



Corso di Dottorato di Ricerca in Scienze della Vita e dell'Ambiente - Ciclo XXXIX

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“WASTE TREATMENT AND DISPOSAL PLANT: EVALUATION OF EMISSION IMPACT AND AIR QUALITY”

Celeste Napolitano

Introduction

Odours are one of the main negative aspects in terms of environmental impact for certain types of industrial facilities, such as water treatment and waste disposal plants. An odour is a volatile chemical substance that triggers an olfactory response that can be of two types - 'bottom-up': a process that starts from the stimulus; -'top-down': starts from an individual's experience, expectations and beliefs. Although no direct effects of odour nuisance on health have been demonstrated, it causes significant and persistent discomfort for those living in the vicinity of these activities and also generates potential conflicts both in relation to existing plants and activities and in the choice of sites for new settlements.

The main objective of the three-year research project is to acquire a scientific basis to support the development of technical standards on odour measurement and limit values for odorous substances from landfills. The measurement of pollutants and the study of odour emissions began in May 2024.

The pollutants considered are ammonia (NH_3) and hydrogen sulphide (H_2S). Setting regulatory limits to minimise the likelihood of odour impact is a problem, which is linked to the subjectivity of olfactory perception and how odours are measured and analysed.

Another important factor is the feedback from the public, for evaluating of odors.

Experimental

➤ Field Sampling:

➤ Air monitoring cabins:

- two sampling points: PA1 (downstream) and PA2 (upstream)
- real- time and continuous data acquisition (hourly)

➤ From 1 Jun 2024 to 30 April 2025

➤ Sensor characteristics:

- The NH_3 analyser is chemiluminescent, and uses a single reaction chamber, a single photomultiplier which cyclically enables the measurement of NO and NO_x .
- The H_2S analyser consists of a sulphur dioxide analysis system coupled to a catalytic converter capable of oxidising H_2S to SO_2 .

