

Estimating methane emission durations using continuous monitoring systems

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Graduate Research and Discovery Symposium



COLORADO SCHOOL OF MINES



A policy driven research project

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

50282 **Federal Register** / Vol. 88, No. 146 / Tuesday, August 1, 2023 / Proposed Rules

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 98

[EPA-HQ-OAR-2023-0234; FRL-10246-01-OAR]

RIN 2060-AV83

Greenhouse Gas Reporting Rule: Revisions and Confidentiality Determinations for Petroleum and Natural Gas Systems

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The Environmental Protection Agency (EPA) is proposing to amend requirements that apply to the petroleum and natural gas systems source category of the Greenhouse Gas Reporting Rule to ensure that reporting is based on empirical data, accurately reflects total methane emissions and waste emissions from applicable facilities, and allows owners and operators of applicable facilities to submit empirical emissions data that appropriately demonstrate the extent to which a charge is owed. The EPA is also proposing changes to requirements that

Federal eRulemaking Portal. www.regulations.gov (our preferred method). Follow the online instructions for submitting comments.

Mail: U.S. Environmental Protection Agency, EPA Docket Center, Air and Radiation Docket, Mail Code 28221T, 1200 Pennsylvania Avenue NW, Washington, DC 20460.

Hand Delivery or Courier (by scheduled appointment only): EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue NW, Washington, DC 20004. The Docket Center's hours of operations are 8:30 a.m.–4:30 p.m., Monday-Friday (except Federal holidays).

Instructions: All submissions received must include the Docket Id. No. for this proposed rulemaking. Comments received may be posted without change to www.regulations.gov/, including any personal information provided. For detailed instructions on sending comments and additional information on the rulemaking process, see the “Public Participation” heading of the **SUPPLEMENTARY INFORMATION** section of this document.

The virtual hearing, if requested, will be held using an online meeting platform, and the EPA will provide information on its website

EPA may publish any comment received to its public docket. Do not submit to the EPA's docket at www.regulations.gov any information you consider to be confidential business information (CBI), proprietary business information (PBI), or other information whose disclosure is restricted by statute. Multimedia submissions (audio, video, etc.) must be accompanied by a written comment. The written comment is considered the official comment and should include discussion of all points you wish to make. The EPA will generally not consider comments or comment contents located outside of the primary submission (*i.e.*, on the web, cloud, or other file sharing system). Commenters who would like the EPA to further consider in this rulemaking any relevant comments that they provided on the 2022 Proposed Rule regarding proposed revisions at issue in this proposal must resubmit those comments to the EPA during this proposal's comment period. Please visit www.epa.gov/dockets/commenting-epa-dockets for additional submission methods; the full EPA public comment policy; information about CBI, PBI, or multimedia submissions, and general guidance on making effective comments.

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40 CFR Part 98:

**Proposed updates to the EPA's
Greenhouse Gas Reporting Program
(GHGRP) to take effect January 2025**

... also proposing a 100 kg/hr CH₄ emission threshold to align with the super-emitter response program proposed in the NSPS 0000b. These emissions are generally intermittent, with widely varying durations ...

