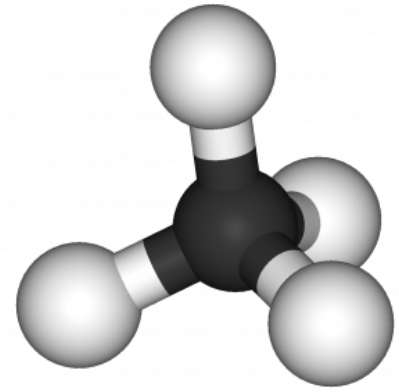
Satelytics

Prepared For:

ONE
OUR NATION'S ENERGY
FUTURE



Market Segments We Serve

How Satelytics Works

1

Data Acquisition

Satelytics takes in multi and hyperspectral data from a variety of third party sources including enterprise satellite data providers using conventional and nano-satellite arrays, plane or drone aerial imagery, and fixed or persistent camera platforms.

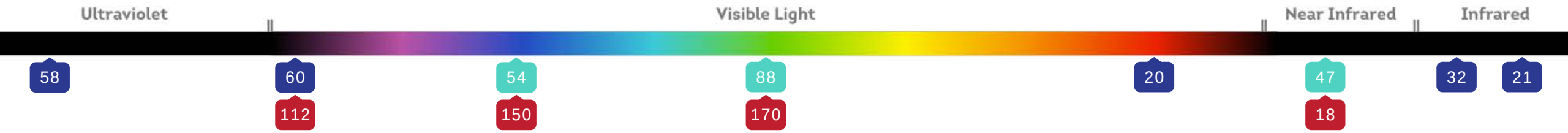
- Satellites
- Nano-satellites
- Aircraft
- Drone/UAV
- Fixed/Persistent Platform

How Satelytics Works

2

Spectra

Visible light and other portions of the electromagnetic spectrum from the sun are reflected off of objects and materials on Earth and into an aerial sensor.



3

Bands

The sensor detects a limited number of bands, or parts of the electromagnetic spectrum, and collates them into data layers that Satelytics can process.

Cameras are sensors that detect the red, green, and blue bands that compose a standard digital image. Multi and hyperspectral images contain many more bands in the nonvisible portions of the spectrum.

Analyzing multiple bands can reveal data values pertaining to the specific phenomena that we're attempting to visualize.

- Liquid Hydrocarbon
- Produced Water
- Building Encroachment

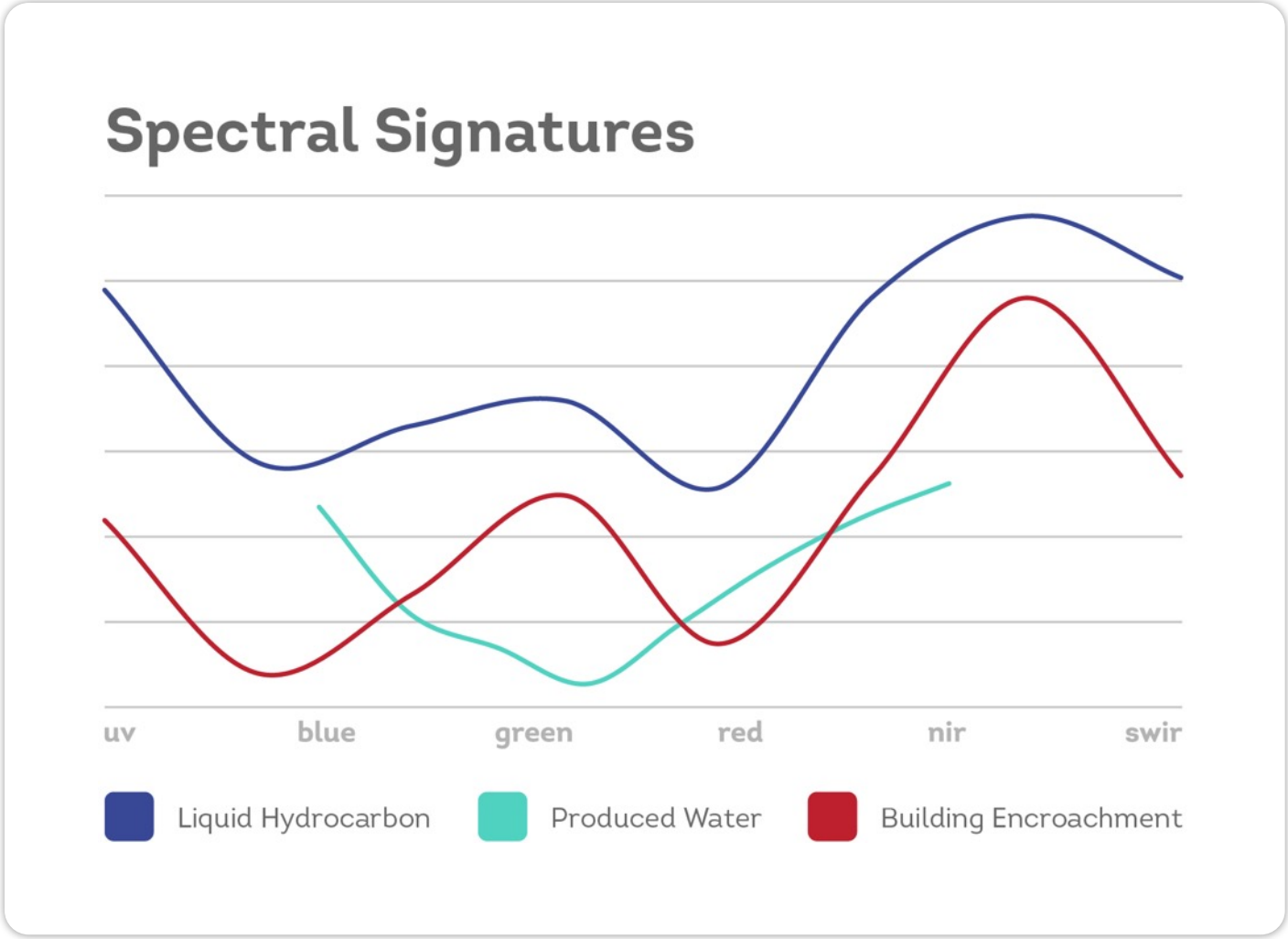
How Satelytics Works

4

Algorithms

Satelytics applies complex, machine learning algorithms to isolate the spectral signatures of objects and phenomena contained in the data, or the pixels, of an image.

Using different bands and computing techniques, our scientists can determine whatever it is we're observing using those spectral signatures.



How Satelytics Works

5

Analytics

Satelytics processes petabytes of data comprising thousands of individual aerial or satellite images and builds a repository of spectral signatures.

We can then use Satelytics to run predictive models or render that data into interactive displays, alerts, and visualizations.

Integration With Other Software Applications on a Number of Platforms

Methane Leak Detection

Gas leak detection during the Aliso Canyon gas leak near Porter Ranch, Los Angeles using satellite data.

