% of the total) have had formal complaints in the past and are considered odour sources. The following figures show the geographical spread and common sources of reported odour issues in Chile.

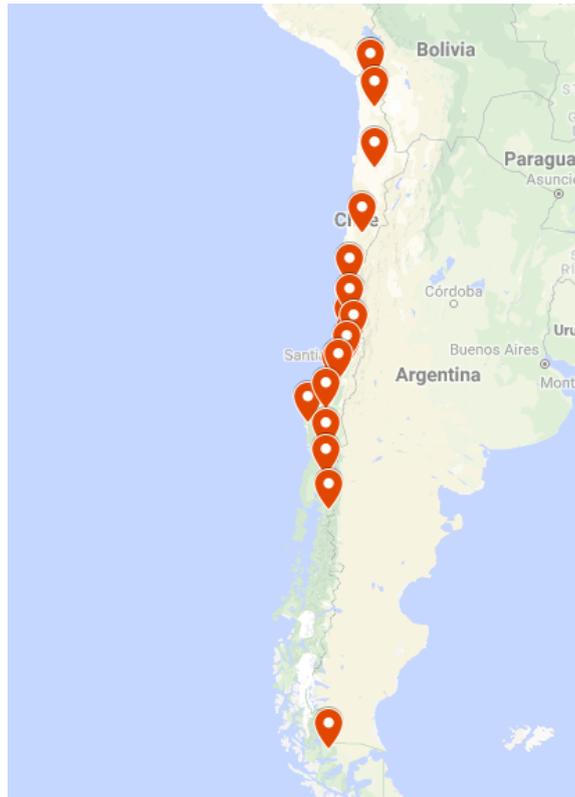


Figure 13: Geographical spread of reported odour issues in Chile

MAIN SOURCES OF ODOUR IN CHILE

Waste Management	Wastewater Treatment	Agriculture/Livestock	Food industry	Industrial
14%	21%	38%	17%	10%

D-NOSES' partner ECOTEC conducted a first comprehensive and detailed study during 2013¹⁰, identifying sources of odour associated to activities that potentially create nuisance. Among the activities that have greater national presence in number and in frequency of complaints are sewage treatment plants, livestock farming in stables (pigs and poultry), tanneries, slaughterhouses, pulp mills, fish and seafood processing and waste landfills, among others. While these are not the only activities generating odour impacts, these correspond to the main sources either by production volume, proximity to residential areas or frequency and duration of odour events. In 2017, the Environmental Ministry updated its strategy on odours, highlighting the following five main sources of odour:

- Wastewater treatment plants

¹⁰ ECOTEC (2013): Antecedentes para la Regulación de Olores en Chile. Final report conducted on behalf of the Environmental Ministry. Available at: <http://portal.mma.gob.cl/wp-content/uploads/2017/06/ECOTEC-Ingenieria.pdf>

- Fish flower plants
- Livestock farming (pigs)
- Pulp production with the kraft process
- Waste disposal facilities and sanitary landfills

Other potential sources include the following:

- Rendering plants and fodder production
- Tanneries
- Dairies
- Slaughterhouses
- Ore processing
- Petroleum refineries
- Aquaculture net cleaning activities
- Others

PROBLEMS CAUSED

Odour can be considered an environmental stressor. Odour can cause the annoyance and nuisance of local citizens, especially during the summer season when meteorological conditions contribute to an increased odour generation. At the same time the impact is higher as neighbours must eventually keep the windows of their homes closed and limit the use of outdoor spaces.

Direct health issues are rare. An exception is the case of the town of Quintero that in 2018 suffered a toxic atmospheric contamination with an unknown but odorous substance from a non-identified source. During several weeks hundreds of citizens attended local hospitals and as a security measure, schools were temporarily closed.

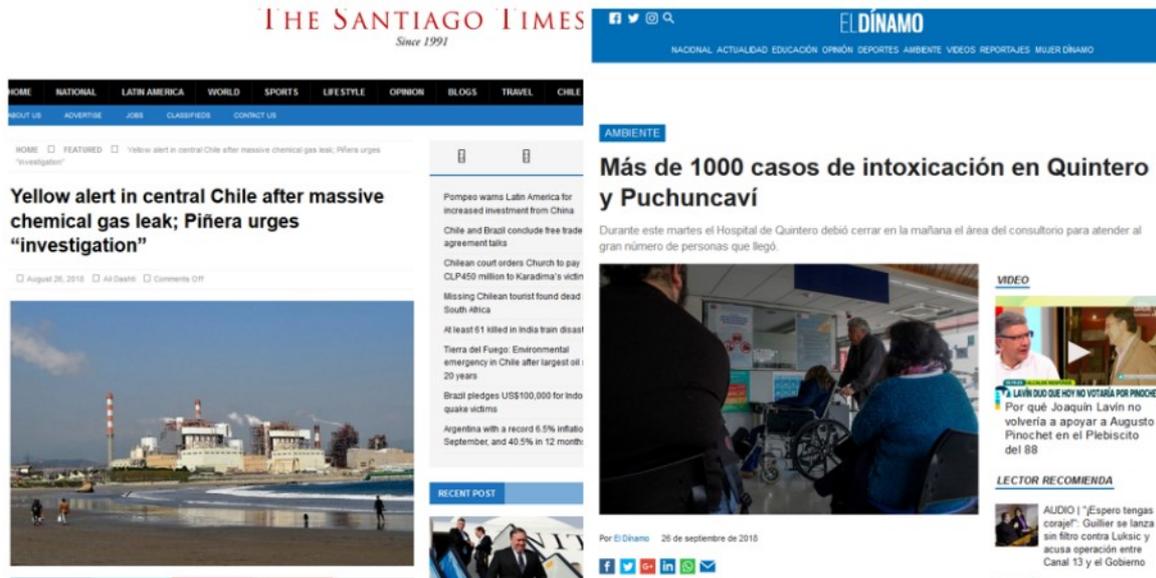


Figure 14: Affected communities by odour pollution in local newspapers (Chile, 2018).

The odour issue is also considered a problem to businesses activities. As Chile lacks formal odour regulation, some investments in the past faced temporal or even definitive closure due to their odorous emissions. In 2013, a pig livestock farming project that included a slaughterhouse, rendering plant and even a port was cancelled after neighbours of the town of Freirina suffered heavy odour impacts in the early stages of the project.



Figure 15: Affected communities by odour pollution in local newspapers (Chile, 2012)

DATA COLLECTED TO MONITOR THE PROBLEM

In the past, there were few regulatory instruments for odour control. The problem has been dealt with, but only tangentially, in the national legislation. As for the legal tools available to manage odours in the country, there is the Sanitary Code which gives jurisdiction to the Health Authority to issue general or specific provisions as are necessary for the proper performance of the Code. Sanctions may correspond to fines, temporal or permanent closures, cancellation of operating permits.

On October 26, 2018, the Chilean House of Representatives approved a legislative proposal for including odours as a contaminating agent within the environmental framework law. The proposal was presented by half a dozen legislators in 2015. Passing the proposal on modification of an environmental bill to expressly treat odour as a pollutant is the first action at the House of Representatives after 3 years of debate.

In Chile, complaints can be made by the community directly to the Health Authority, the Superintendence of Environment or to local agencies like Municipalities. Odours are usually among the first and second reason for citizen complaints, besides noise. Nevertheless, Chilean citizens seldom file in formal complaints compared to European nations. The Superintendence of Environment claims to have received only about 300 complaints on odour between 2013 and 2016. Among the approximately 1,500 complaints received in 2016, 43.7% were related to noise, while odours amounted to 14.7% of the complaints, making odours the second most frequent cause of pollution complaints.

The data collection activities carried out to monitor odour issues relate to odour measurements that are a requirement of the environmental permits for plants or facilities. For more than 20 years, Chile has had an Environmental Framework Law which includes a licensing system with environmental impact assessment scheme (SEIA). As no national regulation on odours exists, regulation from other countries is used instead (e.g. UK, Germany, Spain, the Netherlands or the USA). At the end of 2017, a guideline on odors within the environmental impact assessment scheme was finally published, and, at the same time, technical standards (EU, Germany) on measuring of odours were adopted in Chile. As a consequence, the requirements on odours were increased since 2010. It can be observed that tens, if not hundreds of facilities have (simple) odour management plans that might include some data on odour emissions (measured by dynamic olfactometry), odour dispersion modeling (nowadays using the CALPUFF model), odour impact assessment (by field inspections), or the assessment of odour nuisance (by means of questionnaires). The latter and some requirements to establish formal investigations of complaints made by neighbours directly to the facilities are the only involvement of citizens.

According to the Superintendence of Environment, around 11,000 facilities are monitored in Chile due to environmental permits or any other emission standards. Over a total of 46,000

supervision reports, just over a 1,000 were related to odours (2%), most of them regarding urban activities (e.g. sewage, waste, landfill...) and agricultural activities and livestock farming.

ODOUR MANAGEMENT PRACTICES

From a technical point of view, nearly every possible measure is taken to get rid of odours before they are released to the environment. Typical measures in wastewater treatment plants include confinement of odour emitting units, scrubbers (one stage) and biofilters. In fish flower plants, vapors are collected and burned. In the event of passive sources, masking agents are used to hide odours.

2.7 Odour issues in Portugal

#21 cases identified

GEOGRAPHICAL SPREAD

Portugal presents odour pollution cases especially related to industrial activities and the food industry. These cases are concentrated and restricted to specific areas. Also, the pulp and paper mills industries are an important source of odour problems in Portugal and they are spread all over the country. This is the summary of the odour cases mapped in Portugal:

- **North of PT (10):** 1 oil refinery; 2 food industries; 1 river with stagnated water; 1 landfill site; 1 wastewater treatment plant; 1 animal by-product rendering; 1 manure or slurry application in the field; 1 chemical factory; 1 other source (crematory for animal)
- **Center of PT (3):** 1 wastewater treatment plant; 2 pulp and paper industries;
- **South of PT (9):** 1 oil refinery; 1 chemical industry; 1 food industry; 1 agriculture/livestock; 1 wastewater treatment plant; 1 mineral industry; 1 industry of production and processing of metals; 2 waste management industries



Figure 16: Geographical spread of reported odour issues in Portugal

MAIN SOURCES OF ODOUR IN PORTUGAL

Waste Management	Wastewater Treatment	Agriculture/Livestock	Food industry	Industrial
18%	13,6%	13,6%	13,6%	41%

The emitting activities related to the odour issues reported by citizens are mostly linked to industrial sources (41%), followed by waste management facilities e.g. landfills or integral waste treatment facility (18%). On the other hand, the odour caused by agriculture/livestock and food industry represents 27%. Finally, wastewater treatment is also an important source representing 13,6% of the affected communities by odours identified in Portugal.

PROBLEMS CAUSED

The overall problems caused by the odour issues are mainly classified into the following categories: nuisances, health problems and environmental.

The most common complaints in Portugal on odours are related to nuisances. The second most usually reported are health complaints as odour can be classified as a stressor and emotional disturbance. Following, the environmental problems related to odours are less reported and less known by the general public who report complaints to the central government or local municipality.

Odours are also associated with complaints of discomfort that may:

- 1) Cover a single installation explicitly indicated by the complainers: e.g. One unit in Azeitão (highlighting the proximity between the residential areas) or the one Unit of Setúbal (highlighting the dispersion of the gas effluent plume over long distances);
- 2) Cover a particular industrial area or even a municipality where a set of facilities can be the source of the inconvenience: e.g. Municipalities of Alcanena and Sines;
- 3) The sectors / activities in which these allegations relate may be diverse, never being able to generalize this problem to all the sector. It may, however, be noted that they may be associated with activities as diverse as the agriculture industry, intensive livestock farming, the pulp industry, the chemical industry or the agricultural recovery of sludge.

DATA COLLECTED TO MONITOR THE PROBLEM

There is no legislation in Portugal on odours. In the case of an activity with fixed and diffuse sources, compliance with the “Emission Limit Values” for the quality of air can be confirmed through fixed sources, provided by the legislation or the licenses issued for the installation in question. Regardless:

- (i) Odour emission may be related to the diffuse emission of pollutants. Diffuse emission of pollutants is regulated by Article 9 of DL nr. 39/2018, of June 11, which establishes the legal regime for the prevention and control of emissions of pollutants to the air.

ii) Some Environmental Licenses and in some particular cases, such as Urban Waste Management Operators (Organic Valorization Units), present conditions that aim to monitor, control and / or minimize the odours caused by activities carried out by a particular Operator.

In general, the usual methods and attitudes implemented in Portugal and the way citizens are involved can be summarized into the following:

- The population is organized against bad odours together with associations and organize petitions;
- More than a few letters were sent to various National and European entities exposing this environmental problem;
- There was a case of formation of an “Environmental Observatory” in a specific municipality where this problem was sensitive (Alcanena Municipality - source: <http://cm-alcanena.pt/index.php/noticias/3964-primeirareuniaobservatorioambiental30jan2018>);
- One Portuguese municipality created a form on the municipal site for all citizens to submit their complaints on bad industrial odours (Sines Municipality¹¹), similar to João da Madeira municipality (Portugal pilot 2) that created the Odormap - Sjm.odormap.com, an innovative web platform for the monitoring of odours by the citizens, which allowed them to report episodes of bad smell, not currently available online.

ODOUR MANAGEMENT PRACTICES

Most of the odour management best practices applied by industrial activities causing odour problems in Portugal consists of refurbishment of the industrial process, upgrade of the abatement techniques used or improvement of operational practices.

There are also actions taken by local authorities to manage the problems caused by odours, like the following example:

1. *Complexo Industrial de Sines - Oil refinery process.*

Type of action: Involvement of the local population to detect and establish the odour problems and better rectify them. The Municipality of Sines has also created a form on its website to signal any problem in the local air quality. Any local citizen who detects a situation of bad smells or industrial pollution signals can contact the Municipality of Sines through the form created for this purpose - online resources to better present complaints.

The local authorities points to a wastewater treatment Plant in Ribeira de Moinhos (Southern Portugal) as responsible for the episodes of unpleasant odours in the city of Sines. The correlation between the hydrocarbon smells and the inefficiency of the systems of transport and treatment of the industrial effluents of the Sines complex was thus established.

¹¹<http://www.sines.pt/uploads/document/file/2095/2012-01-05 - NI - C mara de Sines disponibiliza formul rio para mun cipes apresentarem queixas de maus cheiros.pdf>

2.8 Odour issues in UK

#37 cases identified

GEOGRAPHICAL SPREAD

The spread of odour issues, researched through online media, reached across the whole of the UK, with one in Northern Ireland, six in Scotland, three in Wales and in 27 England, as shown in figure 17. The problems have been reported in both a rural and urban context.



Figure 17: Geographical spread of reported odour issues in the UK.

MAIN SOURCES OF ODOUR IN UK

The sources of odour reported were varied. The most common source was from waste treatment, recycling and green energy plants with 15 cases identified. Agriculture, livestock farming and food industry such as meat production was the second most common, accounting for 11 of the cases, followed by wastewater treatment which was the subject of five cases. The remaining five cases included unknown, sewage and construction sources.

