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| ***CHEMICAL ENGINEERINGTRANSACTIONS***  ***VOL. 82, 2020*** | A publication of |
| The Italian Association  of Chemical Engineering  Online at www.cetjournal.it |
| Guest Editors:Selena Sironi, Laura Capelli  Copyright © 2020, AIDIC Servizi S.r.l. **ISBN**978-88-95608-80-8;**ISSN** 2283-9216 | |

Developing of a New Spanish Standard "Building Collaborative Odour Maps through Citizen Science"

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There are many methodologies for assessing odour impact, such as dynamic olfactometry coupled with the use of dispersion models, field inspections, etc. However, none of these techniques is able to link this odour impact to the annoyance caused.

Traditionally, odour impact assessment has been carried out using what is known as *psychometry*. *Psychometry* is a field of study focusing on the theory and technique of psychological measurement that has been used for several decades in the odour field.

However, nowadays it is possible to assess odour impact using more advanced psychometric tools based on the use of mobile applications that record the exact time/ location of an odour observation.

The *International Environmental Association of Odour Managers* (AMIGO), along with other consultants, NGOs, odour emitting activities and public administrations, is developing the first text on mapping odour annoyance by using advanced psychometry. The proposed text will allow the unification of criteria when evaluating the odour annoyance.

After a consultation to the *Spanish Standardization Body* (UNE), it was recommended that, before developing a European Standard, a national standard could be developed, and afterwards, try to become it European. The 3rd of May 2019, took place the first meeting, and since them, several meetings have been carried out . The aim of this paper is to detail the work being done to date in this group to develop the first standard on mapping odour observations.

* 1. Introduction

Traditionally odour dose-response studies have been based on questionnaires, surveys, odour diaries, etc. under the scope of some guidelines and standards (e.g. VDI 3883). However, these methodologies have serious limitations. For example, they lack of some precision on recording in detail the time and location stamp of an odour incident.

However, it is now possible to assess odour impact using more advanced psychometric tools based on the use of mobile applications that allow the exact location and minute of an odour incidence to be recorded.

To date, there are no technical standards to our knowledge, that regulate this methodology, although there are several tools on the market. This is why the initiative to elaborate this standard arises due to the need to standardize the use of this type of technologies that evaluate and map the odour nuisance through the use of citizen science.

The development of this standard is being carried out by a group of experts including some of the actors involved in the subject: consultancies, laboratories, public administration, industrial managers and owners, associations and NGOs. This group has the goal to have a first draft in May.

There have been 3 virtual meetings and 2 face-to-face meetings with all members, till the writing of this text. In addition, there have been multiple meetings of the task groups. The first virtual meeting started with a total of 10 participants. As of today, the group already has a total of 22 volunteers.

The aim of this paper is to describe the work being done at this stage by a group of odour experts from Spain to publish the first standard/guideline that will deal with odour mapping by using citizen science.

* 1. Index

An initial structure was proposed for the index of the document, reviewed by each TG that it’s as follows:

1. Objectives and scope
2. Reference standards
3. Terms and definitions
4. Symbols and abbreviations
5. Participation and transparency
   1. Participation
      1. Actors involved, roles and responsibilities
      2. Action group
   2. Transparency
      1. Entitlement to information or right to information
         1. Communication tools design
         2. Joint evaluation plans design
6. Methodology
   1. Definition of the evaluation area
   2. Coordinator and participants of the citizen science project
      1. Director and coordinator of odor episode alerts
      2. Selection of participants (citizens' panel)
   3. Form Design
   4. Duration of monitoring
7. Plausibility verification
   1. Minimum criteria of representativeness
   2. Minimum criteria for using meteorology
   3. Minimum criteria for using mathematical dispersion algorithms
   4. Other verifications
   5. Task Groups

During the course of the different meetings, several topics have been discussed, among which the following can be highlighted:

* The intention to develop a standard, although it may eventually become a technical guide.
* The need to get funding, to take the standard forward in the Spanish Standardization body.
* The work has been divided into three blocks and three working groups have been created:
  + TG01 Participation and transparency
  + TG02 Methodology
  + TG03 Plausibility verification

Based on this division of tasks, a draft index was defined, as shown in previous section.

The way of working has been defined, based on the creation of an online shared folder, where each task group works on its document and in face-to-face meetings all the work done is shared and decisions are not made until consensus is reached.

* 1. Task Groups

As mentioned above, the work for developing this Standard has been divided into three task groups. The volunteers have chosen to collaborate among one or two task groups, depending on their own experience and interests, and a group coordinator has been elected for each TG. So far, each group has worked independently on the following.

* 1. TG01 - Participation and transparency

The task group TG01 has divided this task into 2 sections: participation and transparency.

In the *participation section*, it is proposed, first of all, to define the actors involved, the different roles and responsibilities:

* **Potential odour impact emitters**: represented by all those industries that generate odour in their daily activities and which may be a potential source of nuisance in either a residential or industrial environment (waste-water treatment plants, waste management centres, pet food production, slaughterhouses, etc.).
* **Potential receptors of the odour impact**: represented by citizens in general and people located close to industrial areas.
* **Government authorities**: represented by organism in charge of control process and communication.
* **Universities, research centres or other organizations** as bilateral groups.

Moreover, the action group has to be defined, which will be constituted by an interdisciplinary team of people and organisms to develop the main action. This group shall consist of the key actors mentioned beforehand. It is essential that the action group takes a proactive position, understanding and respecting the different actors within the same group.