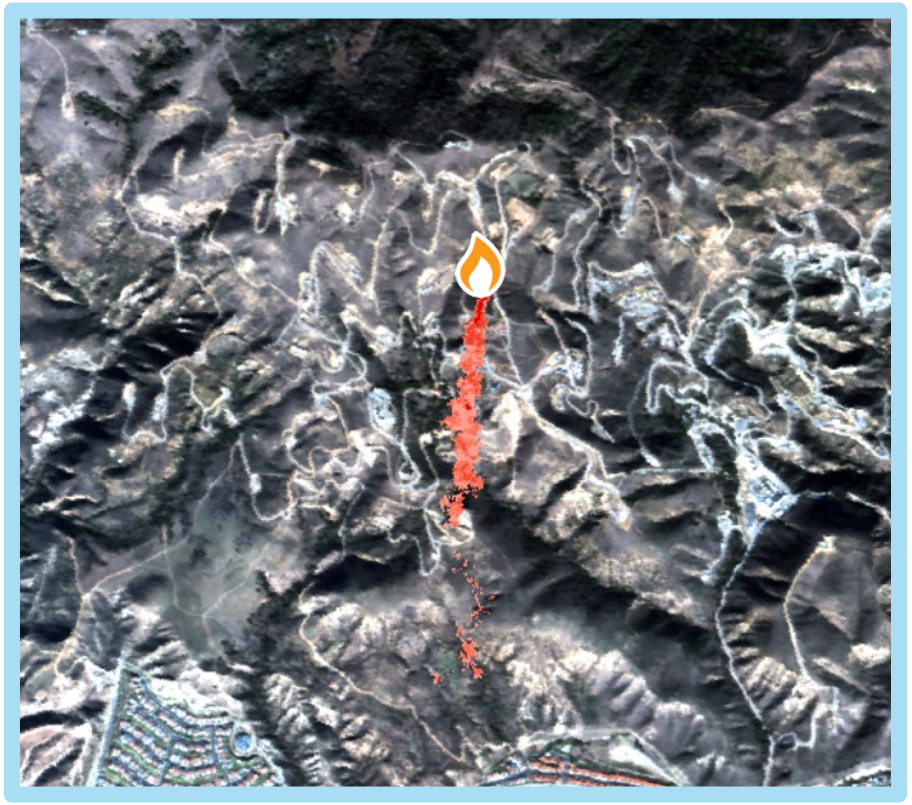
Aliso Canyon – The facts and figures

- Discovered October, 2015
- 97,100 tons of methane and 7,300 tons of ethane released into atmosphere
- Worst natural gas leak in U.S. history
- Local residents report numerous health issues
- More than 2,200 families and 2 schools have been temporarily relocated. Over 6,500 families have filed for help
- As many as 1,000 lawsuits filed
- Estimated remediation cost of $717 million
- $4 million fine for failure to report
- Untold future regulatory and remediation costs as well as damage to local community, company reputation, and the environment

Aliso Canyon Leak

- **104,400 tons of lost product in largest gas leak in U.S. history**
- **Displaced 2 schools and over 11,000 people**
- **$721 million to date in direct remediation and regulatory costs**

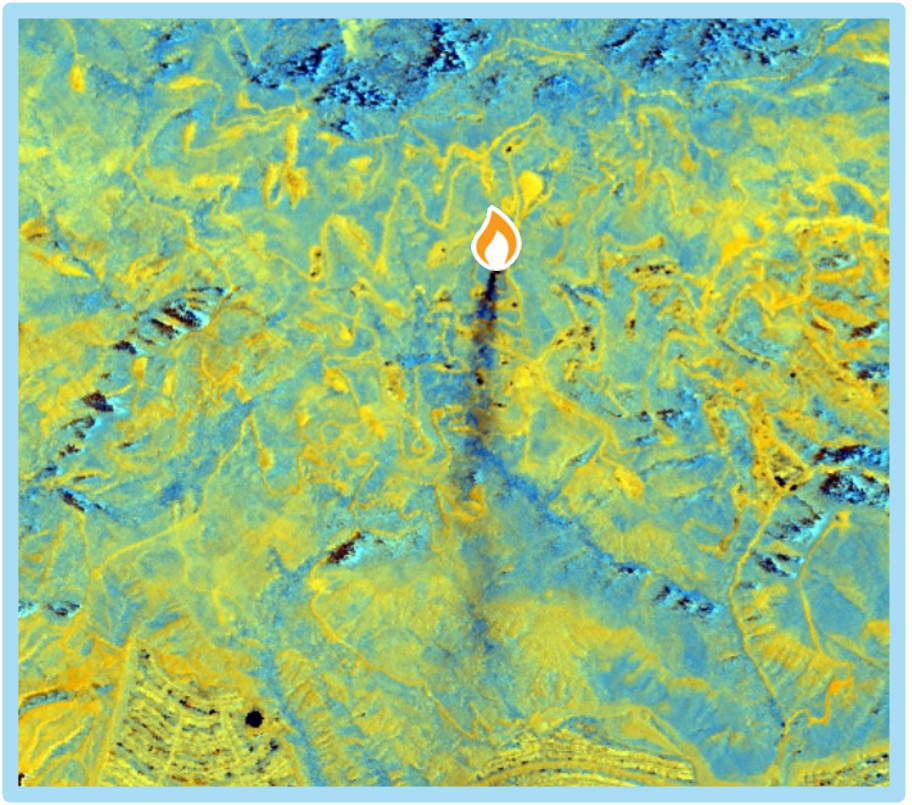
Aliso Canyon Methane Plume Visualization



