



Fugitive Methane

March 26, 2024

THE CITY OF
COLUMBUS
ANDREW J. GINTHER, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES



Agenda

1. Introduction
2. Investigation
3. Solutions
4. Questions

Introduction

Stacia Eckenwiler

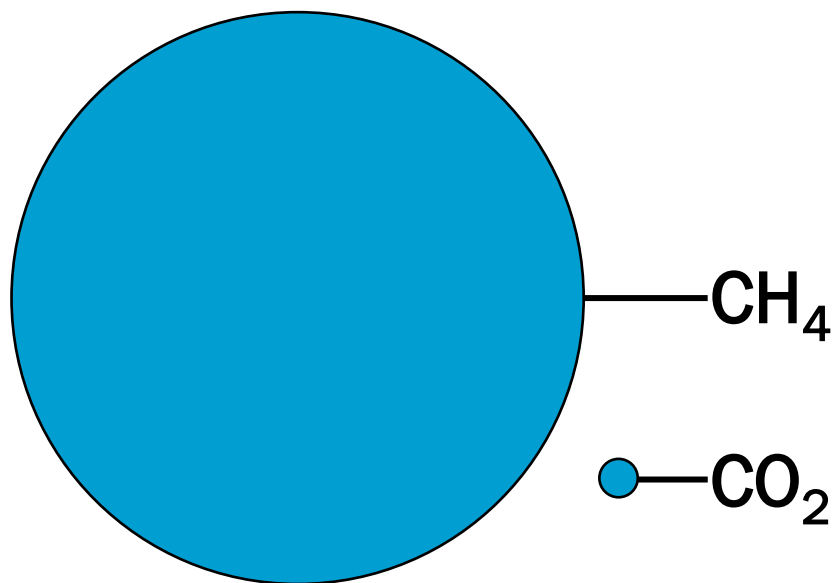
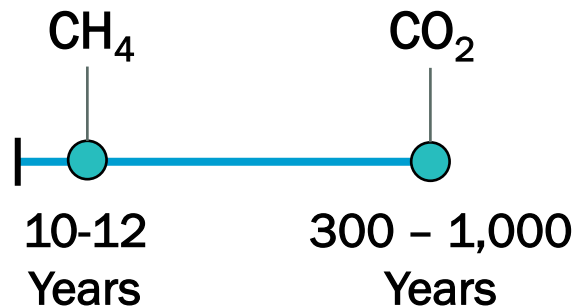
Brown AND **Caldwell** :



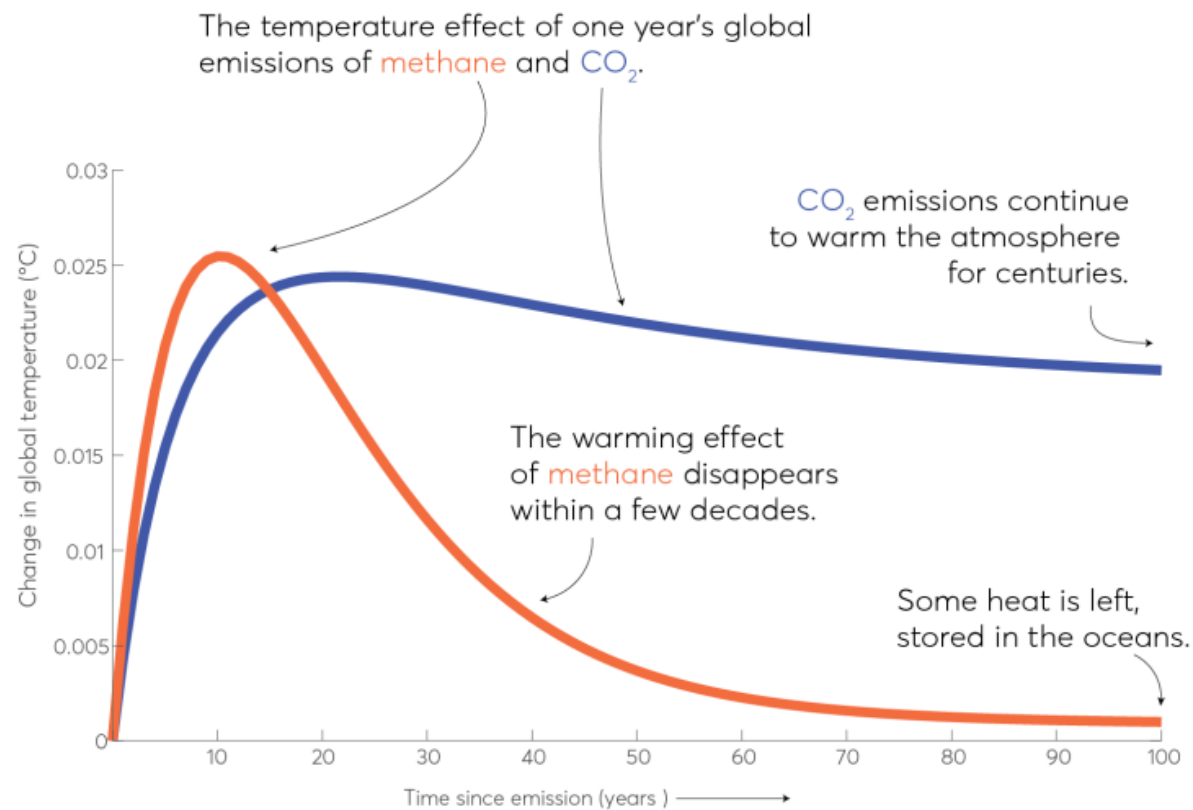
Methane is a Powerful Greenhouse Gas

82.5×

more powerful
than CO₂ over
a 20-year period



Warming from **methane** decreases sharply after ten years.



Emerging Drivers



ENVIRONMENT MARCH 13, 2023

Your Sewage Treatment Plant Is Spewing Methane

Local facilities emit twice as much as previously thought, a new study says.

SIRI CHILUKURI
Bio



A fish eye view of a wastewater treatment facility in Winthrop, Mass. David L. Ryan/Boston Globe via Getty

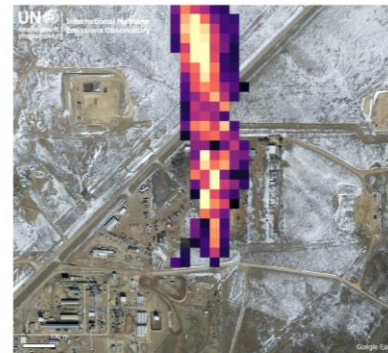
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The World's Big Hidden Polluters

This Five-Mile-Long Cloud of Methane Was Spotted Over Wyoming

Three satellites observed a big plume of the potent planet-warming gas over the state last month, which scientists attributed to a natural gas facility.



Methane observed by NASA's Landsat 9 satellite over eastern Wyoming on Dec. 7. Source: International Methane Emissions Observatory/NASA

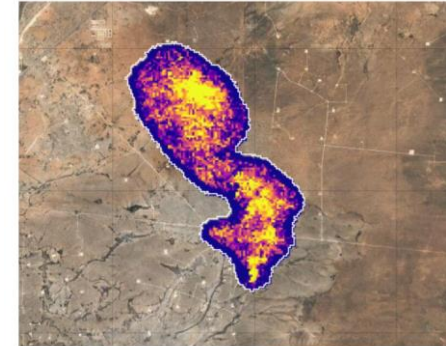
By Aaron Clark
January 31, 2023, 4:00 PM UTC

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The World's Big Hidden Polluters

Exxon Broke Rules With Late Report of Permian Methane Leak

It's the biggest US operator to publicly acknowledge a methane emissions since high-resolution satellite imagery of methane leaks became more widely available.



A Feb. 5 observation from NASA/JPL-Caltech's EMIT instrument onboard the International Space Station. Source: NASA/JPL-Caltech

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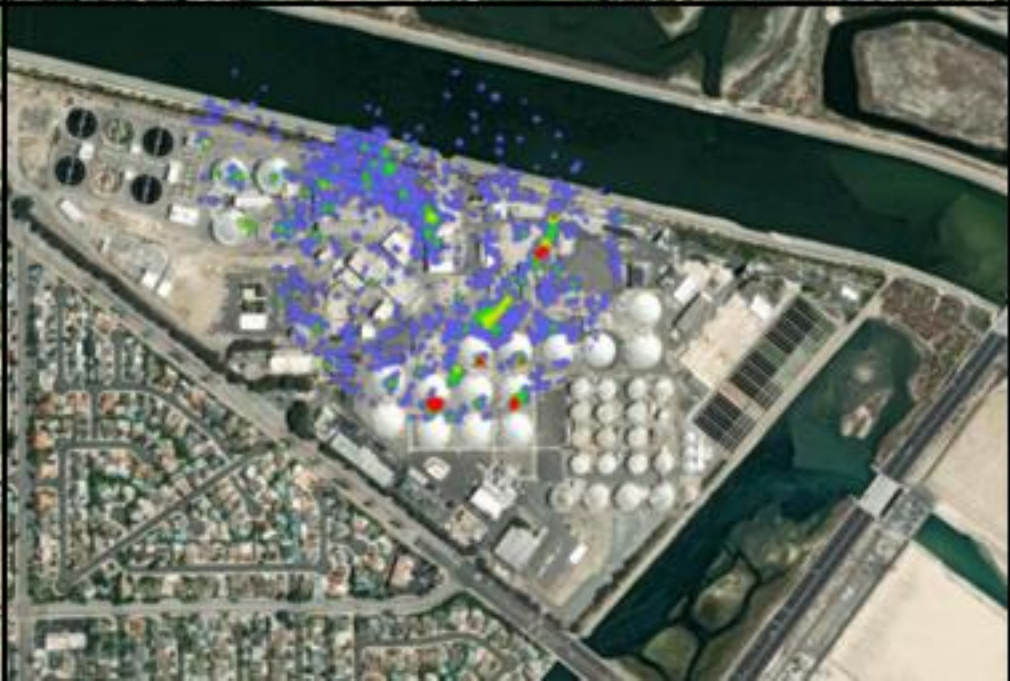
Wildlife | [Energy](#) | [Pollution](#) | [Green light](#)

