

# Cairpol<sup>TM</sup>

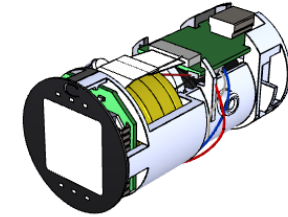
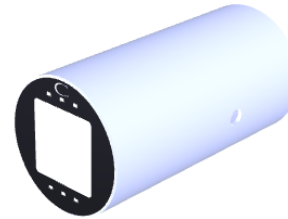
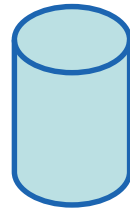
Air Quality and Odours Monitoring using Smart  
MicroSensors



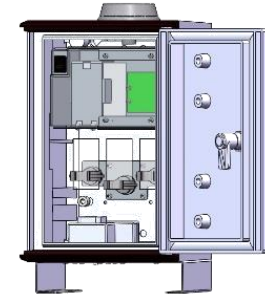
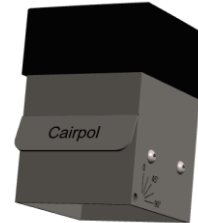
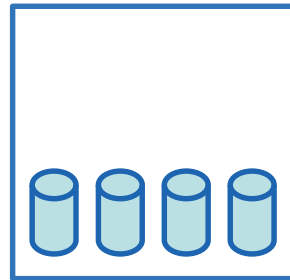
# CAIRPOL – Smart Sensors – Product Range Structure

- **CAIRPOL solutions are built around three main axis:**

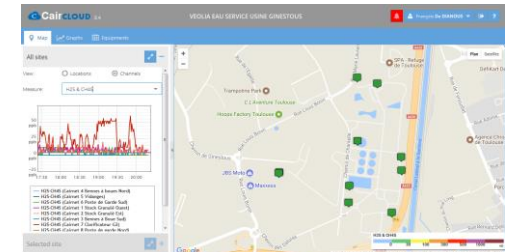
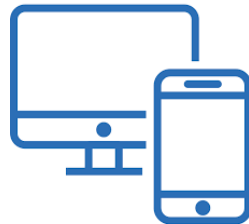
- Sensors



- Housings



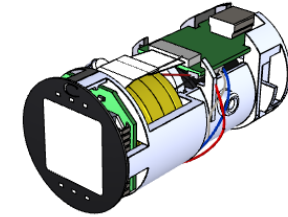
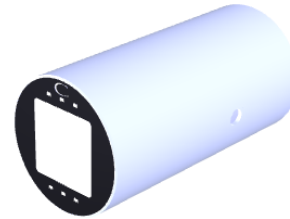
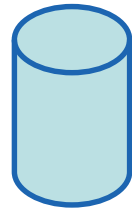
- Software



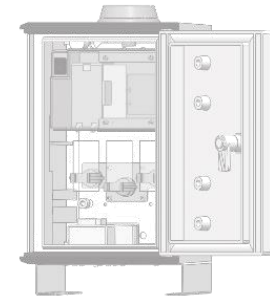
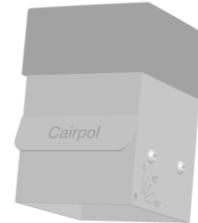
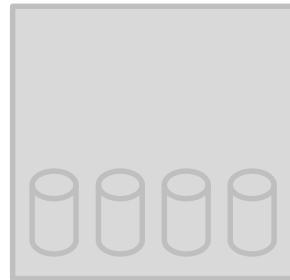
# CAIRPOL – Smart Sensors – Product Range Structure

- **CAIRPOL solutions are built around three main axis:**

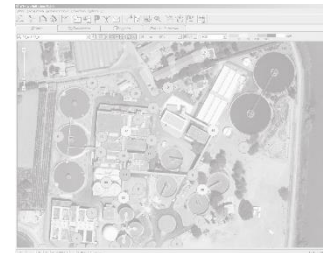
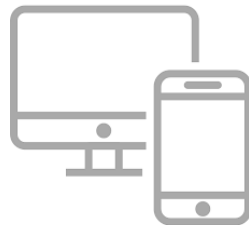
- Sensors



- Housings



- Software



# CAIRPOL – Smart Sensors – Indicators Only

- **No specific certifications exist up to now for sensors**
- **Cairsens sensors are in line with EU Directive 2008/50/EC, and accuracy level requirement requested for INDICATORS**
  - $< \pm 15\%$  for reference devices;
  - $< \pm 30\%$  for indicators;
  - $< \pm 75\%$  for estimators.
- **Cairsens sensors are tools for collecting an indicative information on air quality, to:**
  - Monitoring & control of industrial sites processes
  - Citizen information purposes
  - Ambient Monitoring hybridation
  - Mapping & modelling

# CAIRPOL – Smart Sensors – Technology Overview

- **Electro-chemical sensor for gas (NM VOC excluded)**
- **Dynamic air sampling**
  - Micro fan with power stabilization.
- **Humidity buffer (patented)**
  - Acting as an air conditioning for the sensor
- **Ultra low power consumption**
  - High sensitivity circuit (nA).
  - Data logger.
  - USB connection, HMI.