Study Area

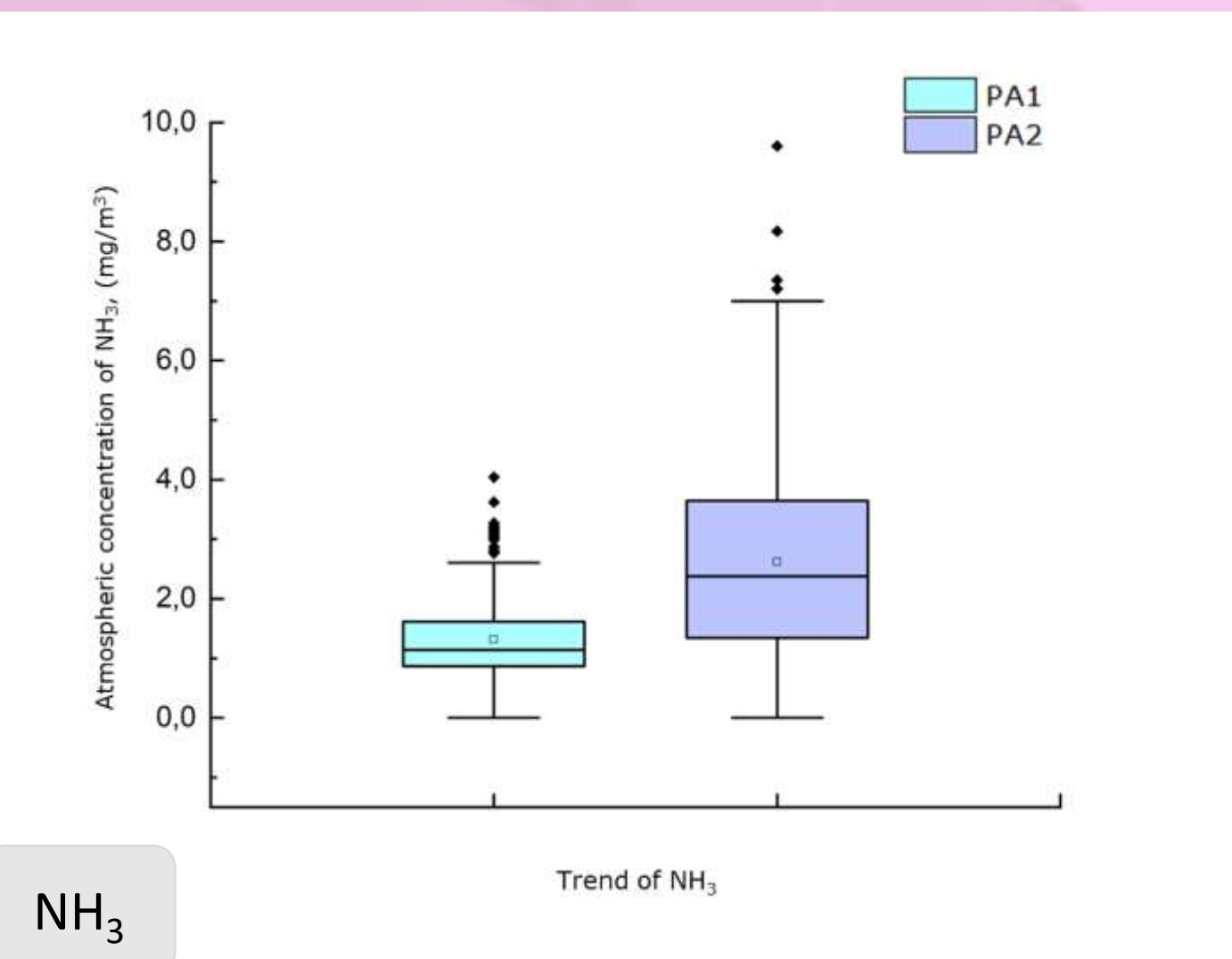


Map of the landfill site with the two air sampling points (PA1 and PA2)