Revealed: 1,000 super-emitting methane leaks risk triggering climate tipping points





Brown and Caldwell



Methods

Bottom-Up Source Identification

Optical Gas Imaging



KONICA MINOLTA

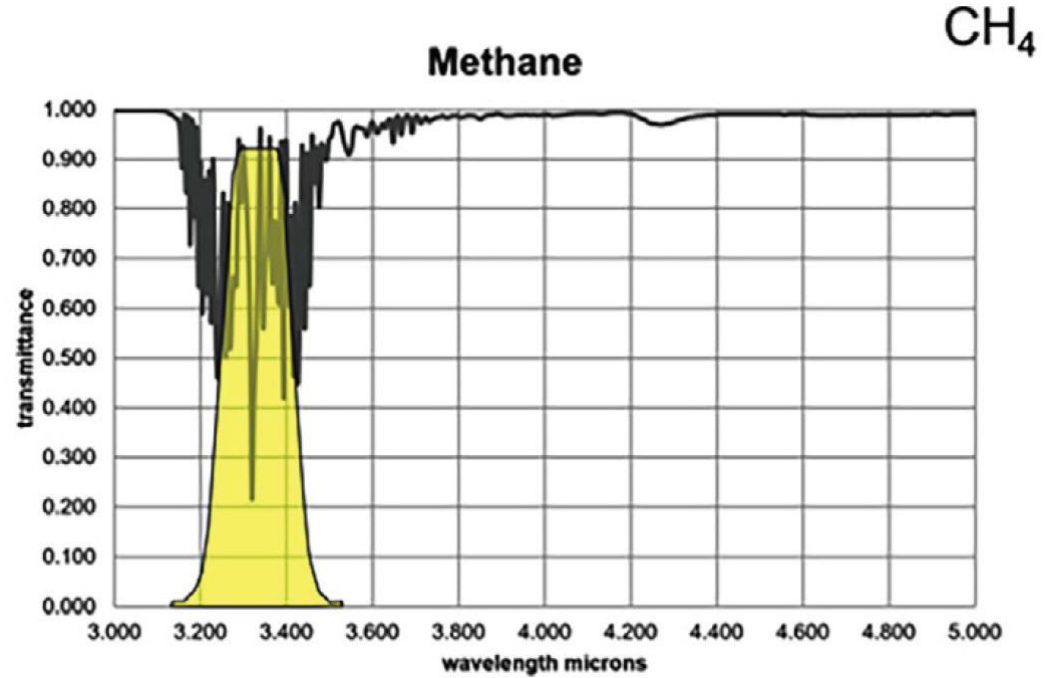
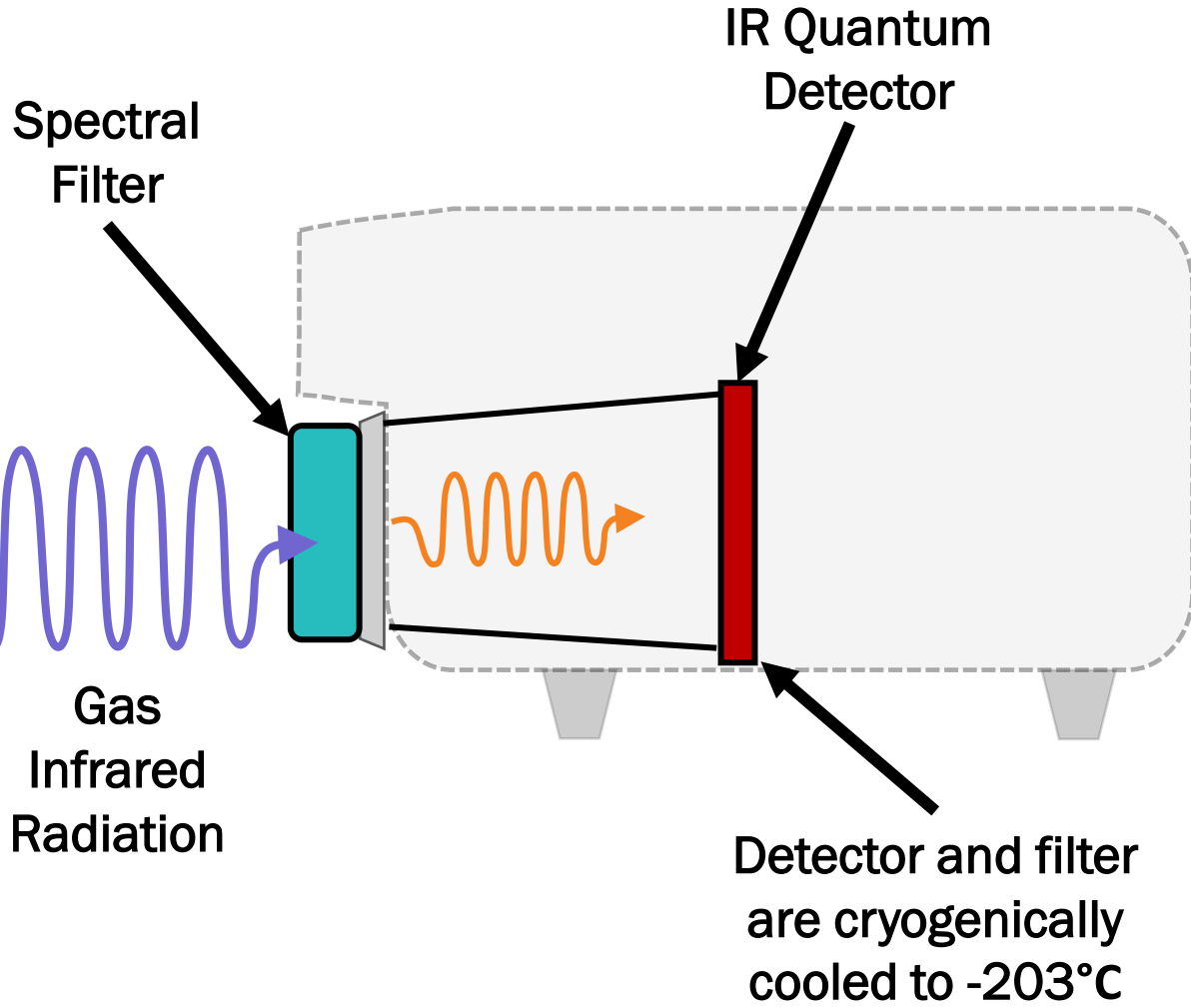