Cost efficient

Miniaturization

Accurate & reliable measurement

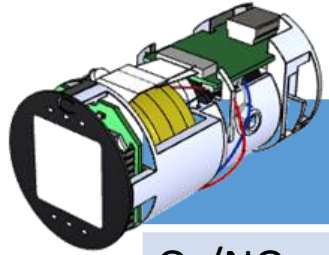
No maintenance, no calibration for 1 year

# CAIRPOL – Smart Sensors – Technology Overview

- **There are 2 type of sensors available on the market**
  - Electrochemical sensors (Cairpol)
  - Solid-state sensors (Unitec, Aeroqual, Odotech, etc...)
- **Weaknesses of Solid-state sensors Vs CAIRPOL:**
  - Need frequent re-calibration (monthly to max quarterly) to guarantee a “good” measurement accuracy
  - Longer response time
  - More sensible to interferences
  - More expensive (maintenance, need of heater, etc.)



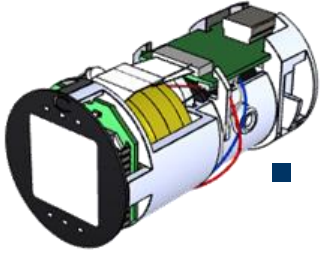
# CAIRPOL – Smart Sensors – Actual Range of Sensors



Pollutants	Principle	Measurement Ranges	Certified* Detection Limits
O <sub>3</sub> /NO <sub>2</sub>	EC	0 – 250 ppb	20 ppb
NO <sub>2</sub>	EC	0 – 250 ppb	20 ppb
CO	EC	0 – 20 ppm	50 ppb
SO <sub>2</sub>	EC	0 – 1000 ppb	50 ppb
H <sub>2</sub> S/CH <sub>4</sub> S	EC	0 – 1000 ppb 0 – 20 ppm 0 – 200 ppm	10 ppb 30 ppb 200 ppb
NH <sub>3</sub>	EC	0 – 25 ppm	500 ppb
NM VOC (PID sensor)	PID	0 – 2 ppm 0 – 16 ppm	200 ppb 500 ppb
PM <sub>2.5</sub> /PM <sub>10</sub> (OPC)	NEPHELOMETER	0 – 1000 µg/m <sup>3</sup>	

\* Delivered with a calibration certificate.

# CAIRPOL – Smart Sensors – Actual Range of Sensors



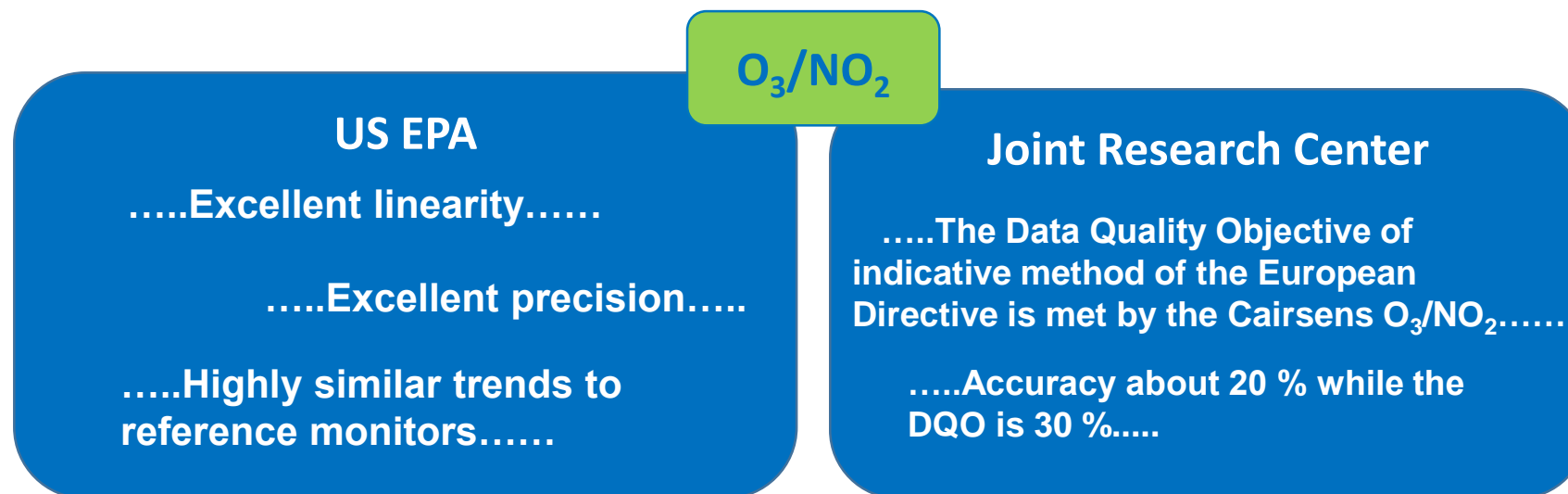
- **2 x Types of CAIRSENS sensors**
  - USB version
  - UART version
- **Analogue output version (Optional)**
  - UART CAIRSENS version + Analogue Converter
  - 4-20mA/0-5V
- **Lifetime**
  - 1 year, without any maintenance or re-calibration
  - During this year, we guarantee the validity of the data.



