Improving Air Quality and Reducing Fugitive Emissions Through Continuous Monitoring Technology

ESAA EnviroTech Conference

June 3, 2021

QUBE

SECURE ENERGY

Presenters

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Agenda

01 Background

02 Technology

03 Outcomes

04 Future improvements

Understanding odours from oil and gas operations

Overview of odours from oil and gas facilities

- Most odours generated at oil and gas facilities are typically harmless however, they do impact air quality and nearby residents' quality of life
- Typical Odours from oil and gas facilities include:
  - Hydrogen sulfide (H_2S)
  - Volatile organic compounds (VOCs)
  - Sulfur dioxide (SO_2)
- Odours often arise from intermittent activities such as tank unloading and episodic venting making it difficult to determine the root cause of the odour

Common odour and their detection thresholds

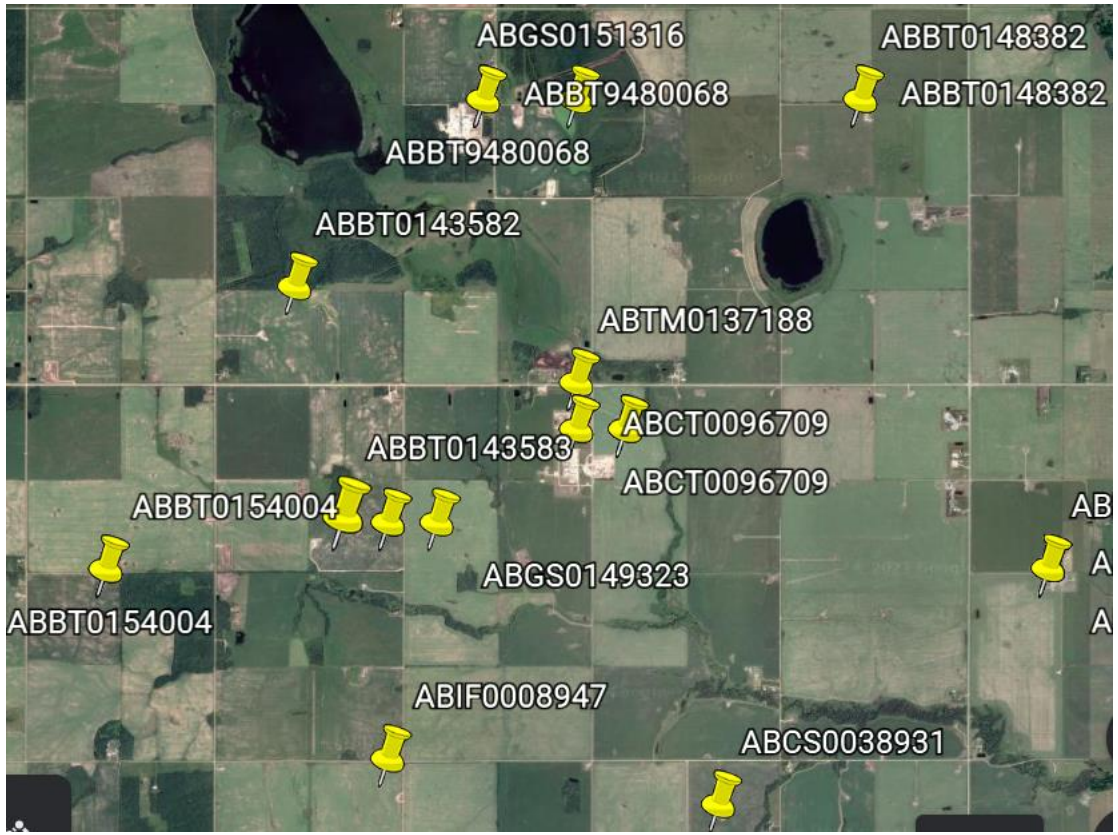
Gas	Odour detection threshold
H_2S	~8 ppb
SO_2	~670 ppb
Mercaptan	~2 ppb
Heptane	~150 ppm
Benzene	~61 ppm
Toluene	~160 ppm
Ethylbenzene	~2.3 ppm
Xylene	~0.8 ppm

