

DISPERSION MODELLING AS A TOOL FOR ASSESSMENT AND MANAGEMENT OF ODOUR EMISSIONS FROM WASTEWATER TREATMENT PLANT

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global omnium



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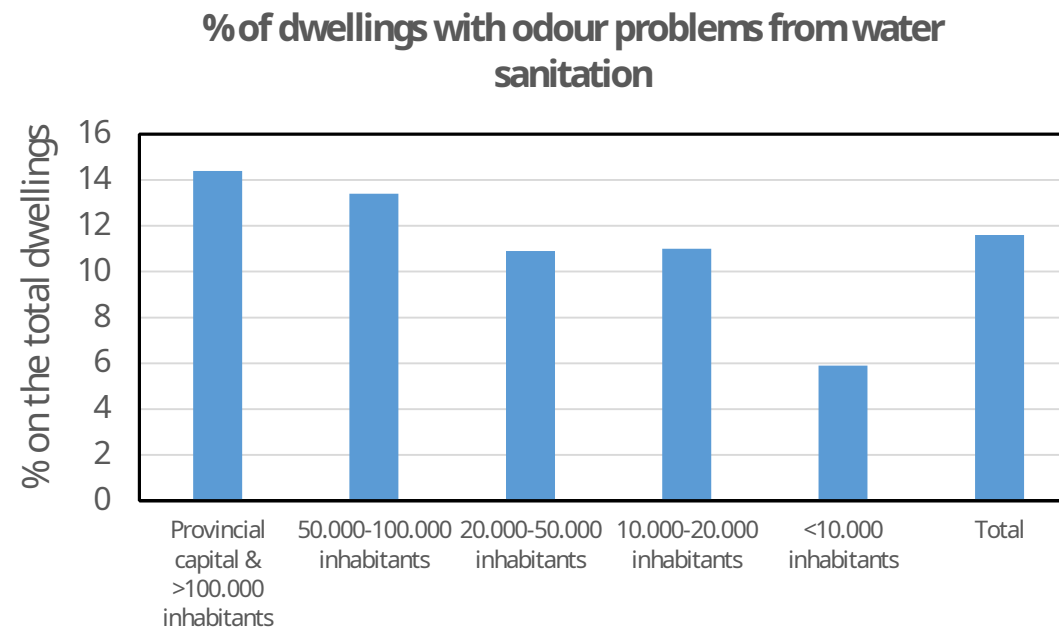
1. Introduction

1.1 Odour annoyances in Spain

Percentage of homes that report having pollution or bad odours



INE. Population and housing census 2001



INE. Household and Environment Survey 2008

1. Introduction

1.1 Odour annoyances in Spain

EL CORREO

Bizkaia

Costa Bermeo Gernika Lekeitio Ondarroa Markina Mundaka Playas de Bizkaia

La depuradora de Munitibar evitará malos olores en su puesta en marcha en verano



La semana que viene comenzarán las pruebas eléctricas de la nueva planta de fecales que ha exigido una inversión de millones de euros

EL COMERCIO

Gijón

Calles de Gijón Barrios de Gijón Villaviecosa Gozón Carreño Sporting

Los vecinos de El Natahoyo protestan por los malos olores en el barrio



capital & >100.000 inhabitants

inhabitants

INE. Hou

odour problems from water sanitation

LA VERDAD

Región **Cieza**

Los vecinos de Cieza vuelven a reclamar soluciones ante los malos olores



Afectados de Santa Clara y otros barrios irrumpen en el Pleno para exigir soluciones al hedor que sufren de las aguas sin depurar de los polígonos

Total

08

INE. Population and housing cen

La Opinión DE MÁLAGA

Málaga Actualidad Deportes Turismo Economía Opinión Cultura Ocio

Málaga Municipios Málaga Costa del Sol Occidental Axarquía Turismo Semana Santa

FÚTBOL Los videos con los goles de la jornada de LaLiga Santander / Los goles de LaLiga Su

laopiniondemalaga.es » Axarquía » Noticias de Rincón de la Victoria

Noticias de Rincón de la Victoria Noticias de La Axarquía

Medio Ambiente

La Mancomunidad elimina los olores de la depuradora de Rincón

La empresa pública Axarquía aplica nuevos sistemas de desodorización, por la cercanía de la EDAR a los núcleos próximos a Añoreta, y mejora la eficiencia energética de estas instalaciones