# CAIRPOL – Smart Sensors – Leader in Quality

## ■ CAIRPOL differentiation Vs other Sensors:

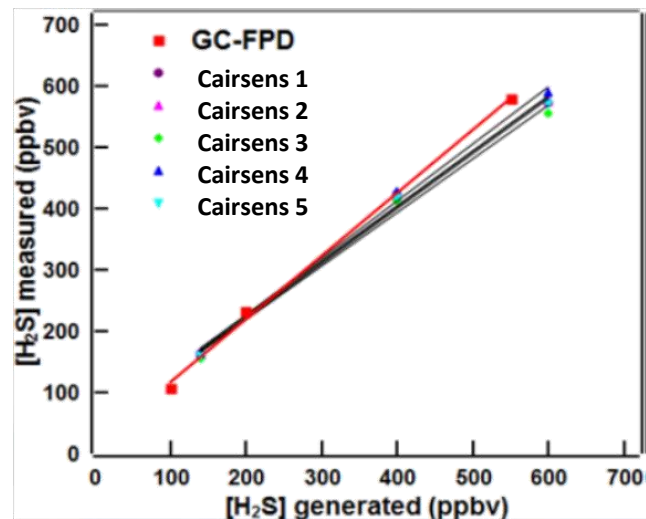
- > 10 years of experience
- Technological choices
- Approved technology
  - Various studies during the last 10 years
  - Reports available (US EPA / Joint Research Center (EU))
  - Recent Test at AQMD CA USA (AQ-TEST)



# CAIRPOL – Smart Sensors – QA/QC (H<sub>2</sub>S Example)

## ■ Factory calibration

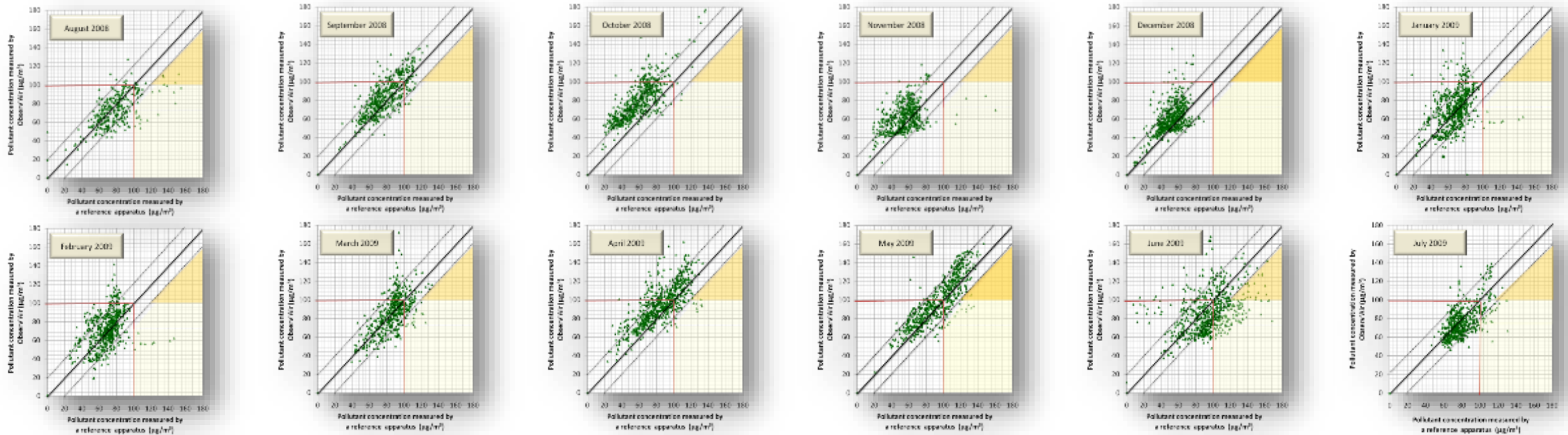
- Use of a calibration device with H<sub>2</sub>S permeation tube (+/- 5% Acc)
- Linearity test with Comparison with reference analyser
  - Reference analyser = gas chromatograph combined with a flame photometric detector GC-FPD, Chroma S
- Reproducibility test
- Sensors are delivered with a control document



- The average sensitivity of our sensors varies by 13% compared to the reference analyser  
=> **excellent correlation**
- There is only a 2% variation in between Cairsens sensors => **high level of reproducibility**

# CAIRPOL – Smart Sensors – Stability & Lifetime

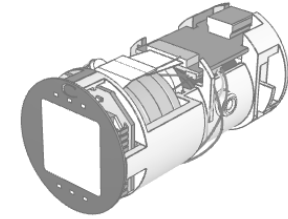
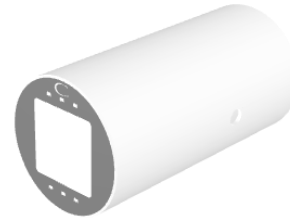
- **Comparison with reference devices in Montpellier (France)**
  - Excellent reliability with the same O3/NO2 sensor, without re-calibration and over one year