Understanding the La Glace area

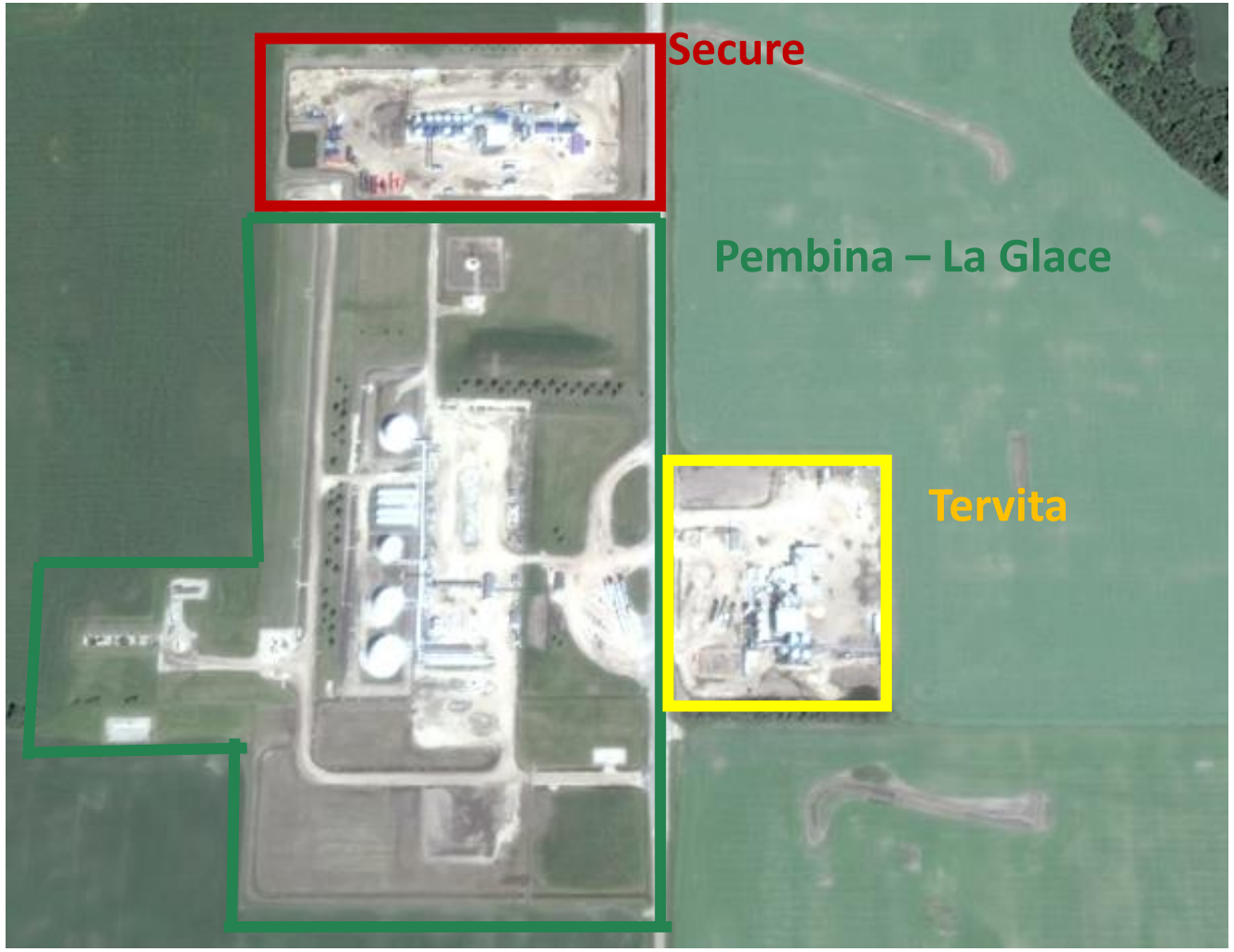
Background

- La Glace is a small town located about 45 minutes northwest of Grand Prairie in an area of dense petroleum development which has led to increased emissions
- Numerous companies have overlapping operations in the area including SECURE, Pembina, and Ovintiv
- Odour complaints have been lodged by nearby landowners as a result of various operational activities leading to challenging stakeholder relations
- The Alberta Energy Regulator (AER) is responsible for investigating odour complaints and enforcing complaint protocols

Aerial view of La Glace facilities



Challenges associated with locating the source of odours



Challenges

- Many events which result in off-lease odours are episodic in nature
- Follow-up inspections from the AER often occur well after the odour has dissipated
  - Odour complaint and AER inspection may occur on different days
- Most technologies have pitfalls:
  - Intermittent
  - Expensive
  - Do not collect local meteorological data

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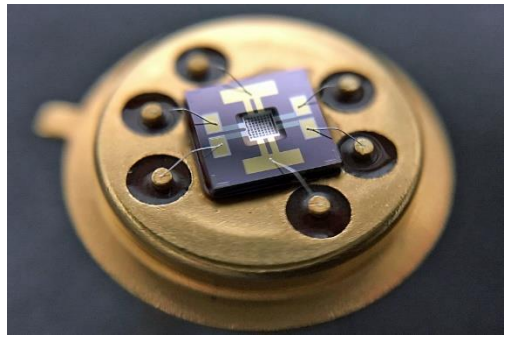
Technologies used to source odour complaints