Waste Management	Wastewater Treatment	Agriculture/Livestock	Food industry	Industrial	Urban odours	Unknown
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41%	14%	24%	8%	3%	5%	5%
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PROBLEMS CAUSED

The main problem caused was the annoyance of the local citizens. Having had a particularly hot, dry summer in the UK in 2018, the odour problem in many cases was highlighted and exacerbated as people were wanting to spend more time outdoors and open the windows to ventilate their homes. Reporting on an odour issue at a recycling centre in Liverpool, The Liverpool Echo stated, “Residents complained that they were unable to enjoy Sunday's hot weather because of a "putrid" odour that forced them to keep windows shut and stay indoors.” In some cases, the increase in temperature also seemed to strengthen the intensity of the odour. In Scotland, speaking of an unidentified odour, Torry Community Council chairman Ron Pushkins said, “the spell of hot weather has made the smell worse” with Aberdeen Council agreeing “The continuing warm weather is likely to be responsible for exacerbating any odours.”

A few cases reported that people’s health was being affected with workers and residents feeling sick. This was of particular concern when the excavation of a construction site in Hackney, London, was emitting odour that caused headaches in school children and the ground was known to contain high levels of arsenic, lead and asbestos fibres. They were ordered to stop activity until further investigation. In 2016, one composting site in Cambridge was fined £50,000 for making workers sick with odour emissions.

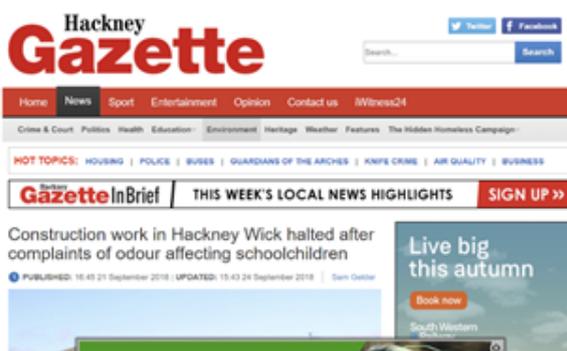


Figure 18: Affected communities by odour pollution in local newspapers (UK, 2018)

One case of odour pollution in Kent reported that a boutique owner blamed the smell of drains for the closure of her business. The organisation responsible for waste water treatment denied there was a problem. This led to further stress for the entrepreneur.

DATA COLLECTED TO MONITOR THE PROBLEM

Under the Environmental Protection Act 1990, local councils in the UK have a duty to investigate all odour complaints. The environmental teams undertake site visits to ascertain

the problem and, if it is identified as a nuisance, will implement steps to mitigate or resolve the issue. This may not always include collecting data. The councils can involve the Environment Agency, Scottish Environmental Protection Agency and Northern Ireland Environment Agency, depending on the situation. These agencies have also published several guidelines on odour management (e.g. Environment Agency, [H4 Odour Management](#) (March 2011), SEPA, [Odour Guidance](#) (January 2010) and on Best Available Techniques for odour emitting industries (e.g. Defra, [Good Practice and Regulatory Guidance on Composting and Odour Control for Local Authorities](#) (March 2009)), and guidelines for [councils on how to deal with complaints](#). The Institute for Air Quality Management also launched a [Guidance on the assessment of odour for planning](#) in 2014 (recently updated in July 2018).

There were several instances where odour was not found to be a problem by the authorities, despite complaints from citizens. An example of this was a case of odour complaints of a chicken farm in East Huntspill where the press reported that “Officers have not substantiated odour on every visit, and on some occasions, reports have been made several hours, or the day after odour was experienced by complainants, making it impossible to substantiate the complaint.” Some investigations however have led to fines being issued and a small number of odour emitters have been required to change their odour management system.

There was one case where the local councillor had been keeping an odour diary of the nearby green energy plant since 2011 to prove there is a problem in her constituency.

There have been no instances of data collected by citizens other than the number and nature of complaints logged by the Agencies.

ODOUR MANAGEMENT PRACTICES

A number of different odour management practices have been implemented within the documented cases, ranging from the Agency issuing a warning to the halting of activities. A glass recycling plant has introduced odour abatement plans; increasing their chimney stack from 13m to 30m and installing a wet scrubber. This follows hundreds of complaints from citizens and a Freedom of Information Request to the Environment Agency showed that the site has been issued with six Category 3 Enforcement notices between March and July 2018.

In the Cambridge composting plant, following the £50,000 fine in 2016, the industry has employed a trained Odour Monitoring Officer to check 17 points across the site every day and record the level of emission. The plant temporarily closes if emissions become too high.

An animal rendering site close to the city centre of Bradford has requested planning permission to install a 33m chimney as part of a larger plan to replace their older abatement equipment. However, residents feel that more should be done to reduce odour rather than simply disperse it and some are calling for relocation or closure.

In June 2018, a waste management company was the first ever to be fined (£60k) by Environment Agency for odour. Rather than being prosecuted for the offence, an 'enforcement undertaking' (EU) has been agreed between the company and the EA. As part of the EU, the

operator has donated £60,000 to a local environmental charity; made compensation payments to a number of local businesses and individuals; and paid the Environment Agency's investigation costs. The use of the EU is a first for the UK one which the Environment Agency described as a "huge achievement."

2.9 Odour issues in Bulgaria

#21 cases identified

GEOGRAPHICAL SPREAD

Our research includes 21 cases, which have been identified across the whole country. More than 50% of them are located in the main cities: Sofia, Varna, Plovdiv and Rouse. The sources vary from industrial to waste treatment activities.

In cities with small population density, the main odour issues are caused by agricultural and livestock activities.

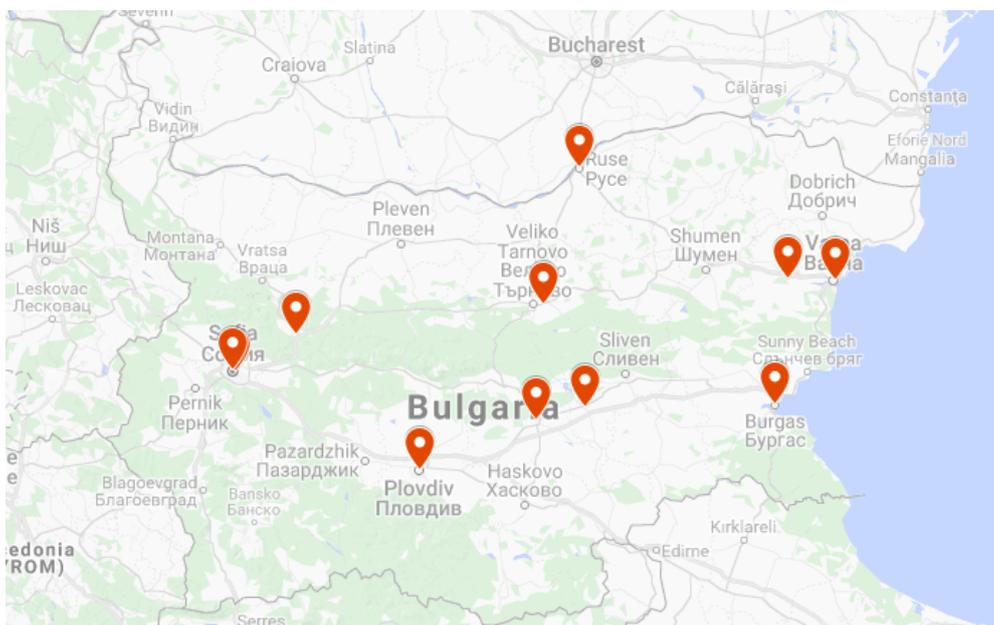


Figure 19: Geographical spread of reported odour issues in Bulgaria.

MAIN SOURCES OF ODOUR IN BULGARIA

Waste Management	Agriculture/ Livestock	Industrial	Urban odours	Unknown
14%	5%	19%	57%	5%

The emitting activities related to the odour issues reported by citizens are mostly linked to waste management and illegal or non-functional landfills. The frequency of the urban waste recollection, the maintenance of containers, illegal burning of waste and the non-regulated

disposal or treatment of industrial waste through refuse-derived fuel (RDF) incineration are some of the problems. Chemical industries (e.g. oil refineries), biogas plants and animal by-product incineration are also an important source of odour.

PROBLEMS CAUSED

The main problem caused by odours is nuisance. Health problems caused by odours have not been reported so far. In rare cases, citizens complain of suffocating smell and difficulty to breathe. Although health problems are not reported, people associate smells with releases of harmful substances into the air and water, especially if they live in the vicinity of an industrial activity and are concerned about their health.

Problems are environmental when measurements prove that not only smelly but also harmful substances in air or water are emitted.

DATA COLLECTED TO MONITOR THE PROBLEM

In Bulgaria, there is no law that regulates odour pollution as a whole. However, the Ordinance related to air pollution includes provisions for the imposition of a sanction for industries releasing odoriferous substances into the air. The authority which imposes such sanctions is the Regional Inspectorate for Environment and Waters. In 2016, a manufacturer of medicines for the treatment, prevention and improvement of animal health and productivity, was fined with the amount of EUR 23,000 due to air pollution with hydrogen sulphide.

Depending on the cases, the competent authorities in Bulgaria are different:

- In cases related to illegal waste burning, the Mayor of the city is a competent authority to solve the issue.
- When odours are generated by agriculture and livestock activities, the Bulgarian Agency for Food Safety monitors the problem.
- The Regional Inspectorate for Environment and Waters monitors environmental problems caused by odours.

The emitting industries have the obligation to implement monitoring plans and to report the results to the Regional Inspectorate for Environment and Waters.

Citizens are the main stakeholders that usually take part in cases of odour pollution, besides local administrations, industries and NGOs. Citizens get organized if problems are persistent and there are no specific actions to solve it. Most of the times they receive support from NGOs. Citizens' protests urge the responsible institutions to take urgent and adequate measures to lower the odour emissions in the region. If odour-preventing actions are undertaken, they are usually a consequence of citizens' protests and actions.

ODOUR MANAGEMENT PRACTICES

Odour management practices are different depending on the source of odours. The emitting industries are installing several diverse filters - biofilters, scrubbers, etc. In some cases, the

competent authorities engaged the polluters to install additional air filters (e.g. the above mentioned medicine manufacturer).

Another example of good practice is one implemented by the town of Rousse, which installed specialized equipment to identify odorous substances. If there are any signals, the equipment can be remotely activated via SMS. After the activation, a few samples will be taken within 5 minutes in two separate containers. One of them will be sent to a laboratory in Italy, where it will be subject to organoleptic analysis. Along with it, another sample will be sent to an accredited laboratory abroad or in Bulgaria for a chemical analysis. Rousse was chosen to test the apparatus because of serious complaints from citizens about the presence of intense odors.

When old landfills or illegal ones cause odours, the Mayor of the municipality is responsible for recultivating them. The landfill Suhodol (near city of Sofia), which has been used for nearly 20 years, is currently being recultivated. During the exploitation, the landfill Suhodol was subject to numerous complaints by residents of the neighborhood and protests.

In Bulgaria, measures to solve odour issues are taken mostly after citizens' complaints and protests.

2.10 Odours issues in Italy

#38 cases identified

GEOGRAPHICAL SPREAD

The most important cases of odour issues in Italy occur typically where big industrial areas, including odour emitting activities, are located close to residential areas (cities or smaller municipalities). This happens quite often in Italy, due to the high degree of urbanization in some areas of the country (Pianura Padana, Northern Italy), and because separation distances are often not respected.

Different cases (38) were identified in Italy as examples of situations where the presence of diverse unpleasant odours is lamented in the same area. This sometimes makes the provenance of the odour nuisance difficult to identify.

As can be seen from the map (indicative), cases where the presence of odours is reported are spread all over the country. The reported cases shall not be interpreted as an exhaustive list of significant cases of odour issues in Italy, but only an indication of some examples for which reports about odour complaints are public, or other odour studies have been published.

About the geographical spread, it can be observed that most Italian waste treatment facilities are concentrated in Northern Italy. Due to the high population density in the whole Pianura Padana area, they are often the main cause of odour complaints. Livestock and agricultural odour complaints are registered in Northern Italy, mainly in the southern part of the region of Lombardy and in the region of Emilia-Romagna, where the livestock concentration is very high.

Industrial odours are the main cause of odour complaints all over Italy, and they include very different odour types. Although Northern Italy is known to be highly industrialized, there are also some significant examples in Central and Southern Italy (e.g., the area around Terni, which is the most industrialized city in Central Italy). Moreover, plants belonging to the oil & gas and petrochemical sector are typically located along Italian coasts.

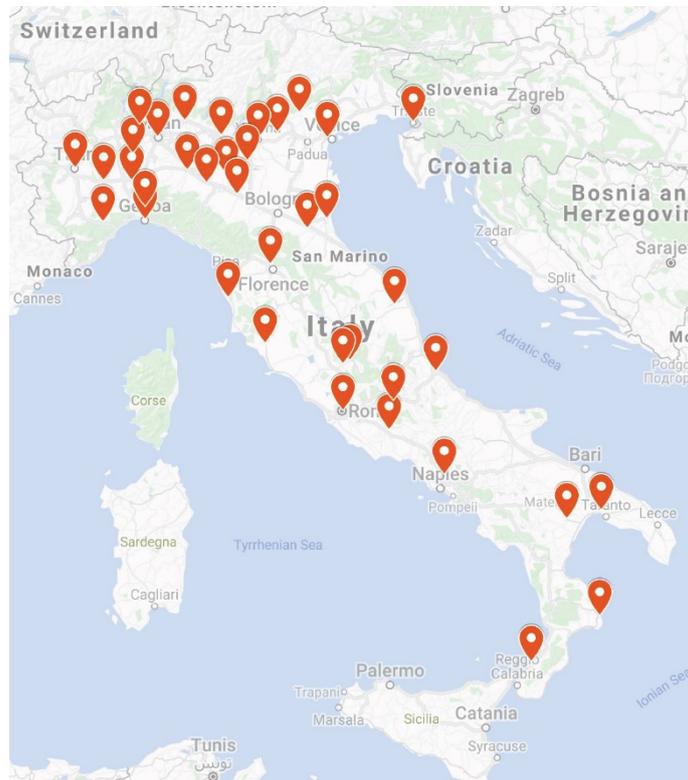


Figure 20: Geographical spread of reported odour issues in Italy

MAIN SOURCES OF ODOUR IN ITALY

Waste Management	Wastewater Treatment	Agriculture/ Livestock	Industrial
36%	12%	8%	44%

The cases that were identified as examples of odour issues in Italy include the odour sources listed in the table above. The industrial activities are the main odour sources representing 44% of the cases including chemical industries, oil refineries, production and processing of metals, etc. The waste management activities (waste treatment plants, landfills) with 36% and wastewater treatment plants (12%) are also identified as odour sources. Livestock odour represents only 8% of the reported cases of odour complaints.

PROBLEMS CAUSED

In Italy there are no known cases, up to now, in which odour issues have been proven to cause direct health effects. The main problem caused by odour issues is nuisance, which may become very serious in some cases, causing repeated complaints to the local authorities. The problem of odour nuisance, even though direct health effects are not proven, is taken very seriously in Italy, often becoming the limiting factor for the realization of new plants or for the management of existing ones.