From: Extremesa / 19-04-2019 / 06:00

La empresa pública Axarquía, dependiente de la Mancomunidad de Municipios de la Costa del Sol-Axarquía y encargada de la gestión del agua en alta procedente del embalse de la Viñuela o del mantenimiento de las principales depuradoras de la comarca oriental, acaba de aplicar nuevos sistemas de desodorización para eliminar olores en la EDAR de Rincón de la Victoria. Estas instalaciones son especialmente sensibles «por la proximidad de las viviendas, al estar localizada en las proximidades de las urbanizaciones y del campo de golf de Añoreta».

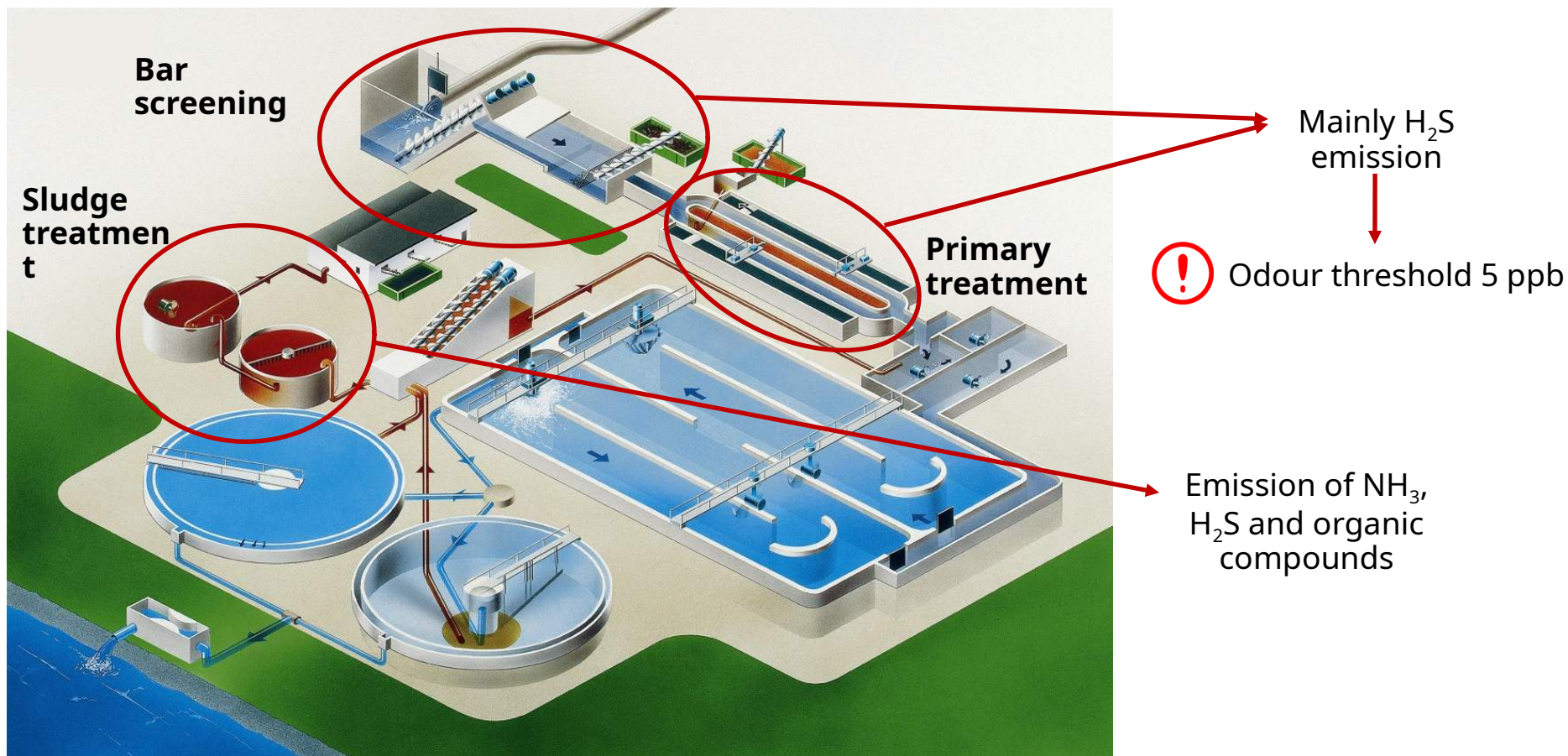
Las instalaciones de la depuradora se encuentran a pocos metros del núcleo urbano de Rincón de la Victoria.