	Low-cost, fixed sensors	OGI cameras	Air trailer	Human senses
Overview	▪ Fixed gas detectors using low-cost metal oxide or electrochemical sensors	▪ Thermal imaging technology ▪ Produces visual image of plumes of gas leaks	▪ Laser based gas analyzers that measure gas concentration at the ppb level	▪ Smell, sight and sound is used to identify the presence of an odour
Limitations	▪ Sensors are sensitive to temperature and humidity and thus need to be calibrated ▪ Not as accurate as gas analyzers	▪ Snapshot measurement ▪ Requires skilled operator ▪ Only measures methane not VOCs	▪ Expensive; limits the number of air trailers and duration for which they can be deployed ▪ Unable to identify location of emissions	▪ Subjective ▪ Snapshot in time ▪ Inspection often occurs on different day than the complaint was lodged



Our mission

To reduce emissions from primary industries through continuous monitoring and artificial intelligence

QUBE

Low-cost, Continuous, AI based solution for environmental surveillance

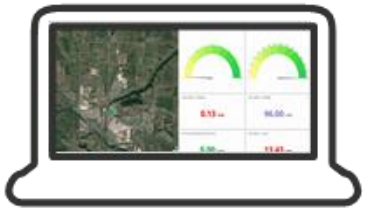
1 **Low-cost IoT device**

Deployed in the field

2 **AI/ML platform**

Analyzed on the cloud

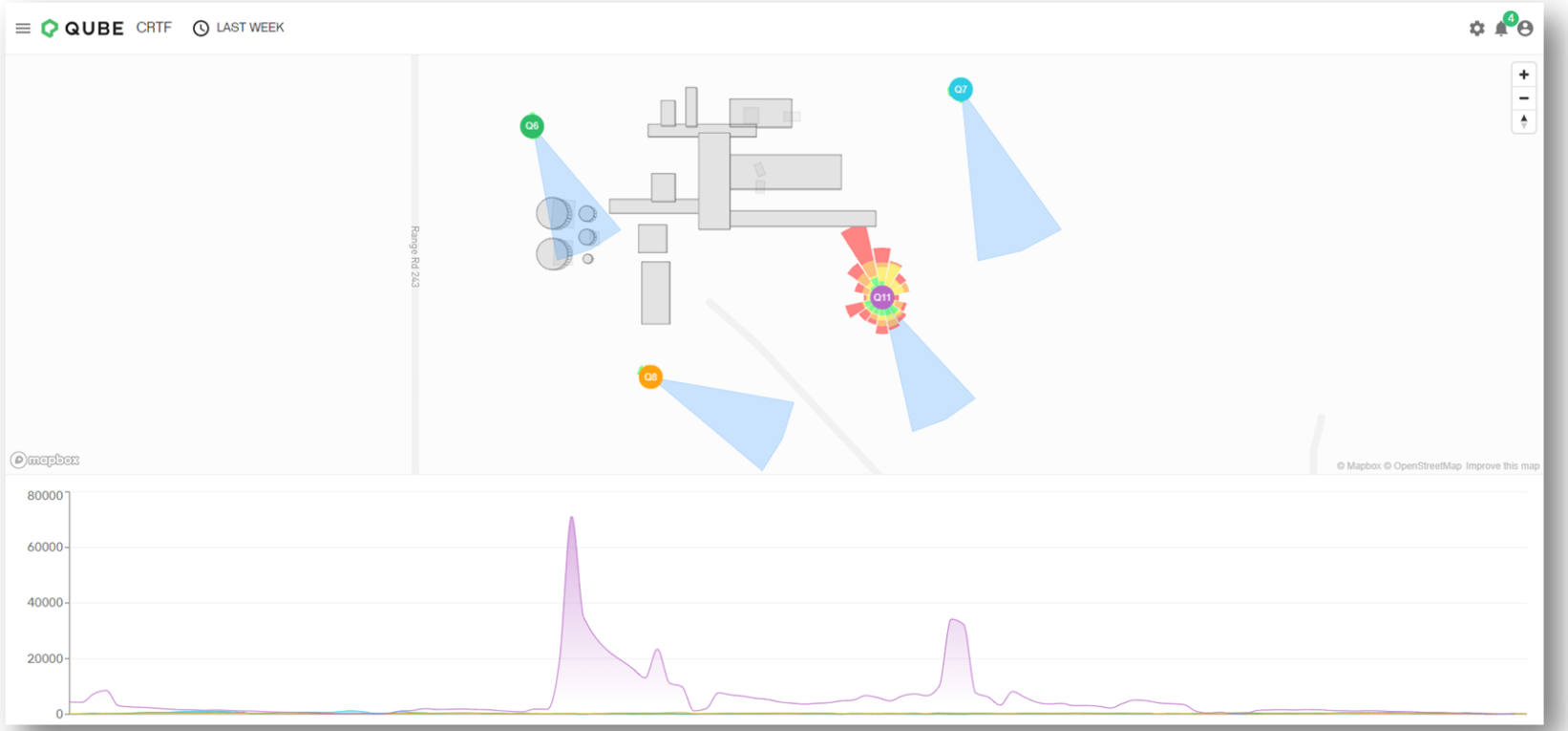
3 **Dashboard and recommendation engine**