DATA COLLECTED TO MONITOR THE PROBLEM

In Italy there is not a national regulation about odour pollution. Most local guidelines currently existing (Region of Lombardy, Region of Piemonte, Region of Puglia, Province of Trento) are based primarily on a modellistic approach. That is why, in general, data gathered to monitor the problem is coming from olfactometric analyses at the source, which allow to characterize and quantify emissions. The data is then used, together with the geographical and meteorological information relevant to the area under study, as inputs for dispersion modelling.

In some cases, citizens are involved with questionnaires in order to verify the model outputs. Only recently, there have been some cases in which telephone calls or apps were used in order to collect odour registrations by citizens. This was the case for the city of Taranto, which will be described later. However, in this specific case, citizen observations were coupled solely with the information coming from odour samples collected in ambient air at receptors, whereby the measurement of the odour concentration is not significant.

ODOUR MANAGEMENT PRACTICES

The practices that can be adopted in order to manage the problem are extremely different, depending on the specific problem. Some examples of possible options that are often encountered in Italian plants are listed below.

- Strategies for improving the emission dispersion capacity: i.e. increase of the height of an emission (stack), or its verticalization (in industrial activities, horizontal emissions are often found, which have a poor odour dispersion capacity).
- Correct management / design of odour abatement systems: a frequent problem that is observed on the plants is an insufficient ordinary management of the abatement systems. In some cases, increasing the exchange frequency of the liquid absorbing solution in scrubbers or of filtering media (e.g. active carbons) or a better regular maintenance of biofilter beds might be sufficient in order to reduce an odour problem. In other cases, under-dimensioned systems are observed, resulting in too short residence times and thus in an insufficient odour abatement efficiency. In such cases, a re-design of the systems and an increase of the treatment capacity might be necessary.
- Re-design of the ventilation system: there are several cases in which diffuse emissions from sheds are the main cause for odour perception outside of plants. In some cases, such emissions are the direct consequence of an insufficient ventilation system, which

results in the opening of doors or windows, which in turn results in uncontrolled diffuse odour emissions. Re-designing the ventilation system might solve the problem.

- Enclosure of area sources. In some cases, when odour emissions from open tanks are very problematic, their enclosure might be necessary.

2.11 Odours issues in Germany

#31 cases identified

GEOGRAPHICAL SPREAD

Odour issues in Germany, which were found using online media search, are distributed throughout the country, affecting mainly the middle and southern parts of Germany. Both rural and urban areas are affected by odour issues, although the majority of cases found affected rural areas.



Figure 21: Geographical spread of reported odour issues in Germany

No odour issues have been identified for Lower Saxony, and the northernmost states of Hamburg and Schleswig-Holstein in our general media search. Even after a subsequent targeted search, we were not able to find any media stories on odour issues. However, the site of Germany’s green political party mentions two areas within the city of Hamburg in early 2017 where there had been odour complaints over the past years. The source of emission was not known and therefore the green party submitted a request for investigation. No results from this investigation or media stories about these issues were found.

MAIN SOURCES OF ODOUR IN GERMAN

Waste Management	Wastewater Treatment	Agriculture/Livestock	Industrial	Urban odours	Unknown
24%	5%	19%	14%	5%	32%

The reported odours resulted from a range of activities. Main sources in Germany were waste treatment, composting plants and landfills with nine cases and livestock farming with seven cases. Other minor sources identified are the chemical industry and the treatment of animal by-products. It is notable that for a large number of cases (12 cases), the source for the odour problem had not been identified.

PROBLEMS CAUSED

In the majority of cases of odour pollution, the main reported problem was the nuisance of residents in the area. Citizens have been mainly complaining about not being able to open the windows to ventilate their apartments/houses and of having the smells stick to their clothes when they hang them out to dry or when they spend time outside.



Figure 22: Residents complain about significant nuisance from the odours that impact their daily lives.

Health problems or significant worries about health have been reported in seven cases. The main health problems encountered were headaches, sleeplessness, nausea and vomiting, asthma and other respiratory problems. In addition, major concerns for cancer and the health of unborn children have been raised.

Furthermore, concerns about environmental problems are often part of the reports, which often focus on the generation of toxic gases. This was the main concern in one case, where the waste incineration plant is located in the middle of a nature reserve (Fig. 23). Regarding other environmental problems, farmers in some areas are supposed to spread sewage sludge over their fields for fertilisation. These farmers have expressed concerns about the environmental impacts of this procedure due to the very high nutrient concentrations in the sewage sludge.



Figure 23: Concerns about the impact of toxic gases on an adjacent nature reserve have been raised when this industry announced a plan for expansion.

One of the identified cases listed loss of tourism as their main concern, as this place is known for its thermal springs and relies on the tourism industry. A loss of hotel or Bed and Breakfast guests is also a concern of many residents in rural areas.

DATA COLLECTED TO MONITOR THE PROBLEM

In the majority of the identified cases, the odour pollution issue has been raised by the local residents. They complain mostly to the mayor's office, hoping for political help in finding a solution with the industry. The usual procedure after receiving a number of complaints is that the mayor and/or other local politicians organise a public meeting, which residents can attend to describe their problems.

In some cases, the political actors have asked the residents to collect data on the odour issue, e.g. using questionnaires, a method standardised in Germany (VDI3883: [Part I Questionnaires](#), [Part II Determination of Annoyance Parameters by Questioning Repeated Brief Questioning of Neighbour Panellists](#), [Part III Conflict Management in air pollution abatement](#), [Part IV Processing Odour Complaints](#)). This was mainly the case in areas where the source of the odour had not been identified. The collected data would then be used to try to identify the source.

Many odour issues that have been reported in Germany are not new, but have been ongoing for several years. In these cases, measurement of the emitting industries have often already taken place at several time points.

Some cases also report the use of trained people to do so-called "grid inspections". For this, people who have gone through odour detection training (with a standard sense of smell according to [EN 13725:2003 Determination of odour concentration by dynamic olfactometry](#)) visit pre-specified points in the affected area (in the form of a grid) and write down whether they can smell an odour, how strong it is and what it smells like, for a period of 10min, with

observations every 10 seconds (thus a total of 60 observations are collected at each point). The observation period last for at least 6 months and ideally one year, to cover all meteorological conditions and results in the calculation of the frequency of perception of a specific type of odour in the area. These “grid inspections” are based on the German standard [VDI 3940:2006 Measurement of odour impact by field inspection](#), which has been recently adopted at the European level ([EN 16841:2016](#)). The standard also set limits for annoyance (15% of maximum frequency of perception in industrial areas and 10% in urban areas).

In one case, the emitting industry asked a private specialised company specializing in the field of odour analysis to publish monthly updates and graphic reports (Fig. 24a). The same company published a template for a “Geruchstagebuch” (literally an “Odour diary”, Fig. 24.b) on its website. Using this template, citizens can report odour types (from A to G), odour intensity (from 1 to 5), and wind intensity (from 1 to 4) directly to the emitting industry.

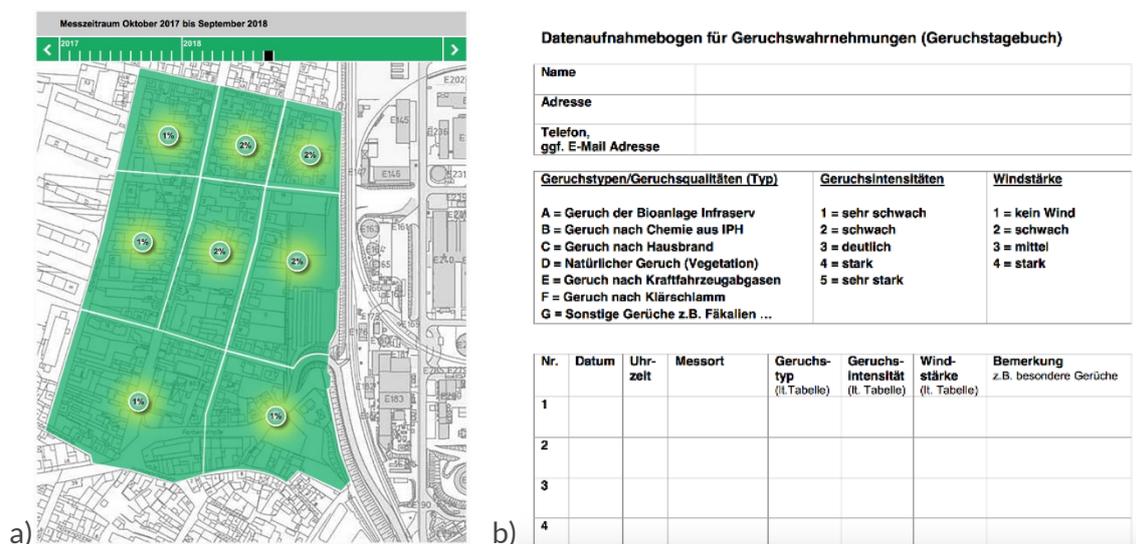


Figure 24: a) A monthly graphical report on odour frequency reductions and b) The downloadable template of the “Odour diary”.

In an attempt to collect information on odour issues directly from regional and local offices that are the first contact point for annoyed citizens, we contacted the main environmental agency in each German state, as well as some of the local surveillance authorities. No regional agency or local authority was able to provide a comprehensive list of odour pollution issues in its area. Even though many citizen complaints are confirmedly addressed to these offices, and the offices act upon such complaints, it seems that Germany does not seem to have any official protocols as to how one should systematically store data on odour complaints. It is possible that there are data on odour issues and complaints at the local council level. However, the size of Germany makes it difficult to contact every single council office to ask for such information in order to collect a comprehensive list of odour issues.

ODOUR MANAGEMENT PRACTICES

Many of the reported cases do not (yet) include any mitigation actions from the emitters. That is because most odour issues in Germany were reported after an expansion plan of the

emitting industry or livestock farming facility was submitted to the according agency. Many residents already felt annoyed by the present odours and were concerned that these would increase upon expansion.

However, several cases mentioned the installation or planned installation of air filter units after the residents filed complaints with the local political actors. In one case, the emitting industry was planning to install a state-of-the-art filtering unit and was also in the process of disposing the wastewater that caused the intense odours. A waste treatment plant had implemented better storing techniques, in which the odour producing wastes were wrapped in foil to minimise emissions. And in a case where a water reservoir caused odour problems due to high influx of sewage, a modern oxygenation system was trialled to avoid anoxic water and to reduce the production of hydrogen sulphides.

In general, the emitters of the odours in Germany take actions to manage the odour problem. However, in several cases the industries (mainly waste management plants) already have the installations (e.g. air filters) that are required by law and therefore do not seem to feel responsible to take any further actions, even though residents are still reporting significant odour pollution.

3

POTENTIAL PILOT CASE STUDIES

This section presents potential cases for conducting citizen science interventions on odour pollution.

D-NOSES will develop at least 10 pilots in European and non-European countries. The pilots will start progressively and will be split into two main rounds. This is to generate a feedback loop that allows us to learn from the first round pilots and iterate the D-NOSES engagement model and toolkit. The first pilots will take place in Spain, Greece, Bulgaria, Chile and Portugal.

Building upon the results of the desk research on affected communities (presented in the previous section), pilot partner leaders have identified potential cases for their pilots interventions. Each country has identified up to 5 potential case studies and analysed the pros and cons of each of them, with the exceptions of Spain, Bulgaria and Portugal. They have selected a tentative pilot case and conducted a deeper investigation on it, especially regarding the stakeholders in the area and possible motivations and barriers for engagement. An important criteria for selecting the preliminary case was the possibility of involving all the stakeholders from the quadruple helix model. In addition, a wide variety of odour sources and socio-economic contexts has been selected.

In Barcelona (Spain), Sofia (Bulgaria) and São João da Madeira (Portugal), the pilot case studies have been pre-selected in the proposal stage, as explained in the DoA. In Sofia and São João da Madeira, the municipalities of the affected area are partners of the consortium, and are interested in tackling the odour problem that affects their communities. In Barcelona, the Forum case has been selected because public authorities, that have jurisdiction over the emitting industry, have already shown considerable interest in using the D-NOSES methodology to explore possible mitigation strategies for the problem at stake and are part of the D-NOSES Advisory Board. Contact with them has been established prior to starting the D-NOSES project (see attached letter of interest in the DoA) and the Project Coordinator, Ms. Rosa Arias, has been working with them and the odour emitting industries in the past, so she has a lot of knowledge on the odour problems in the area since 2005. Thus, it constitute a good occasion to compare traditional top-down approaches to monitor odour pollution with the innovative, bottom-up approach proposed by D-NOSES.

OVERVIEW OF PRESELECTED CASES

SPAIN Barcelona	GREECE Thessaloniki	BULGARIA Sofia	PORTUGAL Porto	PORTUGAL São João de Madeira	CHILE Chimbarongo
 Waste & Wastewater treatment plants	 Oil Refinery	 Waste collection	 Various sources River pollution	 Animal by product rendering	 Wastewater treatment plant

3.1 SPAIN

3.1.2 SELECTED CASE

KEY FACTS		
Fòrum Area, Sant Martí District, Barcelona	Waste incineration plant, Bio-metanasation Waste treatment Plant, Pneumatic Waste Collection Station, Covered Waste Water Treatment Plant (WWTP) and Wastewater sludge treatment plant. Sewage system.	>13,000 ¹² inhabitants
<i>Location</i>	<i>Odour Sources</i>	<i>Population affected (estimation)</i>

The Forum Area is located in the south-east end of the city of Barcelona, by the coastline. It belongs to the neighbourhoods of Diagonal Mar i el Front Marítim del Poblenou (with 13.710 inhabitants)¹³ and el Besòs i el Maresme (22.893 inhabitants)¹⁴, located in the Sant Martí District. The area is bordering Sant Adrià del Besòs municipality.

¹² Diagonal Mar i el Front Marítim del Poblenou has 13.710 inhabitants according to the Statistics Department of the Barcelona City Council; census data 2017:

http://www.bcn.cat/estadistica/catala/documents/barris/69_MA_Diagonal_mar_2018.pdf;

¹³ Statistics Department Barcelona City Council; census data 2017:

http://www.bcn.cat/estadistica/catala/documents/barris/69_MA_Diagonal_mar_2018.pdf

¹⁴ Statistics Department Barcelona City Council; census data 2017:

http://www.bcn.cat/estadistica/catala/documents/barris/70_MA_Besos_mar_2018.pdf

Location



Figure 25. Map of the pilot case study selected area

What is known today as the Forum Area was renewed in 2004 alongside the celebration of the “Forum of the Cultures”, a global event on sustainable development, peace and cultural diversity. It was a controversial process due to the massive high-level property building and coastline changes involved. One of the particularities of the area is the presence of waste treatment plants to supply the city: a Waste incineration plant, a Bio-metanization Waste treatment Plant, a Pneumatic Waste Collection Station, a Covered Wastewater Treatment Plant (WWTP) and a Wastewater sludge treatment plant.

