Air Sensors International Conference

Friday May 13, 2022 / 01:10PM - 03:30PM

"Session 6C: Advanced measurement approaches for fenceline and fugitive monitoring applications"

Jean-Christophe Mifsud

+ 7 other speakers

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On line monitoring of Odor Unit (OU) emissions and odor sources identification, by using a new generation of gas and odors analyzers

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Implementation of unified continuous odour monitoring system in 3 terminals of the Ventspils Freeport

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Implementation of unified continuous odour monitoring system in 3 terminals of the Ventspils Freeport

Object: Ventspils city, company Ventspils Freeport, several terminals, unloading, short-term storage and loading of oil products.

Historical issues:

- Dynamic air pollution sources;
- Emissions of smelling substances;
- Citizen complaints;

New requirements from local council to control and improve situation with odour nuisances.

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VENTSPILLS SEAPORT MONITORING

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- *The Freeport monitors incoming data … if the odour concentration exceeds 5 OU_E/m^3 on terminals border, authorities require the operator of the terminal to do all measures that decrease concentration of the odour (for example, to decrease intensity of loading tanker;*

- *And from the side of the operator ''If the odour concentration on terminal's border exceeds 5 OU_E/m^3, then the operator immediately starts to do measures to reduce the odour concentration.''*

Core of the rules?!

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Emission sources in all terminals are similar

- *Reception process – unloading wagon tanks from piers;*
- *Storage infrastructare – reservoirs;*
- *Delivery process – loading of tankers;*

An interesting fact – terminals are using the same docs for loading tankers but relationships between terminals are not good at all.

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The terms are applicable to 3 terminals:

- ***AS «Ventbunkers»***

Mostly reloads: black fuel oil, sometimes diesel fuel;

- ***SIA «Ventall Terminals»***

Mostly reloads: solvent naphtha and other types of solvents;

- ***SIA «Ventspils nafta» terminal***

Mostly reloads: petrol, diesel fuel and kerosine;

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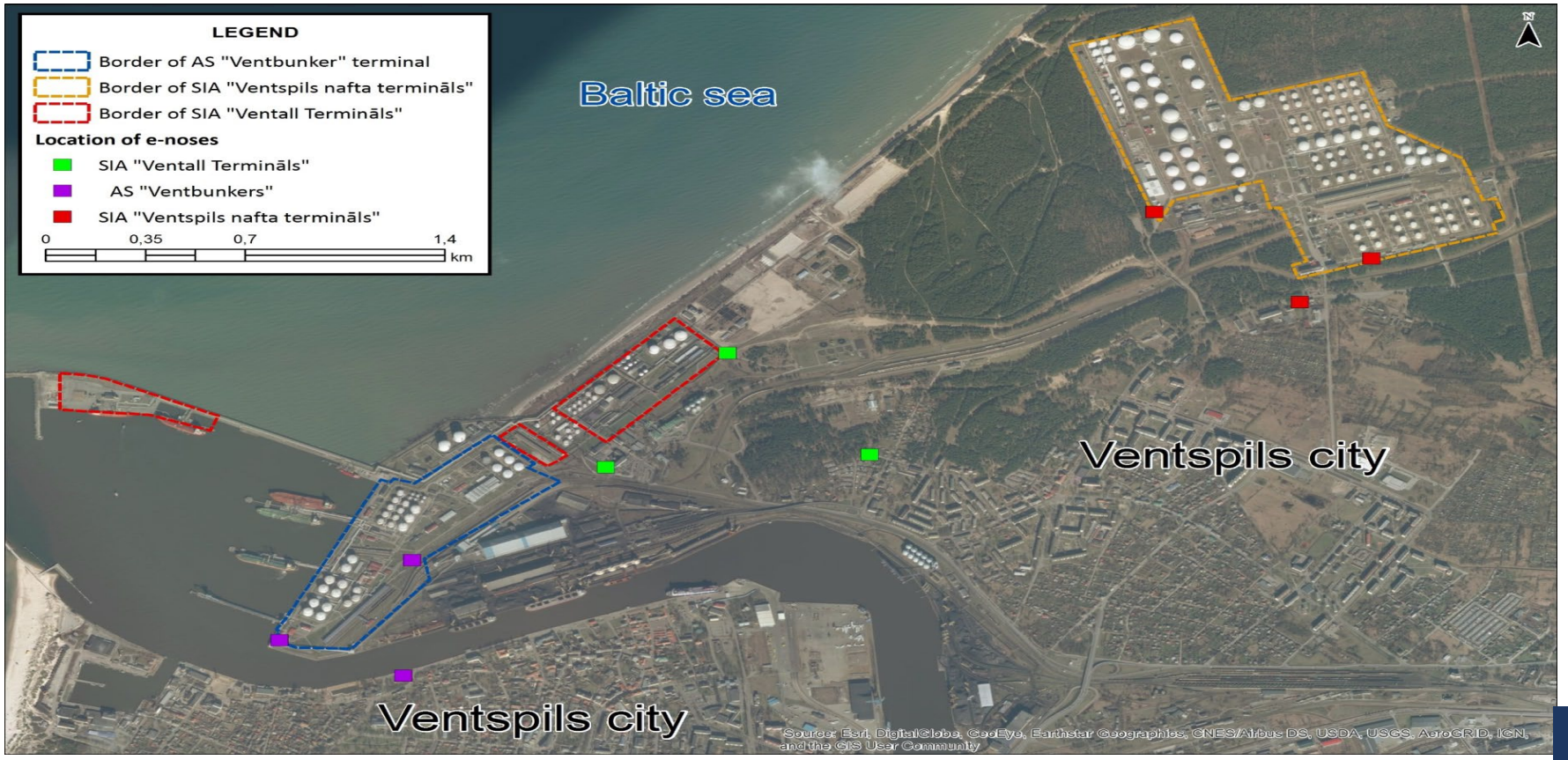
AIRPORTS & SEAPORTS - Ventspills

RIGA – VENTSPILLS CITY



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How the authorities and operators could know from which terminal the odour is coming from

Three main key points:

1. Results of odour monitoring from each station + field survey at increased concentrations;

2. Meteorological information – wind direction and speed;

3. There is the point in the rules, which states, that before every loading of a tanker the operator of the terminal gives an information to authorities about the tanker, doc, type of the product and amount, that they are going to reload;

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Proposed and accepted solution

Introduction of the **ELLONA** continuous e-nose odour monitoring system in all three terminals of Ventspils Free Port.

