



INTEGRATED SYSTEM FOR METHANE EMISSIONS MONITORING, MAPPING, AND QUANTIFICATION



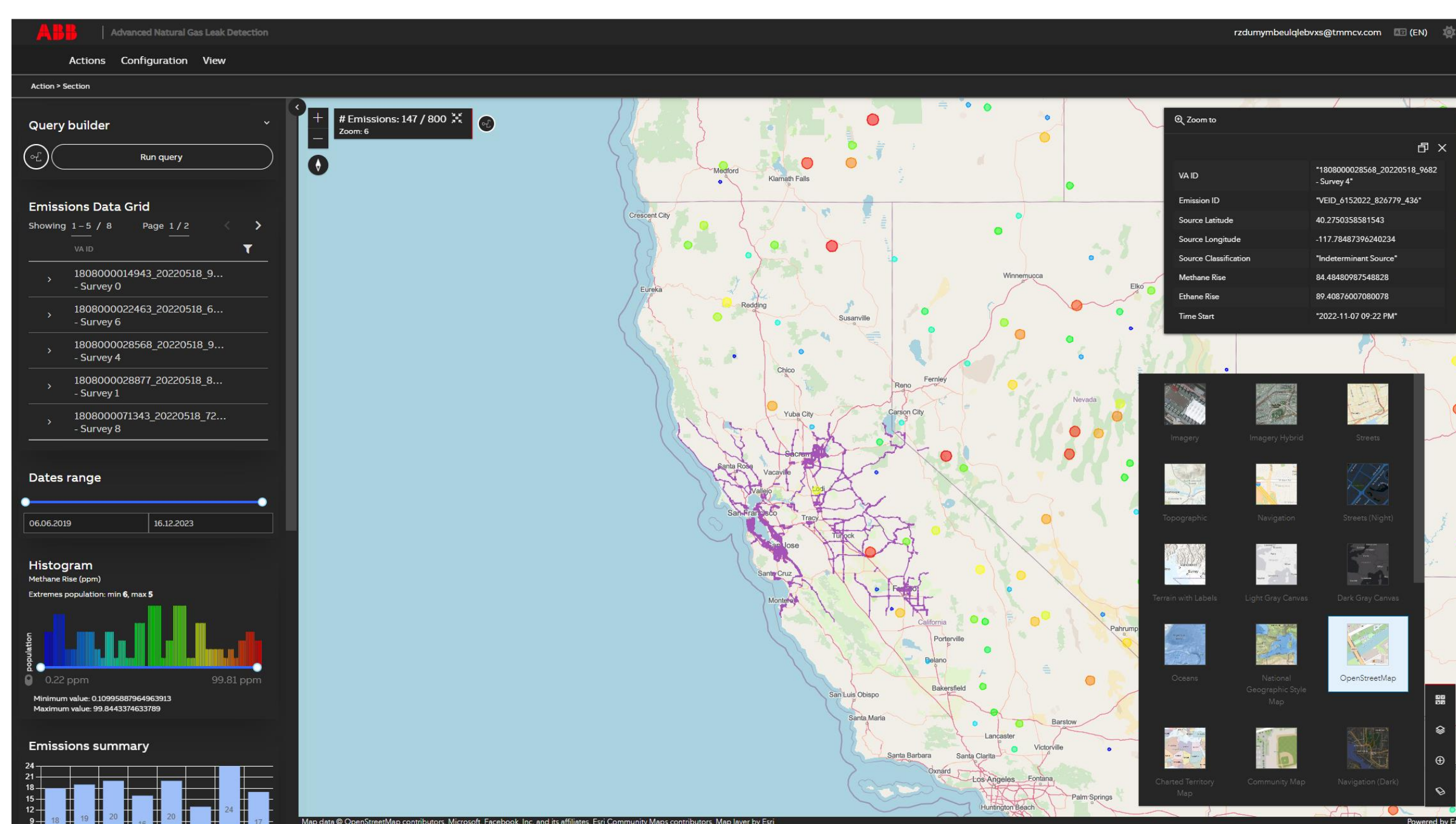
Solicitation: DE-FOA-0002616: iM4 Technologies, AOI-4: INTEGRATED METHANE MONITORING PLATFORM DESIGN
Principal Investigator: Julio D. Lobo, Ph.D./M.B.A.

