kellas MIDSTREAM

# Methane Emissions Monitoring

# CATS Terminal (Teesside)

**February 2022**

## Project Canary

*Kellas (CATS Terminal) is the first installation of a Project Canary system outside the USA*

- Project Canary is a for-profit Public Benefit Corporation, formed to deliver independent Environmental Social Governance (ESG) data; it employs a team of scientists and engineers and is recognised for uncompromising standards
  - The Project Canary advisory board includes members from the science, engineering and business world including, Lord John Browne, former CEO of BP.
- Kellas, supported by its owners Blackrock and GIC, explored the technology options available to continuously measure methane emissions at CATS
- The technology review identified only one product, Project Canary, that was ready for commercial operation and two others that were in the latter stages of development and field trials
- Kellas moved quickly to formalise a commercial agreement with Project Canary to install the first Project Canary system in the UK – and the first application, worldwide, outside of the US

# Technology Overview - Project Canary (1)

*Continuous real-time methane monitoring, leak detection, and alarms*

- The CATS Terminal installed 12 x ‘Canary X’ methane sensors in December 2021
- Delivers **continuous methane monitoring**, with automated alarms to the operator
- The ‘Canary X’ sensor package includes:
  - Methane sensor – can measure methane gas fluctuations down to 250ppb
  - Wind sensor
  - GPS sensor
- The technology is being actively developed, tested, and optimised at Colorado State University’s METEC (Methane Emissions Technology Evaluation Centre
  - Integrate sensor data and cloud analytics to offer a complete IoT solution to detect and quantify methane emissions
  - Advanced filtering techniques to improve fidelity of sensor data, and enhance accuracy of the quantification model
  - The initial focus for quantification modelling is upstream facilities (eg well pads)
  - Midstream plants are not yet covered by the quantification algorithms

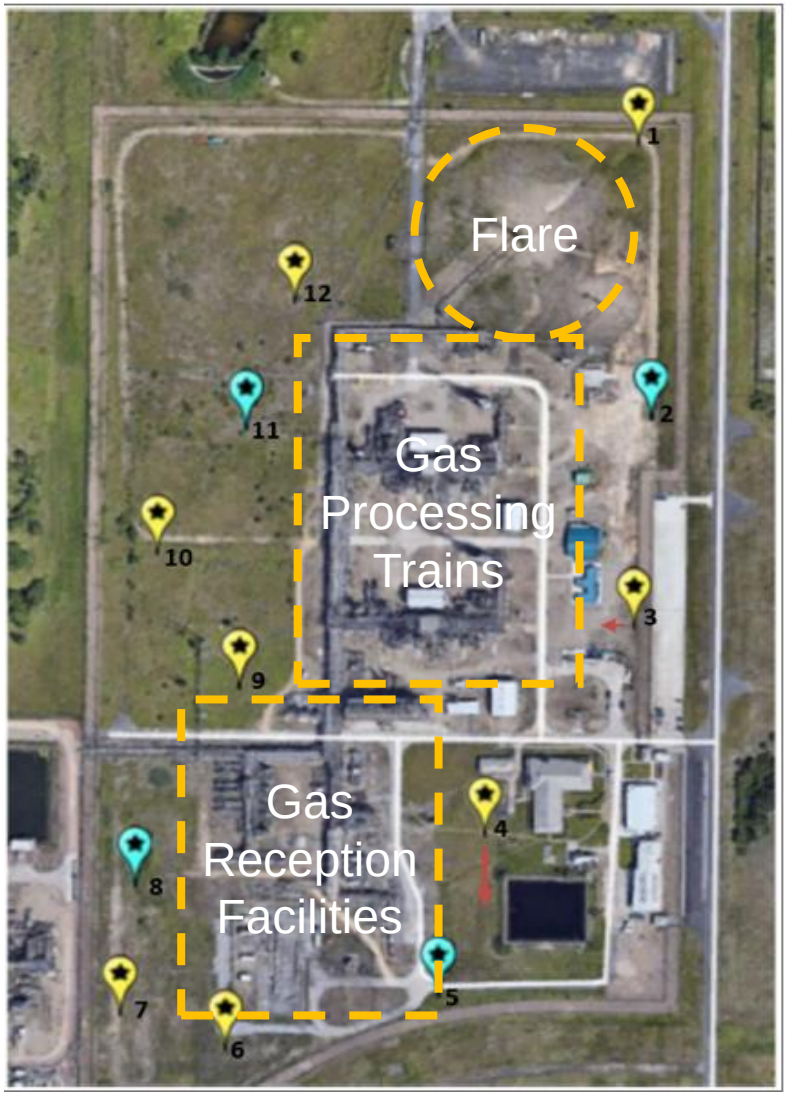
## Technology Overview – Project Canary (2)