Top-down Quantification

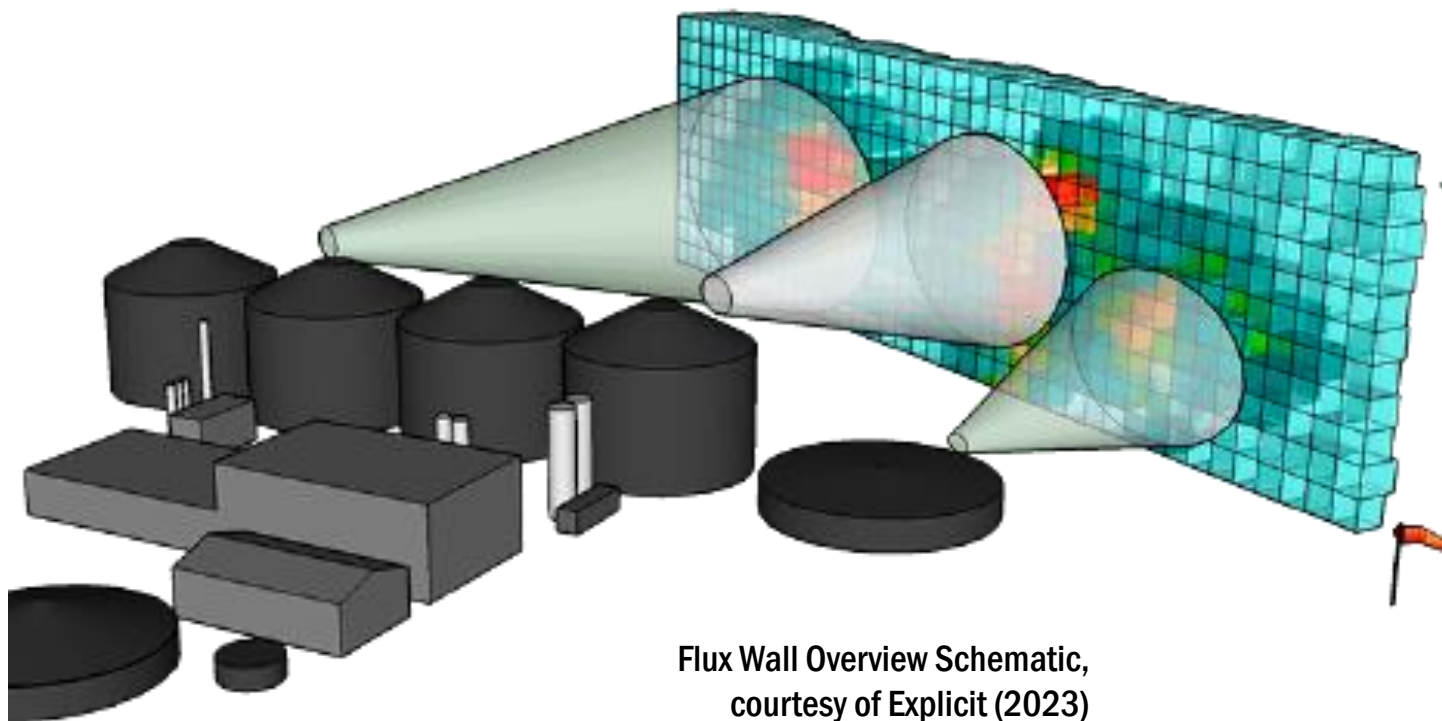
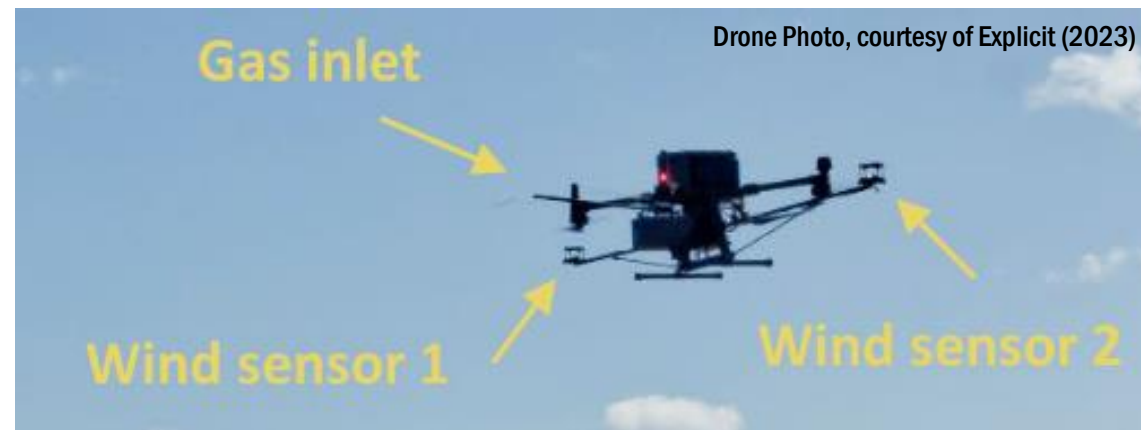
Flux Wall Method



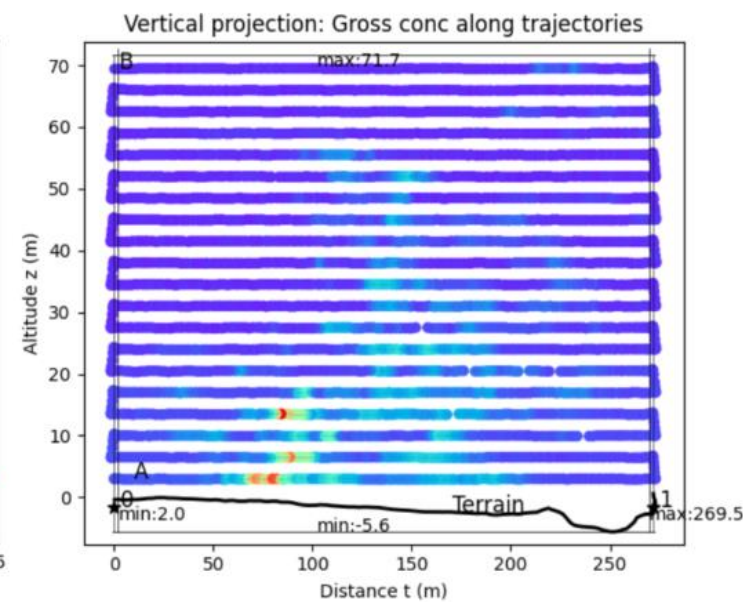
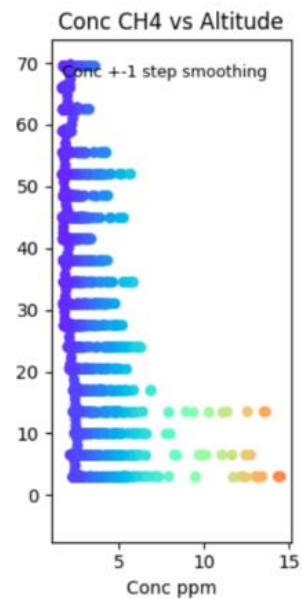
OGI Camera



Drone Flux Walls



Flux Wall Overview Schematic, courtesy of Explicit (2023)



Investigation

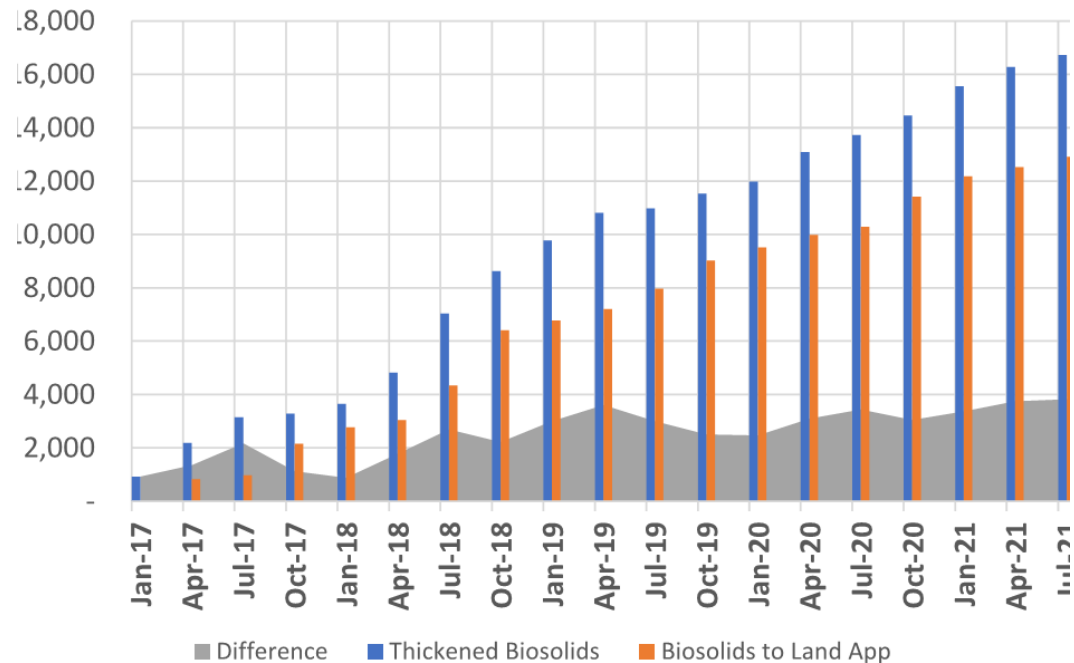
Dante Fiorino



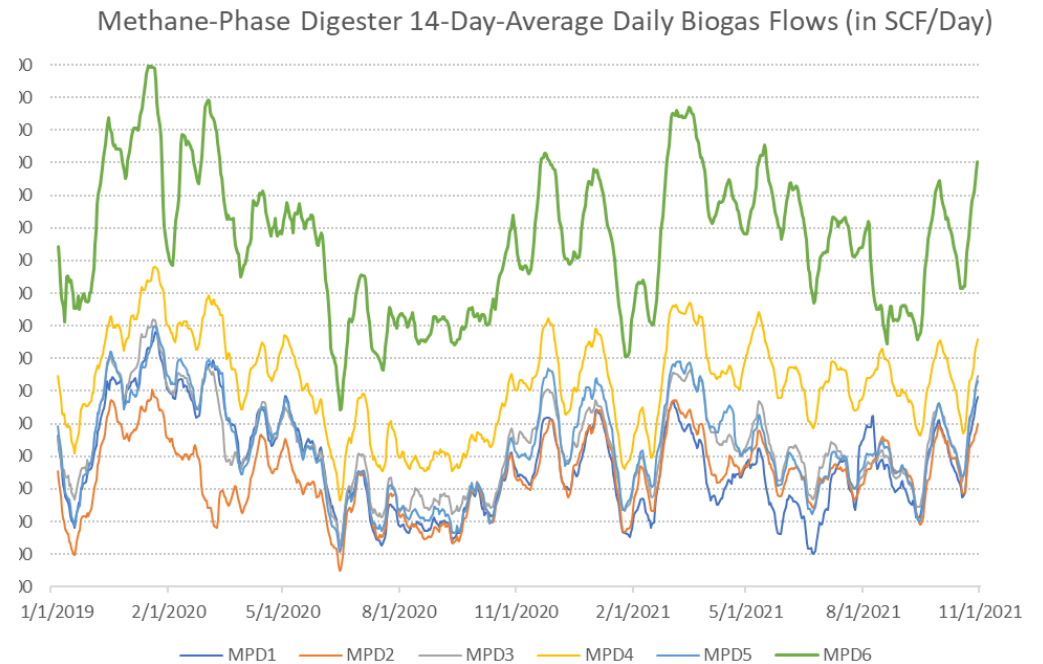
Brown AND Caldwell :