Intelligent dispatch of operational teams

Integrated end-to-end technology stack

Operator Dashboard



Key benefits

Real time notifications and alerts

Mobile and desktop accessible

API enabled (e.g., tie into PowerBI)

Detailed specifications of Qube's device

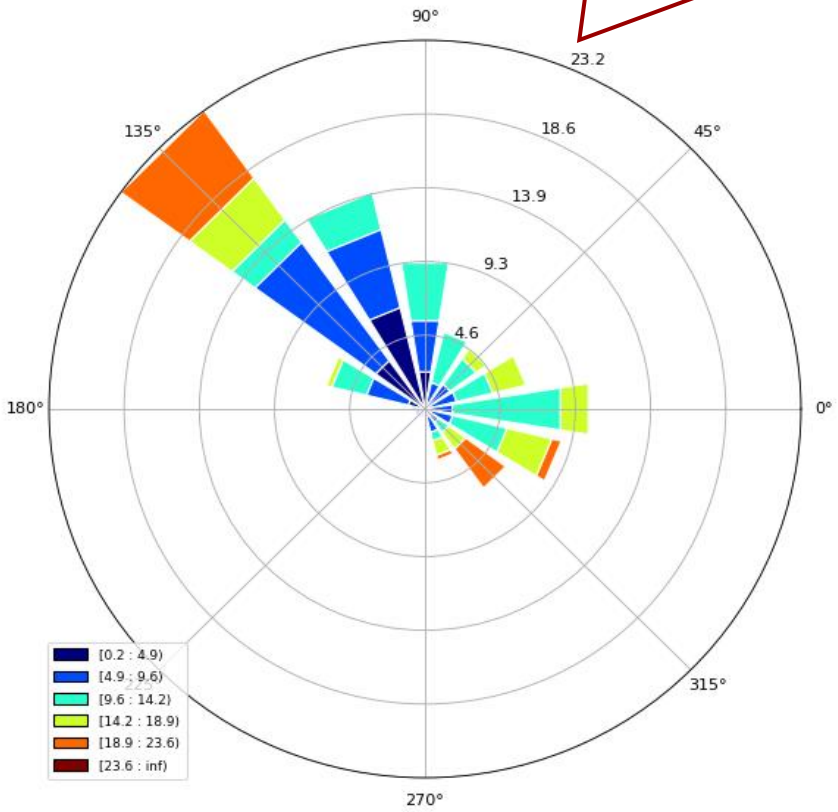
Gas sensors	Resolution	Range
CH_4	≤1 ppm	0 – 10,000 ppm
NO_2	≤10 ppb	0 – 10,000 ppb
H_2S	≤10 ppb	0 – 10,000 ppb
VOC	≤50 ppb	0 – 10,000 ppb
SO_2	≤1 ppb	0 – 2,000 ppb

Environmental sensor	Resolution	Range
Thermometer	≤0.50 °C	-55 to 125 °C
Barometer	≤0.18 Pa	300 –1,100 hPa
Humidity	±3 %	0 – 100%
Anemometer	1 Km/h, 1°	0 – 230 Km/h, 0 - 360°
GPS	±20 m	NA

Qube devices require wind and can detect emissions up to >100m from a source

Alberta has a prevailing wind from the NW

Aggregated data from ~300 municipal weather stations in AB



Each device has a detection coverage of ~100m

Potential device placement and detection coverage for a gas plant near Vauxhall, AB

Legend: Optimized devices placement

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Understanding odour investigation process