*Detect, locate and quantify emission sources, allowing operators to quickly  catch and remediate leaks*

- The Canary X units are completely stand alone, and are solar powered/ charged
  - operate for upto 4 days on a single charge (should solar be compromised).
- Communication of data is via 4G cellular comms to the USA, with the data being sent and then presented via a web accessible dashboard
  - Via Vodafone 4G mobile phone network, with data encrypted
- Access to the dashboard is granted to individuals on a read only basis.
- Alerts are configured by agreement with the Project Canary Team and are sent to individuals by email and/or text message.
  - we have configured alerts each time a Canary measures 10ppm or above
  - the Ops Team then investigate via the dashboard and in the field as necessary

# Continuous methane monitoring – CATS system

*12 units strategically positioned around the perimeter of the CATS Terminal operational facilities*

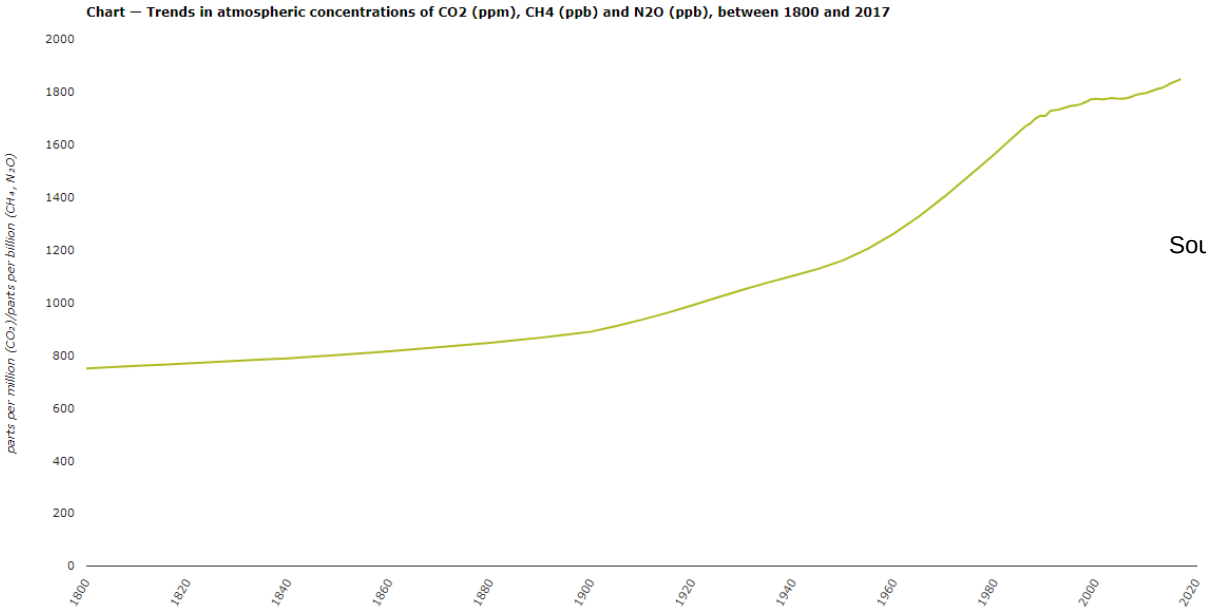



- The units we have installed are the ‘Canary X’ units solely to measure Methane, with the addition of wind speed and direction on four strategically placed units (marked blue on the aerial plot).