Problem Statement

Biosolids Land Application Facility (BLAF)

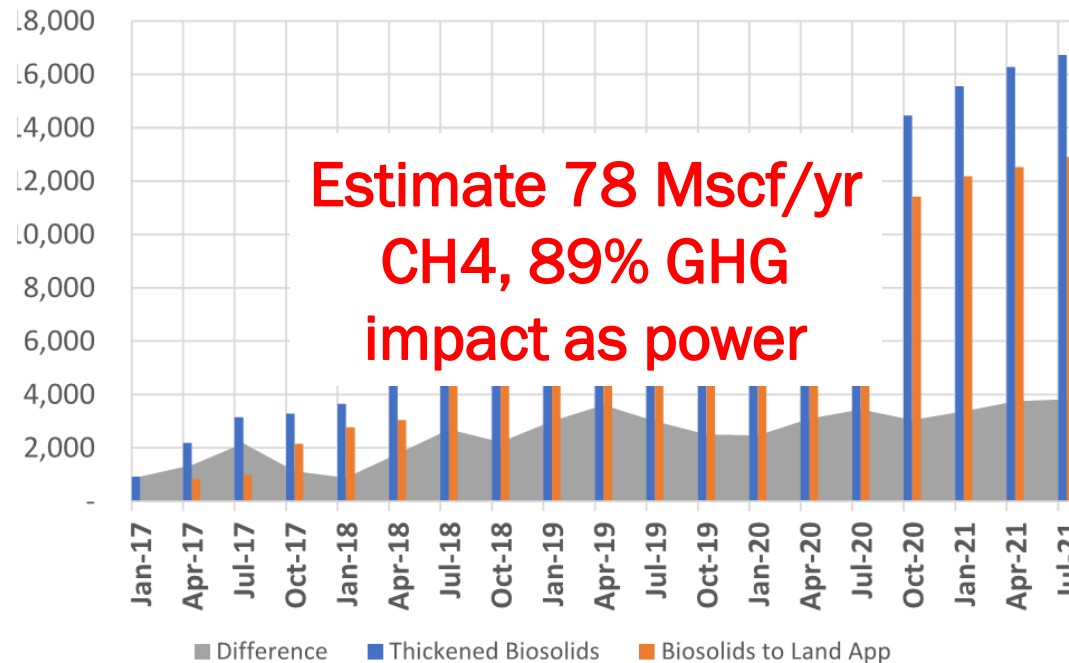


Existing Floating Cover Digesters

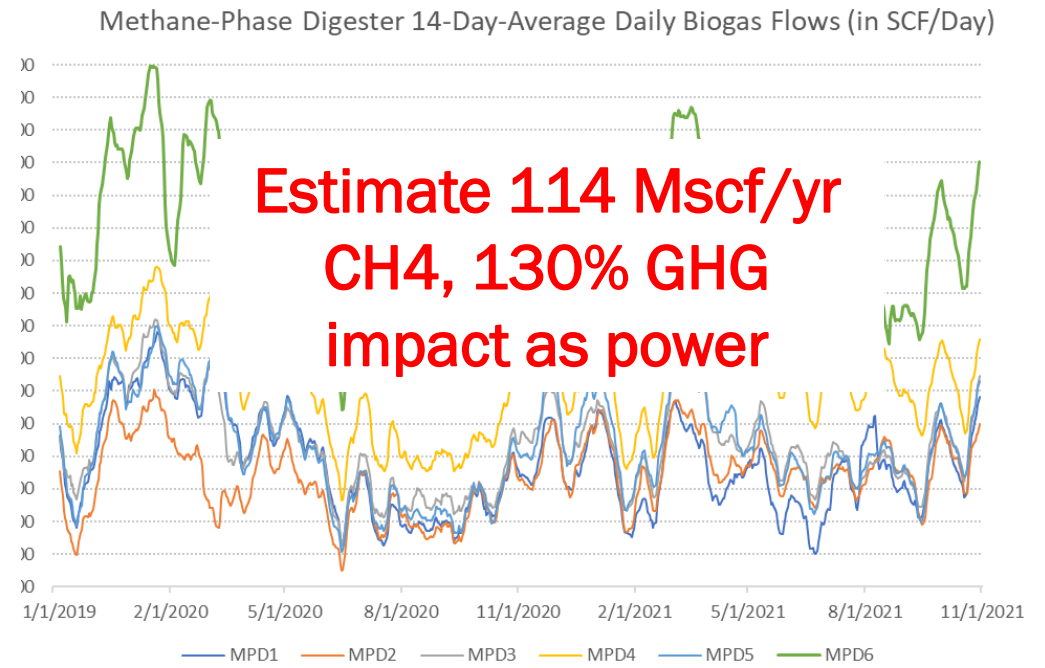


Problem Statement

Biosolids Land Application Facility (BLAF)



Existing Floating Cover Digesters



OGI Camera (Columbus)

Dewatering
Centrate Chute



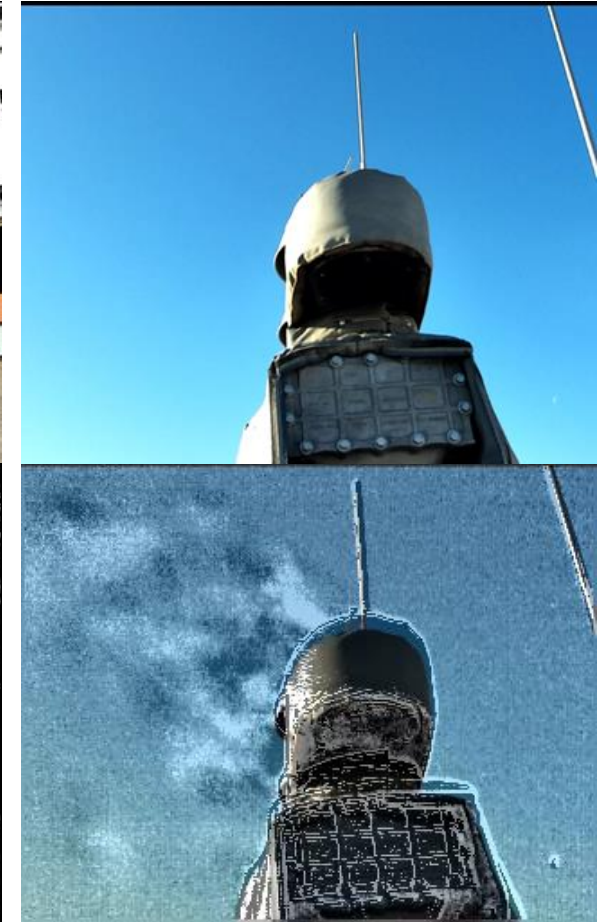
BLAF Biofilters



Cake Loadout



Digester PRV



OGI Camera (Columbus)

Digester Cover



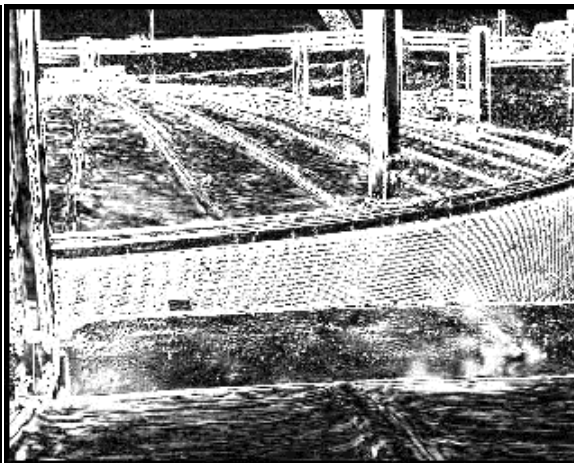
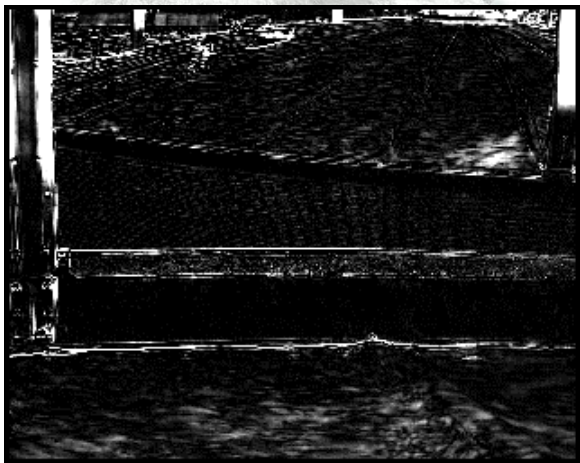
Digester Cover