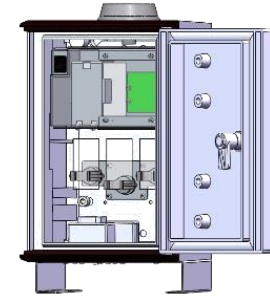
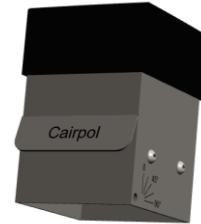
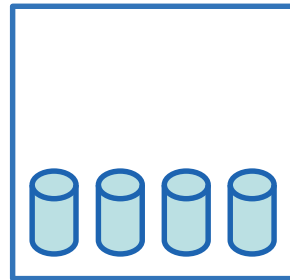
# CAIRPOL – Smart Sensors – Product Range Structure

- **CAIRPOL solutions are built around three main axis:**

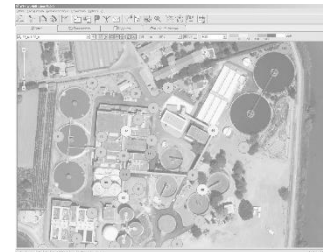
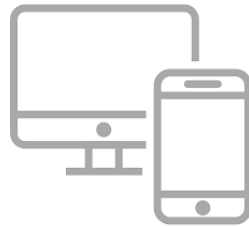
- Sensors



- Housings



- Software



# CAIRPOL – Smart Sensors – Housing & Power supply

- **2 x Types of Housing**
  - **CAIRTUB version**
    - Max 3 x Gas CAIRSENS Sensors
    - Not compliant with PM Sensor
  - **CAIRNET version**
    - Up to 4 x Gas CAIRSENS Sensors.
    - **PM Sensor Version**  
with up to 3 x Gas CAIRSENS Sensors.
- **Radio/3G or GPRS Communication**
- **2 x Types of Power supply**
  - Solar Panel
  - Outdoor charger 115-220 V



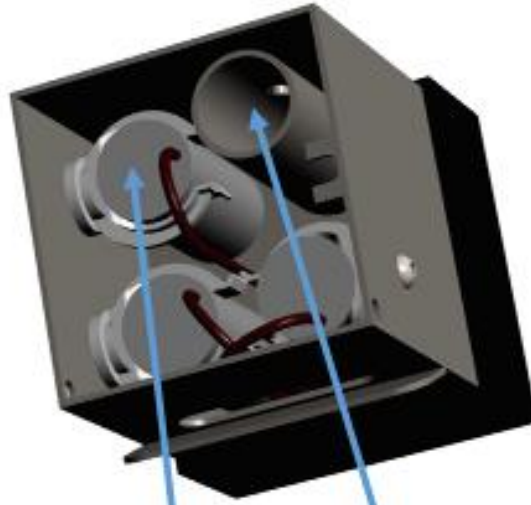


# CAIRPOL – Smart Sensors – Housing & Power supply

- Focus on CAIRTUB version



Location for  
3 x CAIRSENS sensors



Location for CAIRTUB  
support (mast)



# CAIRPOL – Smart Sensors – Housing & Power supply

- **Focus on CAIRTUB version – Main features**

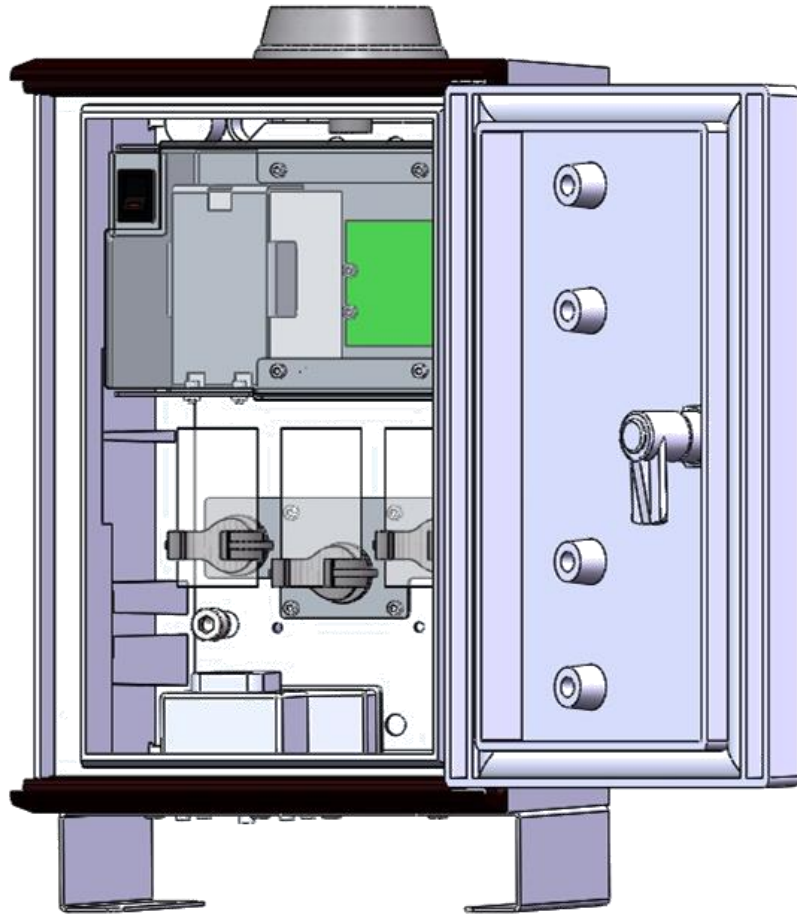
- **Up to 3 parameters (Only gas at the moment)**
- **Autonomy on battery w/o optional power supply:**