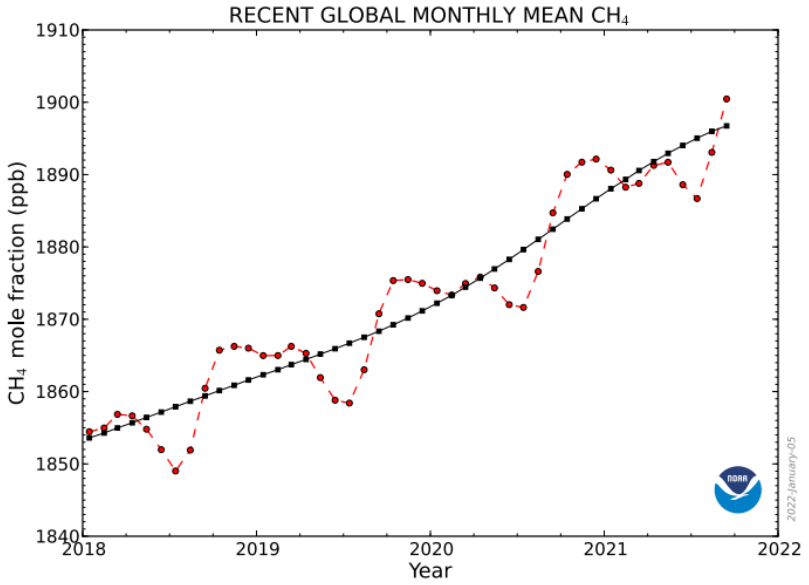
- Photo above: solar powered ‘Canary X’ (#4 on map)

# Trends in Atmospheric ("Background") Concentration of Methane

*Concentration of methane in the atmosphere has more than doubled since 1800; to 1.90ppm (1900ppb) in January 2022*