January 12, 2016, Isolated on Natural Color

Methane Concentration

Low High



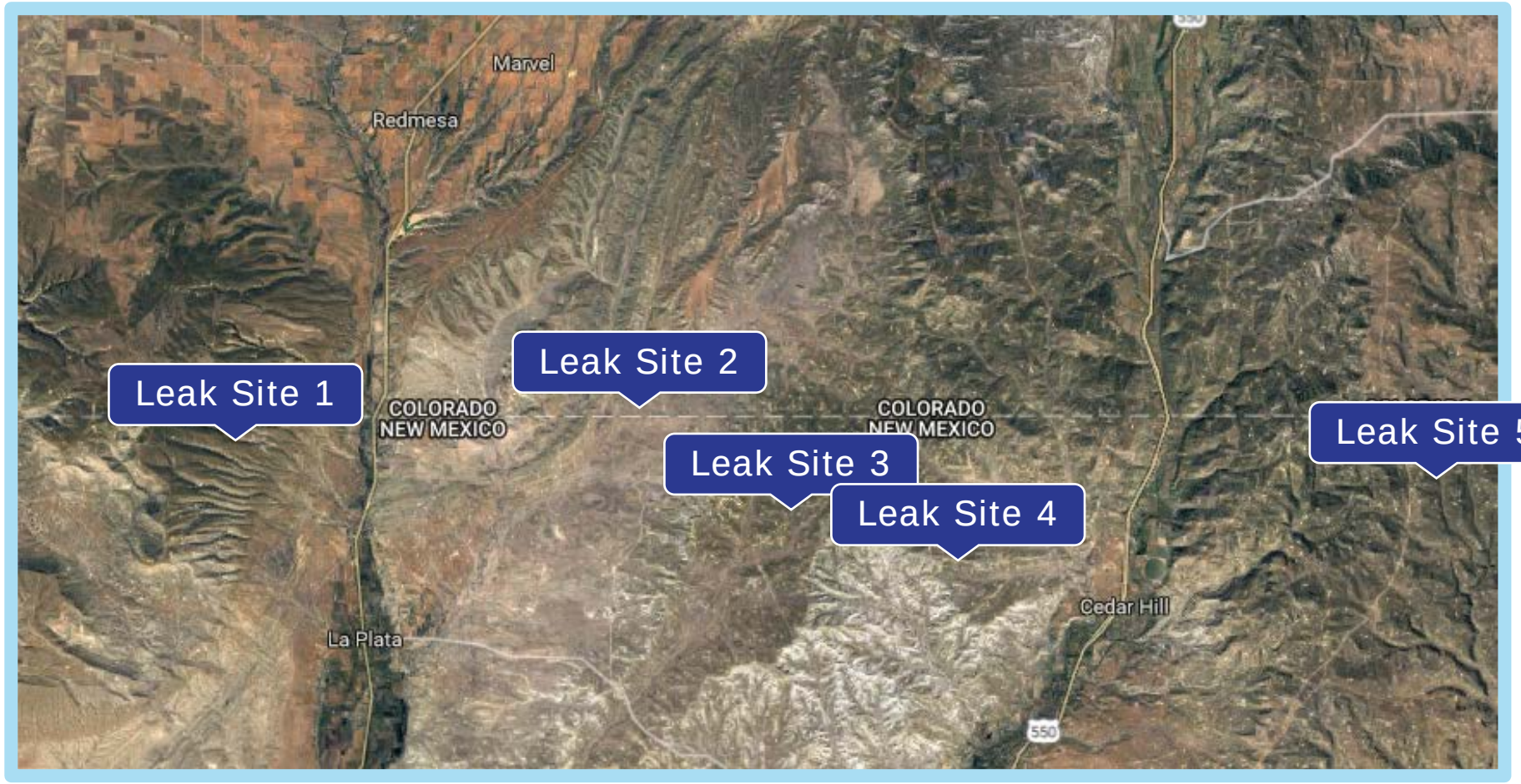
January 12, 2016, Pseudo Color

Methane Concentration

Low High

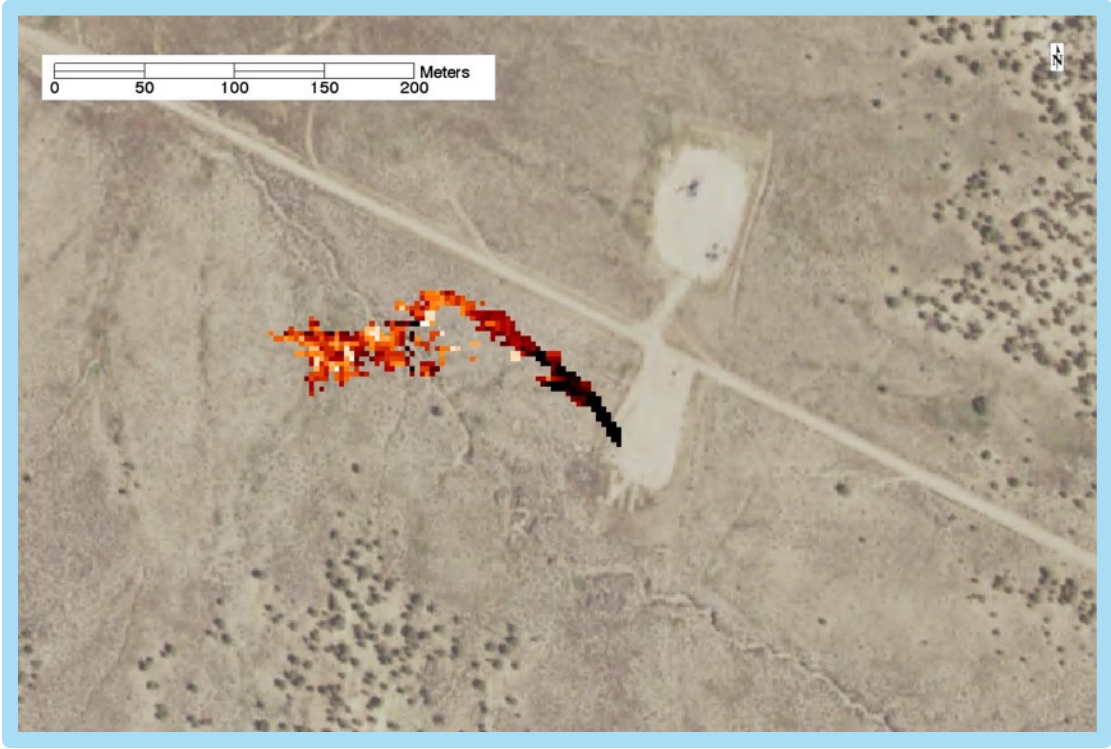
Leak Location

San Juan Basin Region Overview



Leak Site 1

Raw Imagery, 2.8m Resolution



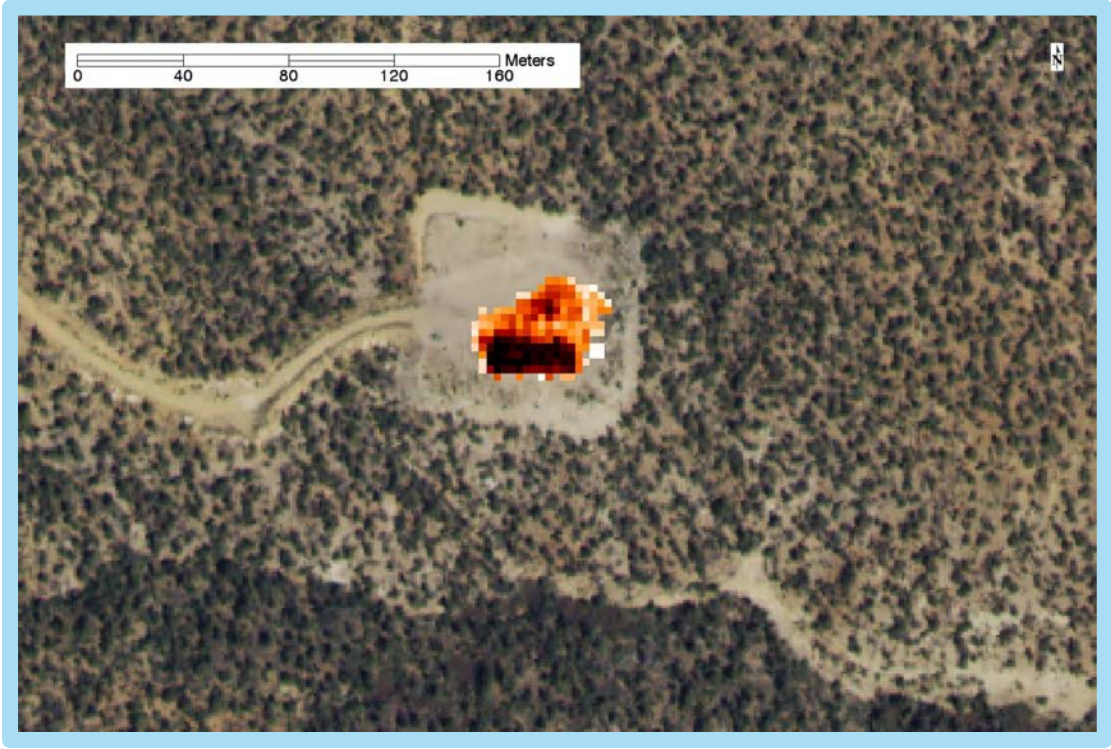
After Analysis, Overlaid on Base Map

Methane Concentration

Low High

Leak Site 2

Raw Imagery, 2.8m Resolution



After Analysis, Overlaid on Base Map

Methane Concentration

Low High