Each terminal ordered:

- 3 electronic noses ELLONA WT1;
- 3 meteorological stations LUFFT WS 200 TITAN, specially adapted for ELLEs needs;

The whole system consists of 9 e-noses and 9 meteorological stations

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Technical solution

- E-nose ELLONA WT1 (forced air flow system, 2 electrochemical cells H2S and mercaptan, 4 MOS sensors);

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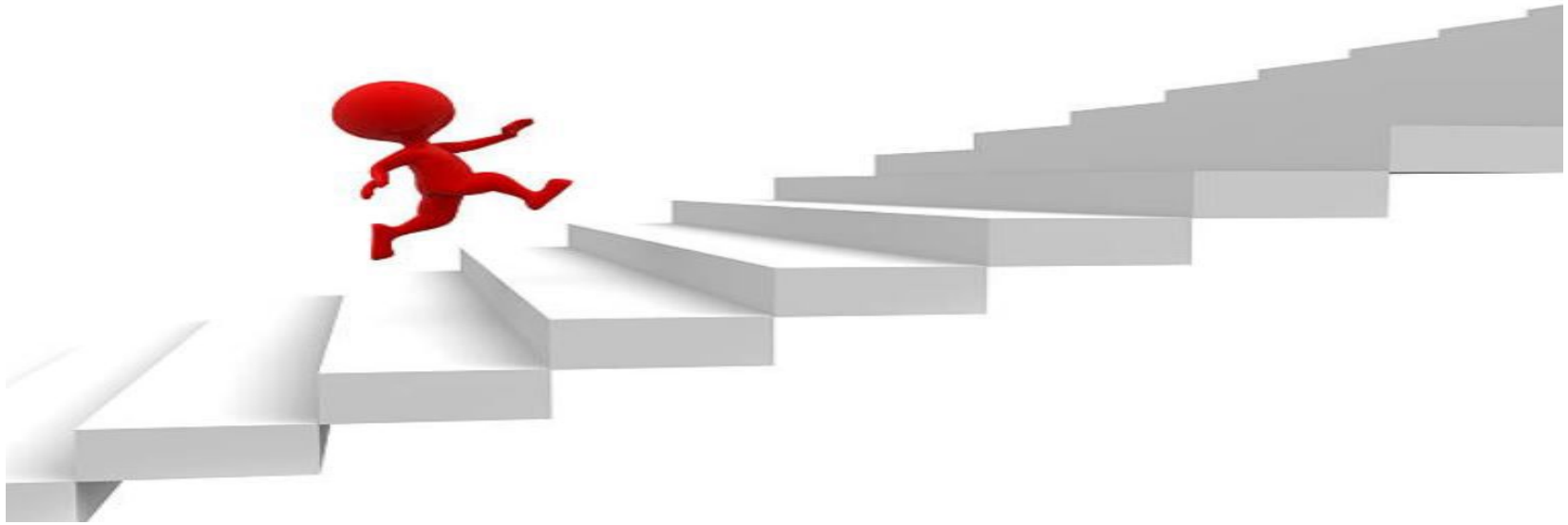
Implementation stages



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1. STAGE

- **Pre-installation study:** Analyses of emission sources, identification of major smelling substances, configuration of e-noses from ELLONA side;

- **Selection of final E-NOSE locations** (after training);