The odour problems caused by these plants are well known in the city, and depending on the time of the day and the meteorological conditions, one can smell fresh wastewater, sludge, fresh waste, decomposed residue or biogas. The communities living nearby have been complaining about these problems for many years. The variety of the odour emitting sources and the area’s demographic, socioeconomic, cultural and urban diversities makes this case study a complex and challenging one to validate the D-NOSES methodology based on citizen science to improve environmental odour management.

Odour sources

In the Forum Area there are two main type of activities emitting odours: the ones devoted to the valorisation of municipal solid waste (MSW) and the ones treating the wastewater generated in the area. The sewage system and some water deposits are still causing some additional odour complaints.

In the case of MSW, the Barcelona Metropolitan Area (AMB) owns the Sant Adrià del Besòs Total Municipal Solid Waste Recovery Facility (PIVR), a municipal solid waste treatment centre consisted on two plants operating on the same site using different (yet complementary) treatment processes, to give compliance to the Waste Management Model of the Metropolitan

Programme for Municipal Solid Waste Management (PMGRM), as summarised in the following image. The model is part of the Integrated Plant Model designed in Catalonia for the management of municipal solid waste, which prioritises recycling and recovery as the preferred alternative, then energy recovery and finally, as last option, controlled dumping of waste. In the Metropolitan Area of Barcelona there is a total of four Integrated Plants for the treatment of MSW (or Ecoparcs) and only one has an associated landfill.

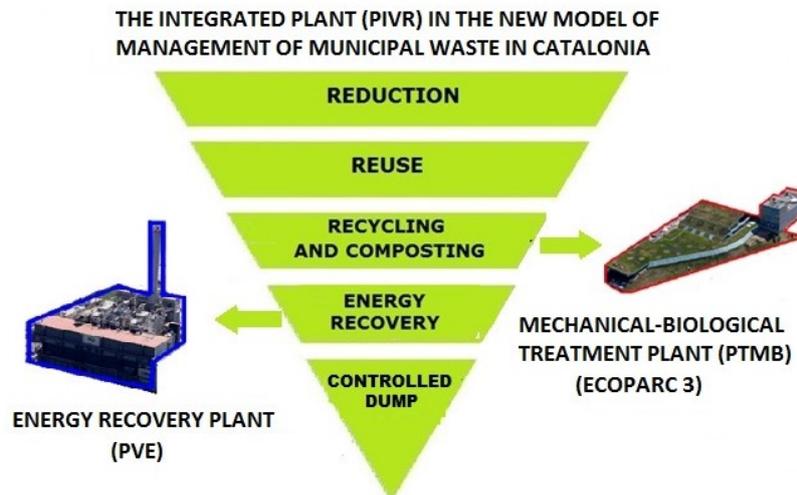


Figure 27. MSW management model in Catalonia, which prioritises recycling and composting through Integrated Plants (or Ecoparcs), in the Forum Area.

- The **Mechanical-Biological Treatment Plant (PTMB)** Ecoparc del Mediterrani (Ecoparc 3) is in operation since 2006, with a treatment capacity of 260,000 tn MSW/yr. Here materials and energy are recovered from mixed municipal solid waste deposited in grey street bins (not sorted), after pre-treatment for recovering glass, metals or plastics, and valorisation by bio-methanisation. There is not specific treatment line for organic waste separated in the origin by citizens, and thus, no associated composting facilities. This fraction is treated in other Ecoparcs in the Metropolitan Area of Barcelona.
- The **Waste-to-Energy (PVE) Plant** (Tersa) became operative in 1975, with three incineration lines of a capacity of 14,5 tn MSW/h. In 2017, it treated more than 368,000 tn of MSW. It recovers energy from waste generated in the Mechanical-Biological Treatment Plant and in other metropolitan plants (the four Ecoparcs in the Barcelona Metropolitan Area), i.e. the non-recoverable fraction. Originally, the waste incinerator worked with non-sorted waste but has been modified to eliminate the non-recoverable fraction from the Ecoparcs, while producing energy.
- Additionally, there is a pneumatic MSW collection facility owned by the private company Ros Roca very close to the AMB plants, with much lower treatment capacity than the Ecoparc 3 and the incinerator.

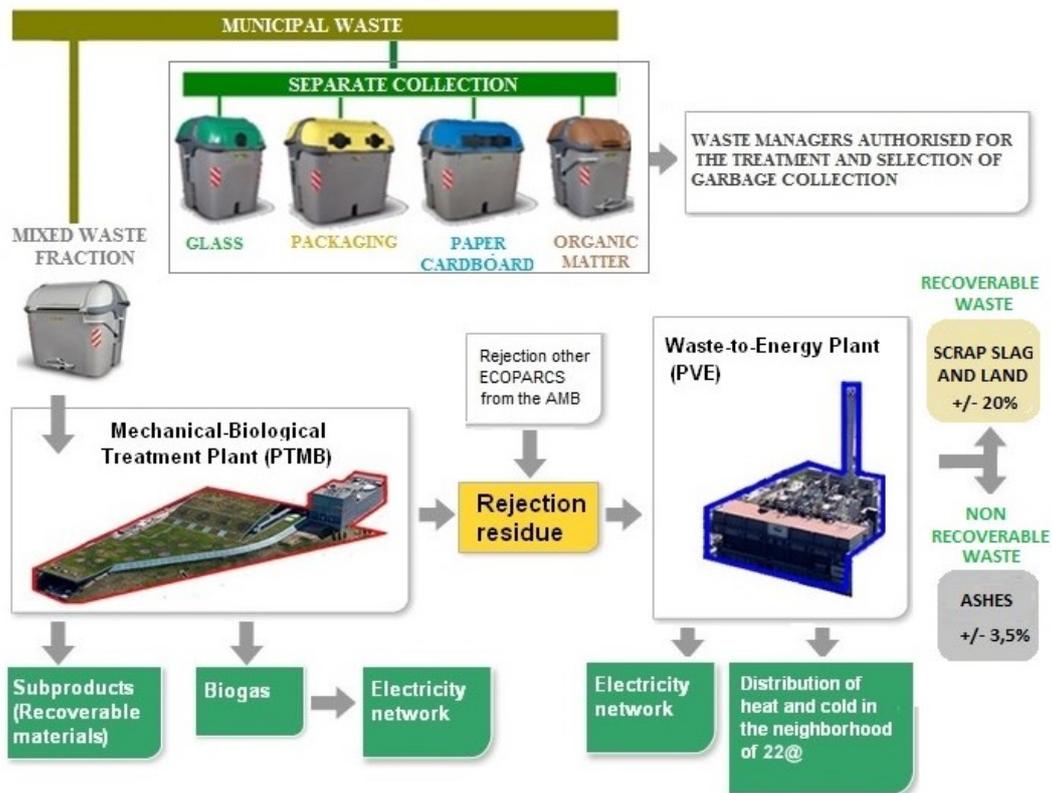


Figure 26. Municipal Solid Waste Management Model in the Forum Area in Barcelona.

In the case of wastewater, the biggest **WasteWater Treatment Plant (WWTP)** of Catalonia is build underneath the Forum plaza. It treats the wastewater from three quarters of Barcelona, Santa Coloma de Gramenet, Badalona, Montgat and Tiana, 2,800,000 population equivalent, with 525,000m³/day design flow, 11,8 hectares of plant surface area and 8 pumping stations. The treated water is returned to the sea 2.9 km of out flow from the plant by marine outfall with a diameter of 2.1m, to a depth of 55m, and the sludge resulting from the treatment process is conducted to Metrofang, a facility that deals with the sludge dewatering and transportation to nearby compost plants. It has a treatment capacity of 160,000 tn/yr of primary and biological sludge.

The WWTP, built on the year 1976, was originally uncovered. In 2004, it suffered a complete refurbishment that implied its complete covering underneath the new Forum Plaza, following urban planning actions in Barcelona that intended to: 1) Conduct the Diagonal Avenue (one of the main city arteries) up to the sea; 2) Revitalise a traditionally depressed area. To bring the Diagonal to the sea, there was a necessity to save the height difference between the street and the sea. The solution was to build the new plaza to hold the Forum Area, just on the top of the old WWTP, where an international event, the Forum of the Cultures, took place in 2004. In addition, the biological treatment of the wastewater was added to the plant following the new European Directives.

Figure 28. Pictures from the “old” WWTP (uncovered) in the Forum Area, with Tera in the top right corner, and from the refurbished Forum Area, with the new Plaza covering the WWTP, the Diagonal Avenue arriving into



the sea, the new hotels, museum and the new harbour, and Tera and the new Ecoparc 3 also in the top right corner.

Currently, the Forum Area holds new high standard apartments, five stars hotels, Conference Areas, the Blau Museum, a new sport harbour, etc., and it has been fully revitalised. From an urban planning perspective, the building of the Forum Plaza was really smart. However, the odour sources already existing in the area were no taken into account, so the problem is still affecting both the old and the new (and much richer) neighbours.

Population

It is interesting to go through the history of the area in order to better understand the demographic and social complexities of the population presented nowadays.

A little bit of history

At the end of the XIX century, the location of the Forum Area today was mostly made of fields in the outskirts of the city. The area was located next to the biggest industrial zone of Catalonia (mainly textile) named Poblenou (“new village” in Catalan). The living and working conditions of the population were precarious, with poor housing next to the industries (surely already suffering from odour pollution), low salaries with endless working hours, child labour and women exploitation. Poblenou is known for its strong community life, with cooperatives and trade union organizations representing the workers, since 1870s. This community sense is still present nowadays, and this is translated into communities organized in neighbourhood associations fighting for their rights, caring for the area where they live, or organising festivities and activities for its communities. Until the 1970s, a part of the population was still living in shacks in the beach, an area known as the Somorrostro, which was created with the migration of Spanish people coming from the south of the country to work in the Universal Exhibition of 1929.





Figure 29. Historical pictures of Poblou Nou (left) and Somorrostro (right)

Transformations: From Campo de la Bota to the Forum Area

Campo de la Bota started to be populated around 1929 by Spanish migrants mainly belonging to gypsy communities. By 1970s there were around 700 shacks and nearly 3500 people living in very precarious conditions. The neighbourhood was demolished at the end of the 80s, and most people was relocated in La Mina neighbourhood (Sant Adrià del Besòs municipality), one of the poorest areas of the Metropolitan Area of Barcelona.



Figure 30. Historical pictures of Campo de la Bota

Big urban changes occurred with the Olympic Games celebration in Barcelona (1992), when the city was literally placed in the world map. More than 20 years later is dying of its success, with 85% of the population putting tourism as one of the main problems of the city¹⁵. The changes had a double-edged sword: the coastal area of Barcelona was renovated and improved but also “cleaned up” with high standard housing built in a speculative way. This resulted in neighbours and families with lower socio-economic conditions leaving space for middle and high-class families inhabiting the area. Since then, the zone has been in constant transformation, becoming the technological district of Barcelona (named 22@), that coexists with façades of old industries, a lively and familiar neighbourhood trying to maintain its popular spirit and newcomers and artists that have been established in the now, gentrified area.

In 2004, with the celebration of the International ‘Forum of the Cultures’, the Barcelona City Council and real estate agencies contributed to the creation of high standard buildings with

¹⁵ “Tourism is the main problem of Barcelona, neighbours says” in one of the leading newspapers of the country: https://elpais.com/ccaa/2017/06/23/catalunya/1498212727_178078.html (June 2017)

apartments and offices, a big shopping mall and a green area giving birth to the new neighbourhood of Diagonal Mar i el Front Marítim del Poblenou. A beautiful residential area was built very close to a variety of waste treatment plants. The odour nuisance has raised concerns within the communities inhabiting the area since then, and have even grown as new neighbours live even closer to the plants affected by the problem. By 2004, there was a campaign calling the event held “Ferum” (“odour nuisance” in Catalan language) instead of Forum. The area is populated with the Natural Sciences Museum of Catalonia (Museu Blau), a big International Convention Center, and the Forum site where big events and music festivals as Primavera Sound or Cruïlla Festival, among many others, are held, with more than 200,000 visitors. In 2016, a new university campus has been built (Chemical Engineering being one of the faculties) with new apartments for students, which are expected to get engaged in the



pilot.

Figure 31. Diagonal Mai i el Front Marítim del Poblenou today and a flyer of citizens campaign “Ferum” (“odour nuisance” in Catalan language)

Socio-cultural profile of the area selected

The area selected for the pilot case study (see map above) is complex regarding the socio-economic, cultural, urban and demographic diversity that it entails. Diagonal Mar i el Front Marítim del Poblenou inhabitants have higher socioeconomic levels with high incomes, clashing with very low incomes in el Besòs i el Maresme neighbourhood. The academic levels of the population between these two close by neighbourhoods are also very different, ranging from 40% with university degrees in Diagonal Mar to 11% in el Besòs i el Maresme¹⁶.

In terms of cultural diversity, Diagonal Mar and Besòs i el Maresme have 81% and 73.9% Spanish nationals respectively. However, foreign nationalities vary from one another. In

¹⁶ Barcelona City Council, Statistics Department, 2017.

Diagonal Mar, we find Italy, Russia and France as the more prevalent nationalities, while in El Besòs i el Maresme, Pakistan, Morocco and China are the most prevalent¹⁷. La Mina (in Sant Adrià) is known for its wide gypsy community living in more disadvantaged conditions. The contrast between urban scenes cohabiting close by can be perceived in the images below in contrast with the previous ones from the Forum Area.



Figure 32. Pictures of La Mina neighbourhood, located in front of the Forum Plaza

In terms of stakeholder engagement, a variety of tailored-made community engagement strategies and participatory actions will be developed taking into account these complexities in order to follow the D-NOSES inclusive and gender balanced approach.