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Oil and gas operators
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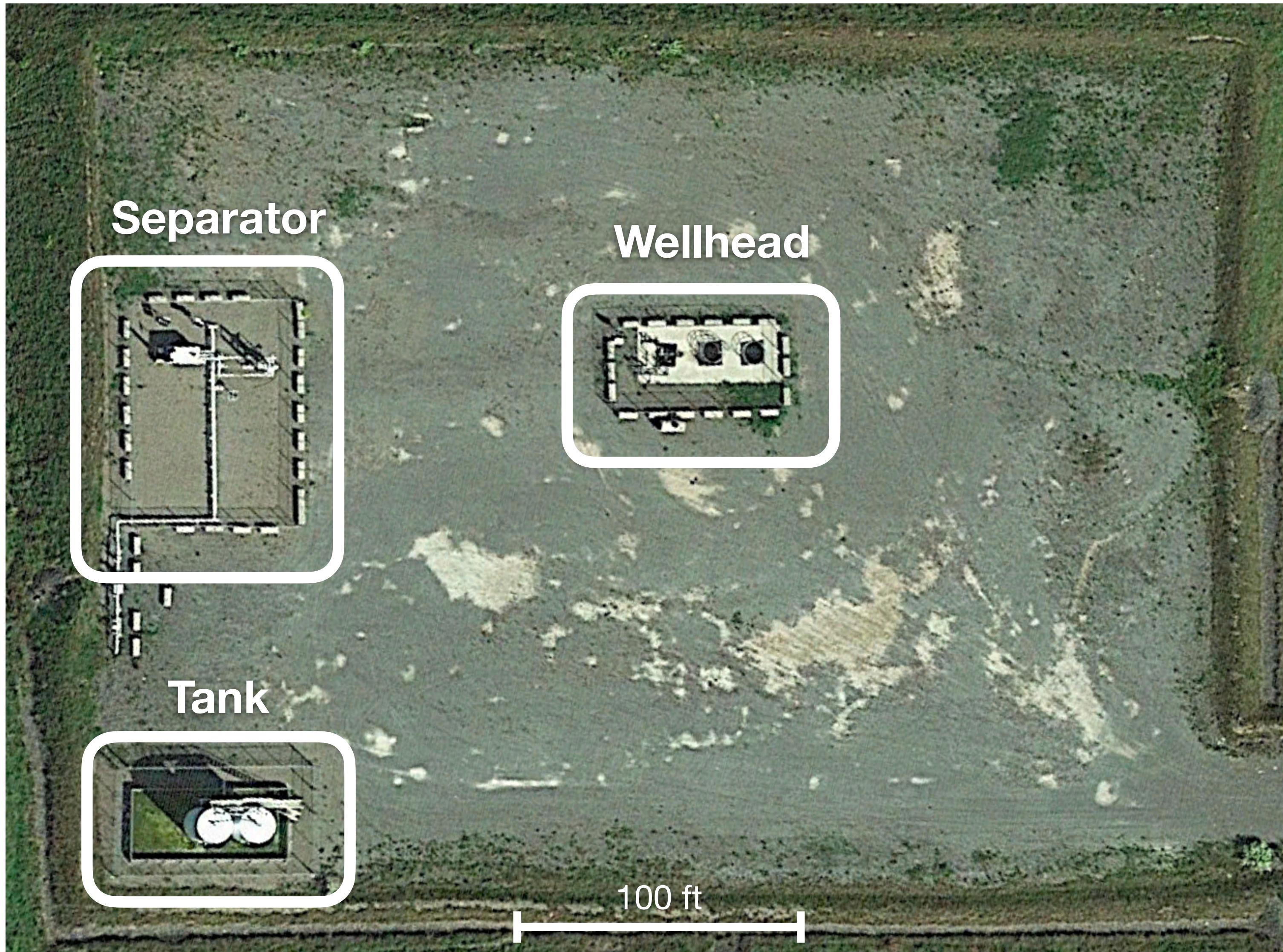
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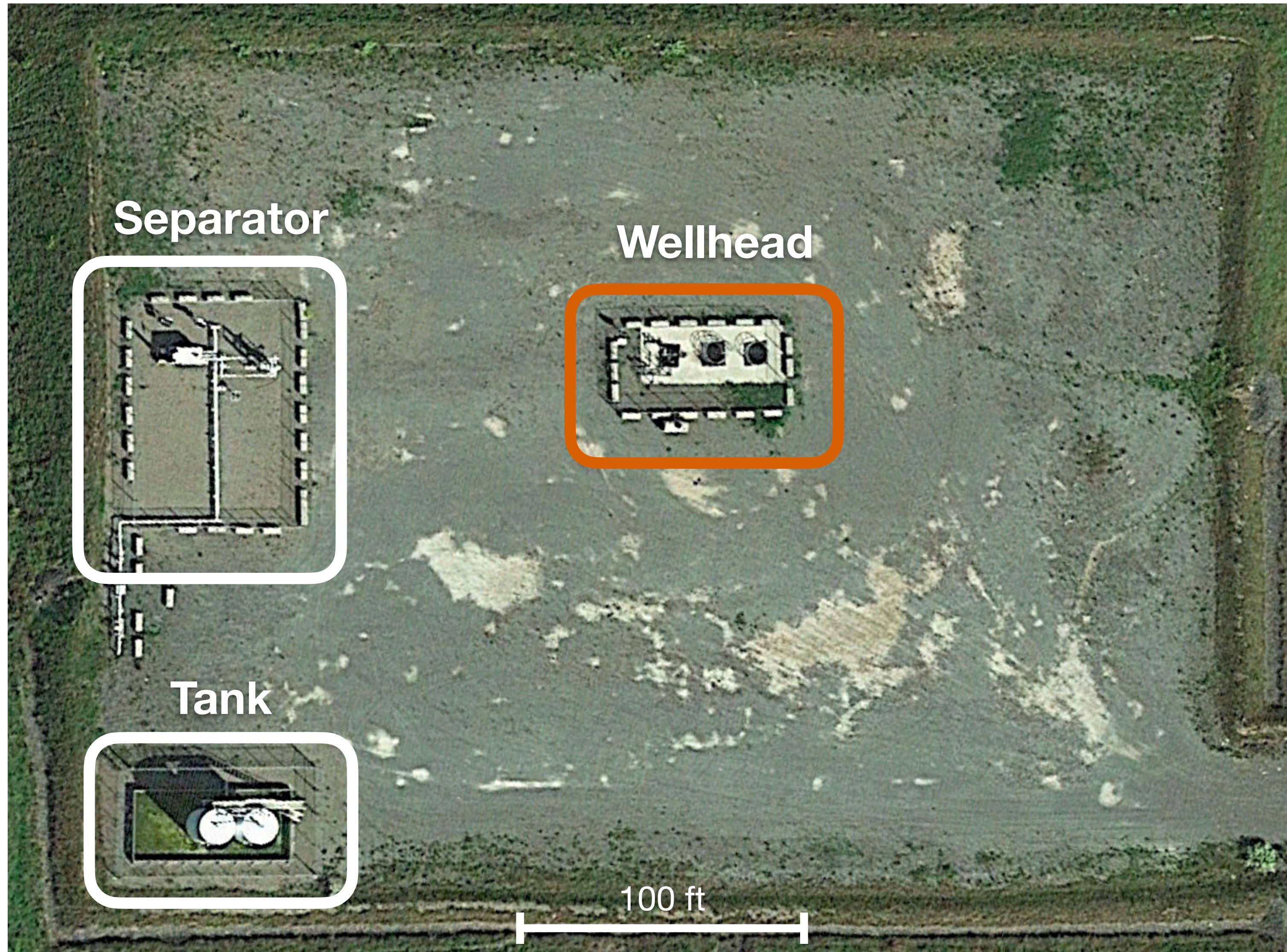
Oil and gas operators
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For each of these emissions,
the operator must estimate
an **emission duration**