	1 Cairsens gas	3 Cairsens gas	1 VOCnm Cairsens	1 Cairsens gas + 1 VOCnm Cairsens
Battery lifetime operation	45 days	15 days	15 days	9 days
Storage capacity for 1 min / data	20 days			

- **Easy to use & move to different locations**
  - No cables just set up and move to different locations on your site as needed
  - Fast, easy mounting and commissioning
- **Ideal for spot measurement.**
- **=> Main applications :**
  - Leak detection and monitoring of fugitive emissions: quarries, storage facilities...
  - Odor monitoring: WWTP, recycling, pulp and paper manufacturing...
  - Indoor ambient air quality monitoring : construction sites, schools, roads, animals farm...

# CAIRPOL – Smart Sensors – Housing & Power supply

- Focus on CAIRNET version





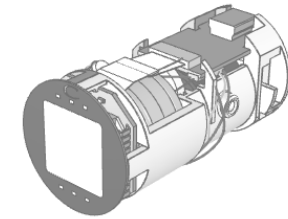
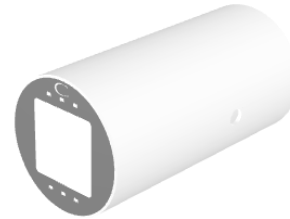
# CAIRPOL – Smart Sensors – Housing & Power supply

- **Focus on CAIRNET version – Main features**
  - **Up to 4 parameters (4 Gas OR 3 Gas + PM10/PM2,5)**
  - **Autonomy on battery from 3 to 6 days**
  - **Easy to use & move to different locations**
    - No cables just set up and move to different locations on your site as needed
    - Fast, easy mounting and commissioning
  - **Ideal for spot measurement.**
  - **=> Main applications :**
    - Leak detection and monitoring of fugitive emissions:
      - quarries,
      - storage facilities...
    - Odor monitoring: WWTP, recycling, pulp and paper manufacturing...
    - Indoor ambient air quality monitoring :
      - construction sites,
      - schools,
      - roads,
      - animals farm...

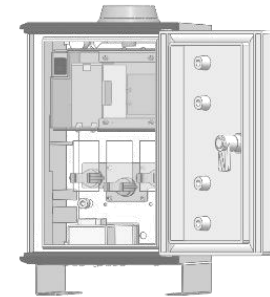
# CAIRPOL – Smart Sensors – Product Range Structure

- **CAIRPOL solutions are built around three main axis:**

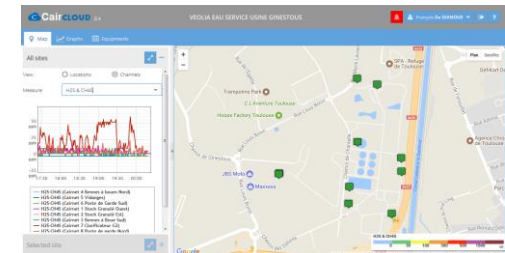
- Sensors



- Housings



- Software



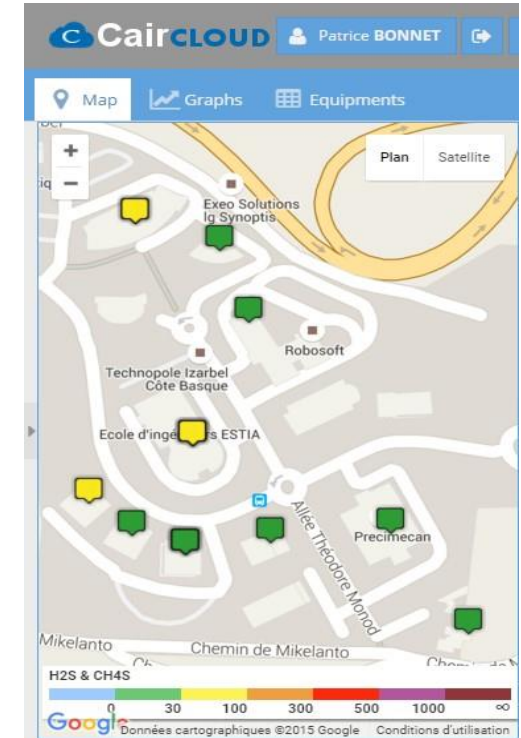
# CAIRPOL – Smart Sensors – Software Solutions

No more **hardware issues** :  
Get all the data from our  
Cairnet GPRS in the Cloud !