Stakeholders identified, motivation and barriers

A map of relevant stakeholders has been constructed following the quadruple helix model approach with the aim of engaging them in the pilot case study. The table below presents the list of stakeholders identified for the Forum area. For each stakeholder type, potential motivations, barriers and mitigation strategies have been identified for them to participate in the D-NOSES pilot. An example of a motivation, barrier and mitigation strategy for each type of stakeholder is presented as follows:

Stakeholder type	Stakeholder name	Motivations and Barriers
Odour emitting sources/ waste managers	ECOPARC del Mediterrani, TERSA, Ros Roca, METROFANG, WWTP, BCSA, Aigües de Barcelona, AMB.	<p>Motivation: To reduce complaints of odour nuisance from communities and other stakeholders.</p> <p>Barrier: Having a lack of confidence in others (academia, citizen scientists, etc.) to fully understand and diminish the problem.</p> <p>Mitigation strategy: Communicate the wealth of experience and ability the team/consortium has and presenting scientific/research evidence to prove it.</p>
Citizens and Affected	Citizens and communities in the following	Motivation: To increase their

¹⁷ La població estrangera a Barcelona. June 2017. Barcelona City Council, Statistics Department.

communities	neighbourhoods: Diagonal Mar i el Front Marítim del Poblenou, el Besòs i el Maresme, Poblenou (Barcelona), Sant Adrià del Besòs (La Mina) and Badalona. University community (UPC), surrounding schools, association members, etc.	understanding of any danger/health issues associated with the odours, reduce nuisance and recover their quality of life. Barrier: Suffering from fatigue and apathy as no significant change has happened yet. Mitigation strategy: Establish direct communication channels with quadruple helix stakeholders, communicate project results and invite engage citizens to participate in decision making.
Citizen associations, NGOs, etc.	AireNet, AAVV ¹⁸ Besòs-Maresme, AAVV Fòrum, Plataforma Qualitat de l'Aire, Zona Forum Association, and other associations to be identified.	Motivation: To improve their reputation for provoking positive change and partnership working. Barrier: Gatekeeper syndrome/control - May not want the project encroaching on their territory/area of expertise for fear of diminished reputation or funding cuts, or egos. Mitigation strategy: Emphasise a joined up and collaborative process to improve/build relationships. Acknowledge and respect stakeholders' existing knowledge, dynamics, roles, networks, etc.
Affected Communities (Economic)	Barcelona District Forum, Hotels, Restaurants, Diagonal Mar, shops, Port Fòrum, Bosc Urbà, La Caixa (Social Housing), Palo Alto Market, International Companies (Sanofi).	Motivation: To reduce odour nuisance for them and their clients. Barrier: Businesses don't believe they can assist or do anything to change the situation. Mitigation strategy: Inspire with storytelling of other successful situations similar to theirs.
Public Sector, Administration, Environmental Authorities	Àrea Metropolitana de Barcelona (AMB), Barcelona City Council, Sant Adrià del Besòs City Council and Badalona City Council, Barcelona Serveis Municipals, Generalitat de Catalunya.	Motivation: To reduce friction and improve relationship with industry and the communities by opening up dialogue. Barrier: The project does not use standard data collection methods and there is no proof of reliability. Mitigation strategy: Reiterate that this is an opportunity to validate innovative, cost-effective, bottom-up approaches and methods, while increasing transparency and improving the relationships with the affected citizens.
Research	Museu Blau Natural Sciences Museum, UPC (Chemical Engineering), URV (dioxins study conducted in the area), D-NOSES project researchers.	Motivation: To contribute to research on odour pollution. Barrier: Silo mentality - insular attitudes with a lack of awareness of cross-disciplinary research.

¹⁸ AAVV = Associació de Veïns i Veïnes (Neighbour's Association)

Mitigation strategy: Organise events and activities to accommodate the audiences' specific needs/availability, e.g. breakfast meetings, child friendly venues.

3.2 GREECE

3.2.1 POTENTIAL CASES

	Brief description	Pros	Cons
<p><i>Case location:</i> Thessaloniki</p> <p><i>Odour source:</i> Refinery close to the metropolitan area of Thessaloniki</p> <p><i>Estimation of the population affected:</i> <i>ca. 100,000</i></p>	<p>The local authorities, municipalities and regional authority are dealing with citizens' complaints about odours from the refinery. Recently the Region of Central Macedonia (RCM) has assigned a project to the University of Thessaloniki to determine odorous compounds and relate them with the possible source (industrial activities). Furthermore, RCM is planning to assign a project for odour modelling and patrol.</p>	<p>There is good communication with local authorities and more specifically with the Regional Authority of Central Macedonia.</p> <p>Data on air quality is available from the industry.</p> <p>Citizen engagement is more organized through social network initiatives.</p> <p>Similar cases are frequent in many industrial areas around the country.</p>	<p>No field studies on odour.</p>
<p><i>Case location:</i> Peloponnese Region</p> <p><i>Odour source:</i> The refining process to produce pomace oil</p> <p><i>Estimation of the population affected:</i> <i>ca. 80,000</i></p>	<p>The municipalities and regional authority, are dealing with citizens' complaint on odours that affect their everyday life in terms of nuisance and for the cases of touristic areas, in terms of business activity.</p>	<p>Existing results on various environmental parameters (air pollution, SPM).</p>	<p>No field studies on odour.</p> <p>The local industries are not cooperative.</p> <p>Not organized citizen initiatives.</p>
<p><i>Case location:</i> City of Volos</p> <p><i>Odour source:</i> Cement production factory & Burning of illegal and unsuitable material by individuals</p> <p><i>Estimation of the population affected:</i> <i>ca. 100,000</i></p>	<p>The City of Volos is a port city in Central Greece. The area surrounding the city is cultivated and a cement factory (co-incineration of waste) is located East of the city. Due to local geographical and meteorological conditions, burning of unsuitable material in fireplaces, as well as melting of cables, etc., from illegal activities make the atmosphere heavy (temperature inversion, smoke is trapped).</p>	<p>Availability of measurements on various emissions due to the environmental permit requirements.</p>	<p>No field studies on odour.</p> <p>Not organized citizen initiatives.</p>

<p><i>Case location:</i> City of Kavala</p> <p><i>Odour source:</i> Fertilizers chemical industry</p> <p><i>Estimation of the population affected:</i> ca. 50,000</p>	<p>A few km east of the city there is a large fertilizers chemical industry. The production of Ammonia and Sulfuric Acid are odorous processes.</p>	<p>Availability of results on various environmental parameters.</p>	<p>No field studies on odour.</p> <p>Not organized citizen initiatives.</p>
<p><i>Case location:</i> City of Piraeus</p> <p><i>Odour source:</i> WasteWater Treatment</p> <p><i>Estimation of the population affected:</i> ca. 100,000</p>	<p>The local authorities, municipalities and regional authority, are dealing with citizens' complaint of odorous atmosphere and several schools have been closed for the protection of children.</p>	<p>Not defined.</p>	<p>There is no verification that the odour is coming from the WWTP.</p> <p>No field studies on odour.</p> <p>Not organized citizen initiatives.</p>

3.2.2 CASE SELECTED

KEY FACTS		
Thessaloniki, Region of Central Macedonia	Petroleum Refinery	~100,000
<i>Location</i>	<i>Odour Source</i>	<i>Population affected (estimation)</i>

Description of the case

The Region of Central Macedonia (RCM) is the second most populous in Greece after Attica. RCM is also a very important region in terms of economic development producing various agricultural products within its plains, hosting industrial activities, services and tourism. The region also hosts a refinery plants that sits very close to the metropolitan area of Thessaloniki, the second biggest city in Greece.

The refinery was established in 1966 and the population at that time was ca. 5,000. Today the population is ca. 100,000 (census 2011) in an area of 13 km² and the current distance from the urban area is less than 500m. The area is largely inhabited by the working class consisting of people who are employed, especially in manual or industrial work, with an average GDP per capita of 13.500€.

There is no data on when the problem begun, but since at least a decade there are documented complaints on odour issues. The refinery claims that it follows the environmental permit

requirements and also participates in major Corporate Social Responsibility initiatives, to develop the municipality's infrastructure and ensure community well being. Recently, the refinery has been involved in panels with the public to explain these processes.

Stakeholders, motivations and barriers

In the following table we identify the stakeholders involved in the pilot, as well as their motivations and barriers to participate.

Stakeholder type	Stakeholder name	Motivations and Barriers
Odour emitting sources	Refinery	Motivation: Restore its relations with the local citizens. Barrier: The nature of the process is steady and difficult to alter.
Citizens and Affected communities	Facebook group 'Breathing is our right'.	Motivation: Better management of the odour issues. Barriers: Lack of knowledge of the refinery process.
Public Sector, Administration, Environmental Authorities	Region of Central Macedonia (RCM) Municipality of Kordelio-Evosmos	Motivation: RCM: Dealing with a serious environmental and social issue. Municipality of Kordelio-Evosmos: Effectively dealing with the odour issue Barrier: Municipality of Kordelio-Evosmos: High impact if high expectations are raised.
Research	Technical University of Thessaloniki	Motivation: Improve its expertise and network coming in contact with one of the biggest companies in Greece. Barrier: Funding issues regarding the measuring equipment.

3.3 BULGARIA

3.3.1 CASE SELECTED

KEY FACTS		
<i>Location</i>	<i>Odour Source</i>	<i>Population affected (estimation)</i>
Sofia Municipality	Waste collection and waste treatment: <ul style="list-style-type: none"> • illegal burning of tires & old clothes • smells from vegetables market • collection of household waste - containers located near the buildings Industry: Factory for rebuilding of starters and alternators.	Citizens of Serdika district – approximately 46,000 people. Citizens of Sofia municipality – approximately 1.700M people.

The biggest odour issue that affects Sofia Municipality comes from activities of waste collection.

As a local authority, the Mayor is responsible for waste management on the territory she governs. According to the Waste management programme of Sofia Municipality adopted by Sofia City Council, the main objective is to reduce the quantity of landfilled biodegradable waste. This complies with the requirements of the European Directive on the landfill of waste - diversion of biodegradable municipal waste from landfills in 2020 to 35% of the total quantity of those wastes generated in Bulgaria in 1995.

In addition to the common European objective, ambitious national targets for the recycling of household biodegradable waste are envisaged in the Ordinance for the separate collection of bio-waste accepted in December 2013. The Ordinance requires mayors in each of the waste management regions under Article 49, paragraph 9 of the Waste Management Act (WMA) to achieve the following regional targets for separate collection and recycling of household bio-waste:

- by 31 December 2020 - not less than 50 percent of the amount of municipal bio-waste generated in the region in 2014;
- by 31 December 2025 - not less than 70 percent of the amount of municipal bio-waste generated in the region in 2014.

To provide theoretical basis for odour pollution prevention and management in regard of the D-NOSES project implementation, Sofia City Council aims to take the appropriate steps in two different, but mutually related directions:

1. Prevention - It is understood that, to achieve results, a 'food behavioural change' have to be the first step to take. That is why Sofia Municipality interlinks the D-NOSES project with TRIFOCAL project, which is funded under the LIFE+ Programme and the City Council is part of it. The main activity of that project is the prevention of food waste by changing planning, shopping, storage and meal preparation behaviours.
2. Based on a few internal organisational documents, it was realised that the main food waste in Sofia Municipality is generated by food service businesses. That is why the Bulgarian Institute for Microbiology has been engaged to examine waste food streams especially from business – HORECA sector. The scope of the service includes the study of the composition of food waste generated by different commercial establishments - fast food restaurants, restaurants in large shopping centers (MOL type), restaurants, "Fresh" bars, retail outlets offering packaged food, hot food stalls, fruit and vegetables, grocery stores, food waste generators, similar, children's and social kitchens. The results of this study are aimed to inform corrective measures (physical, biotechnological, chemical) to reduce and eliminate odour pollution generated from food waste.

Most of the complaints are coming from citizens – due to residual waste containers and food waste containers. The complaints received are related to smell perceived from the containers which are located near the citizens' flats. Different approaches have been tried to resolve the issue: underground bins – placed in underground pits in front and close to households, but some difficulties were faced up regarding their maintenance. Other complaints also come from restaurants, kindergartens, schools, and hotels.

The complaints are received in the form of:

- phone calls in the Municipal Enterprise for Waste Treatment (responsible for the separate food waste collection);
- at the source of the waste – where the waste is generated and collected by the waste collectors;
- Sofia Municipality Contact Center.

In 2014, a system was introduced to separate collection of food waste in the municipality, and the complains worsen. The Municipality consulted the legislation, but neither on national nor on local level the legislation provides adequate measures for odour issues. Therefore, the Municipality started looking for solutions and good practices to be implemented in Sofia. From 2014 until September 2018 the biowaste from more than 660 HORECA activities with more than 1085 containers was collected.

Stakeholders' identification and barriers

The following stakeholders have been identified as potential actors to be involved in the pilot intervention:

1. Policy makers - Ministry of Environment and Waters; Sofia Municipal Council;
2. Local authorities;

3. Citizens;
4. Businesses;
5. Food waste generators;
6. NGOs.

Because of the widespread of the problem there are still parties to be identified for engagement. Sofia Municipal Council & Food waste generators have been already involved.

Odour pollution caused by waste management processes are not covered by the Bulgarian legislation. In that regard, two municipal councilors from the Standing Committee of Environment and The Committee of European programmes and projects have been engaged. As a part of the political cabinet, they will support the efforts and there will be reliance on their experience to propose measures for amending Bulgarian legislation accordingly. In addition, a few NGO's have been identified dealing with issues related to odour pollution generated by waste. A few meetings are planned to be organized with all above-mentioned stakeholders to present D-NOSES goals. With this case, Sofia Municipality aims to test the versatility of the OdourCollect app and the D-NOSES methods to address municipal waste management issues.

Barriers found so far are:

- The participants (food waste generators) included in the separate collection of food waste demand more frequent servicing of the containers due to unpleasant odours. This, from the point of view of the municipality, is financially inefficient and impedes the expansion of the system.
- The proper position of the containers in the facilities is difficult to be found because of the smell of food waste, because is not allowed the containers to be placed in front of the buildings, at the streets, in the kitchen, etc.

Some historical context

The capital of the Republic of Bulgaria has more than 7,000 years of history. Sofia is located in the Sofia Valley with an altitude of about 550 meters on a territory of 1,311 km², of which populated areas and urbanised territories occupy 245.5 km², agricultural land - 509 km², forest areas - 466.5 km², mining areas - 40.5 km², territories for transportation and infrastructure - 20.6 km² and watercourses and water areas - about 40 km².



Figure 33. Pictures of Sofia, Bulgaria

Sofia became capital of Bulgaria as recently as 1879, usurping the position from Veliko Tarnovo after six hundred years. The city's historic buildings date from the turn of the century up until the 1930s, when there was a rush to bring the city up to date and turn it into a modern European capital.

3.4 PORTUGAL

Two pilot case studies will be carried out in Portugal, one in the Porto area (lead by partner LIPOR) and the other one in São João da Madeira (lead by partner São João da Madeira municipality). The pilot case of São João da Madeira has been already selected, since the municipality - D-NOSES consortium partner - has showed odour concerns and worked on a potential solution for many years. In the case of Porto, LIPOR has selected a number of possible case studies and has preselected one.