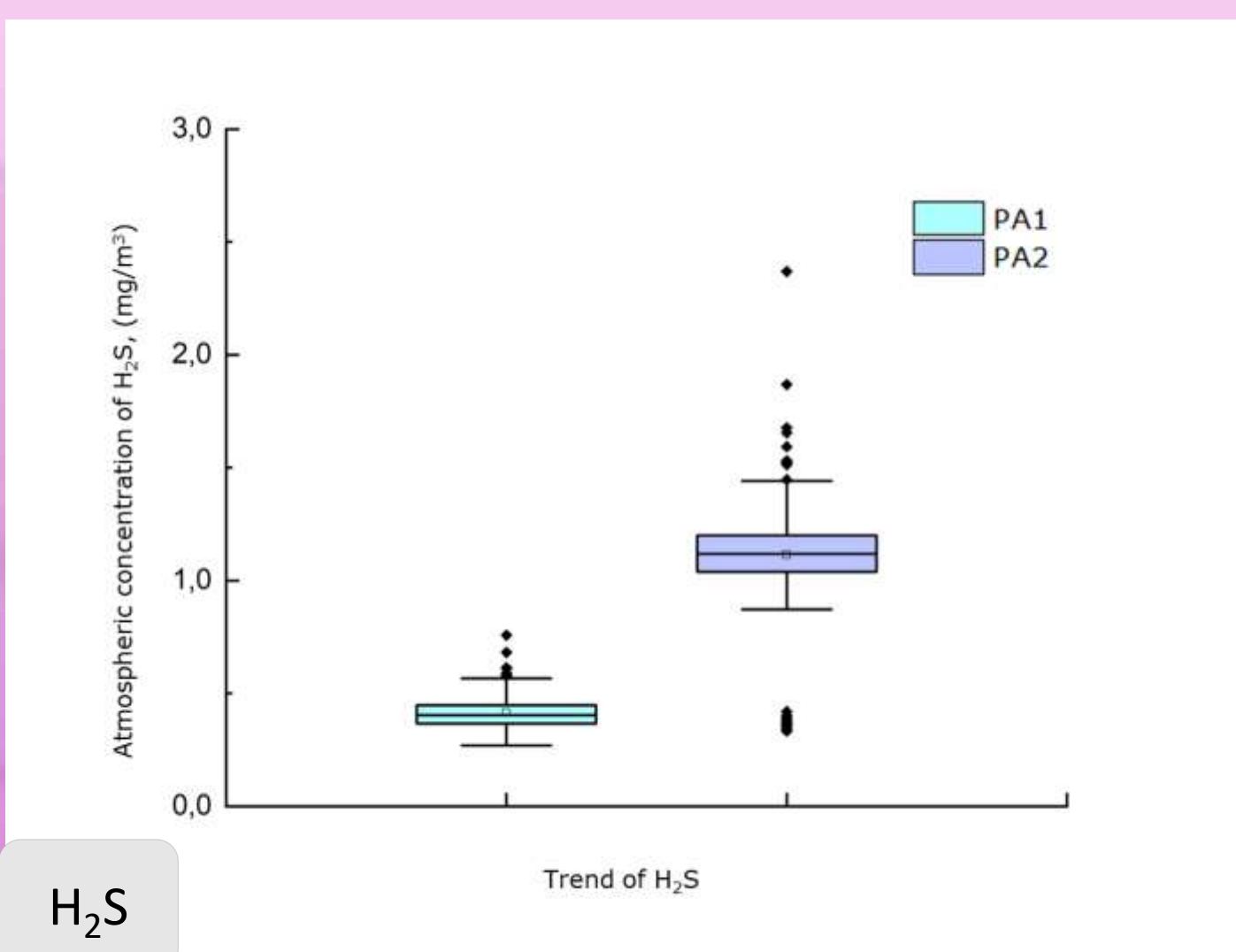


Monitoring cabin

Results and discussion



NH_3

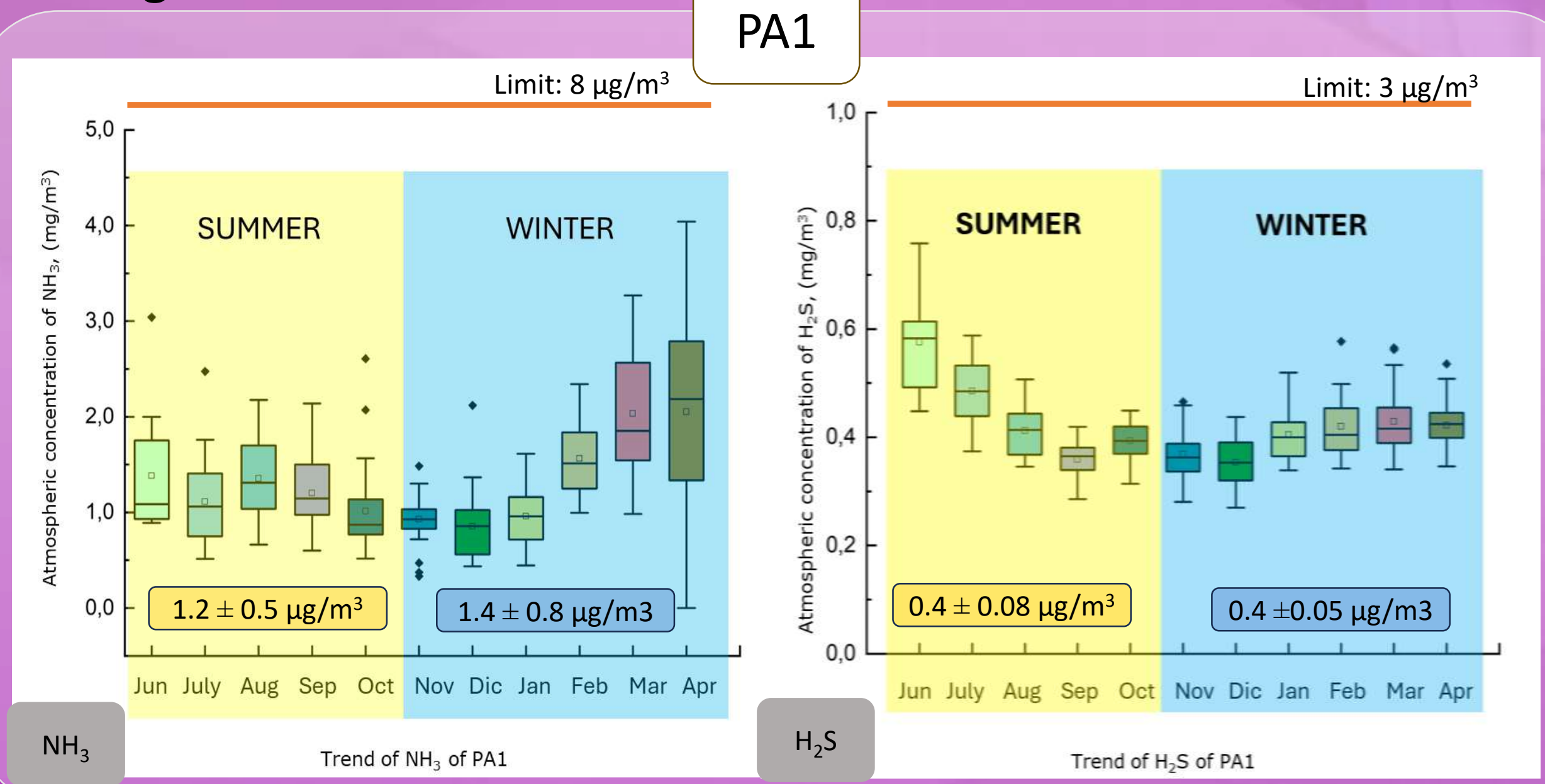