Las instalaciones de la depuradora se encuentran a pocos metros del núcleo urbano de Rincón de la Victoria.

1. Introduction

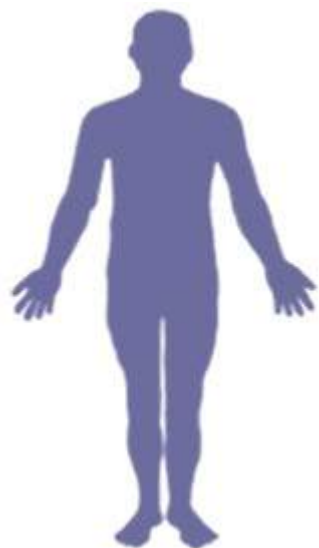
1.2 Odour source in WWTP



1. Introduction

1.3 Effects of odours in human beings

On health



- Stress
- Anxiety
- Irrational attitude

Brennan (1993) and Gostelow et al. (2001)

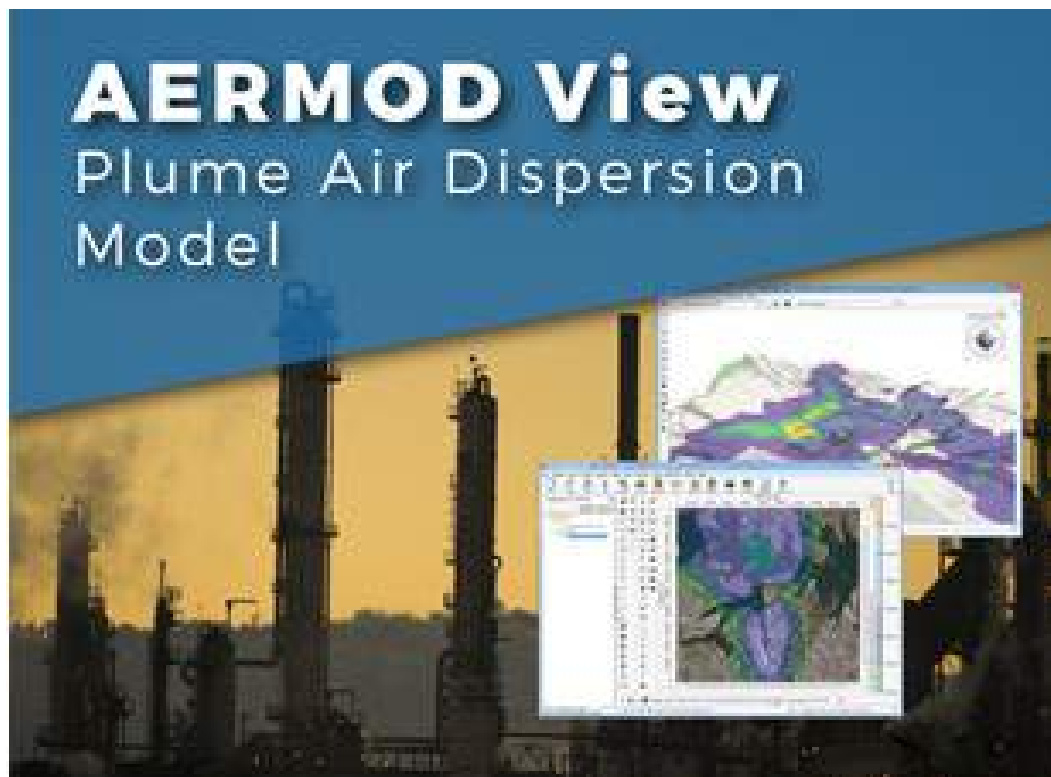
On image of facility manager



Gostelow et al. (2000)