3.4.1 PORTUGAL PILOT 1: PORTO

POTENTIAL CASES

	Brief description	Pros	Cons
<p><i>Case location:</i> Municipality of Maia</p> <p><i>Odour source:</i> Crematorium for pet/animal waste</p>	<p>Small unit situated in a residential area with all permits.</p>	<p>Community is involved.</p>	<p>The owners say they are legal and do not do anything.</p>
<p><i>Case location:</i> Municipality of Vila do Conde</p> <p><i>Odour source:</i> Waste water discharges from a milk factory</p>	<p>Neighbourhood: Rio Ave river in Vila do Conde Municipality.</p> <p><i>Stakeholders identified:</i> Ministry of Economy; Direção-Geral de Alimentação e Veterinária (DGAV).</p>	<p>Community and Municipality are involved. Case frequently reported in the news.</p>	<p>The discharges end before the environmental sectors services arrive. No aperture from the unit to resolve the problem as they deny it.</p>
<p><i>Case location:</i> Municipalities of Póvoa do Varzim and Vila do Conde</p> <p><i>Odour source:</i> Agriculture source: spreading of livestock manure</p>	<p>Situation perceived in the rural area - especially in Póvoa de Varzim and Vila do Conde Municipalities.</p> <p><i>Stakeholders identified:</i> DGAV, Ministry of Agriculture, Forest and Rural Development.</p>	<p>Wide problem in the region since it is a non urban area with many milk producers.</p>	<p>Legislation that allows the streading and burial in a few hours from the application. The farm was already there when the people built their houses.</p>

<p><i>Case location:</i> Municipality of Vila do Conde</p> <p><i>Odour source:</i> Fish cannery (canning factory)</p>	<p>Factory located in the middle of the urban area in Vila do Conde City.</p> <p><i>Stakeholders identified:</i> DGAV, Ministry of Agriculture, Forest and Rural Development, UTAD-CITAB, INIAV</p>	<p>The community is motivated and also the local authorities.</p>	<p>The fines and notifications from the local authorities did not make any effect.</p>
<p><i>Case location:</i> Industrial area at Fajozes, Vila do Conde Municipality</p> <p><i>Odour source:</i> Chemical factory-coating materials</p>	<p>Chemical industry located at an Industrial area (Fajozes, Vila do Conde Municipality).</p>	<p>-</p>	<p>Not only the factory is the cause of odour complaints.</p>
<p><i>Case location:</i> Gondomar, Maia, Porto e Valongo-LIPOR</p> <p><i>Odour source:</i> Rio Tinto-ecological trail</p>	<p>Neighbourhood; community that use the ecological trail.</p> <p><i>Stakeholders:</i> very well identified, and some of them, engaged: Movement of defense of Rio Tinto, LIPOR, Municipalities of Valongo, Maia, Gondomar, Porto, Águas de Gondomar, SA, Águas do Porto, IP / Administration Hydrographic Region North, Águas de Valongo, the Parish of Rio Tinto, Ermesinde, Águas Santas, Baguim do Monte e Campanhã, and Águas de Valongo, SA., DGAV.</p>	<p>Stakeholders have been involved. The river is already in a process of returning to the population.</p>	<p>The extension of the problem.</p>
<p><i>Case location:</i> Gondomar Municipality</p> <p><i>Odour source:</i> Wastewater treatment plant of Gramido, Gondomar Municipality</p>	<p>Wastewater treatment plant at Gramido.</p>	<p>The wastewater is in renewal to resolve items related to odour.</p>	<p>As already started is not possible to access the measures taken because we have no data recorded.</p>
<p><i>Case location:</i> Valongo Municipality</p> <p><i>Odour source:</i> Industrial waste landfill</p>	<p>Industrial waste landfill at Valongo.</p>	<p>Many complaints, communities involved.</p>	<p>Difficult to resolve the problem.</p>

CASE SELECTED: PORTO-TINTO RIVER

KEY FACTS		
Municipalities of Valongo, Gondomar, Maia and Porto	Wastewater discharges in Rio Tinto <i>Illegal industrial discharges in water</i>	163,742 inhabitants
<i>Location</i>	<i>Odour Source</i>	<i>Population affected (estimation)</i>

This atypical case was selected because odour monitoring can help identify other environmental problems like illegal discharges. With this case, LIPOR aims to test the versatility of the OdourCollect app and the D-NOSES methods to address a broader set of environmental issues beyond odour.

The Rio Tinto river presents nowadays serious pollution problems with source in Ermesinde city. There are clandestine discharge sewers in the head of the river and suspected infiltration of untreated water from the landfill (also closed) and of the Wastewater Treatment Plant of the city of Rio Tinto (where the river was tubed in an extension of 600 meters). All these factors contributed to high levels of pollution. The approach to rehabilitating the Rio Tinto river is part of LIPOR's Strategy for Biodiversity and Social Responsibility.

Rio Tinto arises in Ermesinde, Municipality of Valongo, being a small affluent of the Douro river. Rio Tinto has a watershed area of approximately 23.5 km², covering the Municipalities of Valongo, Gondomar, Maia and Porto, and the watercourse is about 12 km long.

During centuries Rio Tinto was the water supply of the population that lived nearby and had dozens of watermills that worked until the end of the 60's. In the last decades due to the urban development, part of the river was channeled, and many ecological crimes made this river one of the most polluted of the North of Portugal.

This project aims to define a joint plan action for the rehabilitation of the river, including registering polluted areas, monitoring the evolution of water quality, engaging scientific and experts' advice, identifying the interventions that are necessary to recover the river and to define sustainable future uses, such as the construction of an ecological trail. To this end, a Monitoring Program for Evaluation of Water Quality and Sediments from Rio Tinto is in progress and aims to contribute to the identification of the causes of degradation of water quality.¹⁹

The photos presented below have been taken before and after the construction works for the implementation of the ecological trail.

¹⁹ Virtual tour of Lipor ecological tread <https://www.lipor.pt/parque-aventura-trilho-ecologico/tour.html>



Figure 34. Picture taken before and after construction works for the implementation of the ecological trail



Figure 35. Number of visitors of Lipor ecological tread in 2018 (potential contributors for the project)

Stakeholders identifications and barriers

The following table presents the stakeholders that have been identified as potential actors to be involved in the pilot intervention, as well as possible risks and barriers for engagement.

Stakeholder type	Stakeholder name	Risks and Barriers for Engagement
Odour emitting sources	Several (wastewater discharges in Rio Tinto).	<ul style="list-style-type: none"> • lack of solutions in the market • high value of existing solutions • lack of real involvement • difficulty in cooperating • feeling of impunity
Citizens and Affected	Population of Municipalities of	<ul style="list-style-type: none"> • weak involvement of population

communities	Valongo, Maia, Gondomar and Porto	<ul style="list-style-type: none"> ● old population that cannot use app ● fall campaigns of dissemination of project ● high expectation of resolutions of the reported problems ● abandon the use of the app during pilot <p>Other economic factors:</p> <ul style="list-style-type: none"> ● low value of the properties ● low interest in investing in the region ● health problems – cost of treatments
Citizen associations, NGOs	Red River (Rio Tinto) Defense Movement	<ul style="list-style-type: none"> ● not believing in the project ● taking extreme positions ● difficulty accepting slowness of decisions ● not working in cooperation with the industry
Public Sector, Administration, Environmental Authorities	LIPOR, Municipalities of Valongo, Maia, Gondomar, Porto, Águas de Gondomar, SA, Águas do Porto, IP / Administration Hydrographic Region North, Águas de Valongo, the Parish of Rio Tinto, Ermesinde, Águas Santas, Baguim do Monte e Campanhã, and Águas de Valongo, SA., DGAV, Portuguese Environment Agency	<ul style="list-style-type: none"> ● lack of local legal expertise ● late answers ● lack of cooperation between the local authorities and population ● not effective cooperation ● no help on the ground ● lack of legislation
Research	Fernando Pessoa University	<ul style="list-style-type: none"> ● limited access to data ● lack of connection to the project ● lack of application from the knowledge generated by the research centres ● small scale projects
Policy makers		<ul style="list-style-type: none"> ● economic factors ● social factors ● conflict industry / political decision-making ● lack of connection to the project ● failure to integrate knowledge generated with the project into sectoral policies ● lack of motivation

3.4.2 PORTUGAL PILOT 2: SÃO JOÃO DA MADEIRA

CASE SELECTED

KEY FACTS		
São João da Madeira	Animal by-products rendering plant	More than 40,000 inhabitants
<i>Location</i>	<i>Odour Source</i>	<i>Population affected (estimation)</i>

This case study is based on the odour emitted by a company dedicated to the processing of animal by-products, installed in the neighbouring municipality of Santa Maria da Feira – Arrifana. This odour problem has had a negative impact in the quality of life of the local residents and neighbouring populations, whose complaints began in 1,970.

The geographical area affected by the problem comprises more than 40,000 inhabitants and includes the following municipalities:

- Municipality of S. João da Madeira: 21,713 inhabitants
- Municipality of Santa Maria da Feira / Village of Arrifana: 6,551 inhabitants
- Municipality of Oliveira de Azeméis: 20,000 inhabitants
 - Village of Cucujães: 10,705 inhabitants
 - Village of Milheirós de Poiares: 3,791 inhabitants

It is notorious that in long periods of the day and during many days throughout the year, intense odours can be perceived in the area. This smell is often nauseating, strongly uncomfortable and harmful to the quality of life of those who live in or visit the city of São João da Madeira. This bad smell is attributed to gaseous emissions resulting from the industrial processing of animal by-products.

Affected communities have expressed their discontent with the odour problem to the municipality of São João da Madeira for many years now. Their claims have also reached the Portuguese Environmental Agency but the problem remains unmanaged.

São João da Madeira municipality installed the Odormap - Sjm.odourmap.com, an innovative web platform for the monitoring of odours by the citizens, which allowed them to report episodes of bad smell²⁰. The platform offered a chronological record of events of odour nuisances. The number of registered users on the platform was high, as citizens hoped that their contributions would help to solve the problem. Local media also had a valuable role in giving voice to concerned communities. This engagement has recently triggered a public petition process, which has been signed by over 5,000 people and is therefore being developed into a resolution by the Portuguese Assembly. However, the communication with the engaged citizens during the recording period was not fluent enough, and many of them felt disenchanting and lost engagement, something that will be changed during the D-NOSES pilot.

²⁰ The Odormap - Sjm.odourmap.com is not currently available online

Stakeholders, motivations and barriers

The following table presents the stakeholders that have been identified as potential actors to be involved in the pilot intervention, as well as possible risks and barriers for each stakeholder group.

Stakeholder type	Stakeholder name	Risks and Barriers for Engagement
Odour emitting sources	Industry dedicated to animal by-product rendering	<ul style="list-style-type: none"> ● appreciation of problems and results ● high value of existing solutions ● lack of real involvement ● difficulty in cooperating
Citizens and Affected communities	Population of Municipalities of São João da Madeira, Santa Maria da Feira and Oliveira de Azeméis	<ul style="list-style-type: none"> ● lack of population adherence ● not believing in the project ● difficulty understanding industry problems ● radical positions ● difficult perception of industry timings ● different languages
Citizen associations, NGOs	Local citizen responsible for the public petition, Association of Municipalities of the Terras de Santa Maria, Commercial Association, School groupings, Entrepreneurs Club and Technological Center of Footwear	<ul style="list-style-type: none"> ● not interested in the project ● not believing in the project ● taking extreme positions ● difficulty accepting slowness of decisions ● not working in cooperation with the industry
Affected communities (economics)	Municipal company Águas de S. João, a company responsible for the cleaning and collection of waste-SUMA	<ul style="list-style-type: none"> ● to hinder productivity ● reduce tourist interest ● not be able to cover costs of technological changes ● non-acceptance of increased cost
Public Sector, Administration, Environmental Authorities	APA - Agência Portuguesa do Ambiente (part of the D-NOSES Advisory Board), CCDR-N - Comissão de Coordenação e Desenvolvimento Regional do Norte, DRAN - Direção Regional de Agricultura e Pescas do Norte, IGAMAOT - Inspeção Geral da Agricultura, do Mar, do Ambiente e do Ordenamento do Território (part of the D-NOSES Advisory Board), Parish Council and Municipal Assembly	<ul style="list-style-type: none"> ● lack of local legal expertise ● late answers ● lack of cooperation not direct involvement ● not effective cooperation ● no help on the ground
Research	Aveiro University	<ul style="list-style-type: none"> ● limited access to data ● little start-up ● lack of connection to the project ● not scientific adjustment of generated knowledge with the project

Policy makers		<ul style="list-style-type: none"> • economic factors • social factors • conflict industry /policy-making • lack of connection to the project • failure to integrate knowledge generated with the project into sectoral policies
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3.5 CHILE

3.5.1 POTENTIAL CASES

	Brief description	Pros	Cons
<p>Case location: Chimbarongo (VI Region)</p> <p>Odour source: Wastewater treatment plant (WWTP)</p>	<p>WWTP located in a rural environment with neighbours at less than 100 meters distance</p>	<p>Two years of field inspections and repeated questionnaires for nuisance assessment carried out. Odour sources are open to contribute. Relatively close to Santiago (150 km).</p>	<p>Rather local problem, Neighbours with expected impact less than 1,000. Rural setting and neighbours with little literacy and use of smartphones.</p>
<p>Case location: Til Til (Metropolitan region)</p> <p>Odour sources: Sanitary landfill, Sewage sludge monofill, livestock farming.</p>	<p>Poor rural area with multiple sources that receive 50% of all waste generated in the capital.</p>	<p>Hot conflict which was settled in the past. Organized community. Odour sources open to contribute. Relatively close to Santiago (80 km).</p>	<p>Received public attention in the past and the conflict was used with political purposes. Probably difficult to establish a confident relationship with the community.</p>
<p>Case location: San Javier (VII Region)</p> <p>Odour source: Livestock farming</p>	<p>A recent facility (pig farm).</p>	<p>The conflict is rather new. Citizens wanted to realize odour measurements on their own. Still reachable for a day visit from Santiago (350 km).</p>	<p>This is a “hot” conflict and probably the quadruple helix approach would not work as the citizens are not willing to negotiate or participate in a mediation process.</p>

<p><i>Case location: San Francisco de Mostazal (VI Region)</i></p> <p><i>Odour source: Multiple sources (Rendering, WWTP, livestock, amongst others)</i></p>	<p>This is an old problem with two out of a dozen odour sources being the most problematic.</p>	<p>A round table on odours was organized in the past to discuss the issue. Several odour studies were conducted. Located relatively close to Santiago (80 km).</p>	<p>Includes about ten sources. No contact with citizen organizations in this area.</p>
<p><i>Case location: Los Álamos (VIII Region)</i></p> <p><i>Odour source: Wastewater treatment plant</i></p>	<p>The WWTP is 13 years old and located next to a (small) village.</p>	<p>Consortium partner ECOTEC is currently conducting field inspections there. The affected community seems open for mediation, as well as the WWTP operator.</p>	<p>Far away from Santiago (700 km)</p>
<p><i>Case location: Los Ángeles (VIII Region)</i></p> <p><i>Odour source: Wastewater treatment plant</i></p>	<p>The WWTP is 13 years old and located next to the city.</p>	<p>ECOTEC will conduct field inspections there. The WWTP operator showed interest in this kind of studies.</p>	<p>Far away from Santiago (600 km). No contact with citizen organizations.</p>

3.5.2 CASE SELECTED

KEY FACTS		
<p>Chimbarongo Colchagua Province, O'Higgins Region (VI Region) 150 km south of Santiago de Chile</p>	<p>Wastewater treatment plant</p>	<p><1,000</p>
<p><i>Location</i></p>	<p><i>Odour Source</i></p>	<p><i>Population affected (estimation)</i></p>

Chimbarongo is a small city located 150 km South of the capital Santiago in the Colchagua Province of the O'Higgins Region. It is well known for the production of wickerwork. The city of around 17,000 people is placed in a rural and agricultural environment. Two mayor wineries are located within the urban area.

The odour problem that will be addressed in this pilot case is caused by a wastewater treatment plant that is nearly 15 years old. The plant consists of activated sludge technology which operates at medium load and a sludge age of between 7 and 10 days. Oxygen is supplied by surface aerators. The wineries are responsible for high organic loads during the grape harvest season, which eventually caused overloads and malfunctioning of the secondary treatment. Since some years now the winery wastewater is pretreated by a physical-chemical

step (dissolved air flotation) and a anaerobic treatment step. Pre-treated winery wastewater then is mixed with the domestic wastewater and treated in the secondary aerobic treatment. Primary flotation sludge is dewatered with a screw press, and the secondary sludge is dewatered with a belt press. Sludge then is then treated with lime to increase pH. The WWTP has three scrubbers and biofilters operation at several sections.

