

INTRODUCTION

In 2017, Lab Service Analytica received funding from the European Commission's H2020 SME Inst. R&I program for the Project "OdorPrep". An integrated system for continuous air quality monitoring and on-demand sampling of odours, Odorprep is an alternative to having a technician on-site. The system samples odours after a complaint has been made, for chemical / olfactometric analysis. Automatic sampling can be activated via the OdorPrep App (available on playstore), this allows the user to remotely control the odour analysis process. Over the last few years, demonstration exercises have taken place in industrially relevant sites. Two case studies.

EXPERIMENTAL and DATA ANALYSIS (ISSeP and Université of Liege)

Belgium Case Study: The study in Belgium was performed alongside the local authorities. They oversaw activation of the sampling devices located in close proximity to industrial areas. Two Odorprep samplers were installed in Engis, a polluted industrial valley, where odour complaints are common. The campaign lasted from November 2018 to September 2019. Two trailers, from the ISSeP institution, equipped with air quality analyzers, measured bihourly NH₃, H₂S, BTEX, limonene and pinene. A meteorological station measured wind direction and speed, T, RH and pressure. Olfactometric analysis was performed by ULiège SAM laboratory with a TO Evolution 6FC according to EN 13725. Odour dispersion modelling was executed with ADMS 5 software (CERC).

EXPERIMENTAL and DATA ANALYSIS (T&A and Lab Service Analytica)

Italian Case Study: The study involved a sanitary landfill for non-hazardous waste (213.000 m² surface and an overall capacity of 6.2 Mm³) located 3 km from Statte, South Italy. Emission of malodorous gas was monitored by an H₂S continuous analyser and by an IOMS. When the threshold for malodour was exceeded, multiple samples were taken by the automatic management system and air sampler in the Odorprep. These were later analyzed by an olfactometry laboratory according to the standard method EN 13725:2004. Alert situations (established with Apulian Environmental Protection Agency), consisted of 2 consecutive measurements at 5 minute intervals by the H₂S analyser of 20 ppb or when overall odour emissions measured by the IOMS exceeded 500 OU/m³ for more than 5 minutes.

RESULTS

Odour concentrations measured after OdorPrep sampling are illustrated below. JWS stands for Joseph Wauters 'School (Engis, Belgio) - PR stands for Prayon Parking lot (Engis, Belgio)

| Sampling date | Sampling time | Analysis date | Results (uo _e /m ³) | Sampling site | Number of bags |
|---------------|---------------|---------------|--|---------------|----------------|
| 15/01/2019 | 13:30 | 16/01/2019 | 54 | JWS | 2 |
| 15/01/2019 | 12:20 | 16/01/2019 | 69 | PR | 2 |
| 18/01/2019 | 09:03 | 18/01/2019 | 494 | JWS | 2 |
| 18/01/2019 | 09:03 | 18/01/2019 | 177 | PR | 2 |
| 25/02/2019 | 13:50 | 26/02/2019 | 112 | PR | 2 |
| 25/02/2019 | 13:50 | 26/02/2019 | 32 | JWS | 2 |
| 26/02/2019 | 14:00 | 27/02/2019 | 79 | JWS | 2 |
| 26/06/2019 | 09:53 | 28/06/2019 | 69 | JWS | 2 |
| 08/08/2019 | 08:30 | 09/08/2019 | 27 | JWS | 2 |

JWS stand for Joseph Wauters' School (Engis, Belgium) – PR stands for Prayon's parking lot (Engis, Belgium)

Table 1: some olfactometric results

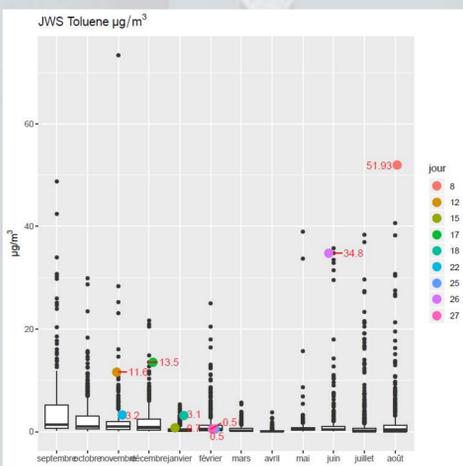


Figure 2: Toluene concentration at Odorprep location. coloured dots: odour events; red numbers: ouE/m³