1. Introduction

1.4 Dispersion Modelling



AERMOD:

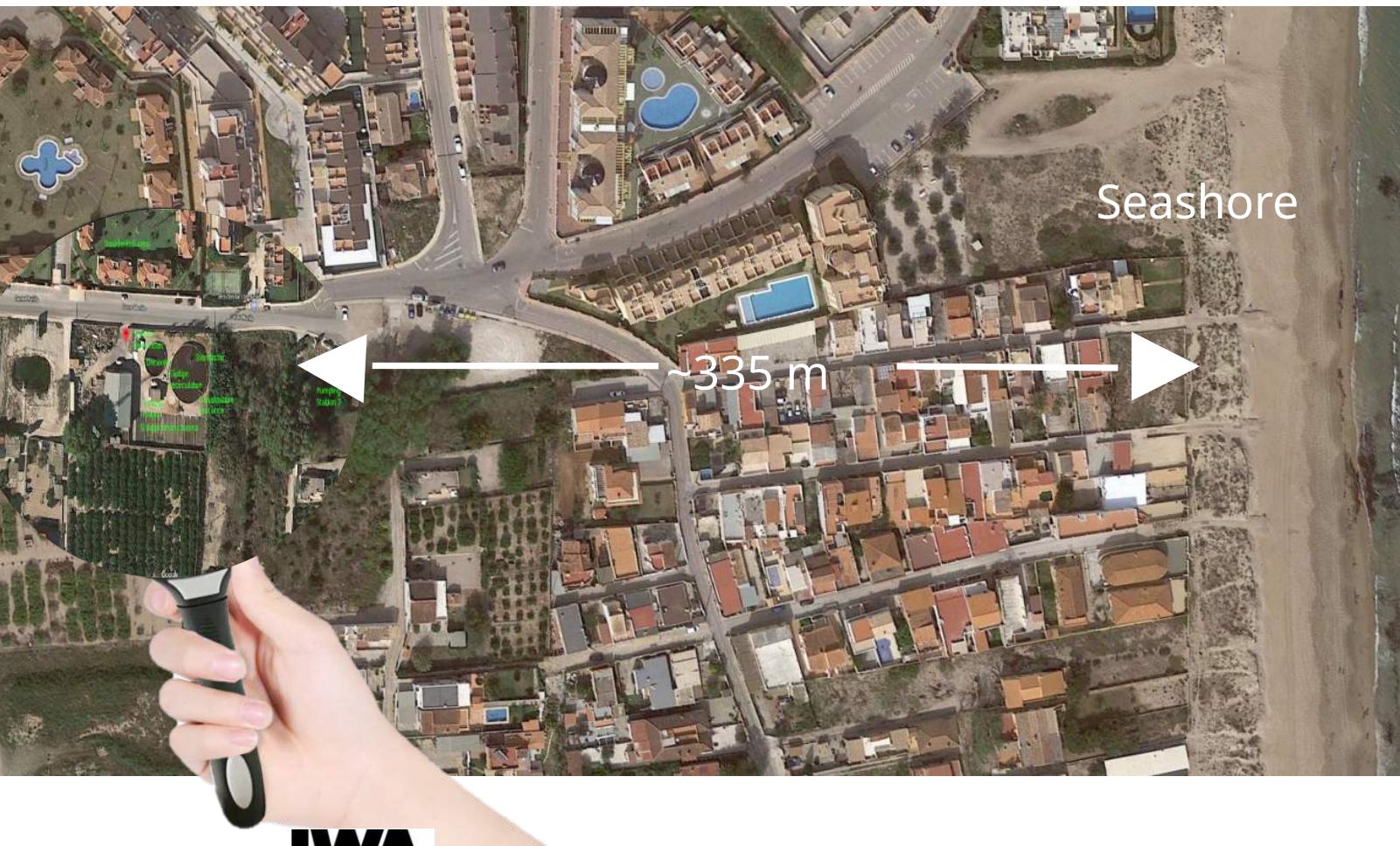
- Gaussian steady-state model plume
- Most used model in literature studies (35 % of total) (Onofrio et al., 2020)
- Enables diagnosis and prediction in complex terrain (Dinçer et al., 2020)
- Useful for wind flow higher than 0.28 m/s (Barclay et al., 2013)