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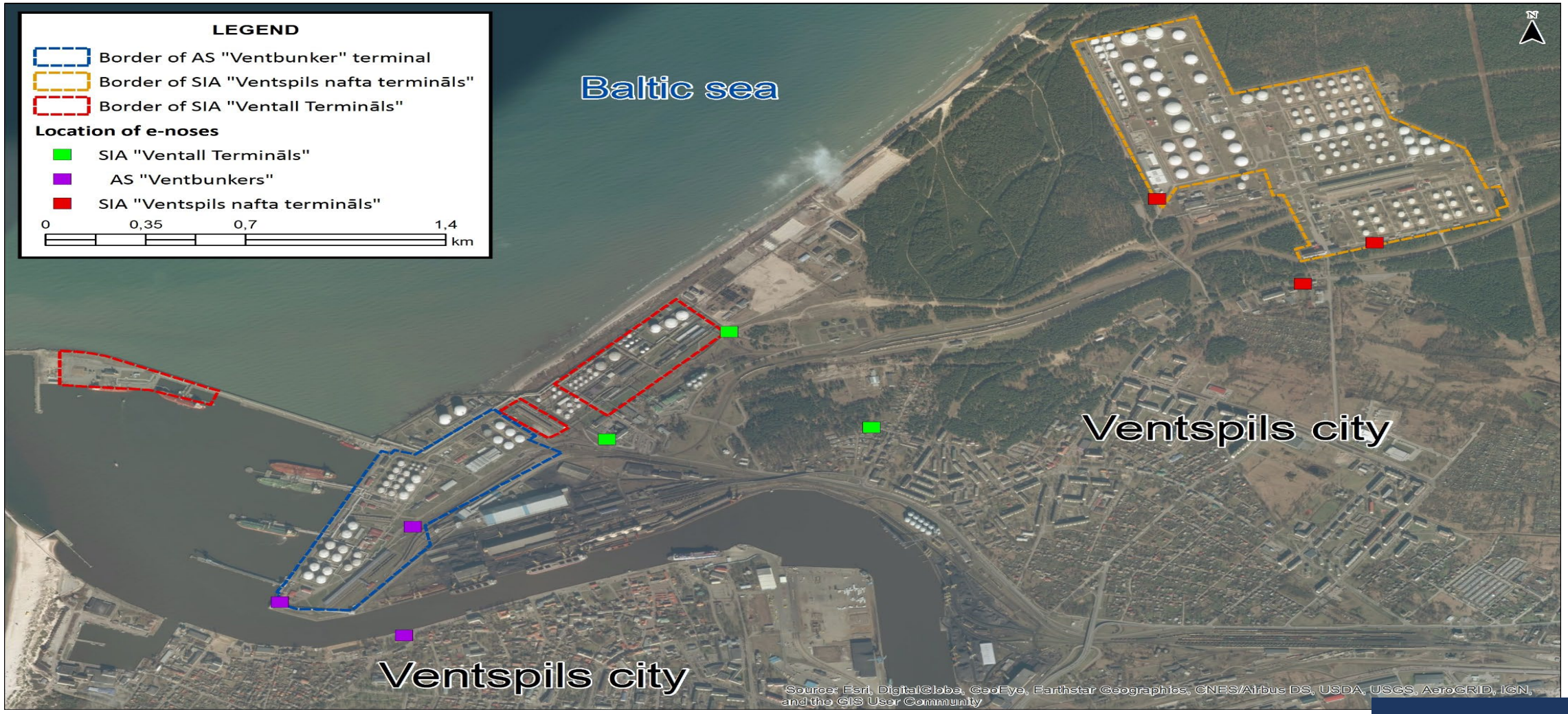

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Observation and calibration stage

1. Odour study according to EN 13725 – ASTM 679 (dynamic olfactometry);

2. Main odour samples – black fuel oil, petrol, solvent naphtha, diesel and kerosine;

3. Each instrument becomes a panel member;

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Technical solution

System specification:

- E-nose ELLONA WT1 (forced air flow system, 2 electrochemical cells H2S and mercaptan, 4 MOS sensors);

- Data transmission modem (GPRS) and LUFFT weather station with specially designed hardware and software for ELLEs needs;

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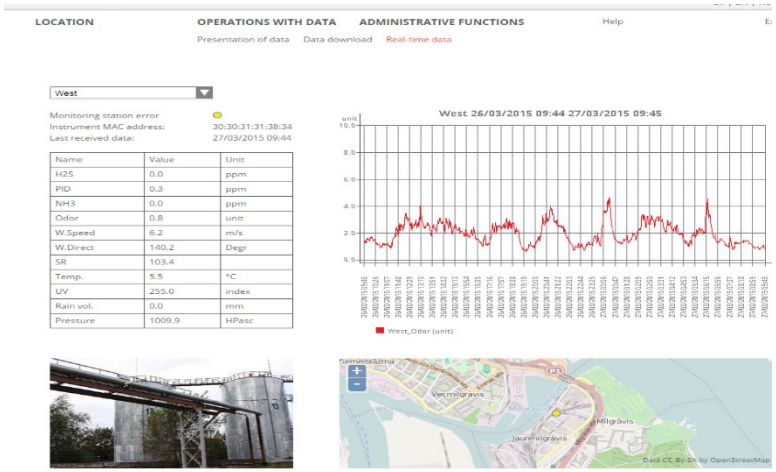
Technical solution – data storage and processing system

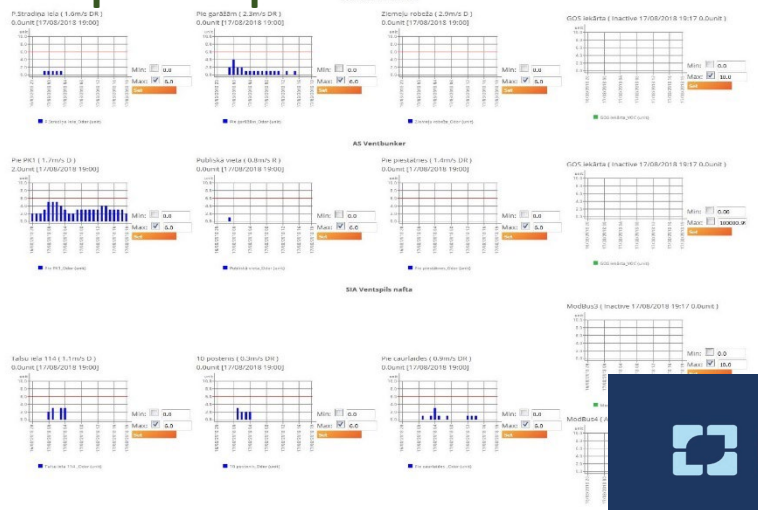
- Server for e-nose data processing (ELLONA);
- Server for data storage and visualization (ELLEs) + WEB application;

2 different WEB interfaces – for terminals (presenting real time results) and for Ventspils Freeport (presenting all monitoring stations in one window and hourly average odour concentrations)

Web interface - terminals



Web interface - Ventspils freeport



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Data flow – complicated and completely dependent on the ELLONA warranty