Digester Tank Leak



First Time Methane Has Been Seen



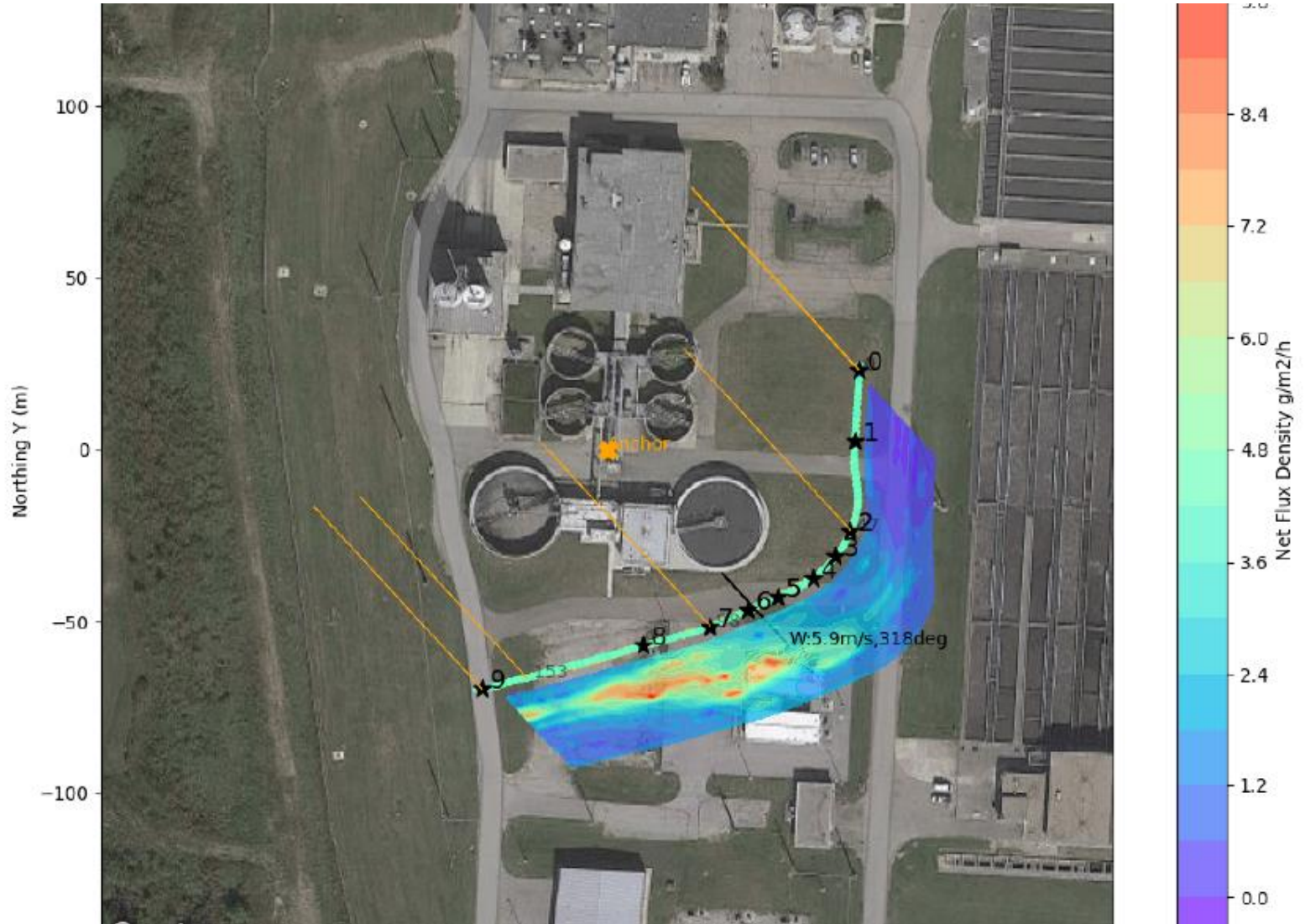
Drone Flux – Waste Gas Burner

- 1.7 kg/hr (1.6 Mscf)
- Less than 0.5% loss
- EPA default 1%
- 80 cars per year



Drone Flux – Biosolids Handling

- 18.3 kg/hr
- **Unexpected contributor**
- Most from biosolids thickening
- 880 cars per year



18 kg/hr CH₄

Gravity Thickeners

Biofilters

Cake Loadout

Dewatering Centrifuges

Post Digestion Thickening Centrifuge

Solids Handling Area

70 kg/hr

~2 kg/hr

WGB

WGB

25 kg/hr

Digesters

Digester Area






Control Building

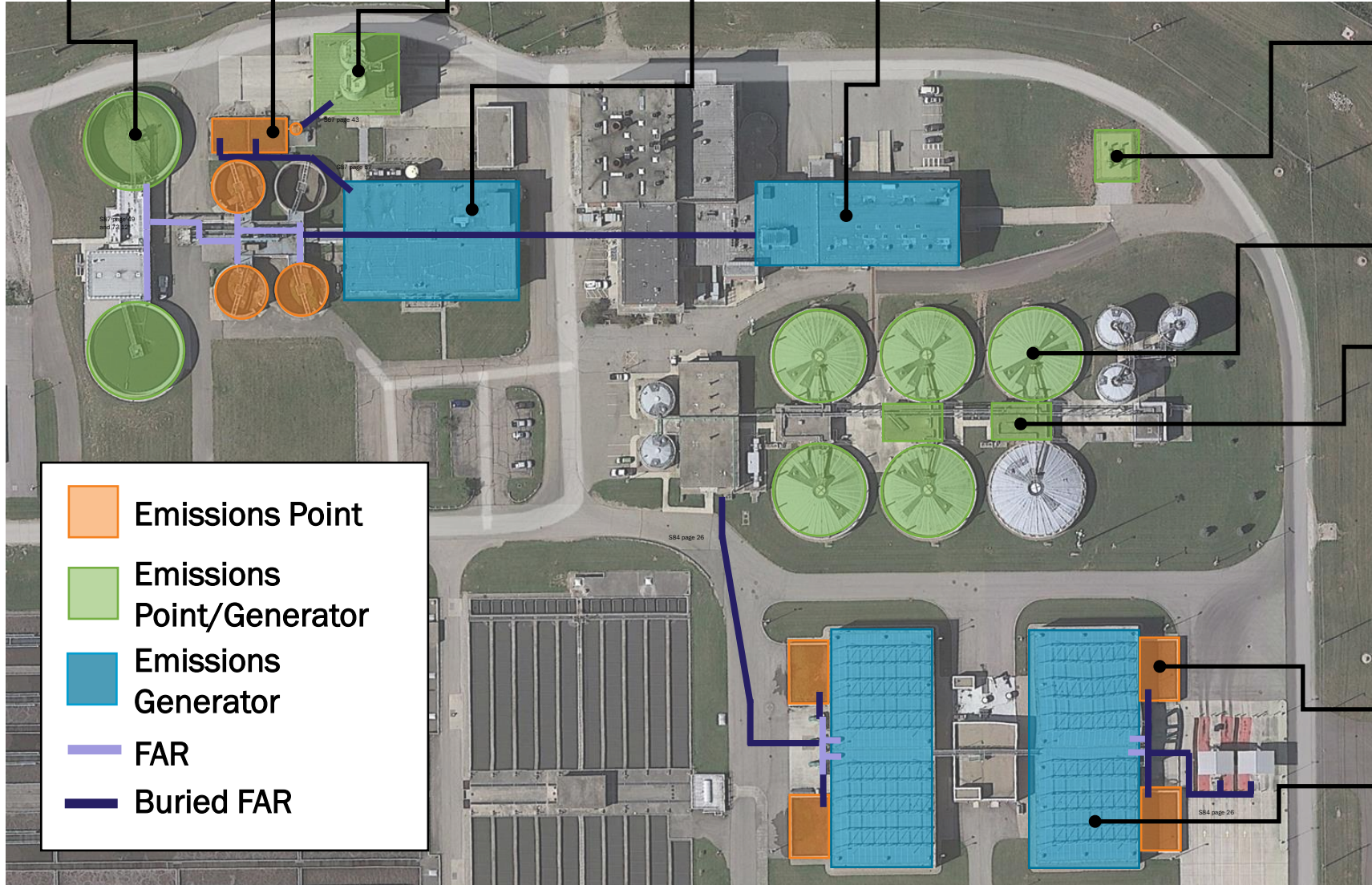
25 kg/hr

Biofilter

BLAF Area

BLAF

-  Emissions Point
-  Emissions Point/Generator
-  Emissions Generator
-  FAR
-  Buried FAR



Solutions

Dante Fiorino

Brown AND **Caldwell** :