Current Results – Algorithm Accuracies

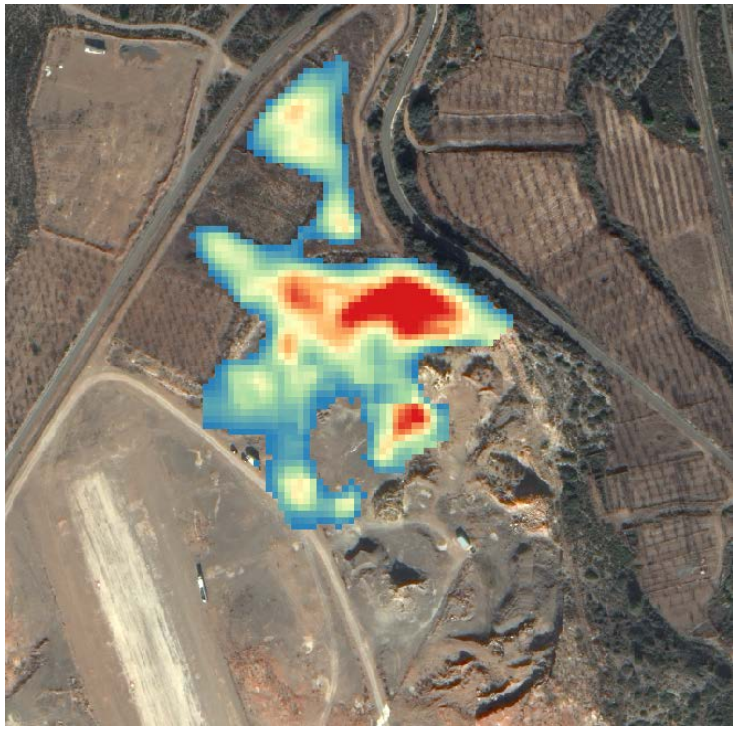
Location (Date)	wind speed (m/s)	Flow Rate (kg/hr)	Actual (kg/hr)	ERROR (%)
METEC (3/4/2020)	1.84	12.39	13.12	5.56
VIVER (12/7/2017)	2.07	59.02	56	-5.39

VIVER Comparison – Original Capture - December 7, 2017

Details Release Rate: 56 kg/hr Wind Speed: ~2.07 m/s Wind Direction: ~198°

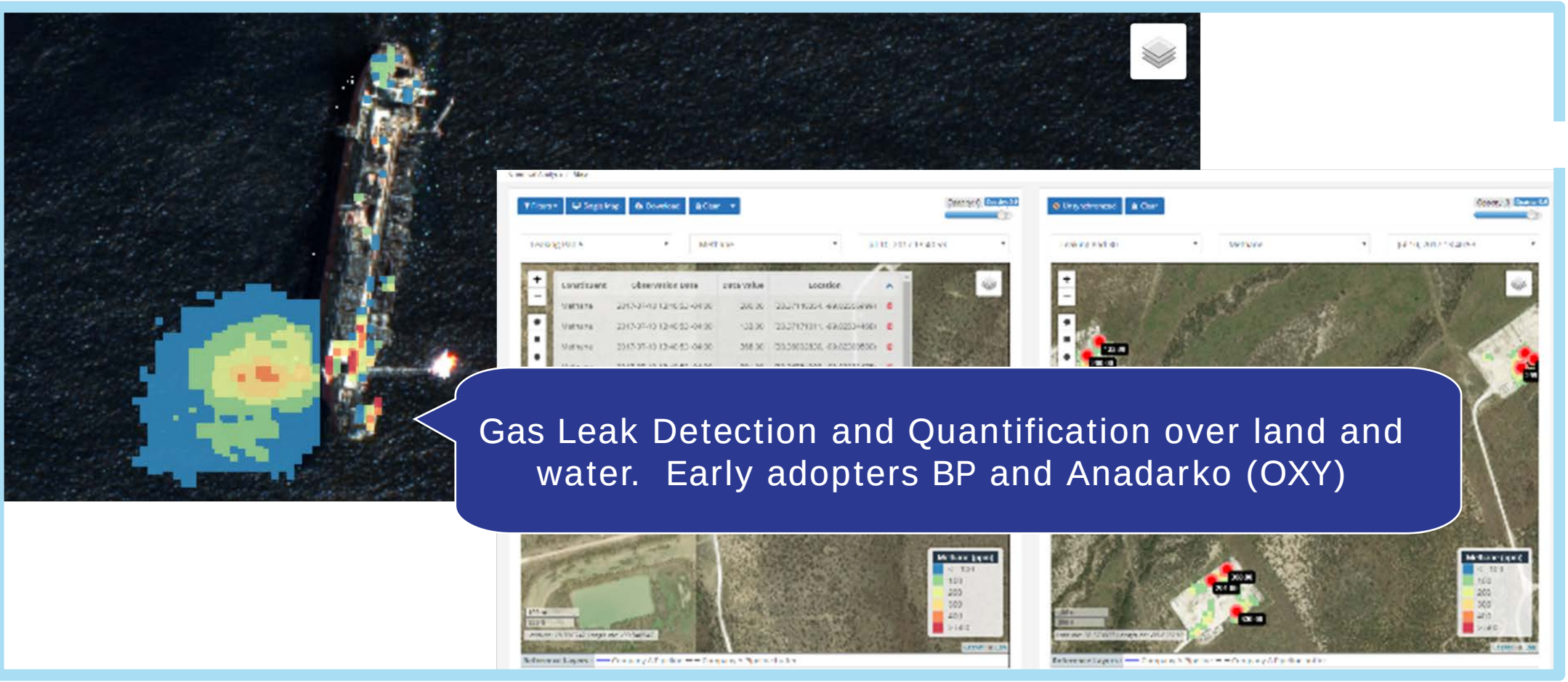
First Release

Improving



Today

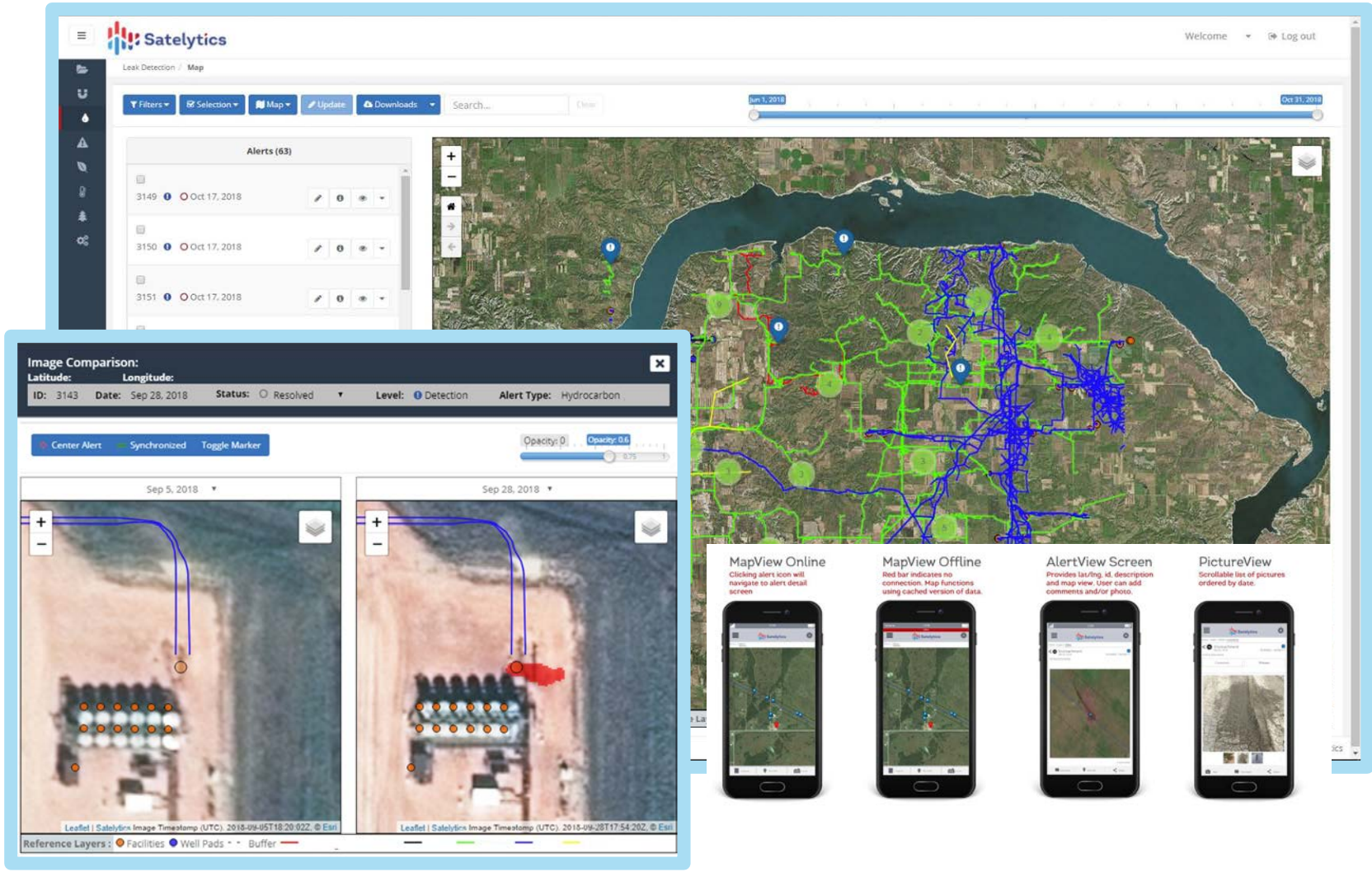
Satelytics can perform many tasks at the SAME time for its customers