E-nose

Meteorological sensor

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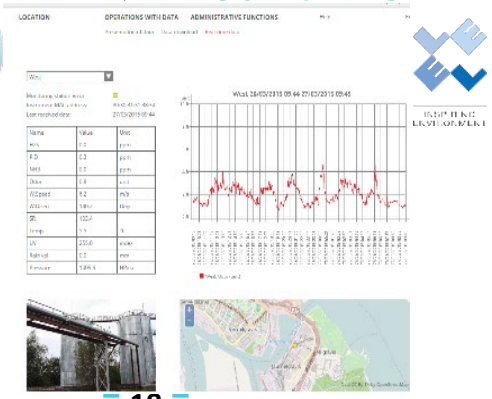
TERMINALS

Freeport of Venspils

Real time



Hourly average

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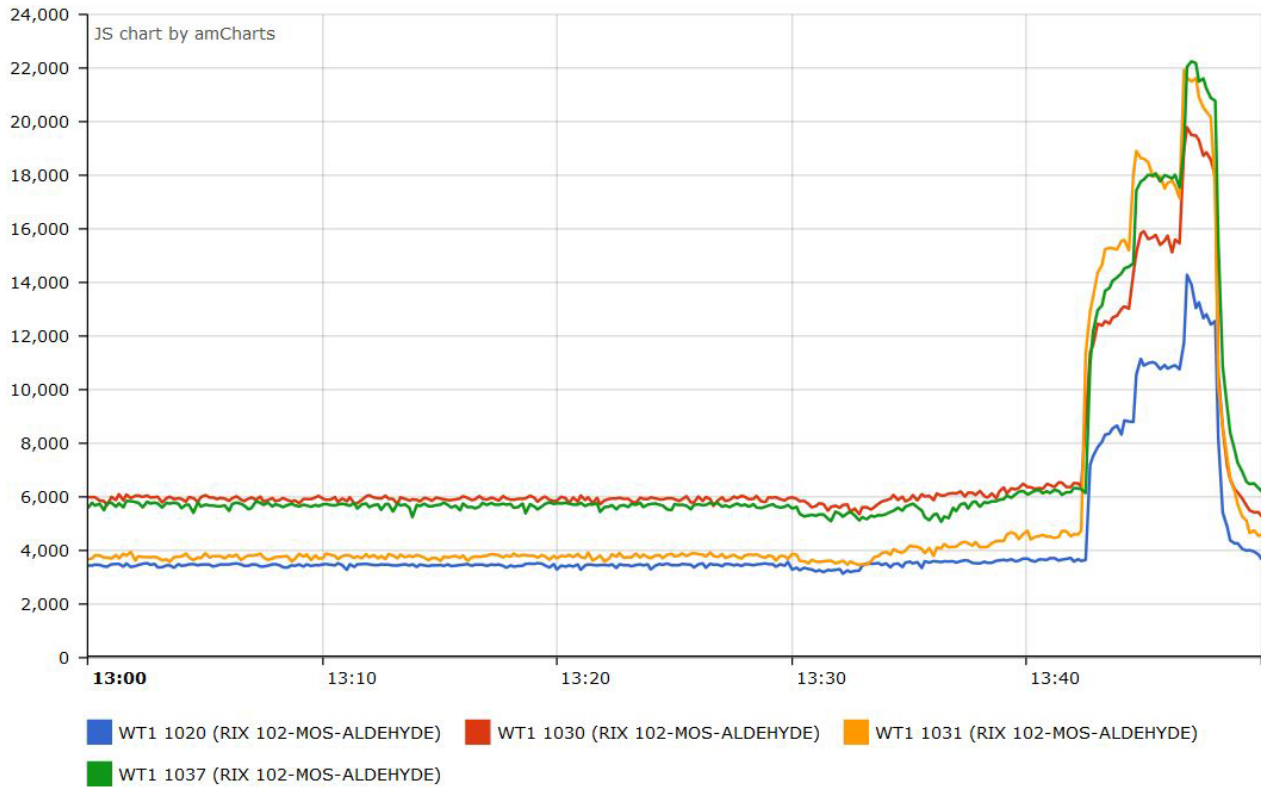
Training process



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Assessment of instruments performance – comparative testing

- Odour study according to EN 13725; ASTM 679
- Each e-nose becomes a competitor of panel;
- Testing results should be within the range of uncertainty of reference method.

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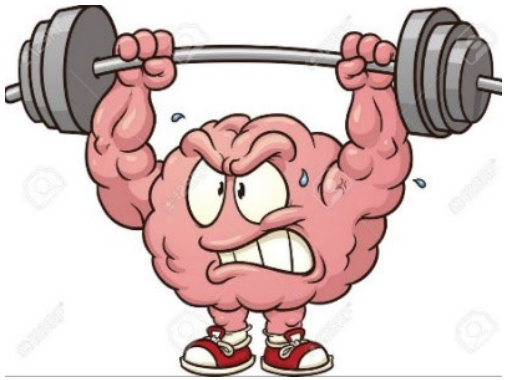
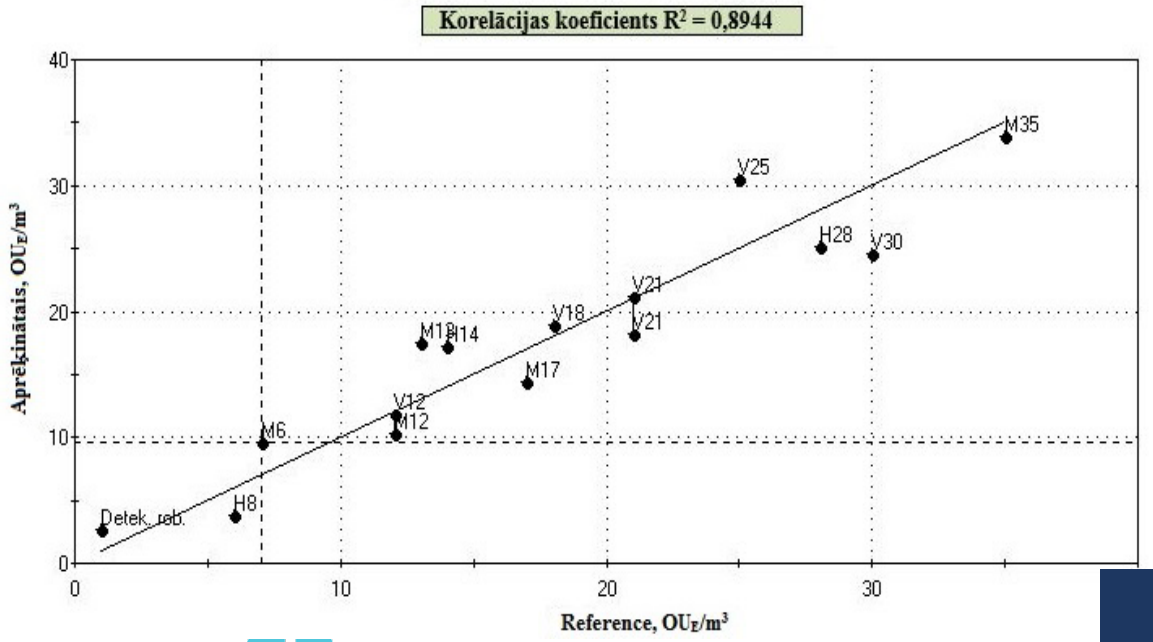
Construction of calibration graphs (brains of e-nose)