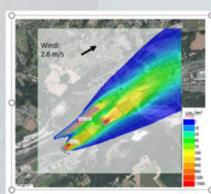
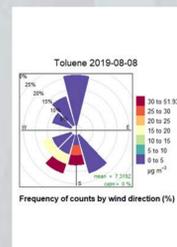


Figure 3: Instant plume for 15/01/2019



Figure 1: Odorprep location (Belgium case)

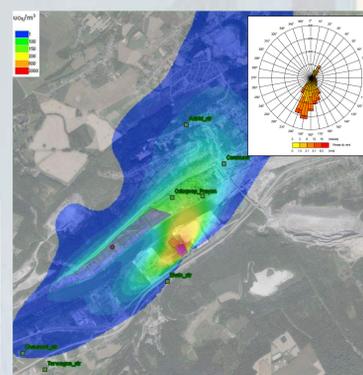


Figure 4: average concentration (ADMS modelling) November 2018 to March 2019.

RESULTS

OdorPrep system application

Application 1:

Training the IOMS to quantify odour emissions from a large landfill

Air samples collected by OdorPrep at the boundary of the sanitary landfill, were used for the training step of the IOMS; the figure 5 shows the sensor response.

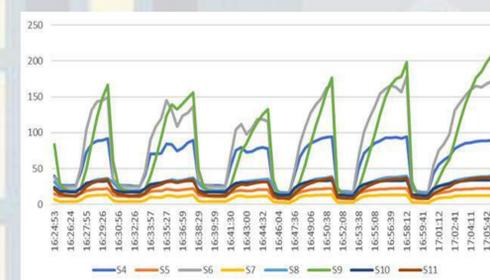


Figure 5: Sensor's response at different samples collected by OdorPrep System.

Odorprep was useful in the training phase as it sampled air at landfill boundary (not at the source) thus representing the same odours potentially perceived by a human receptor, being so suitable for training the IOMS.

Application 2:

Assessing the reliability of IOMS to predict odour emission from the sanitary landfill

A total of 133 alert situations occurred during 10 months of investigation from January to October 2019.

The IOMS predicted odour values with good correlation ($R^2 = 0.61$) between data obtained from samples collected by Odorprep and measured by dynamic olfactometry (UNI EN 13725:2003)

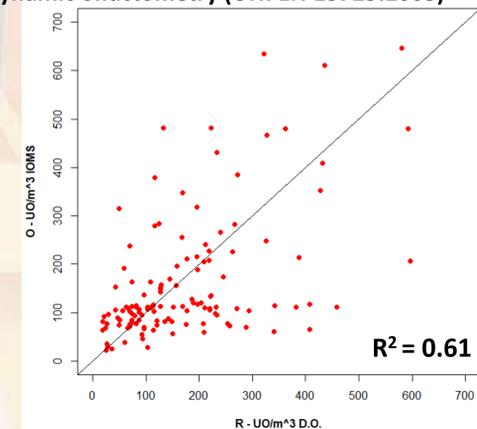


Figure 6: Correlation between the odour concentration monitored by IOMS and the corresponding measurements obtained by dynamic olfactometry (D.O.) during the 133 alert situations.

CONCLUSION

An automatic sampler allows scientists to counter the usual limitations of sampling at the receptor site (i.e. short exposure time and low concentrations). The Odorprep automated sampler is ideal for cases where there would be frequent sampling and always at the same place. The remote control and system conditioning allows for sampling at any time of the day (and night). The systems representativeness is accurate and all materials used ensure no contamination of the odour sample. One aim was to use the odour concentrations measured at the receptor level close to the Odorprep samplers in order to estimate an odour emission rate. This emission rate will then be used to estimate the odour concentration at receptor site.

CONCLUSION

The Odorprep automated sampler is ideal for real-time monitoring of odour impact in a sanitary landfill for non-hazardous waste.

In particular, the Odorprep is extremely useful for the following tasks:

- 1) Training the IOMS to quantify the odours emitted from the landfill;
- 2) Assessing the reliability of IOMS to predict odours in real-time.

The extensive monitoring and the data set collected from this case study strongly supports integrating an IOMS for real-time continuous odour monitoring at the fence of a plant, coupled with the Odorprep automated sampler to capture reliable samples.