Awardee: ABB, Inc.
Award: 13737983

Abstract

The overall objective of this project is to create a comprehensive engineering, design, construction, deployment, and operating plan for an integrated system for continuous methane emissions monitoring, mapping, localization, and quantification across the entire natural gas supply chain and infrastructure. The system, which broadly includes Data Sources, Aggregators, and a Centralized Cloud Information Center, will enable rapid identification, localization, and characterization of super emitters (>10 kg/hour), intermittent sources, as well as chronic, persistent, smaller emission sources (below 10 g/hour).

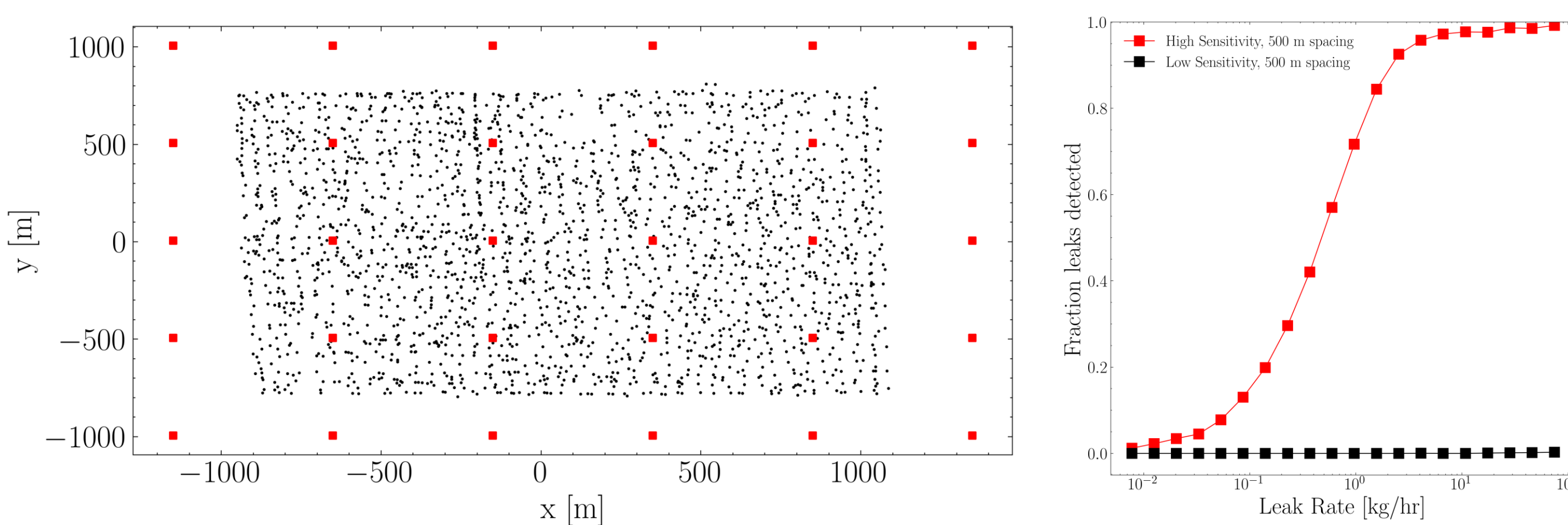
Dashboard and Reporting



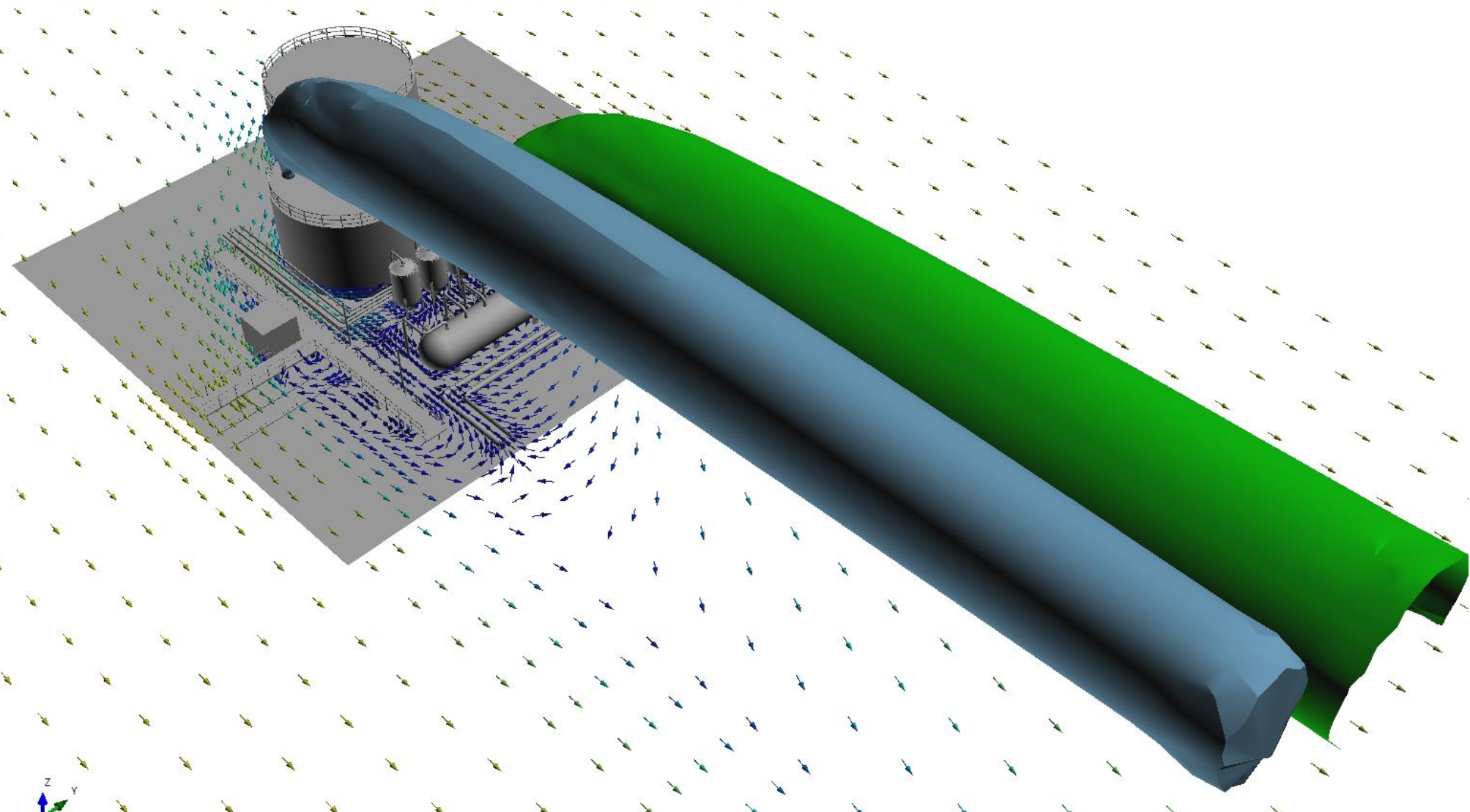
- Dashboard concept with near real-time display of methane emission visual alerts at-a-glance. Each color-coded emission has linked embedded meta-data.
- National coverage including Global Information System (GIS) assets.

System-level Design

Optimize components and physical placement based on precision, reliability, power, historical environmental conditions, cost, and more