1. Data collected during the olfactometry study is used to calculate the model which «translates» sensor data into odour units suited to the site;

2. Model is then integrated into the analyser control software





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PLS created and implemented by modules

1020_JR_komponents - Number of components : 3, R^2 : .9814, Mean absolute error : 1.38
1030_JR_komponents - Number of components : 3, R^2 : .8957, Mean absolute error : 3.2073
1031_JR_komponents - Number of components : 3, R^2 : .9642, Mean absolute error : 1.9607
1037_JR_komponents - Number of components : 3, R^2 : .9516, Mean absolute error : 2.0926
1032_JR_komponents - Number of components : 3, R^2 : .8911, Mean absolute error : 3.2705
1033_JR_komponents - Number of components : 3, R^2 : .8911, Mean absolute error : 3.2705
1034_JR_komponents - Number of components : 3, R^2 : .8614, Mean absolute error : 3.7224
1035_JR_komponents - Number of components : 3, R^2 : .8614, Mean absolute error : 3.6099
1038_JR_komponents - Number of components : 3, R^2 : .5846, Mean absolute error : 6.4396

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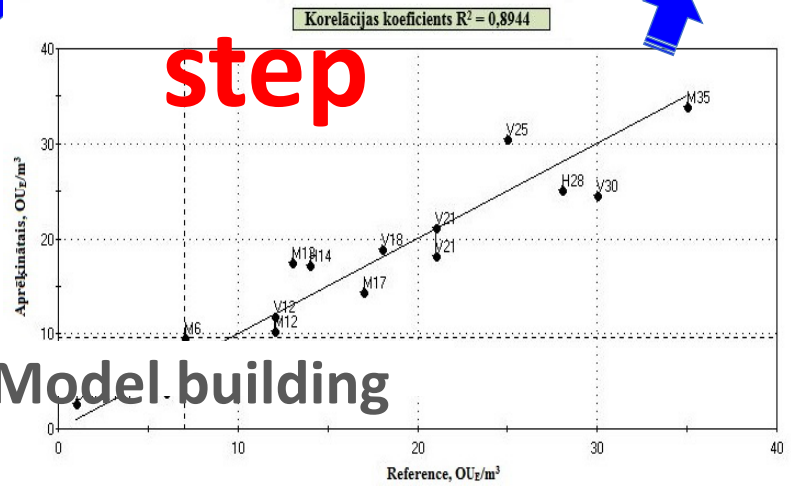
1. step
Collection