iPIPE

iPIPE a consortium of oil and gas operators over North Dakota, new Mexico and Texas use satelytics.io to monitor operations weekly

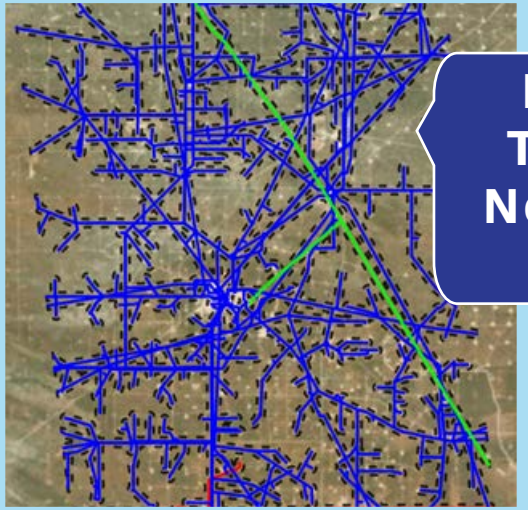
A leak detected early would have cost millions of dollars in remediation. This was identified with costs in the tens of thousands



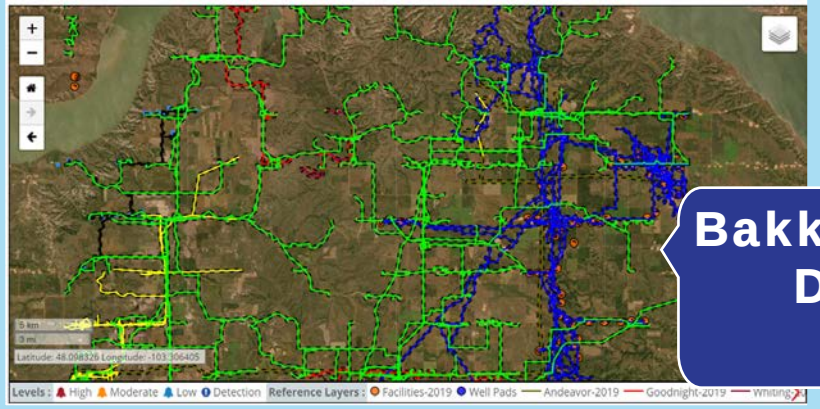
They even try to trick us…

Paddling or kiddie pools filled with liquid hydrocarbon and produced water

iPIPE Members - weekly over Bakken and Permian Basins,



Permian, Texas and New Mexico



Bakken, North Dakota

andeavor

equinor

GOODNIGHT MIDSTREAM

HESS

OASIS MIDSTREAM PARTNERS

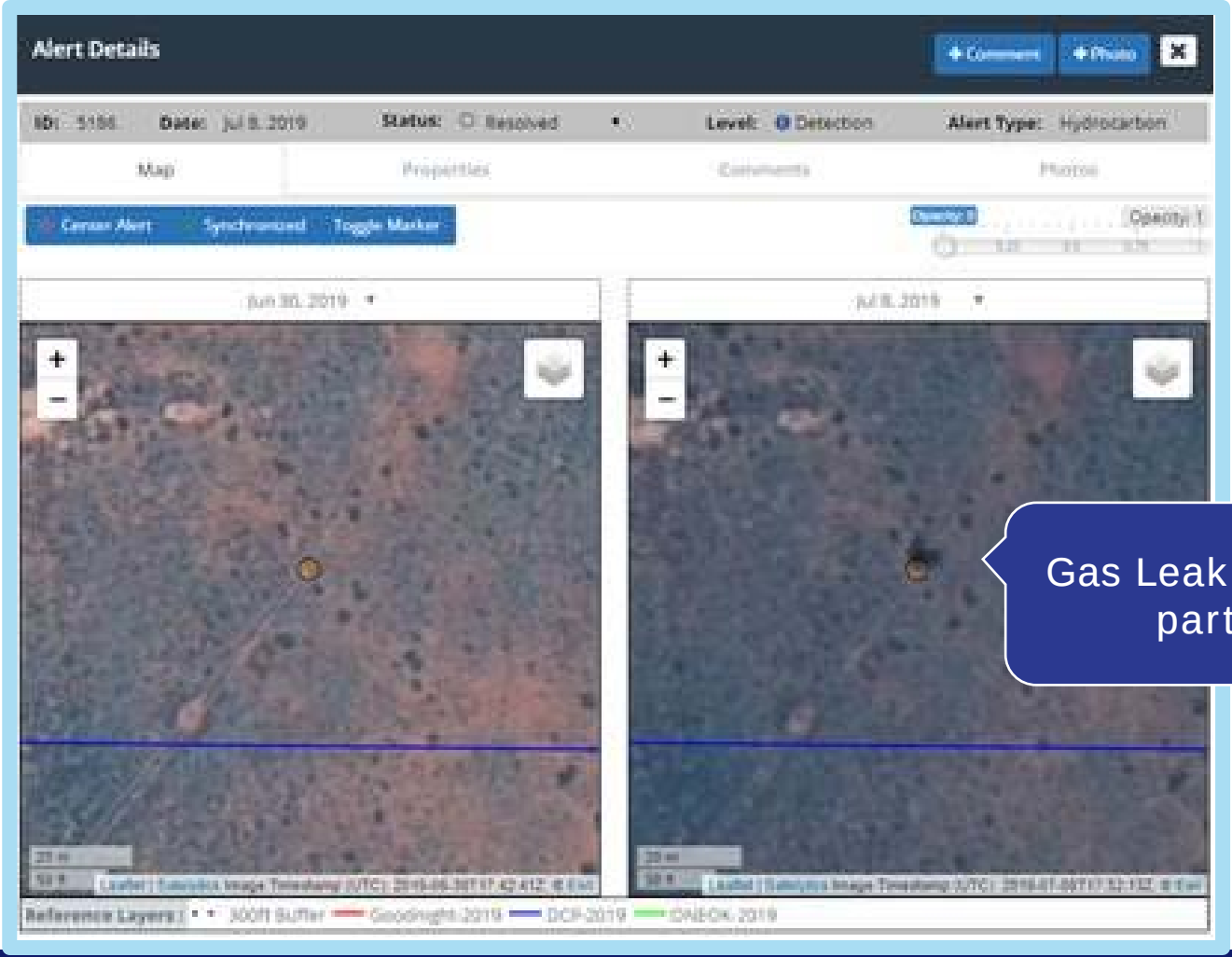
ONEOK

WHITING

dcp Midstream

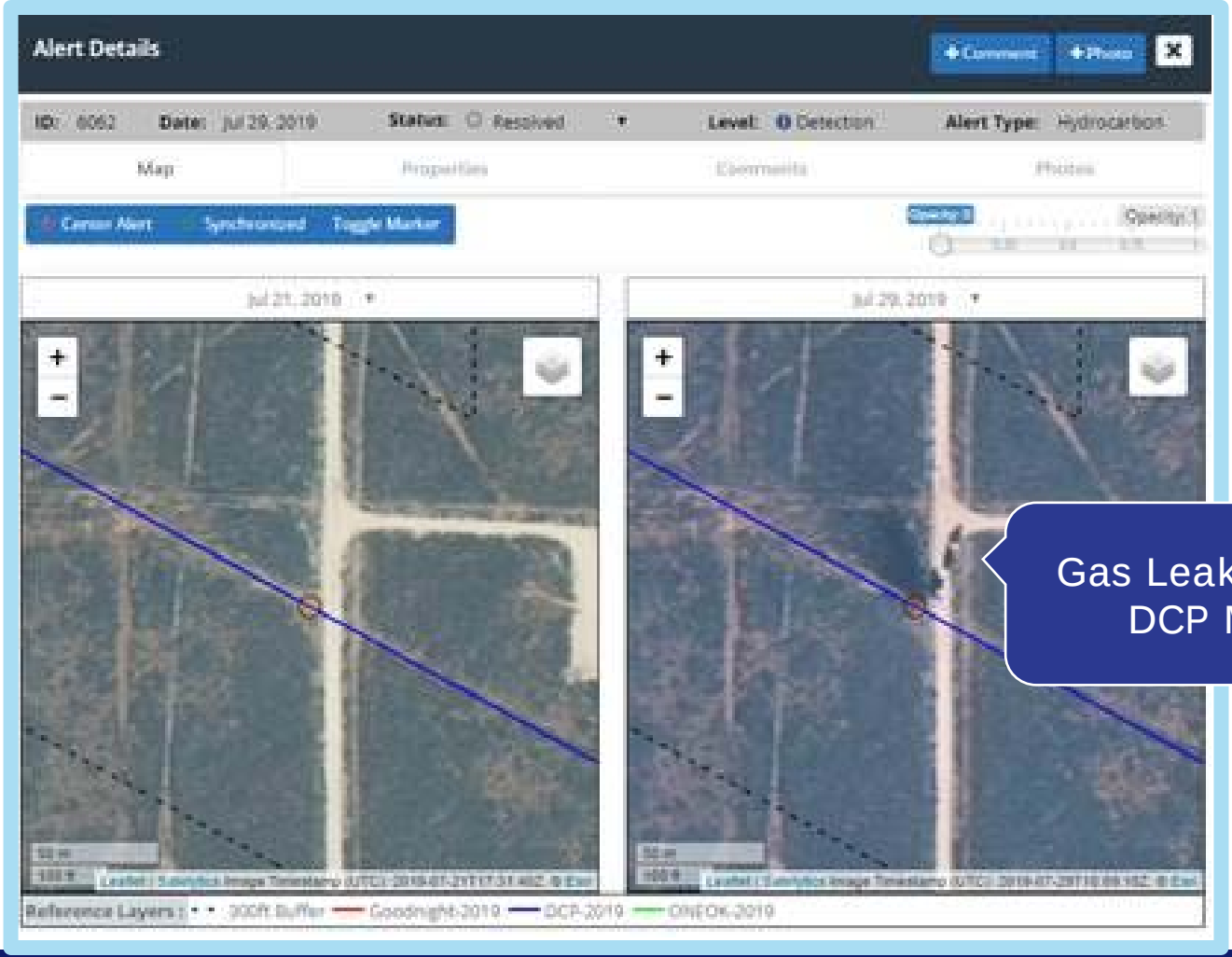
ENBRIDGE

Gas Leak



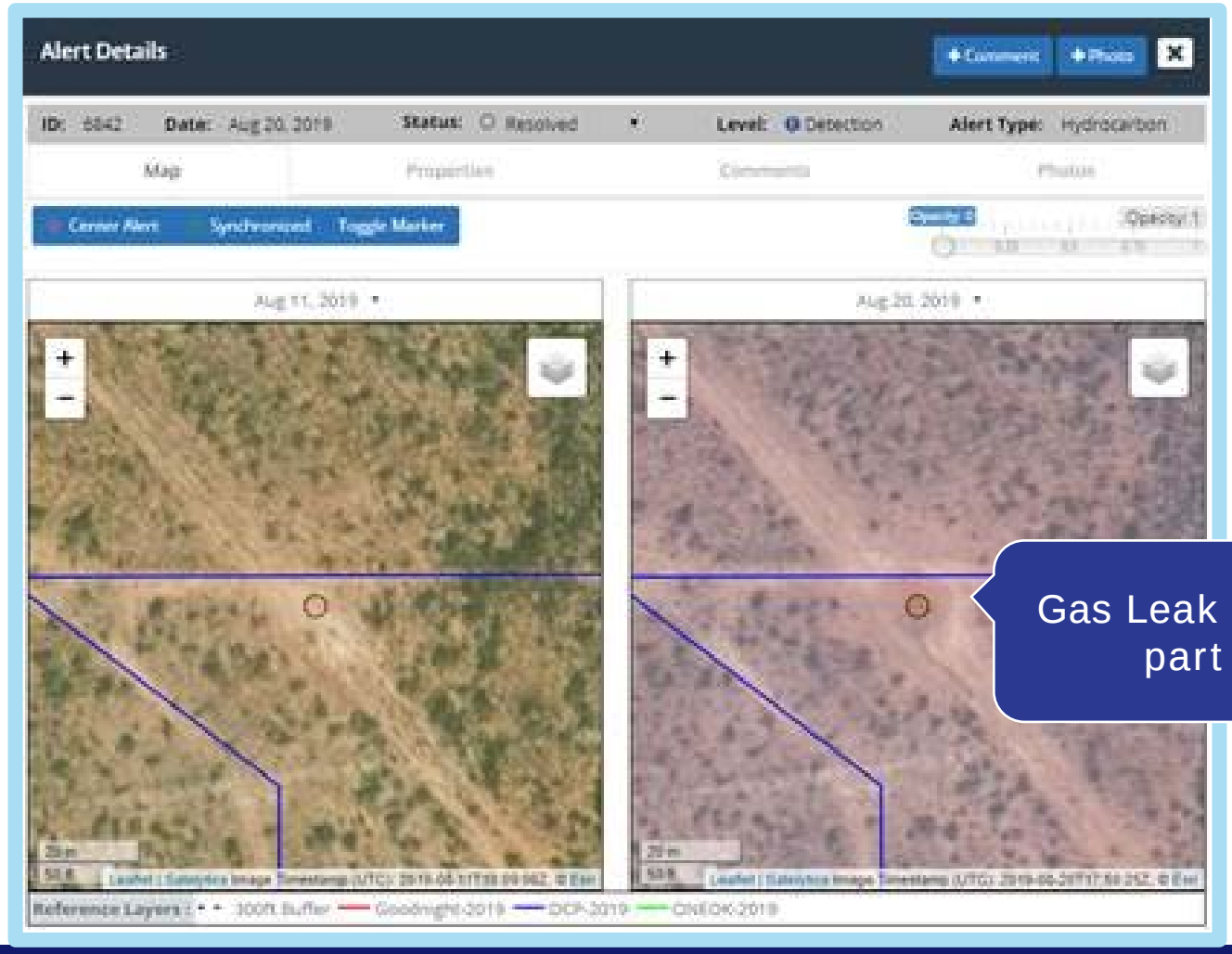
Gas Leak from Permian part of iPIPE

Gas Leak



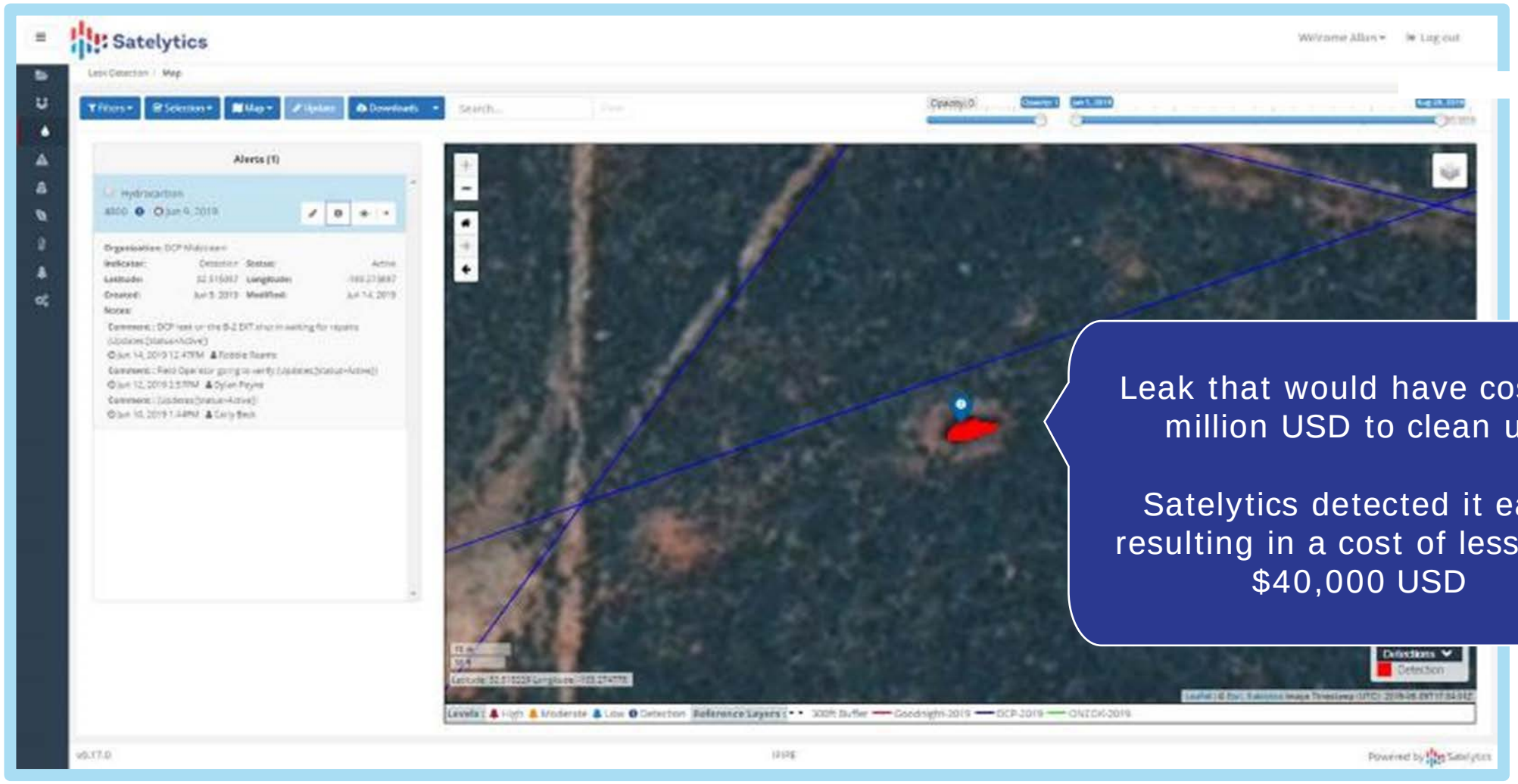
Gas Leak belonging to DCP Midstream

Gas Leak

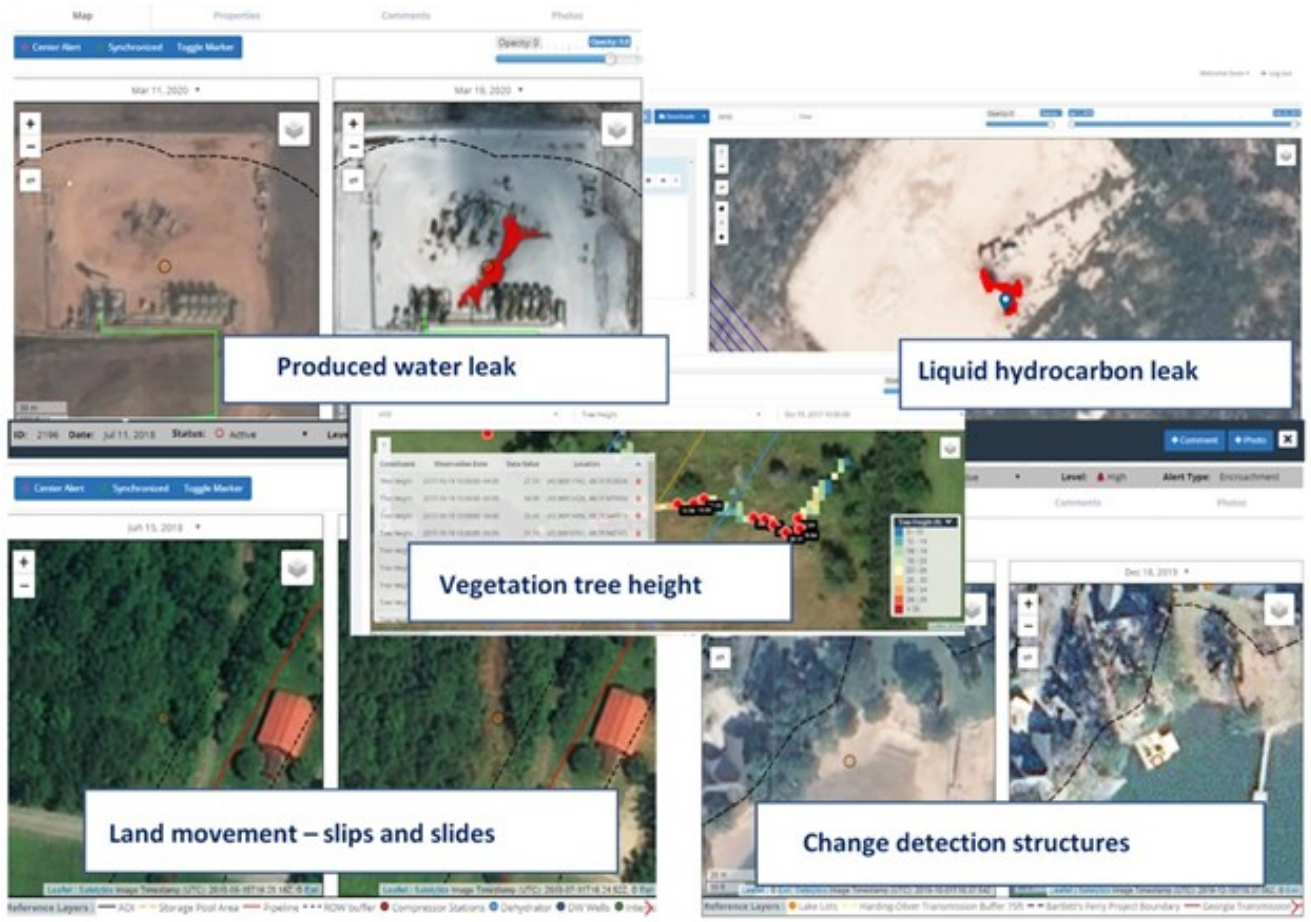