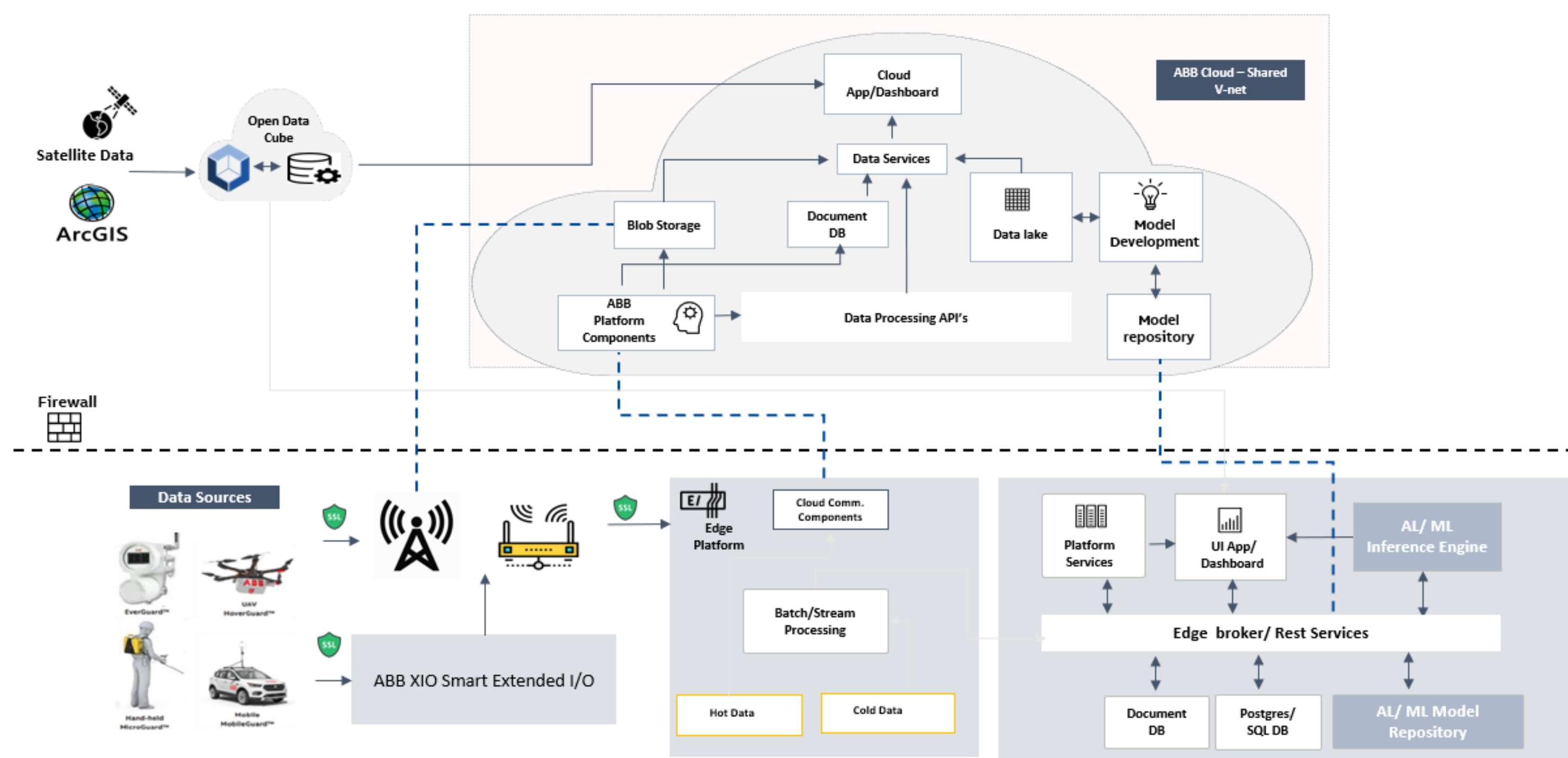


Simple example: A sparse mesh grid of high precision (~3 ppb) sensors can achieve a near perfect detection rate for super-emitters (>10 kg/hr) in a high-density oil well region, e.g. Kern River Oil Field as shown.