2. step
Feeding

3. step
Sniffing

4. step
Model building



Assessment
5. step

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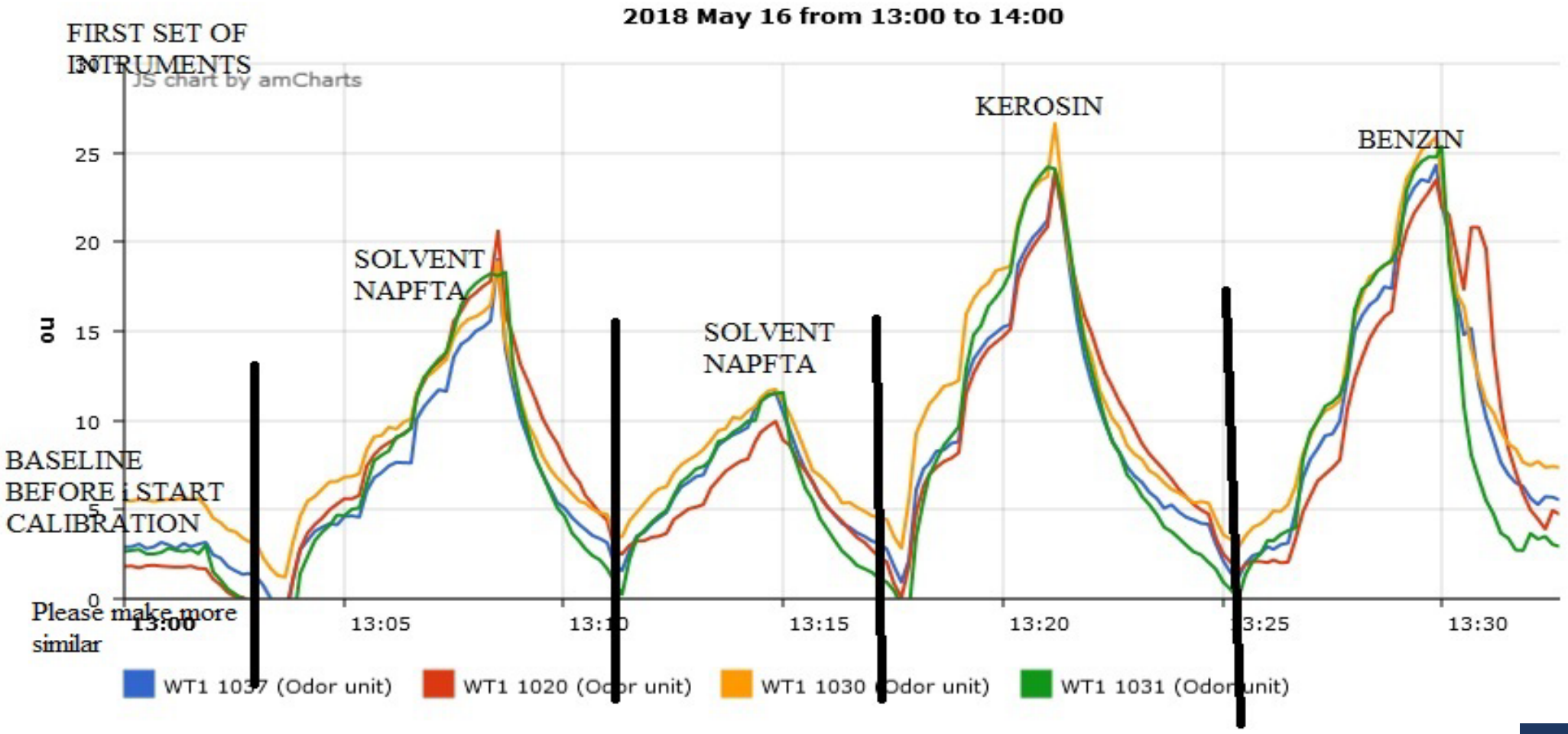
VENTSPILLS SEAPORTS



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Ventspills

Installation sites

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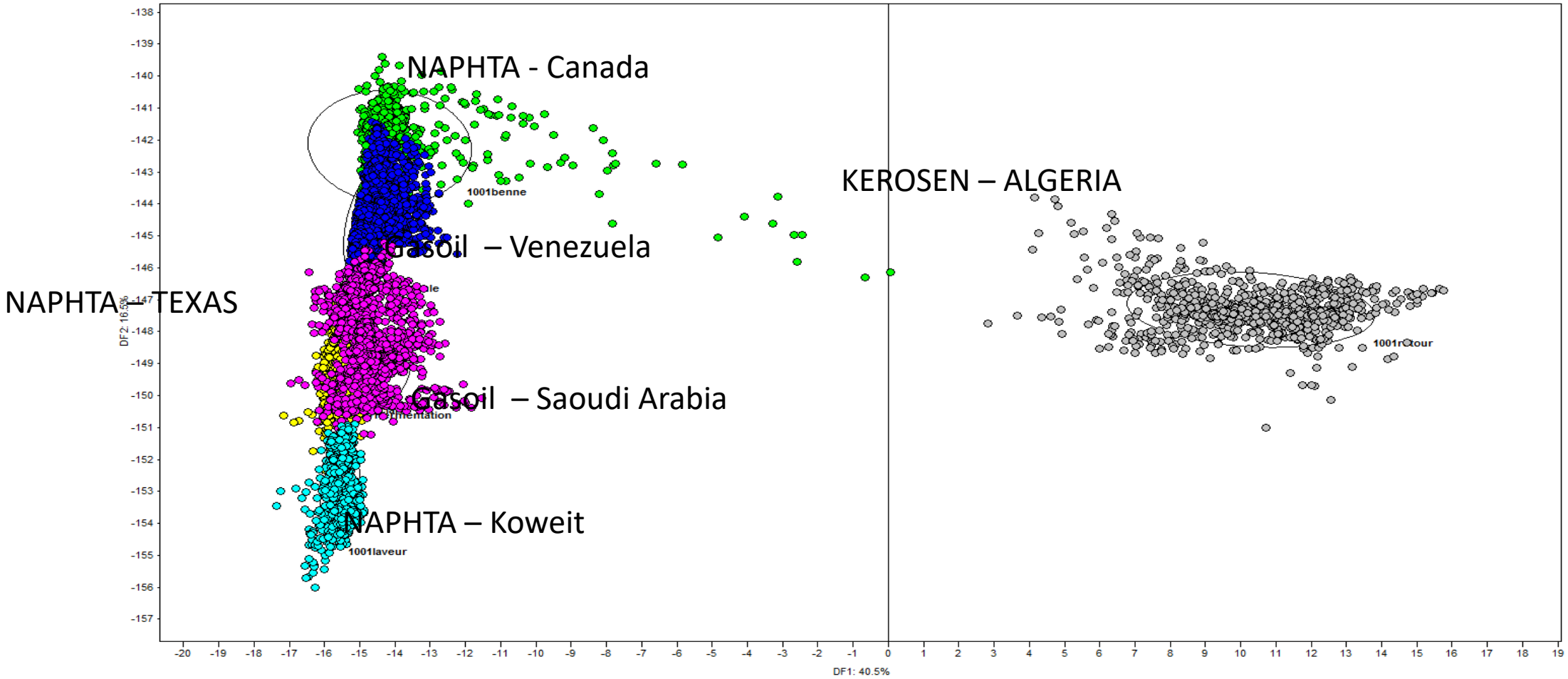