Gas Leak over Permian part of iPIPE

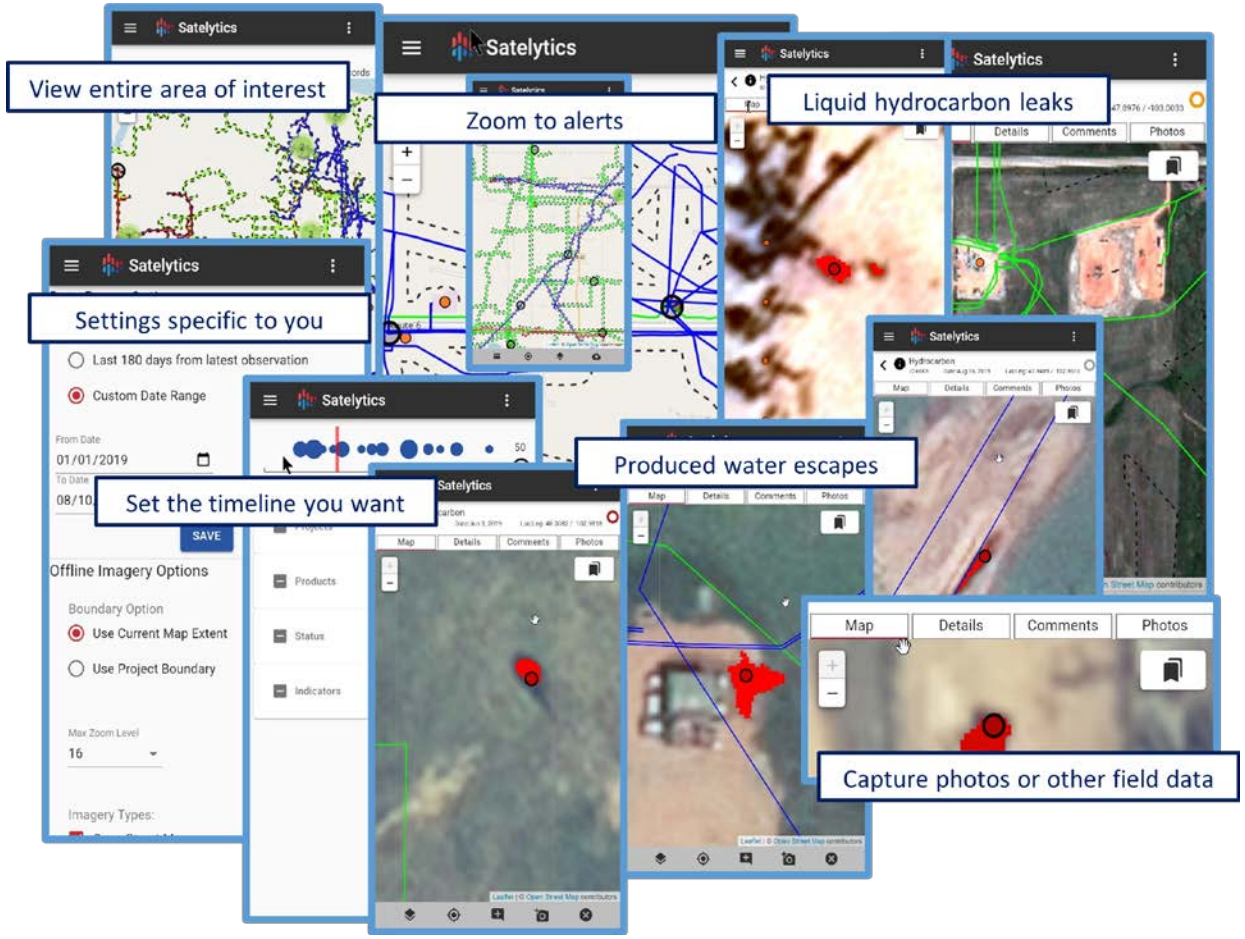
Satelytics Early Detection and Alerts saving Millions of $’s USD



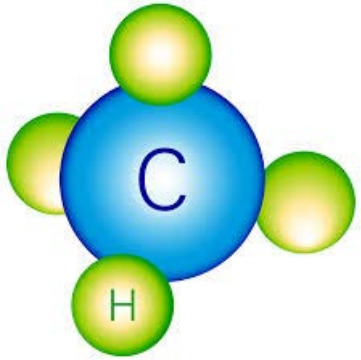
Satelytics – run all the algorithms at the same time for varying business challenges



Satelytics for the “non-connected world”



Observations, Market Challenges, Obstacles, and Vision…



(i) Methane is one of our toughest challenges 18 months to develop

(ii) Host of challenges one set of data – economies to the return on investment – theory $100 divided by 5

(iii) Prescription versus good practice, innovation, and real results

(iv) Pathway to regulatory body acceptance – adopt as an equivalency or better

(v) North Dakota – iPIPE, Lynn Helms Director of DMR and Governor Burgum advocates – even tax credits

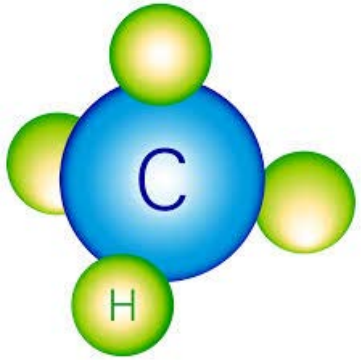
(vi) Federal challenge – AWP alternative work plans – possible?

(vii) Scale – data delivery probability – conflicting contractual challenges – US Govt versus commercial use