H_2S

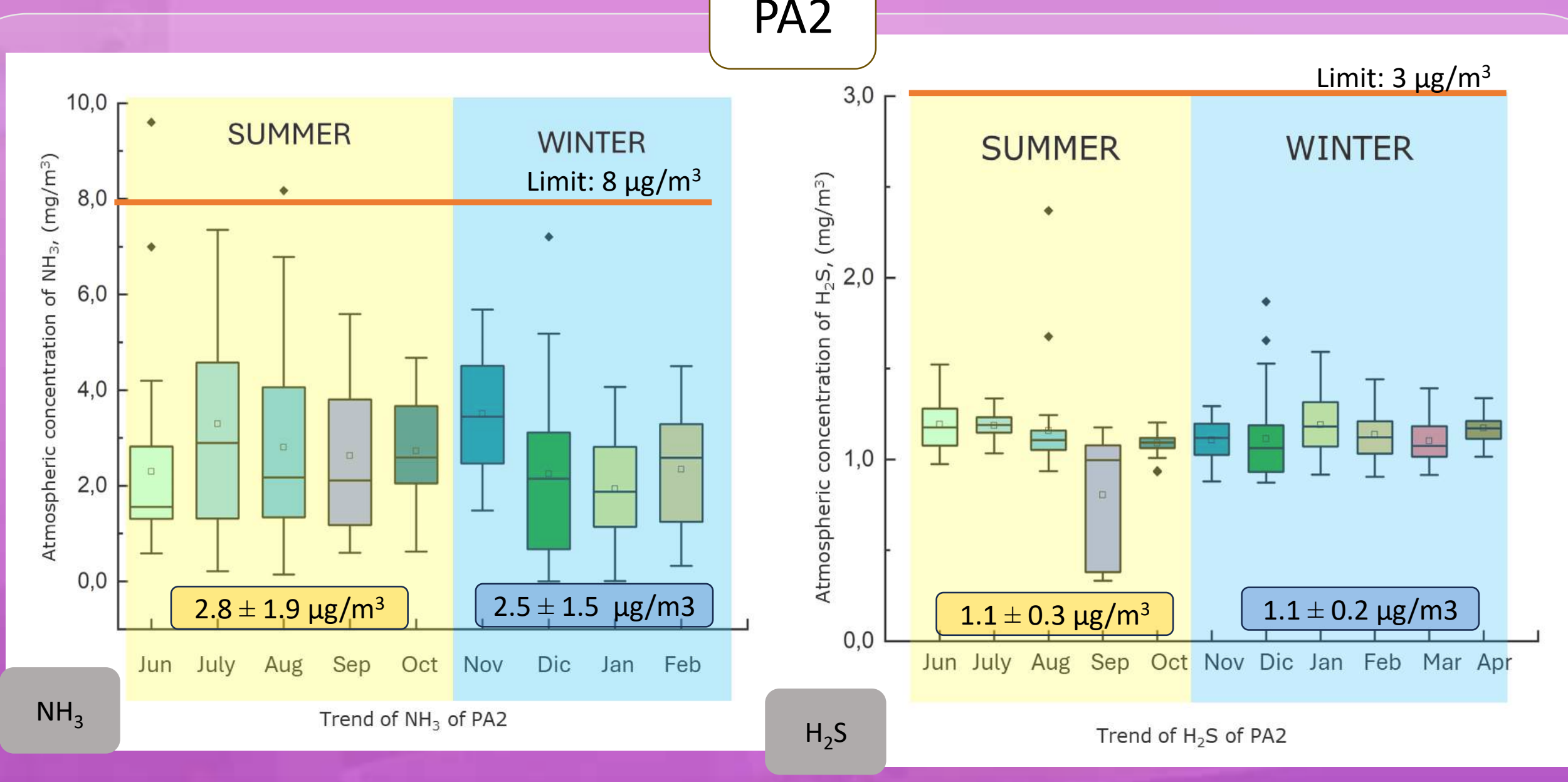
➤ Values in PA2 are higher than those in PA1

- $\text{NH}_{3\text{PA1}} < \text{NH}_{3\text{PA2}}$
 $1.3 \pm 0.7 < 2.6 \pm 1.7$
- $\text{H}_{2\text{SPA1}} < \text{H}_{2\text{SPA2}}$
 $0.4 \pm 0.1 < 1.1 \pm 0.2$