The WWTP is located in a rural setting around 1 to 1.5 km away from the city's urban limits. It has a record of odour complaints as approximately 10 houses are located in less than 150 m distance to the plant. After minor modifications of the WWTP, a new environmental permit was necessary and some studies on odour problems had to be conducted. Field inspections and repeated questionnaires were used to assess the actual odour impact and citizens nuisance.

Studies carried out by ECOTEC show a rather basic literacy which is common among older people living in rural areas. The average age of the people assessed within the questionnaires was about 50 being two thirds of them women. Younger people would rather leave the rural areas in order to seek higher education in bigger cities or search for better paid jobs. Men would rather work in agriculture, which might include not being at their homes for longer periods. Therefore mainly elderly women with low literacy might be the predominant persons to engage in the pilot. The use of cell phones is widespread in Chile, but in the rural area smartphones are rarely used. Also, most of the people use cell phones for communication purposes and might not be willing to install new apps. Data connection (3G, 4G) is good but users might have limited data plans or even just prepaid cards. This may pose a risk for D-NOSES regarding the use of OdourCollect in the Chilean pilot, although the data collection strategy will be adapted to be useful for the local conditions and the tools in the engagement toolkit customised as required.

Stakeholders include:

- Neighbours: ECOTEC is in direct contact with nearly all of them and has cultivated good relationships for nearly two years now.
- WWTP Operator: is ECOTEC's client for field inspections and surveys and has shown interest.
- Local government: no contact established to date.
- Environmental authorities: no contact established by now, but are in charge of deciding if field inspections and surveys will continue. The operator might keep them away from the intervention as the authorities are also in charge of fining.



Figure 36. Chimbarongo WWTP

4

CO-DESIGNING PILOT CASE STUDIES

This section presents initial ideas on how to conduct the preselected pilot case studies. The contents of this section build on the results of the workshop conducted in the consortium meeting held in Zaragoza (18-19th of September 2018) where partners were introduced to the D-NOSES engagement toolkit.

4.1. THE D-NOSES MODEL AND TOOLKIT IN ACTION

The D-NOSES Engagement Workshop carried out in Zaragoza was aimed to 1) present the engagement toolkit co-designed by partners IFC and MfC, with the support from Ibercivis, 2) build a shared understanding among partners about the odour problems experienced in each country, 3) present and discuss the potential pilot case studies and 4) start designing and planning the pilots in terms of the engagement strategy, to tools to be used and the timeline. This chapter presents the results of the pilot design exercise, for the six first pilots that will start in the first piloting cycle (Spain, Greece, Bulgaria, Chile, plus the two pilots in Portugal).

The D-NOSES Engagement workshop was the occasion to test the first version of the D-NOSES engagement model and toolkit. By selecting and combining the engagement activities proposed in the toolkit, the participants created a tentative timeline for their pilots. The overall goal was to invite pilot leaders to think about possible participatory strategies for the different stakeholders, identify tensions, mitigation strategies, propose tools and actions.

The resulting timelines are not meant to be a strict plan for the upcoming months. Rather they function as food-for-thought and a general guide. It is important to validate and iterate the proposed plan together with all the stakeholders who will be involved in a live co-design process, in order to align it with their availability and motivations, as well as with the particularities of the local contexts (e.g. in some countries, it might be very difficult to engage people during summer season or some tools may need to be adapted).



Figure 37: D-NOSES partners discussing and designing the pilots during the D-NOSES Engagement workshop.

The results show the diversity of the D-NOSES pilots in terms of odour emitting activities covered, socio-cultural contexts, type of solutions that can be put in place to mitigate the problem and the level of complexity for implementing them, both at the technical and the stakeholder engagement levels:

- The **Barcelona pilot** is characterised by several odour emitting sources and diverse socio-cultural and socio-economic communities affected, some of them already organized and active on the issue. The main challenge will lie in aligning stakeholders' interests and managing expectations in a complex odour emitting area.
- The **Thessaloniki pilot**, based on the case of a refinery industry, faces the challenge that a mitigation solution might be difficult to propose, as the industrial process itself cannot be altered significantly. Refineries are characterised by a continuous operation and a high amount of fugitive odour sources, and thus mitigation options are usually difficult to implement.
- The **Sofia pilot** focuses on waste collection and touches on human habits as well. In this case, it might be crucial to understand what aspects of the waste collection service causes odour problems. The solution might lie on fostering new habits among the population as well as improving the waste collection service.
- The **Porto pilot** explores the relationship between odour pollution and other environmental issues, such as river contamination and illegal dumping, and it will develop strategies to involve the general public of Tinto River Ecological Trail visitors.
- The **São João da Madeira pilot** will contribute to develop educational actions and training programs for families and students in order to empower them in taking odour

observations. Several actions with the population had been tested in the past to tackle the odour problem, although they didn't resulted in significant improvements of the situation. The challenge for D-NOSES will be to go far beyond past attempts.

- The **Chile pilot** brings the opportunity to test methodologies and tools in a context that is characterised by low literacy and little use of mobile technologies and Internet access. Thus, the D-NOSES engagement toolkit will have to be adapted accordingly.

Some of the strategies identified to engage participants in the different pilots include running educational campaigns, training programs, conducting beta pilots to test and validate data collection methods before scaling them up to the whole community, and creating groups of *community champions*²¹ who are keener than most to learn about odour pollution and data gathering and can pass the knowledge onto other pilot participants.

What is shared among all the pilots is the general goal to gain a better understanding of the problem by leveraging on the capacity of citizens (e.g. affected communities, general public, affected business, school children, etc.) and all the stakeholders, to collect real time data on odour episodes in order to characterise the problem and find possible mitigation strategies.

D-NOSES Engagement Workshop agenda

The following table presents the D-NOSES Engagement Workshop agenda:

Time	Description	Materials
9:00-9:15	Registration and badge collection	
9:15-9:20	Introduction of the meeting's agenda (IBERCIVIS)	
9:20-9:30	Introduction of the workshop goals (IFC)	
9:30 - 10:45	Presentation of 3 pilot case studies (25' per pilot): Spain (IBERCIVIS), Greece (ENV) and Chile (ECOTEC). Please read the instructions in the following document . Feel free to use and adapt the template, which is meant to guide you on choosing the content for your presentation.	Pilot presentation template
10:45 - 11:00	Coffee break	
11:00 - 12:15	Presentations of 3 pilot case studies (25' per pilot): Bulgaria (SOFIA_SM), Porto (LIPOR) and Sao Joao da Madeira (CMSJM). Please read the instructions in the following document . Feel free to use and adapt the template, which is meant to guide you on choosing the content for your presentation.	Pilot presentation template
12:15 - 12:30	Presentation of the D-NOSES engagement framework (IFC+MfC) Participants will be introduced to the overall engagement strategy and pilots structure (phases, goals, methods), which is the result of a combination of the engagement frameworks developed by IFC and MfC.	Presentation
12:30 - 13:15	Hands-on activity 1 - Role play activity on methods for engagement	

²¹ Citizen Sensing. A Toolkit. Making Sense. ISBN/EAN: 978-90-828215-0-5

13:15 - 14:15	Lunch break	
14:15 - 15:15	<p>Hands-on activity 2 - Engaging methods selection.</p> <p>The aim of this activity is to present a set of tools and methods (best practice) that can be used during the pilots. Such tools and methods will be presented through 'activity cards' that briefly explain how the tools work, when and why they can be used.</p> <p>The activity begins with teams reflecting on the purpose of their pilot and its expected impact. Each team is then asked to select the tools and methods that they would like to use during the pilot for growing the community they envision for it.</p> <p>Participants are invited to propose new methods and tools that they are familiar with and share back with the rest of the teams by filling out empty activity cards.</p>	Activities cards + empty cards
15:15 - 15:30	Coffee break	
15:30 - 16:30	<p>Hands-on activity 3 - Pilot timeline.</p> <p>The final activity will be the creation of an experience timeline (i.e, an actionable framework for participation) that brings together the output of the previous activities.</p> <p>Components in the timeline will be a set of cards where participants write down the kind of activity they want to develop, how, when and with whom. You and your team will express your plan in the form of a timeline that extends from the start of the project and goes all the way to your shared vision at the end of the project and possibly even beyond that. Each group will then create a plan for how they aim to bring the timeline to life over the next weeks and beyond.</p> <p>Tools and materials to inspire and help create this timeline will be provided.</p>	Timeline template
16:30 - 18:00	<p>Pilot cities presentation (15' per group)</p> <p>Each group presents their timeline and action plan. The discussion that follows will focus on the similarities and differences in the plans as well as the identification of ideas that can be shared across and between the pilot cities.</p>	
18:00 - 18:10	Closing remarks (IBERCIVIS)	

4.2 BARCELONA (Spain)

OVERALL STRATEGY

The Barcelona pilot case will address odour pollution in the Forum area, where diverse odour emitting sources co-exist (i.e. waste incinerator plant, bio-metanization waste treatment plant, waste pneumatic collection plant, covered wastewater treatment plant and wastewater sludge treatment plant). Given such variety of odour sources, the main goal of the pilot will be to identify which daily operations produce the greatest annoyance at different times of the day and to correlate this information with data of industrial operations at the treatment plants in order to co-design possible corrective measures to mitigate the nuisance.

In order to reach this goal, we will seek the collaboration and participation of different stakeholder groups; first the most affected citizens, but also emitting industries and public authorities that can contribute with the data of industrial operations causing the odour.

The data collection period will ideally last for one year, during which several odour observations per day and in different points of the neighborhood will be collected. The OdourCollect App will be used to collect and store data gathered during the pilot, together with several sensing stations located at critical points in the different neighbourhoods.

One of the main challenges is to engage pilot participants over a year-long period and reach great capillarity in data gathering. To address this challenge, we propose a strategy that allows to reach both geographical and temporal sampling and ensure sustained participation. The proposed strategy is based on three key elements:

- *Odour citizen experts & community champions*: We will form two core groups of participants (about 25 per group) who will be trained as odour experts and will lead the data gathering activities during two entire seasons (spring-summer, autumn-winter). They will also be involved in the co-creation of the complete sensing strategy for the pilot. These groups will be formed by people with a variety of skills (e.g. technological skills, different educational skills, community activists, data experts), high level of motivation, and leadership among the different communities, taking into account inclusiveness and gender criteria.
- *Odour sensing stations*: In order to ensure geographical coverage in the data collection, we will install odour sensing stations across key points of the neighborhoods. These stations are aimed to collect odour observations from passengers at any moment of the day at specific locations. The location of these stations will be co-designed with the collaboration of pilot participants and by drawing upon information from previous odour modeling studies and field panels. Some stations will be deployed at locations that are frequently visited in the Forum area (e.g. Museu Blau, Civic centers, Tram station, etc.). The community champions will be the guardians of the stations. For instance they can be in charge of notifying pilot coordinators in case of anomalies or technical problems. In order to increase awareness on the pilot and broaden the base of participants, the odour sensing stations will be co-designed and built in community workshops carried out in fab labs and makerspaces.
- *Sensory walks*: In order to ensure temporal coverage in data collection, sensory walks will be organised to collect data during specific times of the day. Sensory walks are collaborative walks through the neighborhood during which participants take notes about their observations on odours nuisances and use OdourCollect. Sensory walks can also be proposed as an educational activity to local schools and museums. Community champions can also organise sensory walks to cover moments of the day

where engagement might be difficult to achieve (e.g. during night) or to cover specific critical times of the day with higher impact (e.g. in times with unfavourable dispersion conditions).

In addition, wider activities using participatory strategies for an inclusive involvement of affected communities by odour issues in the Forum Area will be deployed. In order to comply with the D-NOSES inclusive engagement approach, participatory strategies will be identified to embrace the socio-cultural diversity of the Forum Area and gather views and data collection from people inhabiting the area. A gender perspective will be always taken into account.

PILOT TIMELINE & METHODS

MONTH 1 & 2 (November-December 2018)	
P1 FRAME	Meetings with regional authority (AMB), Barcelona city council, odour emitting sources First contact with local institutions to gain understanding on the odour problem and the stakeholders to involve (e.g. Museu Blau)
MONTH 3 - 4 (January - February 2019)	
P1 FRAME	Meeting with affected communities: CSOs AireNet, AAVV Zona Forum, AAVV Besòs Maresme. Continuous meetings with Museu Blau, AMB, City Councils, local businesses, UPC University Campus, odour emitting sources, etc.
P2 PILOT DESIGN	Communication campaign for the public pilot launch
MONTH 4 - 5 (February - March 2019)	
P2 PILOT DESIGN	<ul style="list-style-type: none"> ● Kick off meeting to co-define specific pilot goals with participants . Also to form the first group of community champions (approx. 25 people) who will be involved in all the next activities of the pilot ● Co-creation workshop with first group of community champions to co-design the sensing strategy ● Co-creation workshop to design the odour sensing stations in local makerspaces ● Co-design the training program for community champions ● Co-design data collection protocol for sensory walks
MONTH 5 - 10 (March - August 2019)	
P3 DATA COLLECTION	<ul style="list-style-type: none"> ● Training first groups of community champions ● Sensory walks (e.g. students, neighbours in civic associations, etc.) ● Install odour sensing stations ● Other participatory strategies to involve affected communities
MONTH 7 - 10 (May - August 2019)	
P3 DATA COLLECTION	<ul style="list-style-type: none"> ● Training second groups of community champions and data collection ● Sensory walks (e.g. students, neighbours in civic associations, etc.) ● Other participatory strategies to involve affected communities

P4 DATA ANALYSIS	<ul style="list-style-type: none"> Data analysis of the first three month of data. Correlations with daily operations data from the odour emitting sources. Continuous data analysis of all inputs collected. Identifications of situations of improvement for the different odour emitting sources.
MONTH 11 (September 2019)	
P5 ACTION	<ul style="list-style-type: none"> 1st workshop on co-creation of mitigation measures with industries, local communities and public authorities
MONTH 12 (October 2019)	
P5 ACTION P6 OUTPUTS	<ul style="list-style-type: none"> 2nd workshop on co-creation of actions Final event and celebration

4.3 THESSALONIKI (Greece)

OVERALL STRATEGY

The pilot case of Thessaloniki is characterised by the odorous nature of the problem, as well as potential environmental issues that derive from the process. The main goal of the pilot is to understand in depth the problem and find, if possible, a way to manage the odour pollution.

Key aspects that make the pilot challenging are, the process itself that is continuous and cannot be altered significantly, as well as the correlation between the level of ambient pollution and the frequency of odour complaints. These are two variables that need to be better understood and be interpreted in a way that will make the connection of information useful to all stakeholders. Another aspect is the fact that the area surrounding the refinery is industrial; therefore, an assessment needs to be done to investigate whether or to what extent other companies are also affecting the local citizens - apart from the refinery.