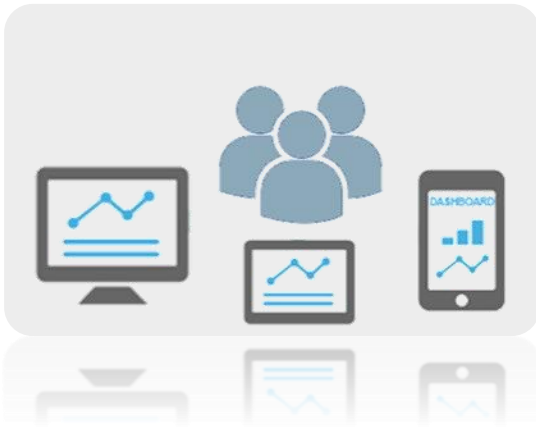
Access from **anywhere**,  
**anytime**, with **any**  
**connected device**.  
Touchscreen compatible.



**Full secured access**, with  
accounts management.



**Easy management:**  
sensors availability,  
alarms, technical  
data, etc.



# CAIRPOL – Smart Sensors – Software Solutions



# CAIRPOL – Smart Sensors – Software Solutions



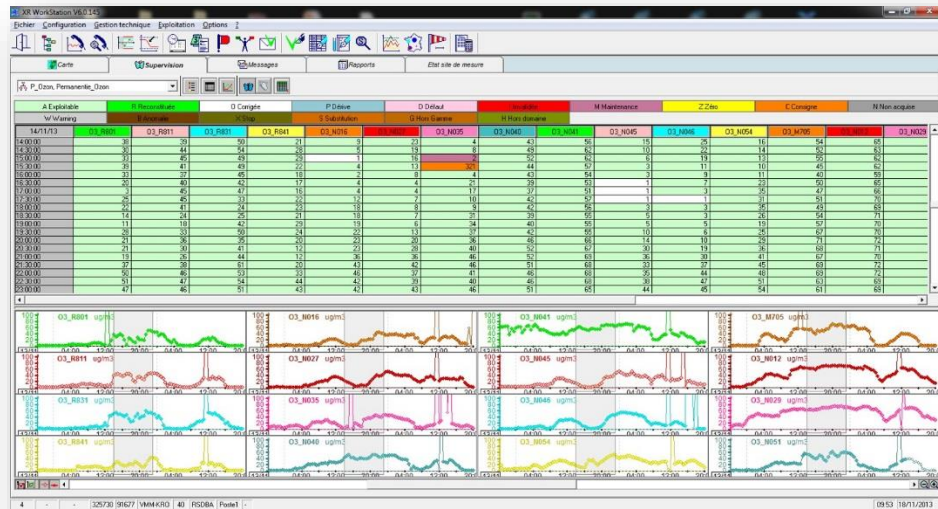
- **“Access your data When and Where you want”**
  - Data acquisition and processing secured web-based interface
  - Real-time air quality data with dynamic view (tables, graphs, filters...)
  - 1 minute data displayed
  - Programmable threshold alerts
  - Data storage up to 3 years
  - Auto data export via FTP, SFTP, API REST
  - Status tracking of the battery charge, power supply, Cairsens™ sensors' lifetime
  - Compatible with Air Quality Data Acquisition systems and databases such as the XR© or WEX © software suite from ENVEA





# CAIRPOL – Smart Sensors – Software Solutions

- **CAIRMAP – The offline alternative**
  - Similar to XR, our DAHS for Ambient
  - Data acquisition
  - Data storage in a local database (Local Computer)
  - Based on fixed License