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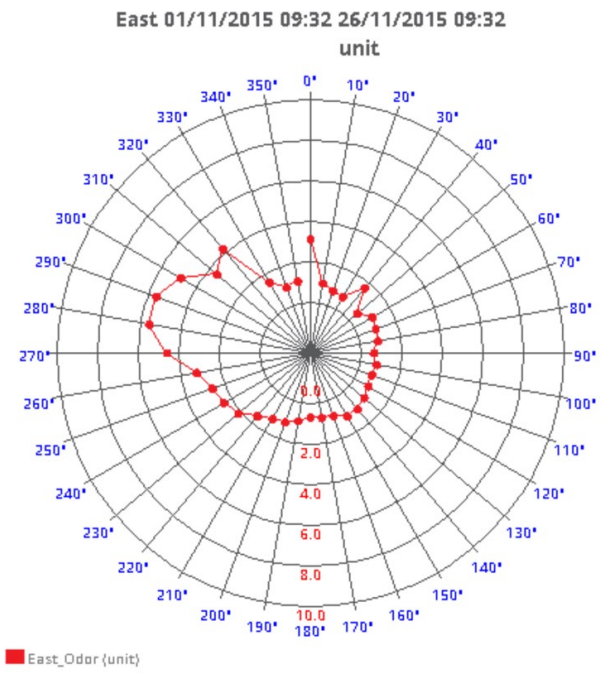
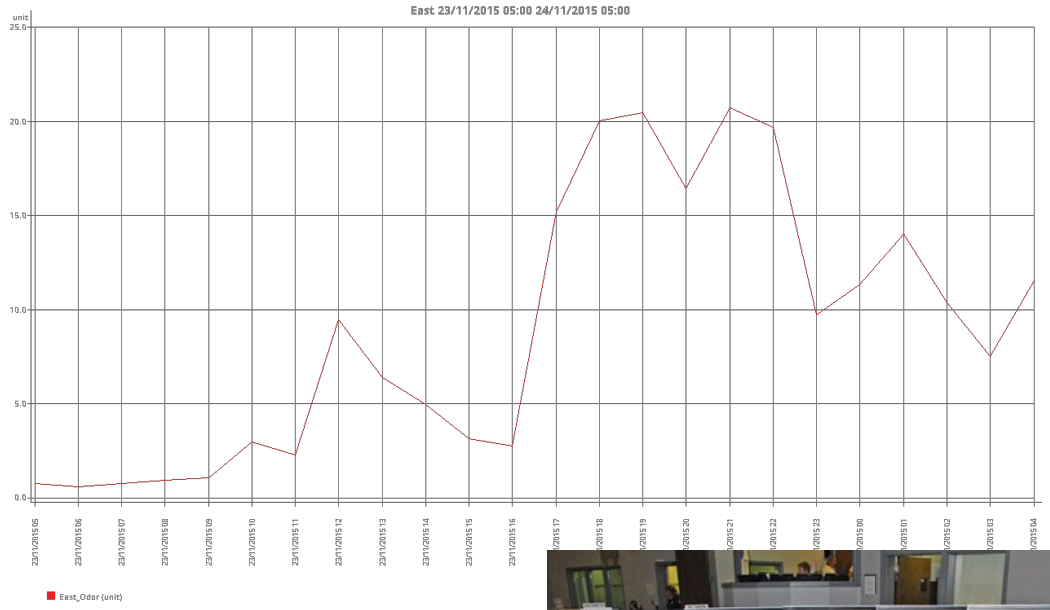
City Control Panel

Operator can follow real time data and check previous monitored results





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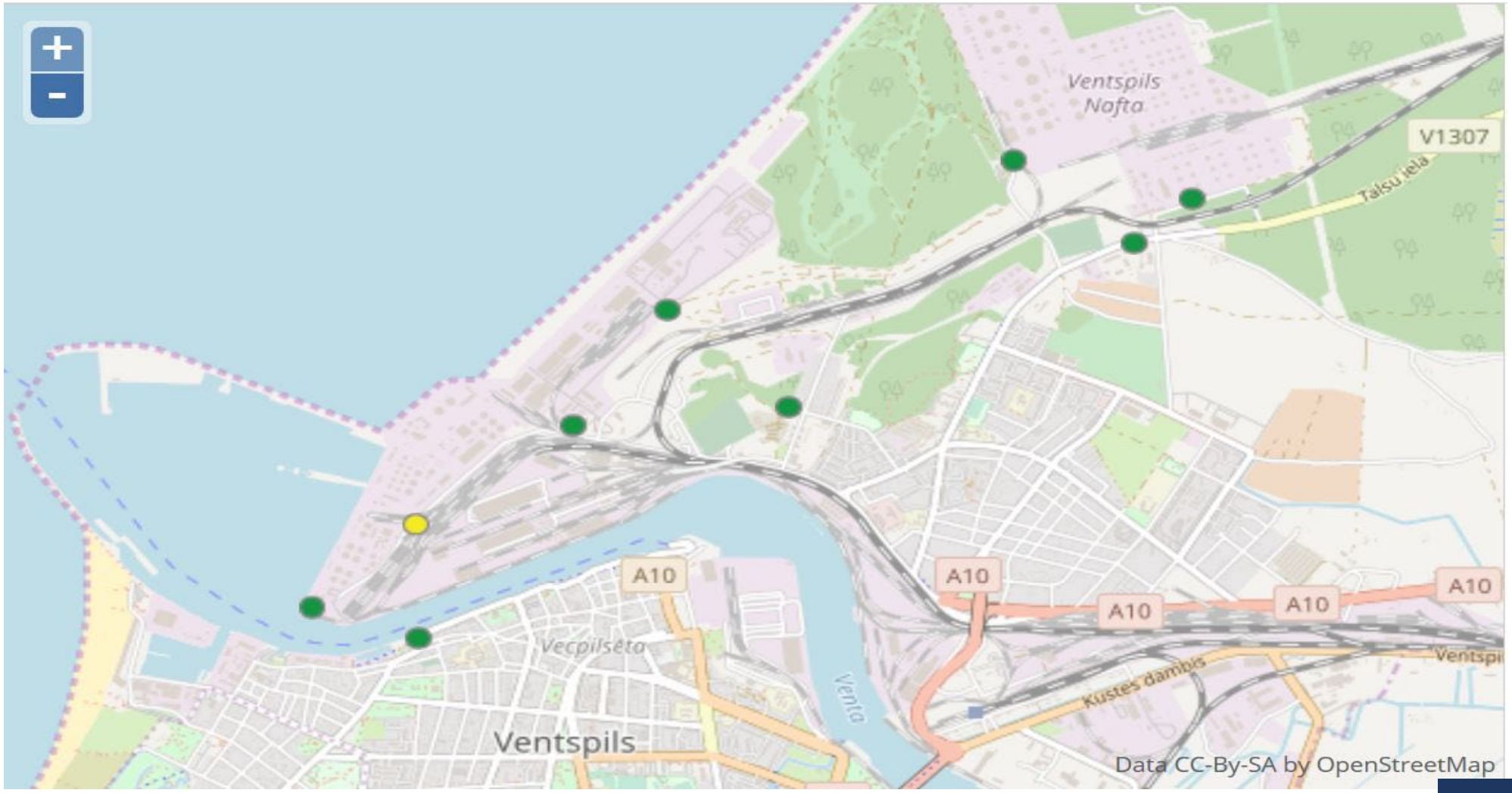
SUSTAINABLE SEAPORTS and TRAFFIC LIGHT MANAGMENT