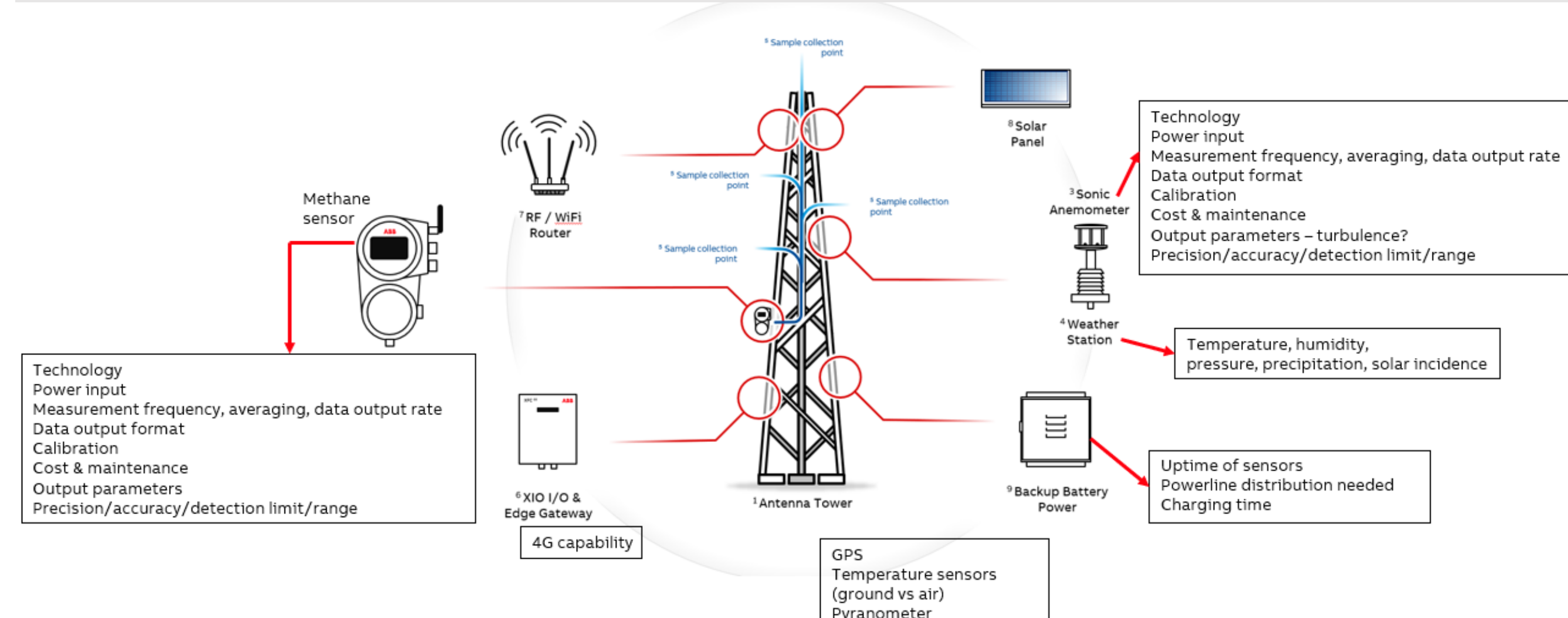


Source-level and site-wide emissions can be visualized and quantified through simulations (digital twin + CFD) → optimized measurement strategies, e.g. stationary sensor placement, mobile survey paths.

Architecture



Measurements



Example node in the stationary monitoring network

Leak detection systems	Technology classes	Example technologies
Stationary monitoring systems	Closed path	OA-ICOS, CRDS, TDLAS, LAS
	Open path	Dual Frequency Comb
	Open air	Thermal conductivity
	IR Imaging	OGI
Vehicle mounted sensors	Closed path	OA-ICOS, CRDS, TDLAS, CEAS, LAS
	Open path	WMS
	Open air	XPOD
Aerial mounted sensors (drones & airplanes)	Closed path	OA-ICOS, TDLAS, CEAS, LAS
	Open path	LiDAR
Portable/handheld sensors	Closed path	OA-ICOS, TDLAS, CEAS
	Open path	OPLAS
	Open air	Thermal conductivity
	IR Imaging	OGI
Satellite based sensors	IR imaging	Hyperspectral

Comprehensive review of available potential measurement devices.

Integrated Testing & Validation

- Follow-up surveys conducted with increasingly higher sensitivity, higher localizability, and quantification methods.
- System provides automated follow-up survey areas and work orders to link survey results to parent.
- Simulated (left) and collected data (Right) show potential and actual use of mobile sensors, such as ABB MobileGuard™ for validation of emission, location, and quantification