# Applications examples





# Case study

## ☁ Odorous gases monitoring on a wastewater treatment plant

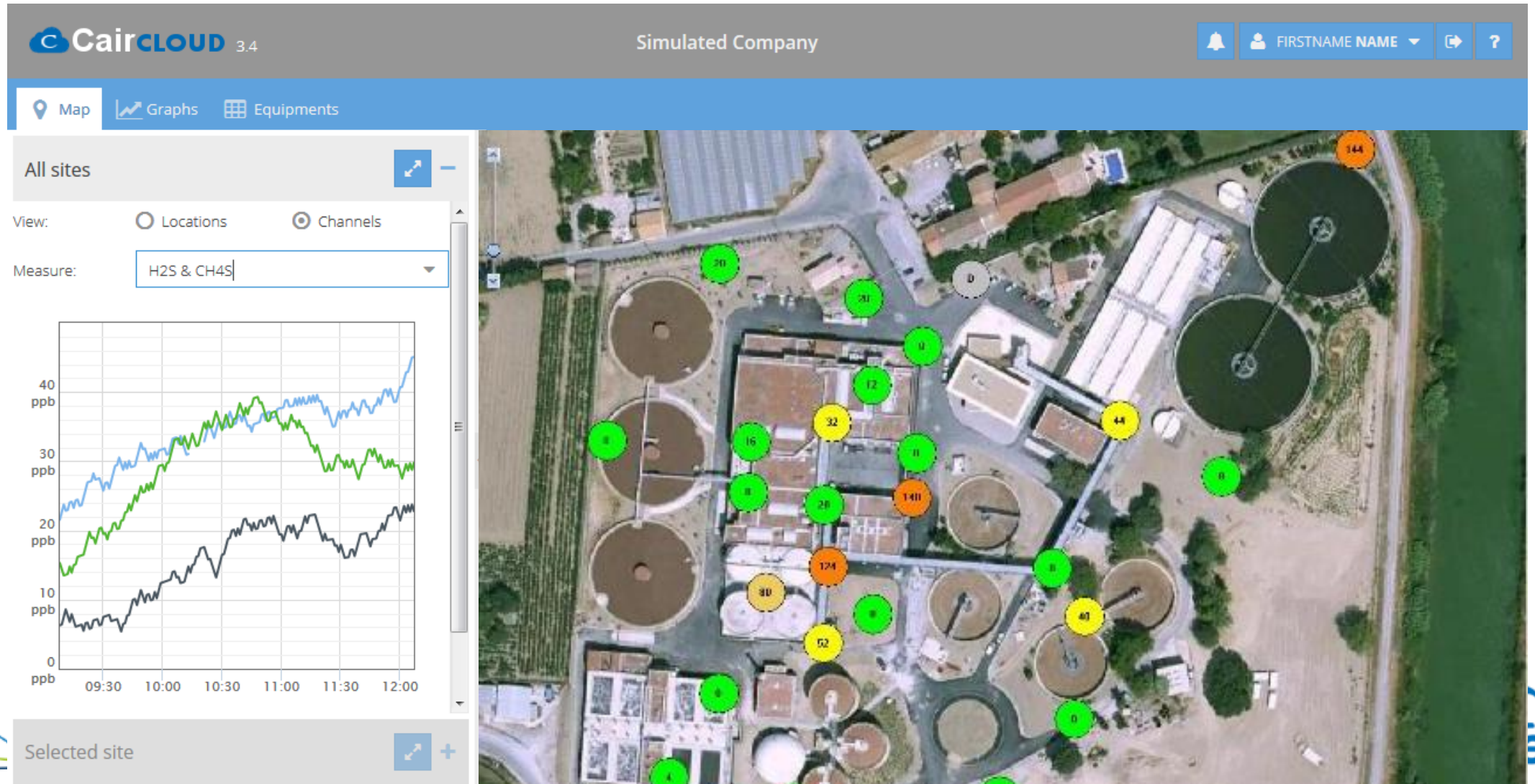


- **500 000** inhabitants-equivalent
- Parameters monitored : **H<sub>2</sub>S** & **CH<sub>4</sub>S**
- Complete Radio network of **29 sensors**