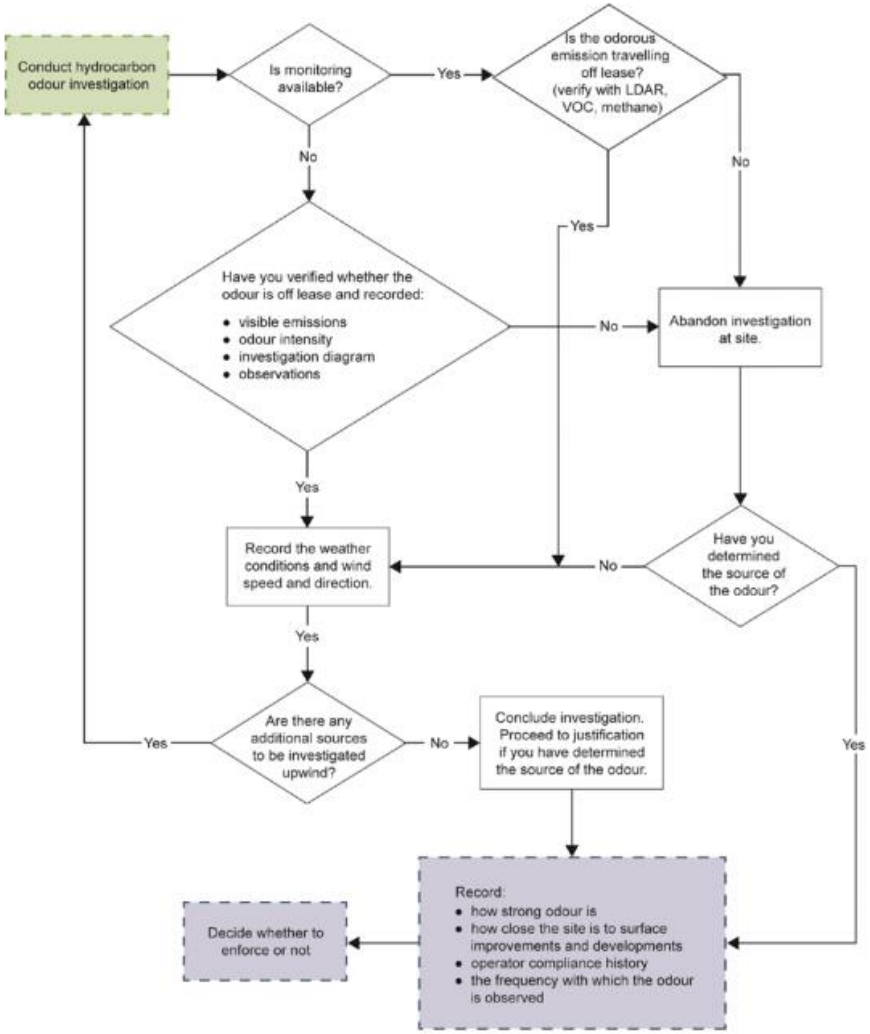
AER Procedure

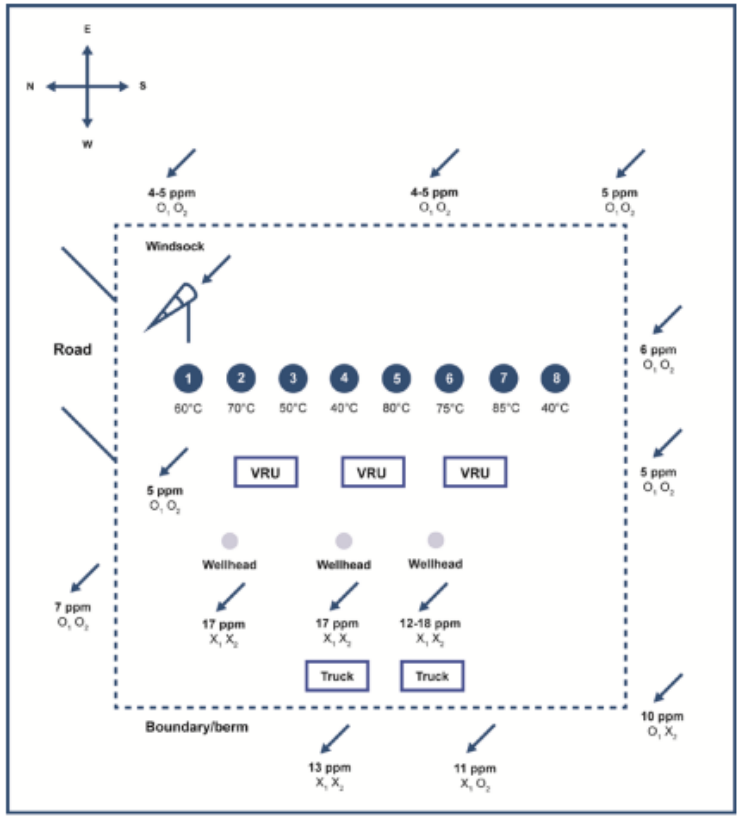
1. Odour investigation
   - Specify data collection method e.g. OGI camera
   - Record complaint location
   - Record presence or absence of odours
2. Evidence collection
   - Draw birds eye view of equipment on site (baseline map)
   - Walk around site and collect evidence i.e., instrument readings, methane concentrations, windspeed and wind direction
3. Presenting evidence
   - Plot point-in-time measurements collected at time of inspection on map

Qube Procedure

1. Odour investigation
   - Collect gas concentration and windspeed data continuously using Qube's IoT device
   - Request additional operational data from operator
2. Evidence collection
   - Locate all equipment via satellite image of site and mark locations of Qube devices
   - Collect continuous gas concentration and windspeed data
3. Presenting evidence
   - Isolate peaks concentration over time period odour complaint occurred
   - Plot the peak concentration and wind data on the satellite image of the site

Odour management protocols from AER





Legend:

X_n - offensive odour

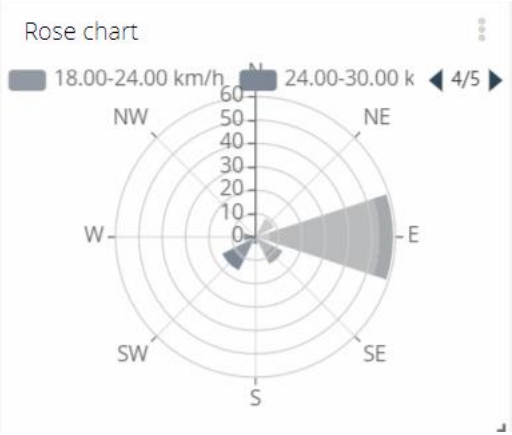
O_n - no odour

n = 1 - inspector 1

n = 2 - inspector 2

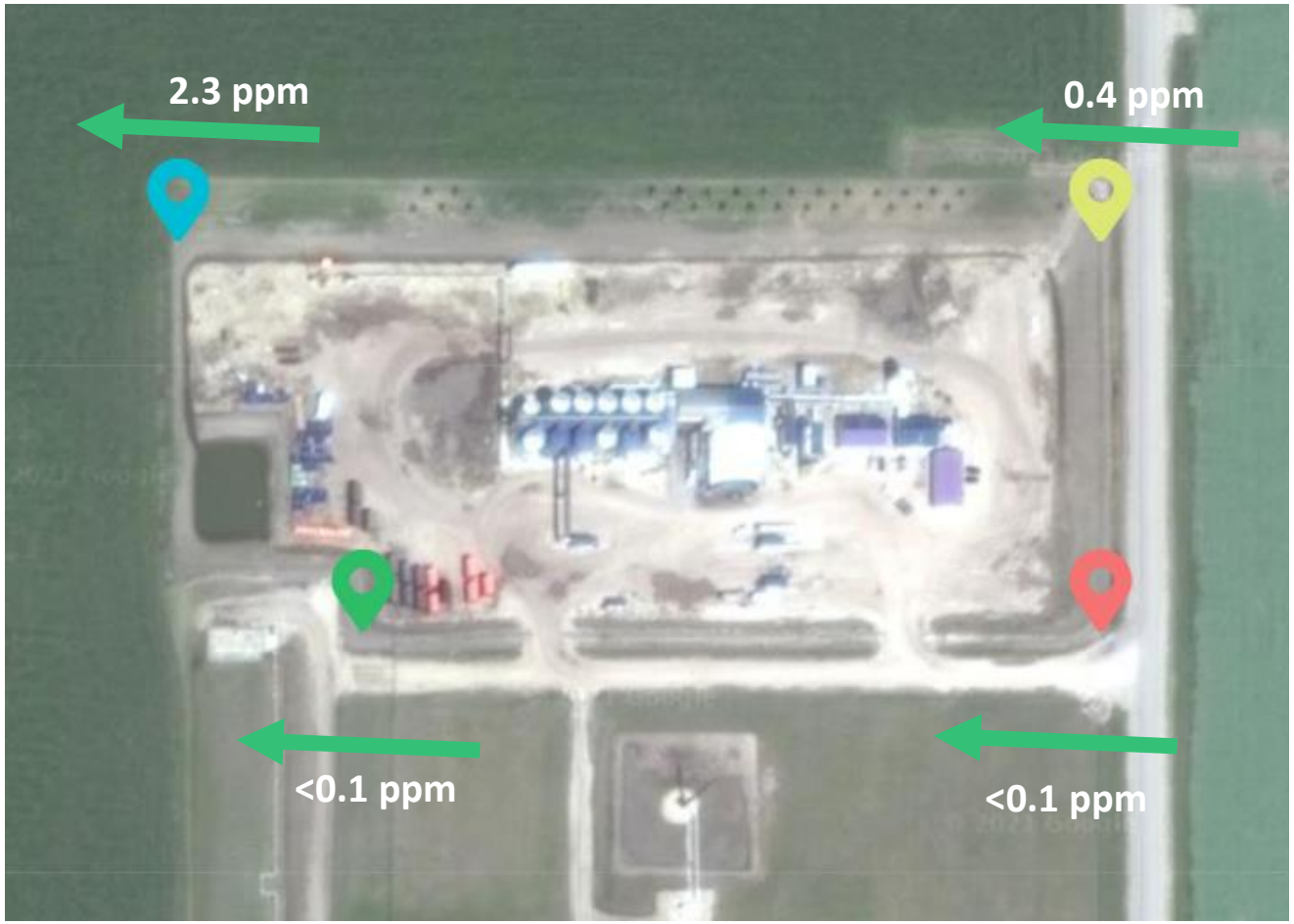
- wind direction

Example baseline maps from Qube's deployments



1. Identify and record peaks in gas concentration in this example, we are looking at the VOC sensor
   - Sensor 4 = 2.3 ppm
2. Record historical wind direction at time of peak
   - Wind direction = 100 degrees (ESE)