Some of the roles of the main actors are highlighted below:

* Potential emitters must have knowledge of all the processes and activities that may generate potential odor emissions and will play an active role in resolving the impacts they generate.
* Potential receptors; one of the key tasks will be the reporting of nuisance or impact due to odor. These reports should be objective regarding the existence or not of odor, the degree of discomfort or intensity.
* Government authorities will have as their main and transversal role in the odor mapping process to be the mediator between all the entities involved. On the other hand, they must also inform and be informed, control the incidents produced, coordinate the Action Group, as well as encourage and promote citizen participation. Government authorities will be to establishing norms, guidelines, as well.
* Universities, research centres or other organizations will generate valuable information and advice in the process of dialogue and progress for the identification and expansion of information, as well as to create complementary ways to solve the problem.

In the *transparency section*, the right to information is defined through several guidelines, such as the design of communication tools, a communication portal, basic content, project image, etc.

This section should also include the design of joint evaluation plans, in order to strengthen the legitimacy of the evaluation group, select follow-up indicators, identify and eliminate conflicts of interest, make the evaluation visible, etc.

* 1. TG02 -Methodology

There are many apps in the market dealing with mapping odours such as *Nasapp*, *Odourmap*, *Odour Collect*, etc. The aim of this group is to specify, what these apps should contain in order to have a better representativeness of an odour mapping project, in order to be comparable with each other, repeatable, reproducible and consistent.

The group coordinator has prepared a document in which he has included the following:

First of all, the evaluation area must be defined and delimited according to the characteristics of the source(s) and taking into account when there is one or more of them.

Several roles should be defined inside the project: a coordinator, a director and participants of the citizen science project are then selected. The responsibilities and tasks to be carried out by each actor must be defined. The director must be particularly careful to ensure that participants comply with the established criteria at all times. A minimum number of participants is established according to the population density and the number of existing odour-emitting sources. This number of participants must be maintained throughout the whole project. **In addition, the participants must receive training** in odour identification on a regular basis to maintain motivation and their engagement throughout the duration of the Project.

Moreover, in order to be completely inclusive, it is proposed to collect data in 3 ways:

* On paper form
* In digital format
* Through a computer tool (app)

For this purpose, a form has been proposed to be collected on digital format or on paper, or when applicable, the data should be collected in each record through the app. This last option provides automatically the real time and position (coordinates) of each odour record.

In addition, the duration of monitoring period should be defined. The time of the project should be the maximum possible to contain different meteorological conditions along a year. At this stage, the text recommends that the duration of the project should be 12 months (establishing a minimum of 6 months).

Finally, the procedure for measuring/verifying the results obtained must be defined in accordance with the task group 3 that deals with plausibility check.

* 1. TG03 - Plausibility verification

Odour observations depend on 1) *experience*, 2) *expectation*, 3) *motivation* and 4) *alertness*. For example, if you play hide-and-seek many times, your *experience* will tell you that there will probably be someone below the bed. Also you will *expect* to be hiding in the next go and for this reason you will be highly *motivated* to seek anywhere. Also your senses will be more *alert* to perceive small noticeable differences that will indicate that someone is around.

The *observer effect* is a type of reactivity in which individuals modify an aspect of their behaviour in response to their awareness of being observed. This can undermine the integrity of the results of a project, that is why, there is a need for a check on the plausibility of the odour observations.

Having people experienced, motivated, alerted and with expectations to change an odour-impact situation, will produce a certain bias in the results. The aim of the plausibility checks is not to correct that bias, but to check that the participant’s observation could be fairly correct.

The easiest way to check if an odour observation was right or wrong is by checking wind direction/intensity at a suitable weather station. The German standard *VDI 3883-4*has been proposed as a basis to start this section of plausibility verification, which checks plausibility according to meteorology. However, using just meteorological observations will not be sufficient, for example, in cases were complex topography, unknown odour sources or changing land uses that are relevant to a case study. That is why, the use of dispersion modelling with the calculation of retrotrajectories are useful in many cases.

However, TG3 has considered other factors to check plausibility observations, such as the group effect, that is, the number of similar reports made on the same time. The minimum number of reports from different participants and the time period in which they are received should be defined by the group members, depending on statistics, learned experiences or by consensus (still to be defined). Also, the radius of application (study area), the odour typology, and taking into account land use(rural, industrial, etc) or whether the odours come from one or several sources, should be defined.

Several thoughts and experiences were shared, in which the validity of complaints was treated according to the size of the population and the number of plants in the studied area and taking into account the quality and intensity of the odour.

Also the possibility of validate meteorology using different methods was proposed by the use of: 1. Weather stations, 2. Weather models, 3. Transport models and 4. Odour dispersion models.

All these proposals from the experiences and know-how of the volunteers of the group, who have been working in these area for years, are on the table and must be treated and voted based on, first of all, scientific information, and if not possible, in learned cases from the past.

* 1. Conclusions

The aim of this paper is to describe the work being done at this stage by a group of odour experts from Spain to publish the first standard/guideline that will deal with odour mapping by using citizen science. By the time this paper is written, there is no draft available to comment, but a wide set of different documents that have to be integrated into a single comment.

As the development of a national Standard is not an easy task, no publication date is foreseen for this standard. However we expect to share the first draft of the standard during next NOSE2020 in order to have some feedback from the odour experts present in the auditorium.

Acknowledgments

This group wish to show its appreciation to all the volunteers of the group that are contributing to the development of this Spanish Standard, as they have dedicated part of their time, their expertise, know-howand money for travelling, as well as the enthusiasm shown and the work done during all these months. Thank you all!

Besides, we will like to thank the work of Ms. *Nancy Castaño* from Colombia, for sharing her own experience and the statistics engine to calculate representativeness of odour observations, and to even attending video-meetings very early in the morning.

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