(viii) Practical reasons dictate – pipeline satellite, facilities could be more flexible

(ix) Data cost – ingredient up to 86% of project cost

Observations, Market Challenges, Obstacles, and Vision…



(i) Satellite provider charges three times the cost for SWIR, versus other data

(ii) iPIPE extension the Permian, data sharing cost principle – refreshing

(iii) June 2020 three-source data sets trialing – Fixed wing (hyperspectral), Satellite, and Drone – data fusion

(iv) Bakken Basin weekly monitoring launching in 2020 – objective costs to similar to aerial operations…

(v) Basin monitoring offering solutions for other challenges, eventually including methane

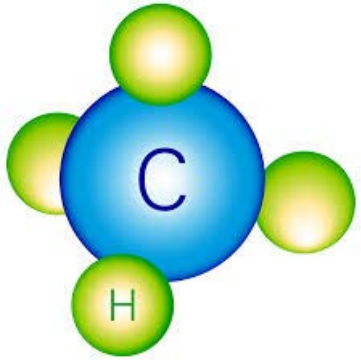
(vi) Data source to accommodate the entire need for GHG reduction programs, CO2 and Gas speciation

(vii) Current providers moving rapid pace – Airbus – HAPS and willingness to load new sensors

(viii) Stratellites – operating in the stratosphere where different set of rules compared to earth or space

(ix) Indian Government launching a midwave infrared capable satellite – one example, gas speciation

Observations, Market Challenges, Obstacles, and Vision…



(i) Early adopters are the necessary visionaries, essential for ground-truthing and beyond

(ii) Satelytics and BP conducted METEC project to gain industry recognition

(iii) Resolution coarser that 3.5 pixels per meter square simply does not work…. Specificity

(iv) Bad actors playing both sides of the fence - paints all with the same accusation – “Major emitters”

(v) Sub pixel analysis – just not scientifically possible

(vi) 20 million synthetic data sets

(vii) Critical data that influences quantification - wind, wind velocity, and relative humidity

(viii) Flow and Flux rates working alongside early adopting customers is the here and now!

(ix) Flaring – request from some of our current iPIPE participants

Our Customers and Partners

Satelytics