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- Implemented gas intensity monitoring network works as warning system
- On line Odor intensity monitoring according to EN 13725 (ASTM 679) implemented
- On line odor (various petrochemical products and countries) sources identification implemented

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SUSTAINABLE SEAPORTS

- IOT SOLUTIONS FOR AIRPORTS and Seaports
- A tool for mapping and monitoring industrial nuisances related to transit activity and in particular toxic substances (gas, odors, noise, particles...)
- An identification tool (gas, odors, noise and soon particles
- A health and wellness tool for employees and the neighborhood
- A tool to improve citizens' engagement and communication
- A tool for better management of transport activity (optimization of operations, optimization of maintenance operations, optimization of cleaning processes)
- A remediation tool (traffic management...)

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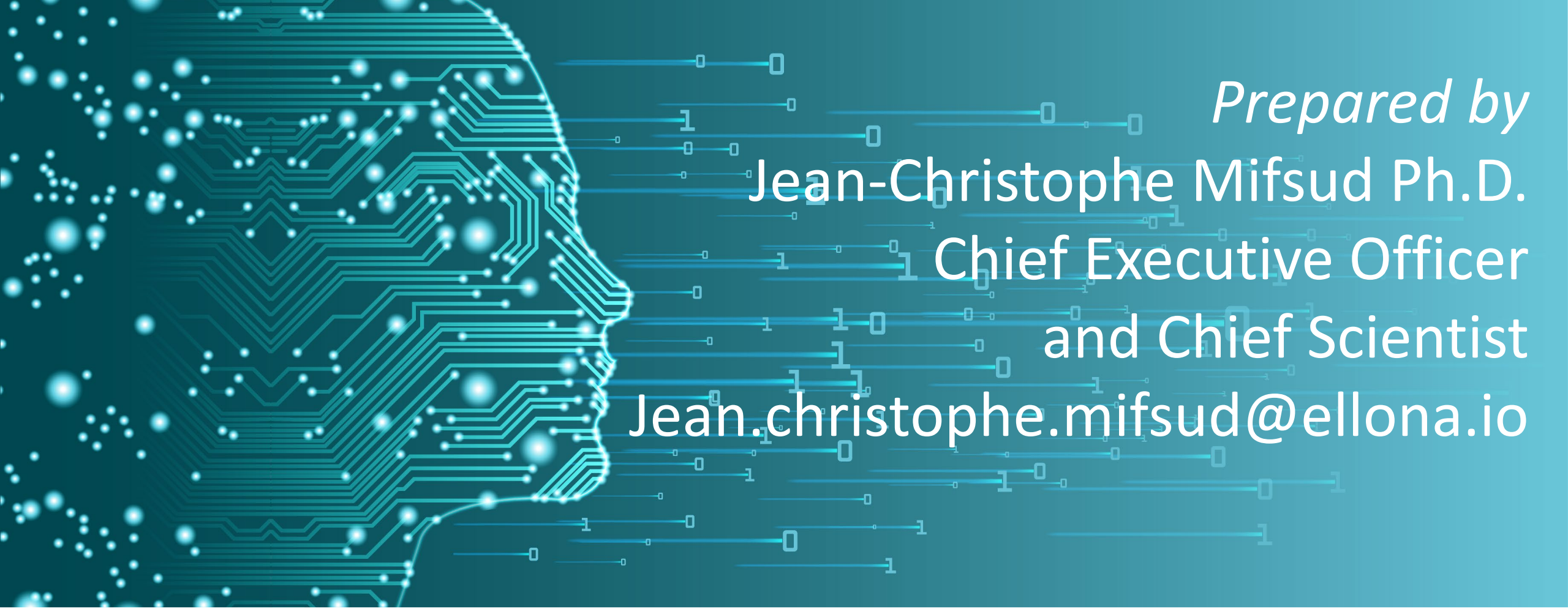

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