Creating a baseline map from continuous monitoring data



Findings

- Small peak in VOC concentration was identified on April 29th at 6 am on sensor in NW corner
- Wind direction was from ESE
- Based on wind direction, emission was likely coming from SECURE facility, however, it was **below** the odour threshold and no complaint was filed with the AER
- Outcome: monitor for future peaks in gas concentration at same sensor and record wind direction

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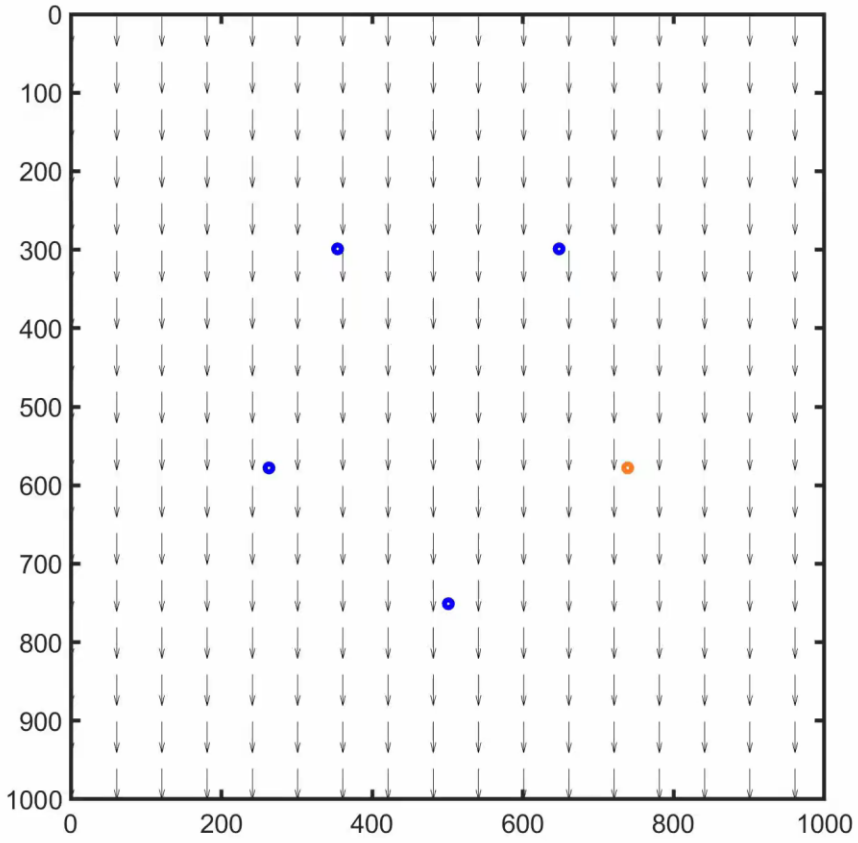
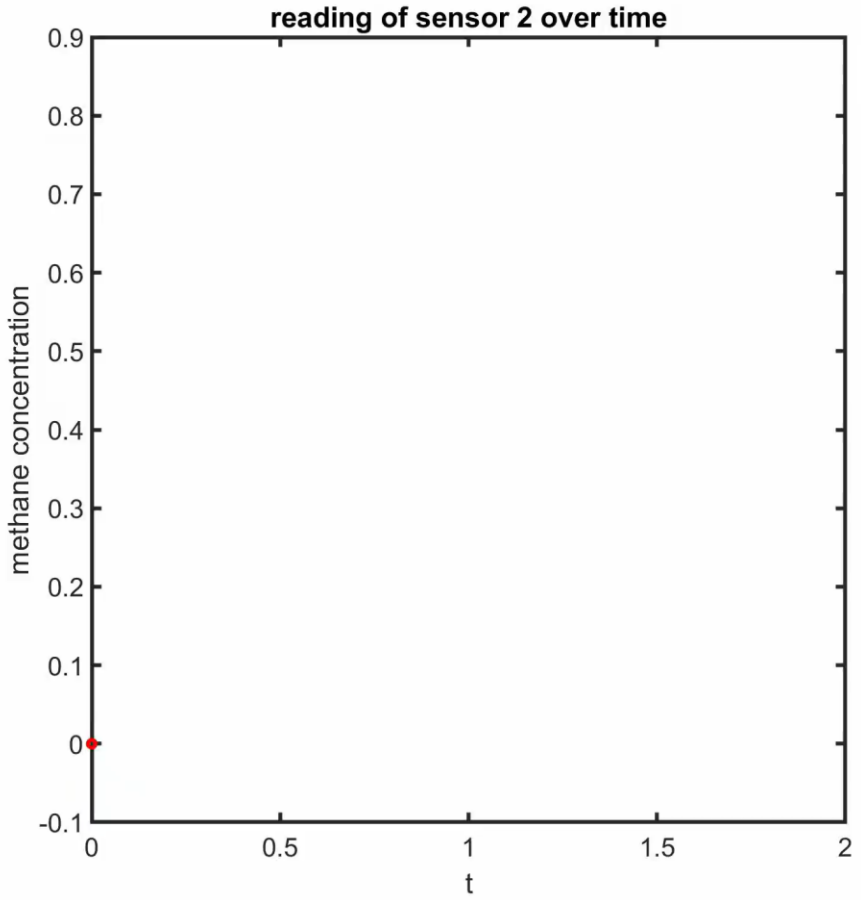
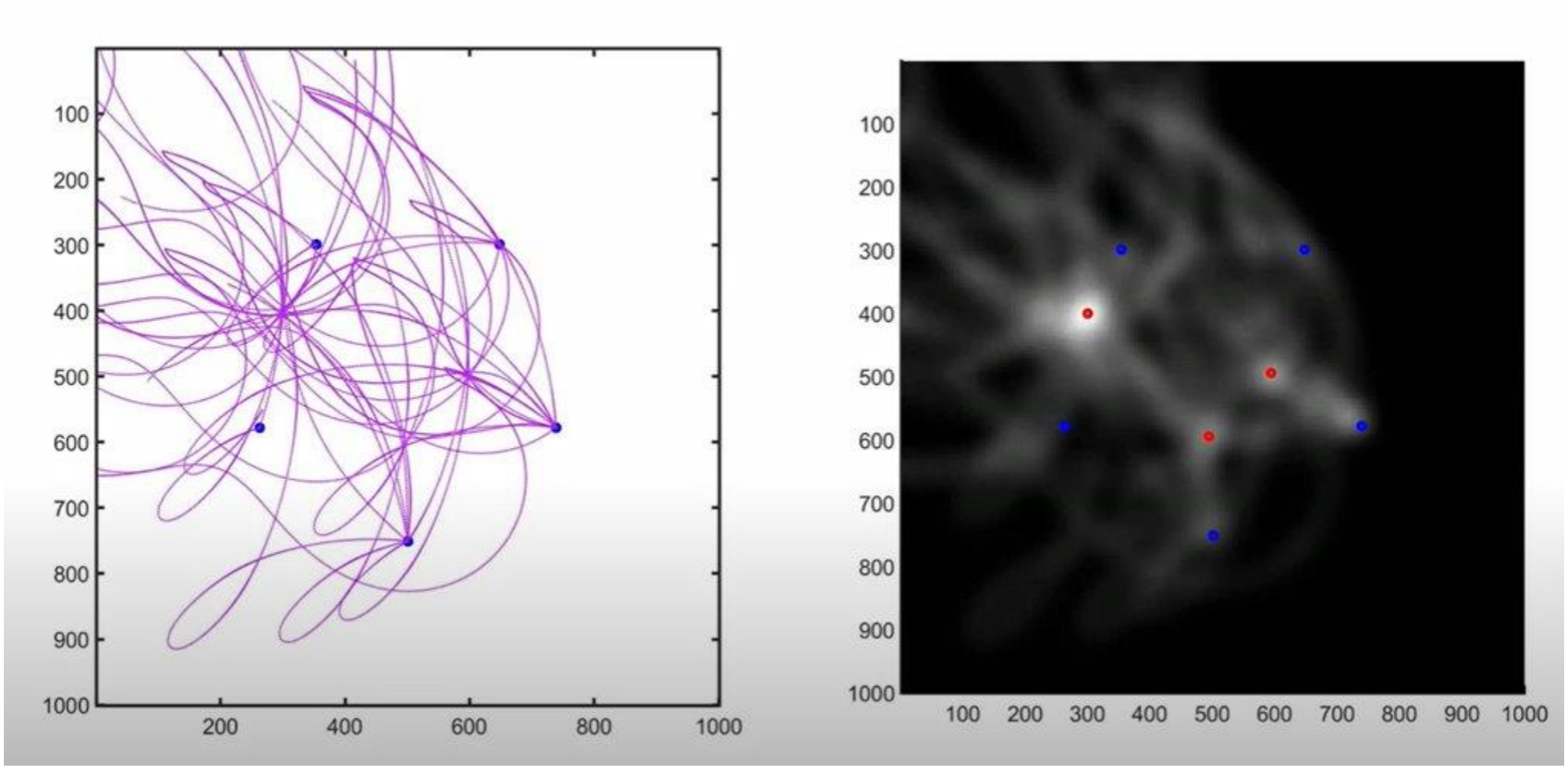
Localization model to automatically identify source





Possible to identify multiple leaks and identify probable sources



Qube’s Testing Facility – Accelerating Development of Quantification Model

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