2. Objectives

- To determine whether or not mitigation measures are necessary to protect adjacent dwellings from odour
 - Identify the odour compounds emissions sources in the WWTP
 - Verify if they are the cause of complains in adjacent resident area
 - Find out the reason of the emission of odour compounds
 - Implement an action to mitigate odour emission
 - Bear out the upgradings done in the WWTP mitigate odour emission

3. Materials & Methods

3.1. WWTP



- Treatment flow: 287 m³/d
- Location:
 - 335 m from seashore
 - 14 m dwellings
- WWTP description
 - 7 sludge drying basins (No operation 15-6 to 15-9)
 - 1 bioreactor (22 m dia.)
 - 1 settle tank (12 m dia.)

3. Materials & Methods

3.2. Odour measurements



★ Nasal ranger®

- D/T: 60 – 2
- OU_E/m^3 : ~70- ~2.5



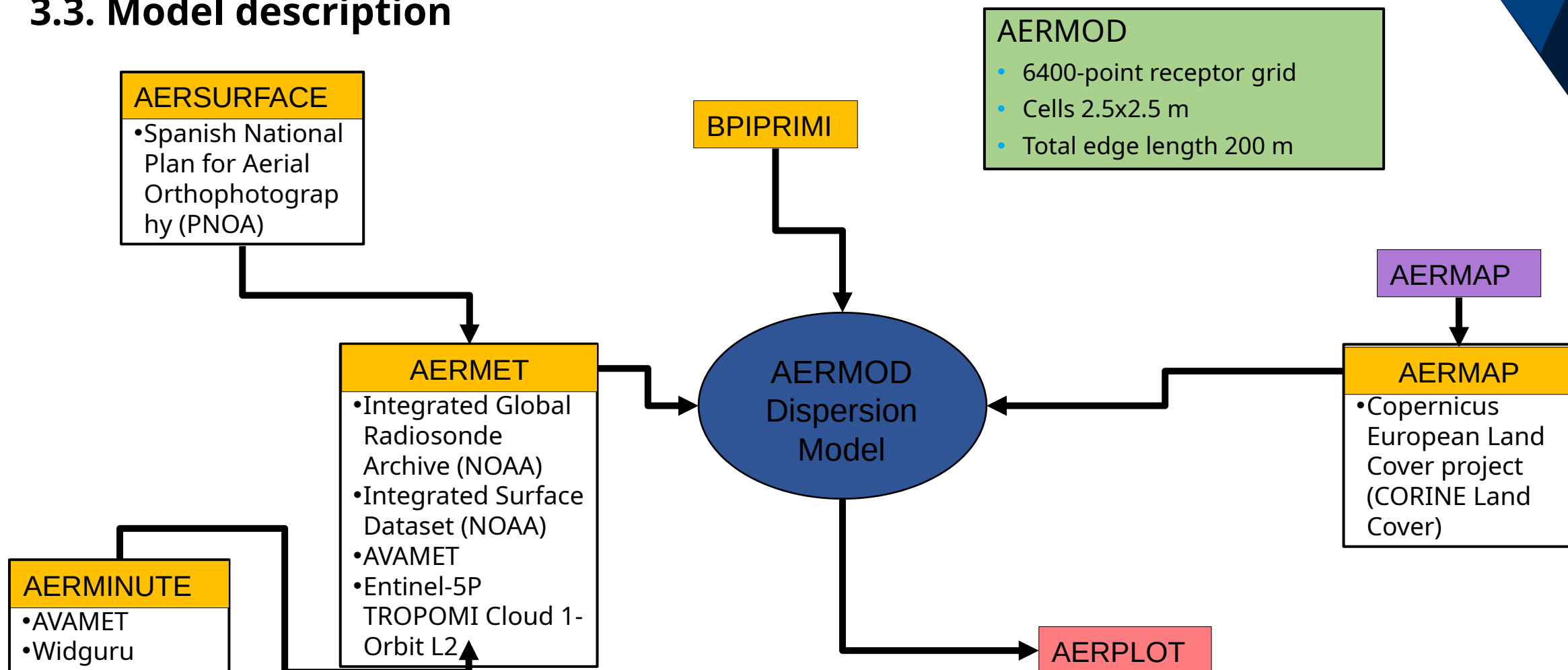
◆ DrägerPolytron 7000®

- Range: 1-100 ppm
- Accuracy: $\pm 3\%$ or 0.5 ppm



3. Materials & Methods

3.3. Model description

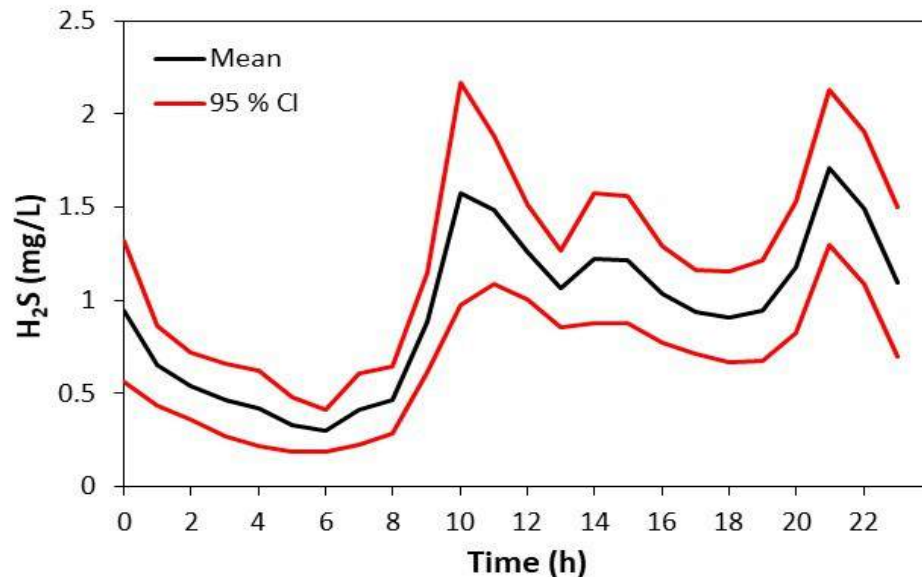


4. Results & Discussion

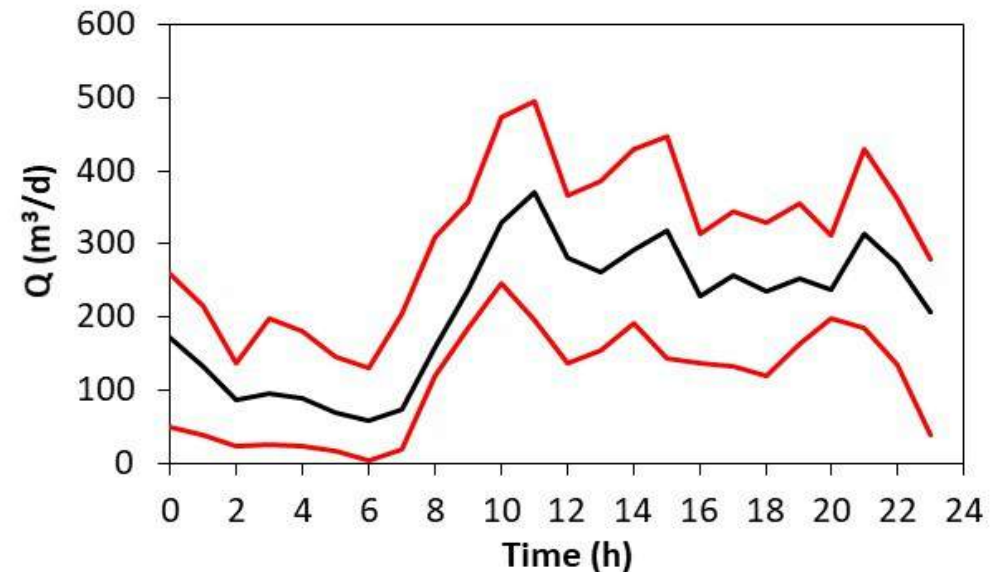
4.1. Air quality measurements