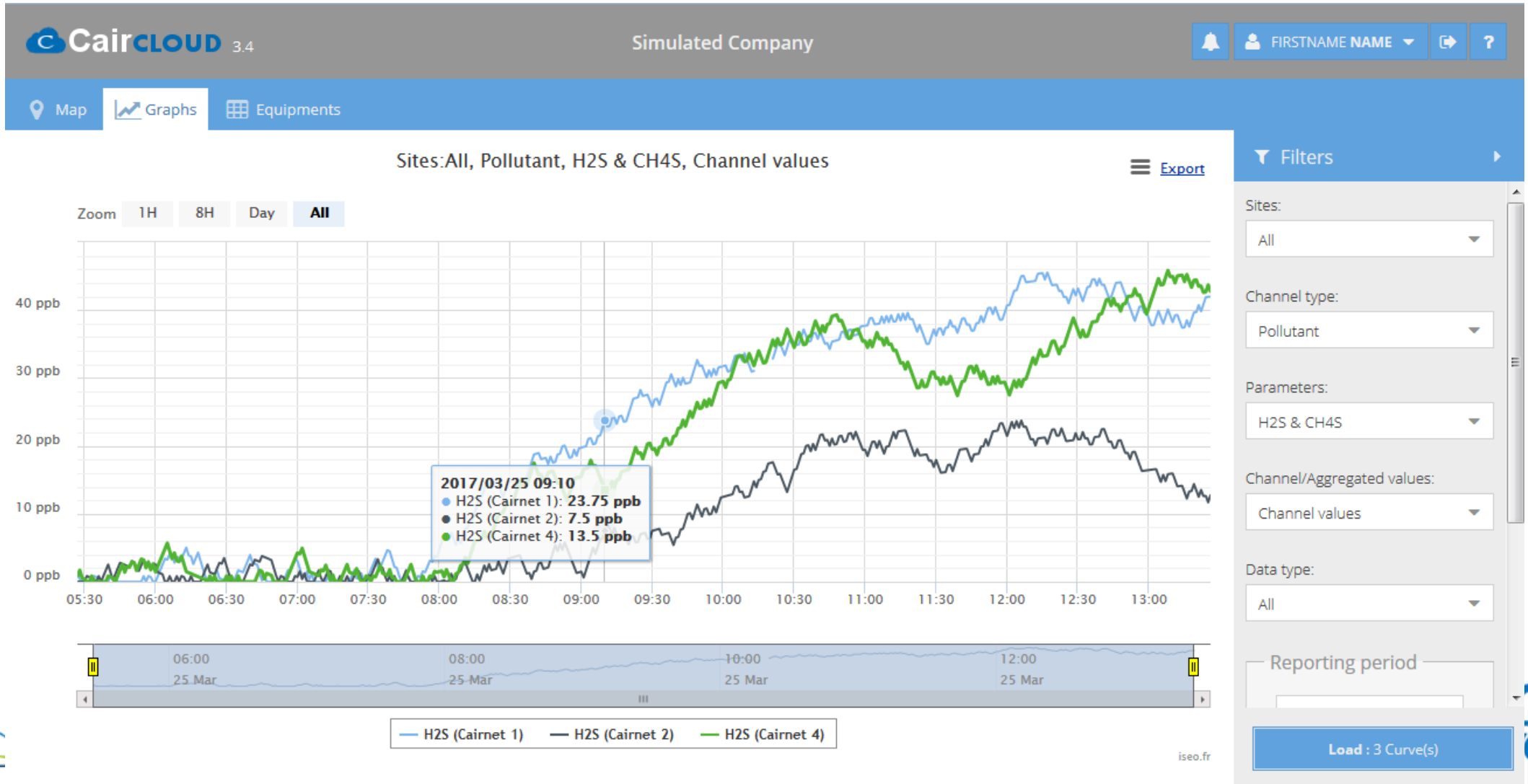
# Interface

☁ Every sensor is displayed, with real-time concentration.



# Interface

☁ Detailed data is available, per station or per network.



# Interface

🌩️ Network management is easy and centralized.

CairCLOUD 3.4

Simulated Company

🔔

👤 FIRSTNAME NAME

🔗

?

📍 Map

📈 Graphs

📋 Equipments

Type	Serial Number	Label	Remaining use	Last data		Alert threshold	Actions
▼ 📶 Cairnet 3G	imei-1234567890	Cairnet 1			-		
🏠 Cairsens Dust PM10 & PM2.5	DDP0209999990	-	90%	13 µg/m3- 25 Mar 2017 13:25	-		
📶 Cairsens H2S-CH4S 0/1000 ppb	CHM0209999991	-	80%	42 ppb- 25 Mar 2017 13:26	-		
🏠 Cairsens NH3 0/25 ppm	CAV0000000009	-	70%	29 ppb- 25 Mar 2017 13:26	-		
📶 Cairsens O3-NO2 0/250 ppb	CCB0000000010	-	60%	25 ppb- 25 Mar 2017 13:26	-		
▼ 📶 Cairnet 3G	imei-1234567891	Cairnet 2			-		
🏠 Cairsens NH3 0/25 ppm	CAV0000000001	-	50%	40 ppb- 25 Mar 2017 13:26	200 ppb over 6 mn		
📶 Cairsens O3-NO2 0/250 ppb	CCB0000000002	-	40%	40 ppb- 25 Mar 2017 13:26	-		
🏠 Cairsens CH2O 0/1000 ppb	CFM0000000003	-	30%	26 ppb- 25 Mar 2017 13:26	-		
📶 Cairsens H2S-CH4S 0/20 ppm	CHM0000000004	-	20%	13 ppb- 25 Mar 2017 13:26	-		
▼ 📶 Cairnet 3G	imei-1234567892	Cairnet 3			-		
📶 Cairsens COV-NM 0/16 ppm	CIV0000000005	-	10%	35 ppb- 25 Mar 2017 13:26	-		
📶 Cairsens NO2 0/250 ppb	CNB0000000006	-	0%	7 ppb- 25 Mar 2017 13:26	-		
🏠 Cairsens CO 0/20 ppm	COV0000000007	-		27 ppb- 25 Mar 2017 13:26	-		
🏠 Cairsens SO2 0/1000 ppb	CSM0000000008	-		34 ppb- 25 Mar 2017 13:26	-		
🏠 CairSPM SPM Module	DDP0209999991	-			-		
▼ 📶 Cairnet 3G	imei-1234567893	Cairnet 4			-		

# Benefits

☁ **Real-time monitoring of H<sub>2</sub>S & CH<sub>4</sub>S concentration on the whole site**

➤ **Operating cost savings** : process adjustment, leak detection, etc.

☁ **Possibility to compare any event at any given periods (every day at the same time, weekly occurrences, etc.).**

➤ **Improve communication** toward local (neighbors and authorities)

☁ **Configuration of automatic reports, distant access**

➤ **Remote control** of the site

# Worldwide references

☁ Every year, hundreds of sensors are delivered by ENVEA and are deployed as:

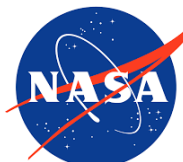
## 1. A efficient tool for odorous gases monitoring worldwide :

- ✓ Wastewater treatment plants and landfills with SUEZ and Veolia in **France, USA, Mexico, Korea, Australia, Spain...**
- ✓ Gas refinery with British Gas in **Tunisia**
- ✓ Seaweed decomposition in **Martinique** (French Caribbean)

## 2. A cost-effective tool for impact measurement campaigns by **TOTAL**

## 3. A reliable portable equipment for O<sub>3</sub>/NO<sub>2</sub> exposure surveys by the **NASA, USEPA, USDA, etc.**

## 4. An alternative to AQMS stations: in France, UAE, India







envea