Alternative Approach

Established Solutions

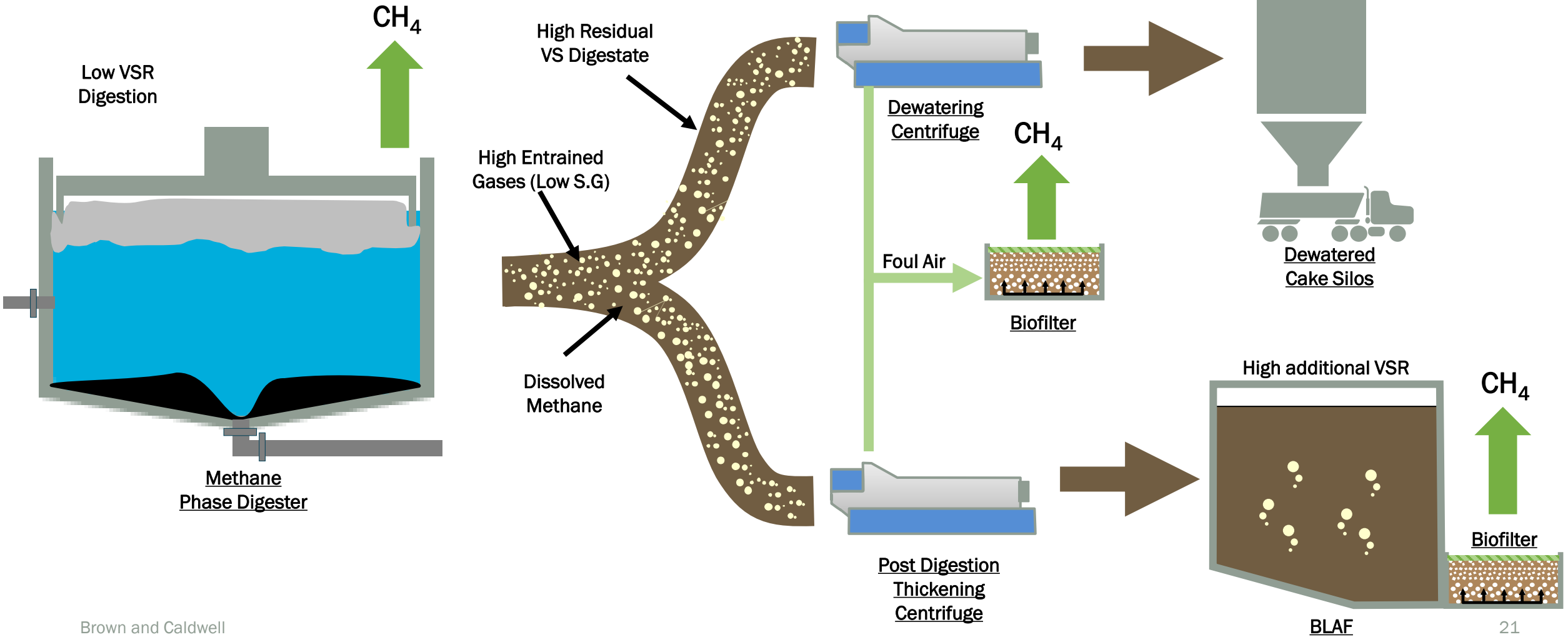


Innovative Solutions

Design Standards

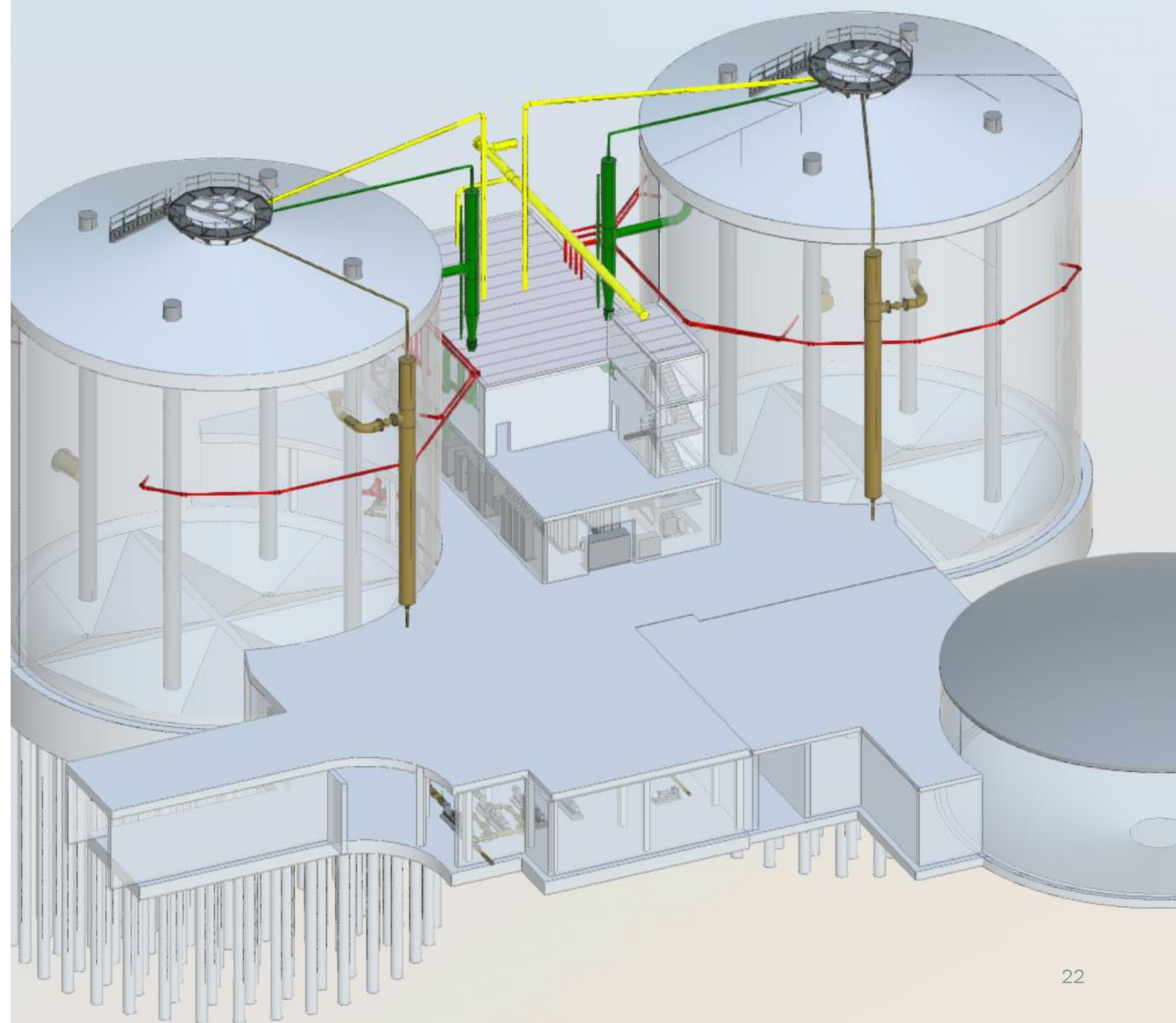


Existing State

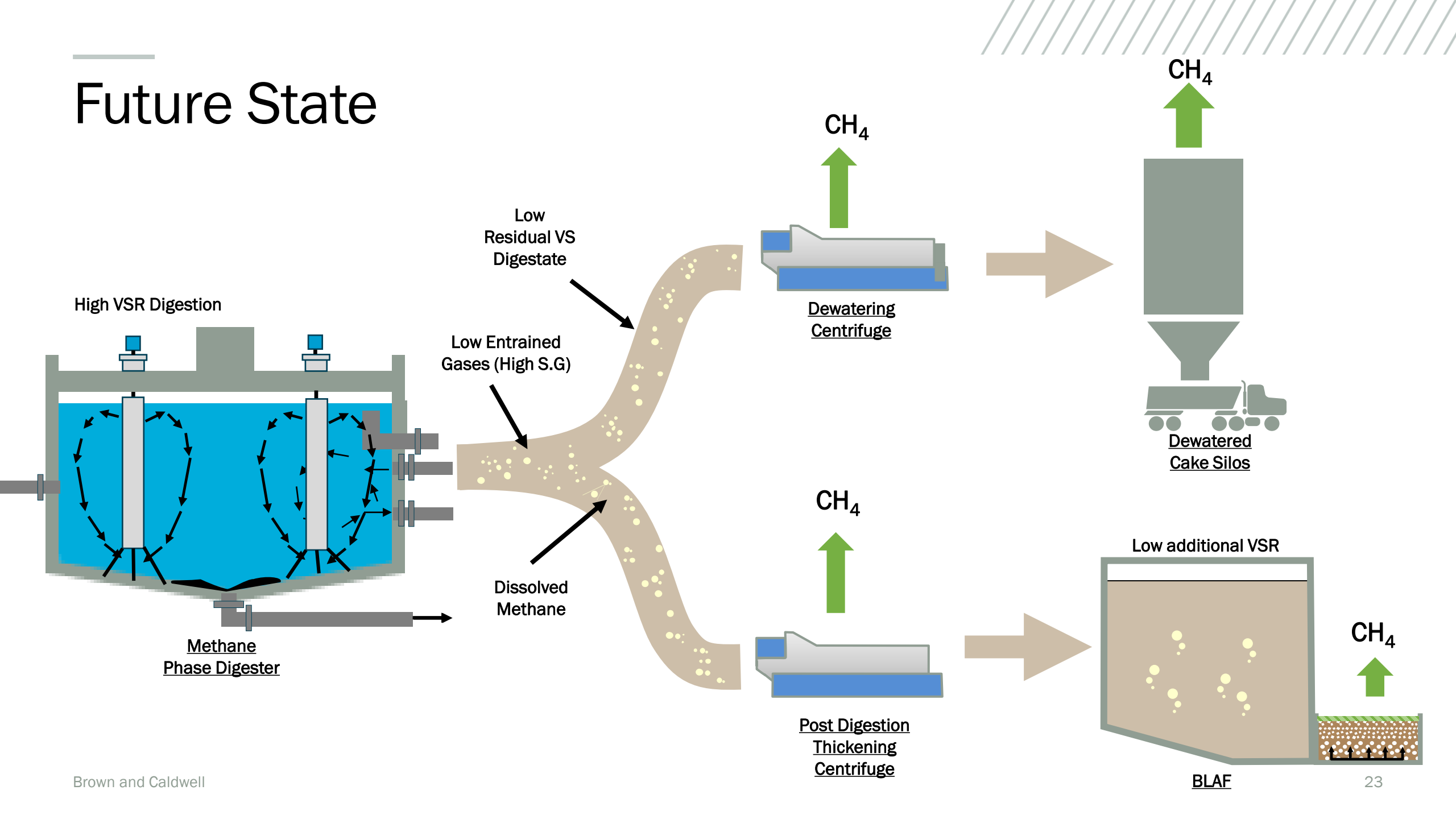


Next Gen Digestion

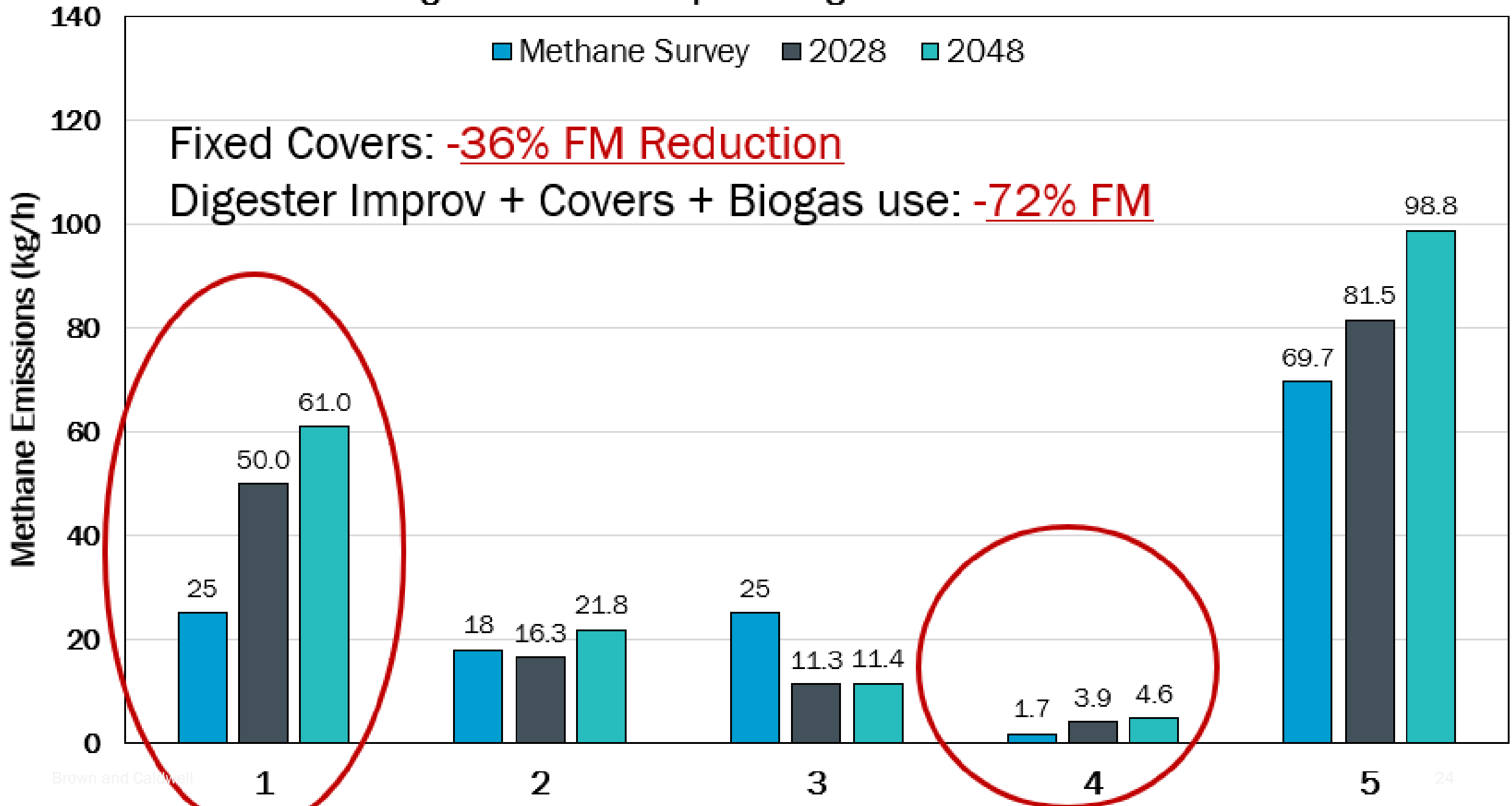
- Constant mixing
- Surface withdrawal
- Longer SRT
- Fixed digester covers
- High design biogas pressure for PRV leaks



Future State



Fugitive Methane - Improved Digestion Performance



BLAF Foul Air



B1 - Augmented Biofiltration



B2 - Vapor Combustion Unit



B3 - Regenerative Thermal Oxidizer



B4 - Fixed Concrete Cover



B5 - Fixed Stainless-Steel Cover

BLAF Foul Air

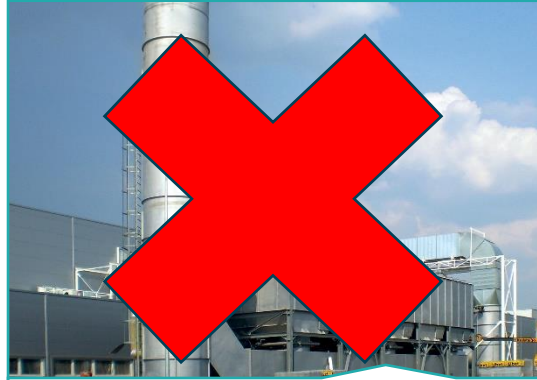
Methane content too low at BLAF tanks