- All measuring points below detection threshold, except inlet
- Maximum $[H_2S]_{inlet} = 50$ ppm
- Correlation between water flow and H_2S emission ($R^2=0.86$)

Aggregated hourly mean of H_2S emission in inlet



Hourly mean of the influent flow



4. Results & Discussion

4.1. Air quality measurements

- All measuring points below detection threshold, except inlet



0 2 4 6 8 10 12 14 16 18 20 22
Time (h)



0 2 4 6 8 10 12 14 16 18 20 22 24
Time (h)

4. Results & Discussion

4.2. Field olfactometry

- Field olfactometry corroborated air quality measurements in reactor inlet and pumping well
- 20 meters distance of emission source (points 3-5) odour < 7 OU_E/m³
- Point 7: odour related to traffic

Olfactometry indicators obtained in field olfactometry

Olfactometry indicator	Point1 Well	Point 2 Reactor inlet	Point 3 Reactor	Point 4 Recirc	Point 5 Drying basins	Point 6 Street 1	Point 7 Street 1	Point 8 Street 1
Nº of measurements	30	24	28	28	8	28	28	28
Nº identified odours	1	3	1	2	0	0	3	0
Average episodes with odour	23.3	33.3	14.3	14.3	0	0	10.7	0
Average comprising odour (OU _E /m ³)	5.1	23.7	7	4.3	0	0	2.8	0

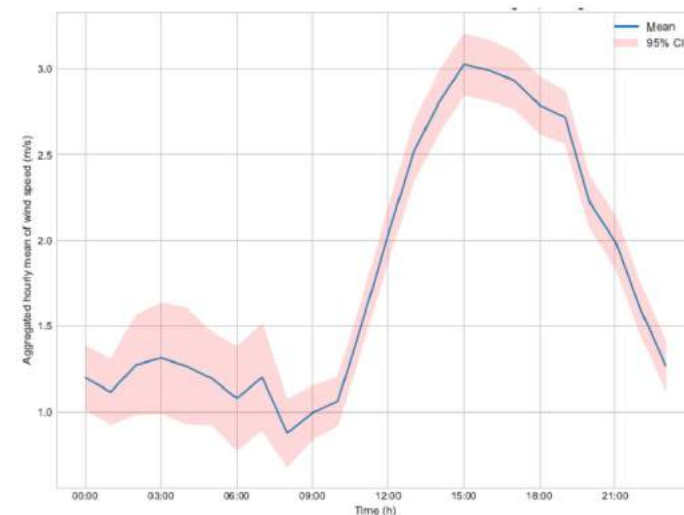
4. Results & Discussion

4.3. Wind patterns in summer time

- Wind blows mainly towards the residential housings
- Wind speed generally increase during afternoon and evening



Wind rose during summer time



Aggregate hourly mean speed (m/s) during summer time

4. Results & Discussion

4.4. AERMOD modeling results

- Only 2 timestamps have [H₂S] of about 5 ppb in dwellings (in evenings): source concentration of 6.9 and 24.6 ppm
- Submerging wastewater stream directly into bioreactor decrease [H₂S] until obtaining 100% time values under 5 ppb in dwellings



Contour maps with H₂S concentrations during 2 weeks before changing inlet of WWTP

5. Conclusions

- Modelling was shown as useful tool for the odour annoyances management in WWTP
- No perceptible concentrations occurred during studied periods, except of two single events
- Change in inlet was effective to reduce [H₂S] in WWTP and surroundings
- Field olfactometry corroborated modelling results

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