Source: European Environment Agency https://www.eea.europa.eu




Source: NOAA Global Monitoring Laboratory, https://gml.noaa.gov/

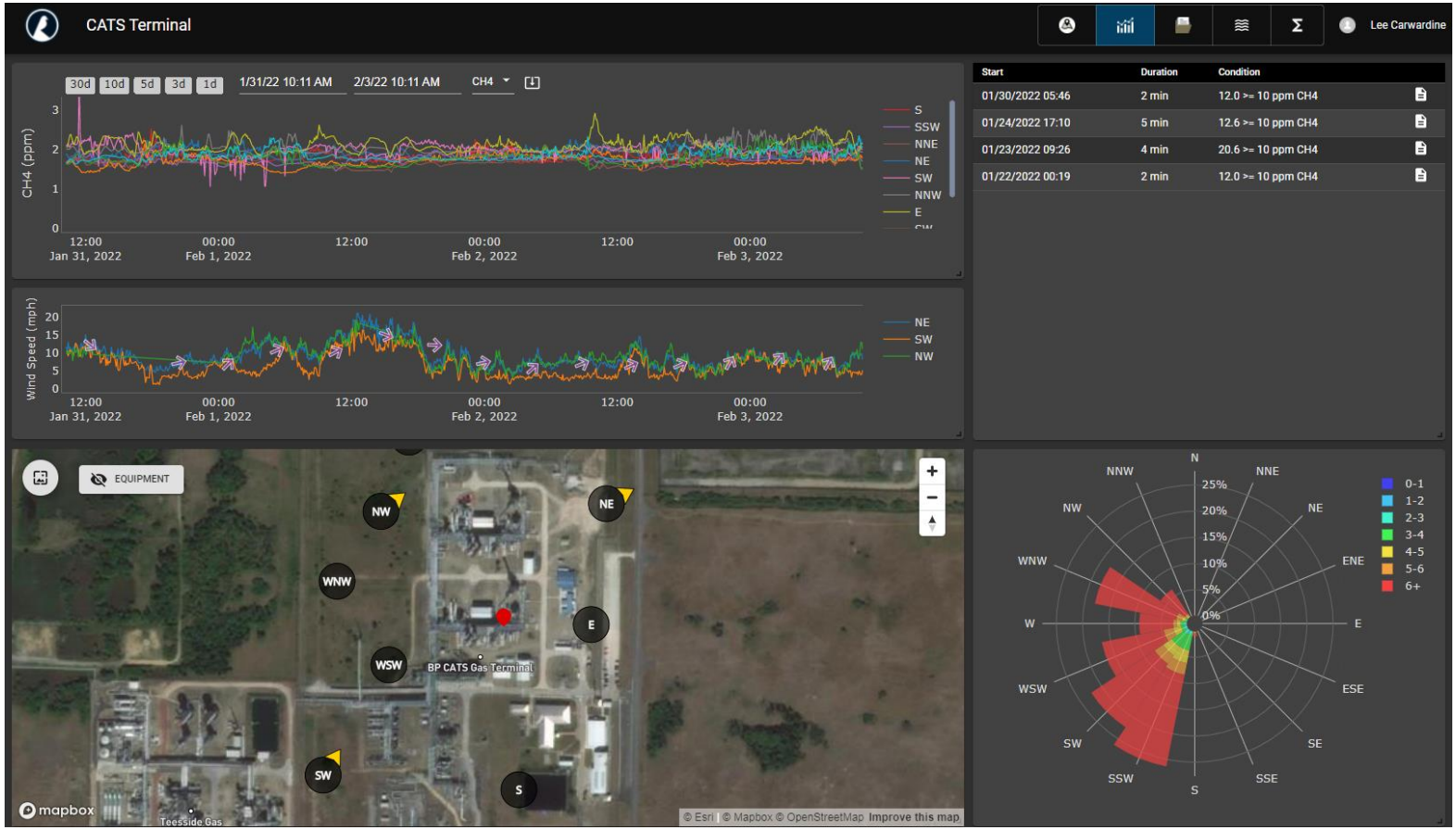
## Installation & Initial Operating Experience

*Detect, locate and quantify emission sources, allowing operators to quickly  catch and remediate leaks*

- Working with the Project Canary Team has been straightforward, even though based in US
- Training has been rolled out to key users in the engineering and ops teams
  - Minimal time zone challenges, and customs delivery issues
  - Contract discussions were straight forward – we are leasing the units for a fixed period (several years) at a fixed annual fee
- The delivery, install and commissioning went well
  - Support from a Project Canary Technician on-site during the install was beneficial as there were a few issues getting some Canary Units connected to the 4G network.
- Training has been rolled out to key users in the engineering and ops teams
- Dashboard is easy to use

# Dashboard Screenshot – ‘baseline’

*3 days data from CATS Terminal (February 2022) – consistently measuring ‘background’ levels of ~ 2 ppm CH4*




- Top left graph shows Methane readings in ppm (background ~ 2ppm).
- Middle graph shows wind speed and direction – to aid diagnostics when determining potential release points for likely emissions
- Radar plot - the colour represents the wind speed (in mph) and the percentage represents the duration of time that the wind has been from that direction at the associated speed

# Dashboard Screenshot – ‘event’

*Short duration excursion (methane peak at ~20ppm identified in SW corner of CATS Terminal on 23 January 2022*


- Wind direction suggests the event emanated from offsite and lasted for less than 5 minutes
- Detection by only one Canary X suggests the event/source was extremely localised