\$6.1 million NPV

Not effective
requires pilot
testing



B1 – Augmented Biofiltration



B2 – Vapor Combustion Unit



B3 – Regenerative Thermal Oxidizer

Structural concerns with
concrete weight



B4 – Fixed Concrete Cover



B5 – Fixed Stainless-Steel Cover

\$32 - \$58
million NPV

Solids Handling Foul Air



S1 – Augmented
Biofiltration



S2 – Vapor Combustion
Unit



S3 – Regenerative
Thermal Oxidizer



S4 – Vacuum Extraction

SH Foul Air

Requires pilot testing



S1 – Augmented Biofiltration

\$4.7 million NPV



S2 – Vapor Combustion Unit

\$5.0 million NPV



S3 – Regenerative Thermal Oxidizer

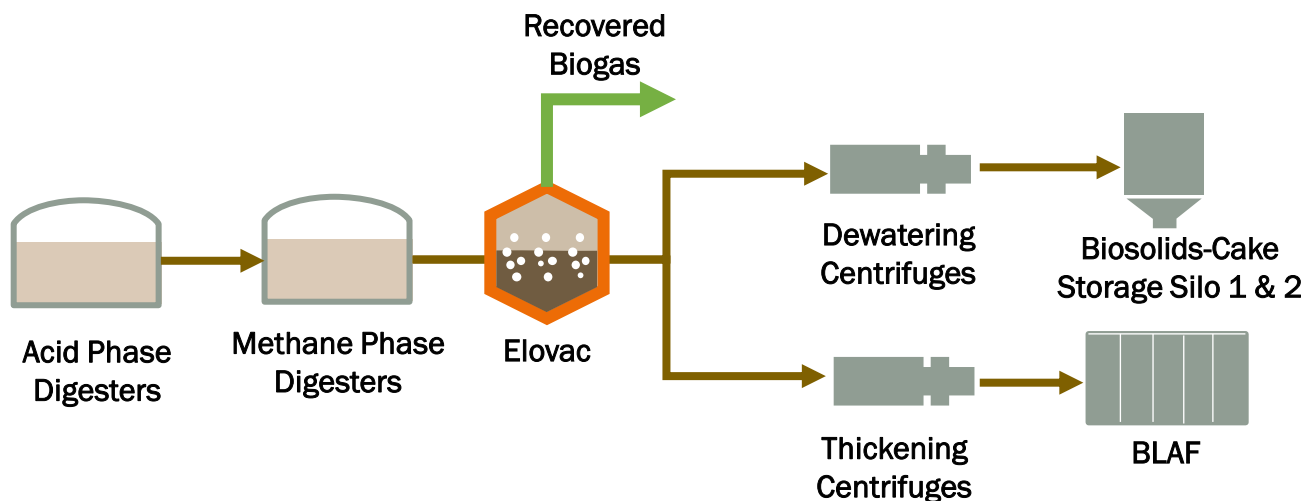
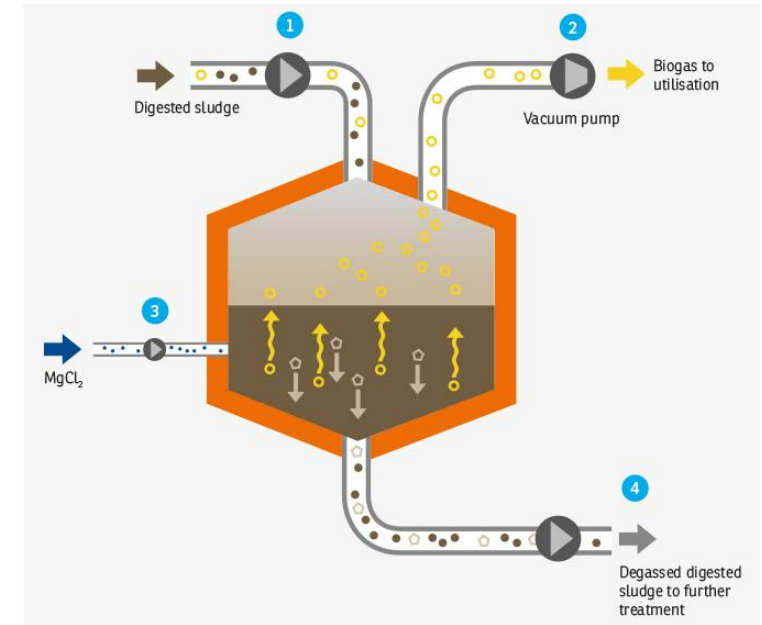
No reuse regulations in Ohio