Odorigen conctect



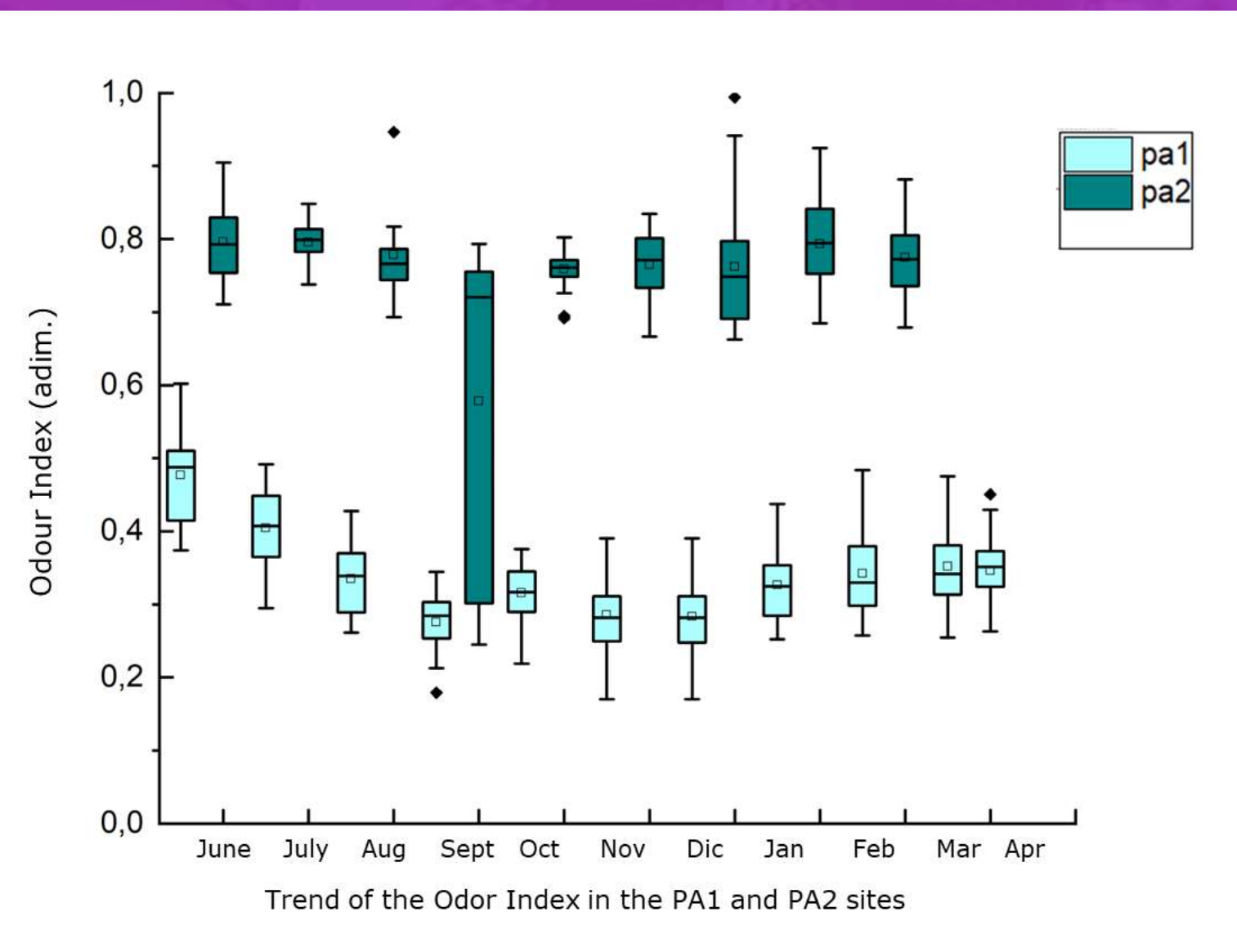
PA1



PA2

The overall avarage concentration oh NH_3 and H_2S did not vary between summer and winter. However mounthly NH_3 content an increase during the summer period, while H_2S tended to decrease.

At this site, both NH_3 and H_2S show a constant trend over the sampling period.



Odour Index (OI)

OT: minimum concentration of an odorous substance
OI: standardize and make comparable the assessments of odor perception, based on the logarithm of the SOAV, which provides an overall measure of the odorous activity of the mixture of compounds in an air sample.

$$\text{OAV} = \text{Ci} / \text{OTi}$$

(Ci: actual odour concentration, measured in odour units per cubic metre (o.u./m3)
(OTi: odour threshold, which is defined as the minimum concentration at which at least 50% of people can perceive the odour)

Results:

$$\text{OT}_{\text{PA1}} < \text{OT}_{\text{PA2}}$$
$$\downarrow \quad \downarrow$$
$$0.3 \pm 0.1 < 0.8 \pm 0.1$$

Conclusions:

1. Preliminary results on odour emissions in a landfill.
2. PA2 showed higher values of contaminants than PA1.
3. PA1 showed a seasonal trend of both NH_3 and H_2S concentrations.
4. Values were below legal limits, with the exception of some few values of NH_3 and H_2S in PA2. OT values in PA2 were very close to the odour perception threshold of 1.

Future perspectives

- Analysis of the effect of meteorological phenomena on pollutants;
- Move the point (in agreement with the provincial orders);
- Sampling of PM_{10} sub-fractions (by cascade impactor).