The steps that are necessary to achieve an effective conclusion depend on the level of engagement of the stakeholders. Regarding the local citizens, we plan to upskill those interested in participating, for instance by training them in filling in specialised questionnaires and using the OdourCollect app. From the local authority and university side, we anticipate that they will provide us with monitoring equipment that will be installed in several areas of interest, in order to correlate the odour observations with some chemical measurements. This is only possible in cases where a specific compound is the main odorant of a mixture and can be used as a tracer, although is not the usual case (environmental odours are usually complex mixtures of hundreds or thousands of volatile compounds). Tests will be carried out in order to see if chemical measurements are suitable for this case.

In addition, on top of data collection and interpretation, Envirometrics will conduct a study on the type of industries in the area to assess their potential contribution to the overall odour issue. Furthermore, the weather patterns will be taken into consideration for each odour

observation gathered. The end goal is to achieve a better understanding on the nature of the incidents, in terms of industrial process, weather specifics and type of nuisance that is being caused. Once achieved, possible ways to mitigate the issue will be co-designed with all the involved stakeholders.

PILOT TIMELINE & METHODS

MONTH 1 - 2 (October - November 2018)	
P1 FRAME	Meetings with local authorities + university
P1 FRAME	Meetings with Hellenic Pet (refinery)
P1 FRAME	Meetings with Facebook group citizen "Breathing is our right"
MONTH 3 - 5 (December 2018 - February 2019)	
P1 FRAME	Educational (recruitment) sessions. <i>Target: citizens, university students.</i> <ul style="list-style-type: none"> - sensory walks - training on odour
MONTH 5 (February 2019)	
P2 PILOT DESIGN	Workshop - Mapping the common within the Facebook community
P2 PILOT DESIGN	Workshop of co-designing a sensing strategy. <i>Target: citizens more interested</i>
MONTH 6-8 (March to May 2019)	
P3 DATA COLLECTION	Data collection with citizens (possibility to be continued after the Elections)
MONTH 8 (May 2019)	
P4 DATA ANALYSIS	Analysis of the data and results (<i>In the middle of the Major Election Campaign</i>)
P5 ACTION	Possibility to be continued after the Elections (timeline to be updated accordingly)
P6 OUTPUTS	

4.4 SOFIA (Bulgaria)

OVERALL STRATEGY

The key aspect that characterises the pilot strategy in Sofia is the need to gain a better understanding of the problem of odours generated by food waste. Here the goal is to get in closer touch with the stakeholders and to co-design corrective measures that are financially feasible for the municipality of Sofia and more likely to be accepted (adopted) by other stakeholders, including citizens and other food waste generators.

PILOT TIMELINE & METHODS

MONTH 1 (October 2018)	
P1 FRAME	Survey about service for HORECA and other business owners: <i>Would you like to take part in a research project to improve our services and reduce odour complaints associated to waste food management? How would you like to record this? Email/app?</i>
MONTH 2 - 3 (November - December 2018)	
P1 FRAME	First draft of survey & Feedback
P2 PILOT DESIGN	Co-design complaint and inspection database with municipality, inspectors and waste collectors, to analyse the main issues associated to the odour complaints
MONTH 3 - 5 (December 2018 - February 2019)	
P3 DATA COLLECTION	Collect complaints and inspections in a database
P4 DATA ANALYSIS	Collect and analyse survey results to identify the main issues associated to the odour complaints
MONTH 5 (February 2019)	
P2 PILOT DESIGN	Roundtable with representatives of all 24 districts in Sofia to discuss best practices and new ideas to reduce associated odour issues, open to the participation of citizens
P4 DATA ANALYSIS	Analyse the outcome of roundtable
MONTH 6 (March 2019)	
P2 PILOT DESIGN	Meeting conversation to discuss best practices with other countries Definition of new participatory strategies and tools if required Involvement of other types of stakeholders if required
MONTH 7 (April 2019)	
P5 ACTION	Develop best practices: Launch new chip for household food waste (Evaluation)

	=> Replication of the results to improve household food waste management in the city of Sofia, involving citizens
MONTH 8 (May 2019)	
P3 DATA COLLECTION	Repeat survey with HORECA and other businesses owners to evaluate the results of the corrective actions
MONTH 9 (June 2019)	
P4 DATA ANALYSIS	Survey results and analysis Analysis for actions at the level of households food waste, involving citizens
MONTH 10 - 12 (July - September 2019)	
P5 ACTION P6 OUTPUTS	Draft proposals to be included in regional waste management plan for odour control. Budget proposal for municipality & increase budget for food waste if data from citizens show a problem.

4.5 PORTO (Portugal)

OVERALL STRATEGY

There are many visitors that use the Tinto River Ecological Trail every day. The strategy consists on disseminating the project to these visitors and inviting them to use the OdourCollect app to help mapping the problems in the river *in situ*. The visitors are already there, so it will be very easy for them to collect the observations while they are visiting the Trail, while they increase their knowledge in odour pollution and awareness is raised.

To complement this, we will involve the stakeholders who are already committed to the project and have knowledge in the field. They can help to organise local workshops, suggesting best hours or days, determine the best way to disseminate the project (e.g. priest, local newspaper, local radio, social media) to reach to the population that is affected with the environmental issues at stake from the different municipalities.

PILOT TIMELINE & METHODS

MONTH 1 - 2 (October to November 2018)	
P1 FRAME	Workshop: Stakeholder mapping with existing network to reach wider community & present D-NOSES inputs on design
MONTH 3-4 (December 2018 to January 2019)	

P2 PILOT DESIGN	Formal presentation of the project
MONTH 4-6 (January to March 2019)	
P2 PILOT DESIGN	<p>Local workshops in different areas. Meeting with local and regional stakeholders of Rio Tinto (Red River)</p> <p><i>Target:</i> Local communities and actors. <i>When:</i> multiple, x5 workshops</p> <p>Training of the river guard</p> <p>Preparation of a sensorial space with good and bad smells, to be integrated into the circuit of visits</p> <p>Training actions in the 5 town councils involved, 1 to the Rio Tinto Defense Movement</p> <p>D-NOSES Informational Board Placement on Rail</p> <p>Implement alternative solutions to non-adopters of the new technologies - suggestion box</p>
MONTH 6 -8 (March to May 2019)	
P3 DATA COLLECTION	<p>Training in data collection: Sensory walks at Lipor installation / Kids trained with different odours: waste water sample, manure, river, etc. <i>Target:</i> all school kids. <i>When:</i> March - April - May</p> <p>Participatory data collection: sensory walks and classroom talks. <i>Target:</i> Kids, parents, environmental agents</p>
MONTH 9 -12 (June to September 2019)	
P3 DATA COLLECTION	<p>Adventure park activity</p> <p>Participatory data collection: sensory walks. <i>Target:</i> families, neighbours</p>
P4 DATA ANALYSIS	Analysis of all collected data to identify situations of improvement and co-design mitigation options with all involved stakeholders
MONTH 10 -15 (July to December 2019)	
P5 ACTION	Potential adoption of identified mitigation options.
P6 OUTPUTS	<p>Disclosure of the project in schools in Rio Tinto's area of influence</p> <p>Exhibition of documentary photography. Dissemination of the pilot results.</p>

4.6 SÃO JOÃO DA MADEIRA (Portugal)

OVERALL STRATEGY

The municipality of São João da Madeira has defined together with the D-NOSES Consortium, that its strategy for 2019 will be based on **environmental education with the central theme on odour**. Different actions will be developed with teachers and students of São João da Madeira, to raise awareness on the project and educate them on the theory and practice of odour pollution and monitoring. This will be done with the goal of training students and their families to be able to map odour episodes using the OdourCollect app and further participating in data analysis and in the co-design of mitigation options.

Regarding the general public, we intend to carry out a conference cycle, with the objective of informing the population about the topic, disseminating the project and the platform of odour registration, and raising awareness.

Furthermore, a meeting has already been held with the odour emitting company whose owner agreed to be a partner of the pilot and collaborate in the transfer of information and communicate the best available technologies.

PILOT TIMELINE & METHODS

MONTH 1 (October 2018)	
P1 FRAME	Exploratory conversation with industry (11th October municipal day of SJDM)
P2 PILOT DESIGN	General training in schools starts (in academic year 2018-2019, probably continuing in 2019-2020)
MONTH 2 - 4 (November 2018 - January 2019)	
P3 DATA COLLECTION	Sensory walks + physical installation
P5 ACTION	High level working group in odour pollution
MONTH 4 - 9 (January - May 2019)	
P3 DATA COLLECTION	OdourCollect + training kids The data collection should allow citizens from other municipalities to engage
MONTH 6 - 9 (March - May 2019)	
P3 DATA COLLECTION	Sensing diaries

P4 DATA ANALYSIS	Regular analysis of all data collected Feedback meeting with citizen & Feedback meeting with industries
MONTH 8 (May 2019)	
P5 ACTION	Co-design workshops with all engaged stakeholders to evaluate potential mitigation options
P6 OUTPUTS	Dissemination of results. Conference on Odour Pollution at University Aveiro.

4.7 CHIMBARONGO (Chile)

OVERALL STRATEGY

Even though the majority of people living in the pilot area are annoyed, previous field inspections commissioned by the WWTP and conducted by ECOTEC's odour experts did not show relevant odour exposure. This might be due to the "odour memory effect"²², but additional data need to be collected in order to confirm or discard this hypothesis. To avoid that only few positive odour measurements are reported, a short beta pilot is proposed to help to define and try out different methods of data gathering that might be suitable to the given context (OdourCollect App, pen-and-paper such as described in VDI 3883 part 2, others).

One of the main challenge of this pilot case is the fact that there is little technology literacy and limited access to mobile network with flat-rate among people living in this area. It is thus critical to design data gathering methods and tools that can be easily used by participants. For instance, it needs to be assessed whether it is feasible to use smartphone apps, such as Odour Collect, or whether it might be more appropriate to develop data gathering strategies based on SMS, for instance. Taking these considerations into account, the beta pilot will aim to test and iterate several different data gathering methods with a small group of participants. These will act as community champions in the successive pilot, encouraging the participation of other neighbours and providing them support in the data gathering process.

The beta pilot could be conducted during the summer season (December to March) or the spring period (March to May) when higher odour emissions can be expected due to higher temperatures and also higher organic loads.

As we have had good access to the neighbours, we assume to start the beta pilot fast, once the WWTP operator is willing to do so. A first meeting with technical staff from the WWTP on October 11, 2018 was positive, but still the decision of the higher management is pending. Contacts to local authorities (city mayor) will have to be established. Local authorities are aware of the problems and have a long record of dealing with odour complaints by citizens.

²² Olfactory memory refers to the recollection of odours. Studies have found various characteristics of common memories of odour memory, including persistence and high resistance to interference. It may happen that citizens affected by odour pollution for several years "recall" differently their past perceptions due to the memory effect or even to the feeling of the overall community.

With the results of the beta pilot the used methodology will be assessed and a decision will be made if the following pilot will take place in the area or another site will have to be chosen.

PILOT TIMELINE & METHODS

MONTH 1 - 2 (October - November 2018)	
P1 FRAME	Request permission to WWTP Contact community champions Search for places where to conduct the potential workshops Understand communication channels and technologies availability of the community
P2 PILOT DESIGN	Design the sensing strategy: <ul style="list-style-type: none"> - tools development (e.g. sensing diaries, questionnaires, OdourCollect) - training program Co-creation workshop to co-design the strategy & the tools
MONTH 3 - 4 (December 2018 - January 2019)	
P2 PILOT DESIGN	Training sessions: <ul style="list-style-type: none"> - visit to water plant - how to use sensing tools
MONTH 3 - 6 (December 2018 - March 2019)	
P3 DATA COLLECTION	Data collection through: <ul style="list-style-type: none"> - sensing notes - app mobile - operation diaries for workers
P4 DATA ANALYSIS	Check-in with community (once a month) to assess data quality and ongoing data analysis. How: calling them & face-to-face
MONTH 6 - 8 (March - May 2019)	
P4 DATA ANALYSIS	Provide feedback to users Plot data: did it smell? when? where?
MONTH 8 - 10 (May - July 2019)	
P5 ACTION	Meeting with WWTP to discuss results and plan future actions.
P6 OUTPUTS	Co-design workshop with the engaged stakeholders to identify mitigation options BBQ+celebration

5

FINAL REMARKS

This document has presented the *beta* version of the D-NOSES Engagement framework, a set of tools to put it into action, and initial results of how pilot partners completed the first phase of the framework. It provided an overview of cases of odour pollution that affect eight countries in Europe (Austria, Bulgaria, Greece, Germany, Italy, Portugal, Spain, UK) and Chile. This mapping has allowed to start building a knowledge base on odour sources, common problems generated by odour pollution and best practices on odour management and data collection. The deliverable also presents an initial plan for six citizen science interventions that have started in Q4 2018 and will continue in 2019 in Spain, Greece, Bulgaria, Portugal and Chile.

The proposed engagement framework does not seek to be a silver bullet for citizen science interventions in odour pollution, but rather it meant to provide a set of guidelines for stakeholders to create participatory pilots that put the concerns of citizens at the center of the process. Assessing and tackling odour pollution requires highly specialised knowledge. However, on the one hand, laypeople affected by the problem often have very little knowledge about the technical aspects of odour pollution, but have the best sensor to gather odour observations: their own noses. Thus, and helped through expert training, they are wonderful candidates to provide technically sound data to better understand the problem. On the other hand, the experts have little experience on how to collaborate with citizens in a horizontal and collaborative process. D-NOSES sits at the intersection of this challenge and pursues the goal of infrastructuring bottom-up participation so that citizens can contribute to tackle the issue by adding their valuable insights and knowledge as local experts, while upskilling odour experts and other stakeholders so that they can plan an intervention with citizens in mind.

The proposed framework provides a way to measure and compare pilots' results against a set of standardised phases and goals. This standardisation is instrumental to knowledge transfer, and, consequently, for informing public policies. However, while there is a need to standardise the approach to address each case study, we need to be careful not to erase the particularities of each situated case. The description of the D-NOSES pilot case studies provided in this deliverable shows their variety and richness, and explains why the framework has to be carefully adapted to tackle the different contexts, issues and community motivations.

This deliverable, although at an early stage of the project, already produces a number of contributions. It has presented an engagement framework and a set of tools to conduct citizen science interventions in odour pollution. It has provided structured knowledge on how to document cases of odour pollution, which can be used in the future for reporting odour cases through the International Odour Observatory. It has presented best practices on odour management, which can be used to foster basic ideas on how to tackle odour problems.

The results presented in this deliverable have built the base for the work to be conducted in the following months of the project (*WP5 - Local case studies for citizen science interventions and capacity building*). Pilot leaders are already in touch with local stakeholders of the selected case studies to explore the viability of the proposed plans and further co-design it with their support. The first pilot activities and data collection campaigns are expected to take place in early 2019, according to the preliminary timelines presented in the previous section. The timelines will be updated and co-designed in each pilot as the different stakeholders are getting involved, and thus proper participatory strategies and data collection methodologies adapted to the local contexts accordingly. In future deliverables, the results of the D-NOSES pilots will be further analysed and used for the second round of pilots (to be starting from September 2019). The overall analysis of the pilots will constitute the main results of D-NOSES, such as the DIY Guidelines for replicability, the scientific guidelines and the policy recommendations, in the form of the Green Paper in odour pollution and the medium to long term roadmap, to be delivered by the end of the project.