S4 – Vacuum Extraction

Vacuum Extraction (Elovac)

- Vacuum degassing technology for digested sludge
 - Strips dissolved and entrained methane for recovery
 - Can add P precipitation
- First installation in 2016 with 9 installs globally (1 in USA)
- Improves dewaterability, reduces polymer



36 kg/hr CH₄

Gravity Thickeners

Biofilters

Cake Loadout

Dewatering Centrifuges

Post Digestion Thickening Centrifuge

Solids Handling Area

131 kg/hr

~5 kg/hr

WGB

WGB

47 kg/hr

Digesters

Digester Area






Control Building

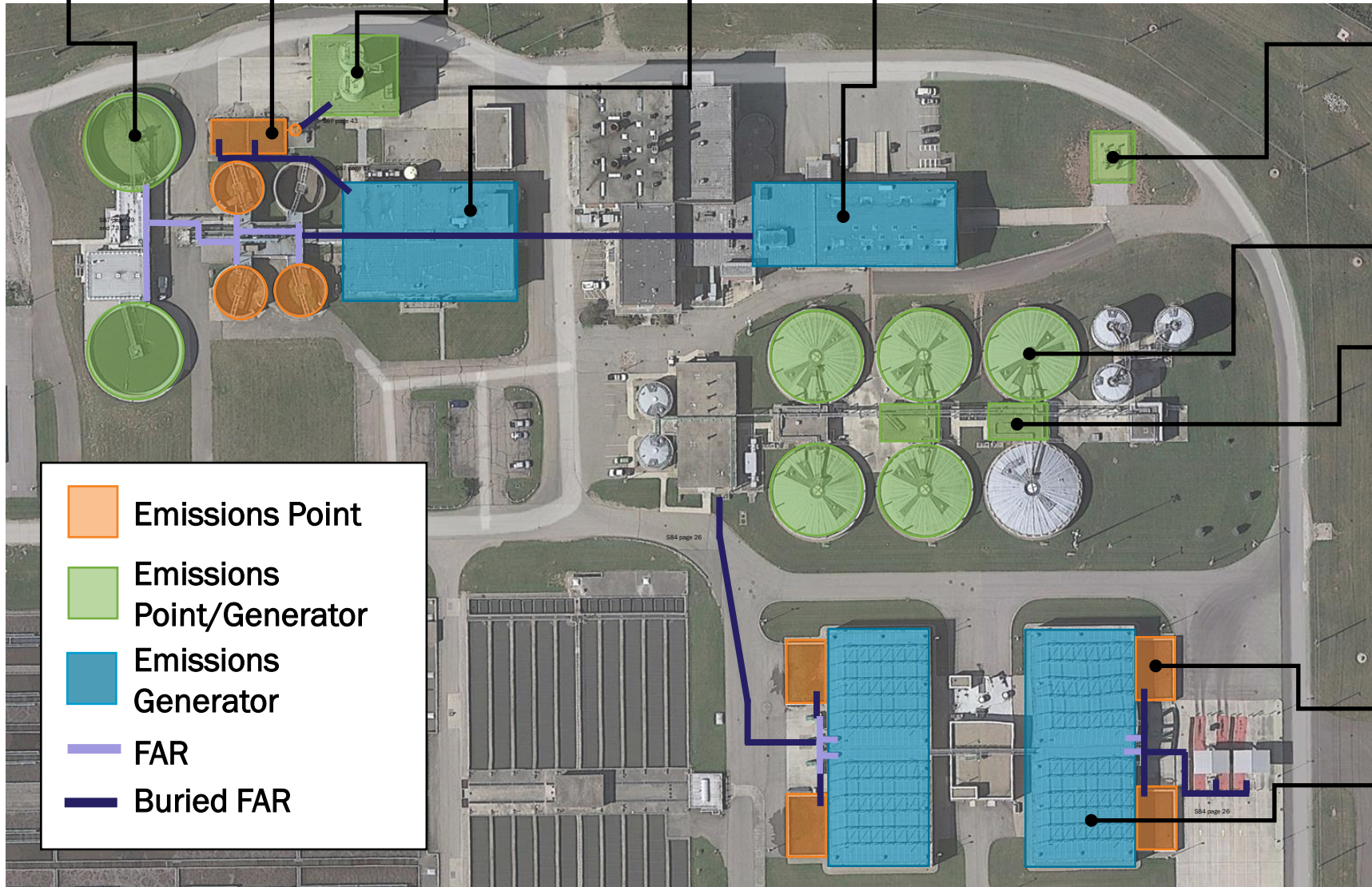
43 kg/hr

Biofilter

BLAF Area

BLAF

-  Emissions Point
-  Emissions Point/Generator
-  Emissions Generator
-  FAR
-  Buried FAR



<3 kg/hr CH₄ RTO or VCU

Solids Handling Area

<6 kg/hr (-95%)

Gravity Thickeners Biofilters Cake Loadout Dewatering Centrifuges Post Digestion Thickening Centrifuge

<1 kg/hr
Biogas Used

WGB

<1 kg/hr

Fixed Concrete

Digester Area

Control Building

Improved Digestion

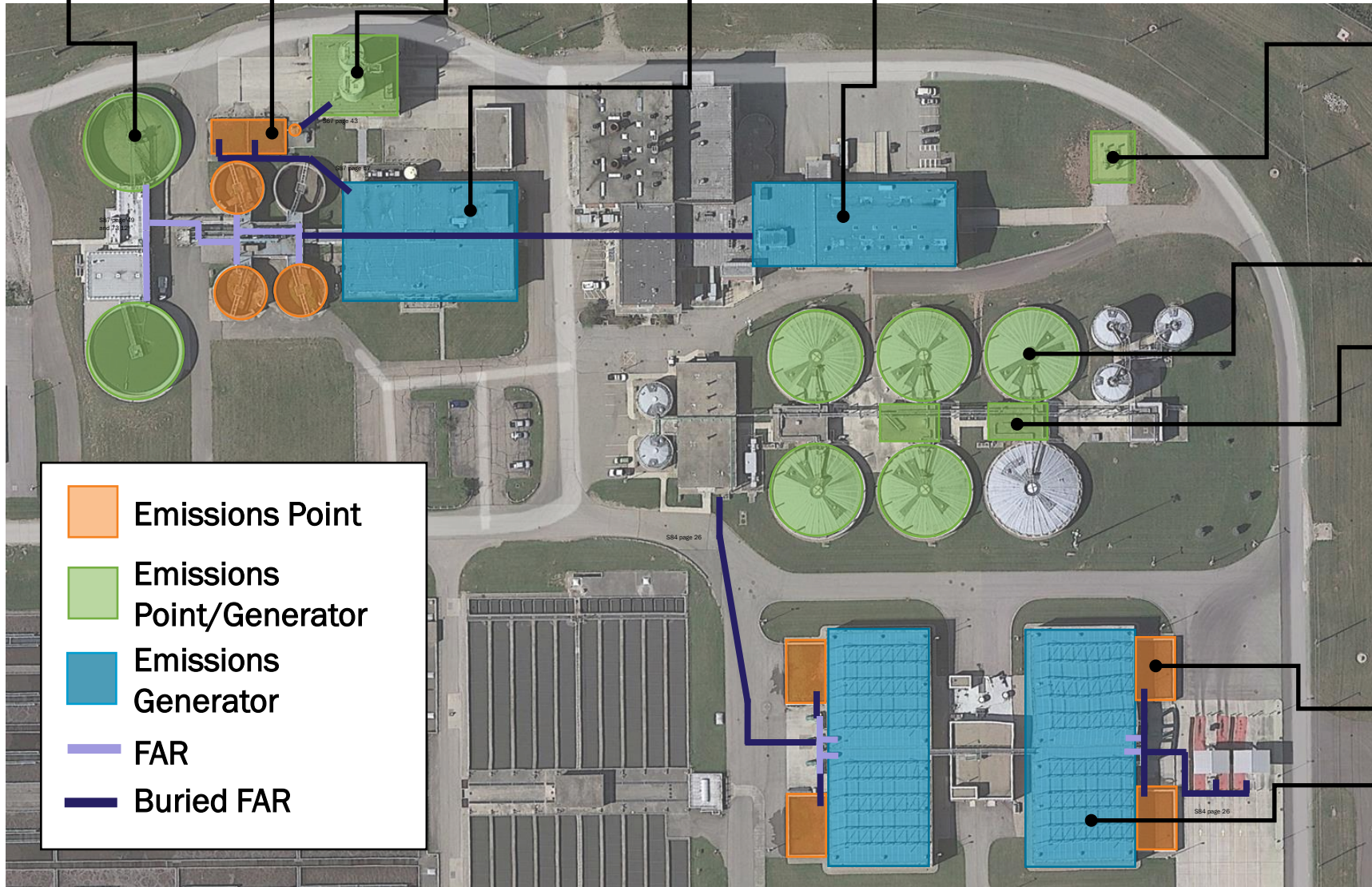
<1 kg/hr

RTO

BLAF Area

Biofilter

BLAF



- Orange square: Emissions Point
- Green square: Emissions Point/Generator
- Blue square: Emissions Generator
- Purple line: FAR
- Dark blue line: Buried FAR

Thank you.

Questions?

Brown AND **Caldwell** :