Example oil and gas production site

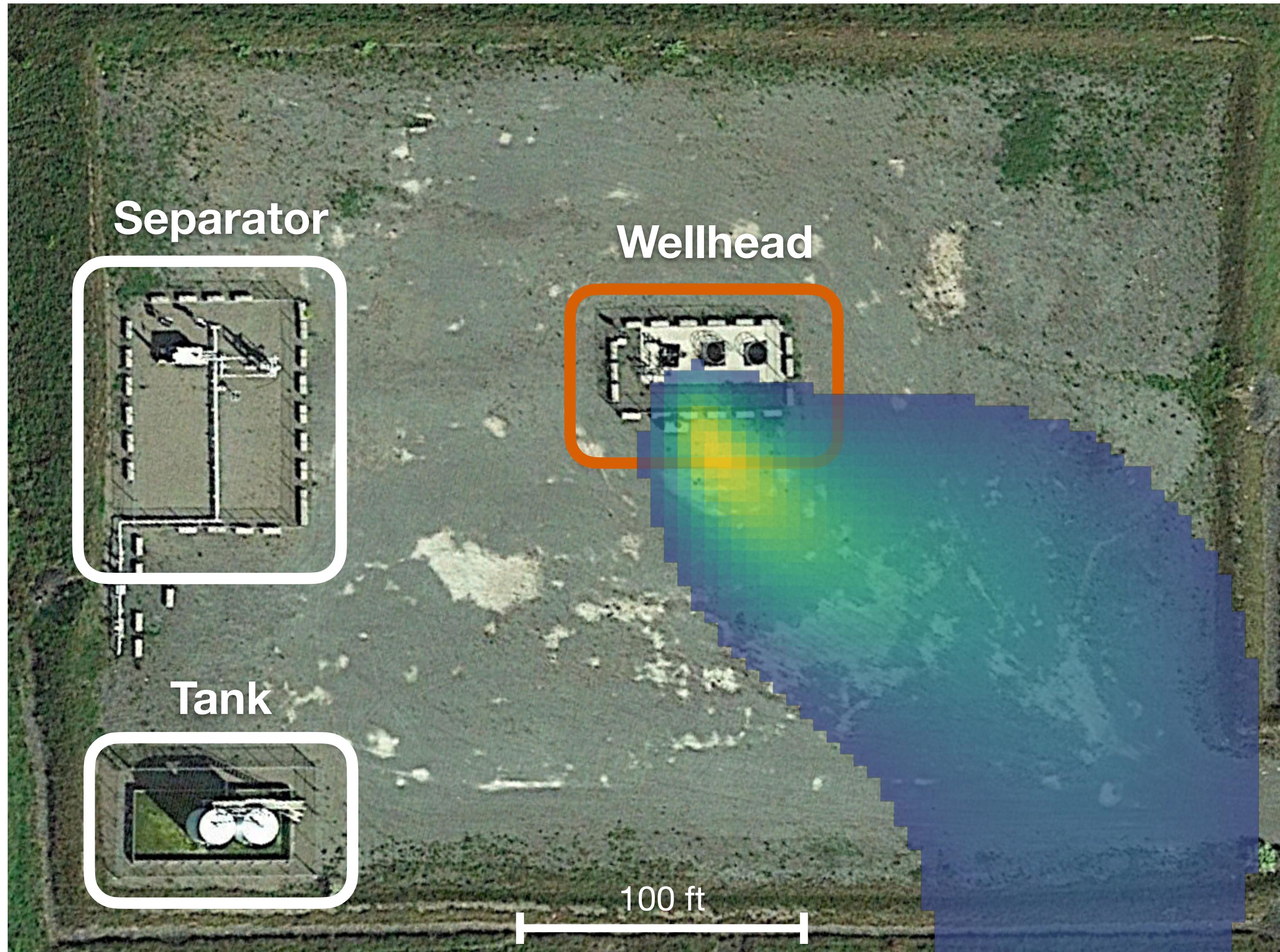


Example oil and gas production site



Wellhead emission:

Example oil and gas production site

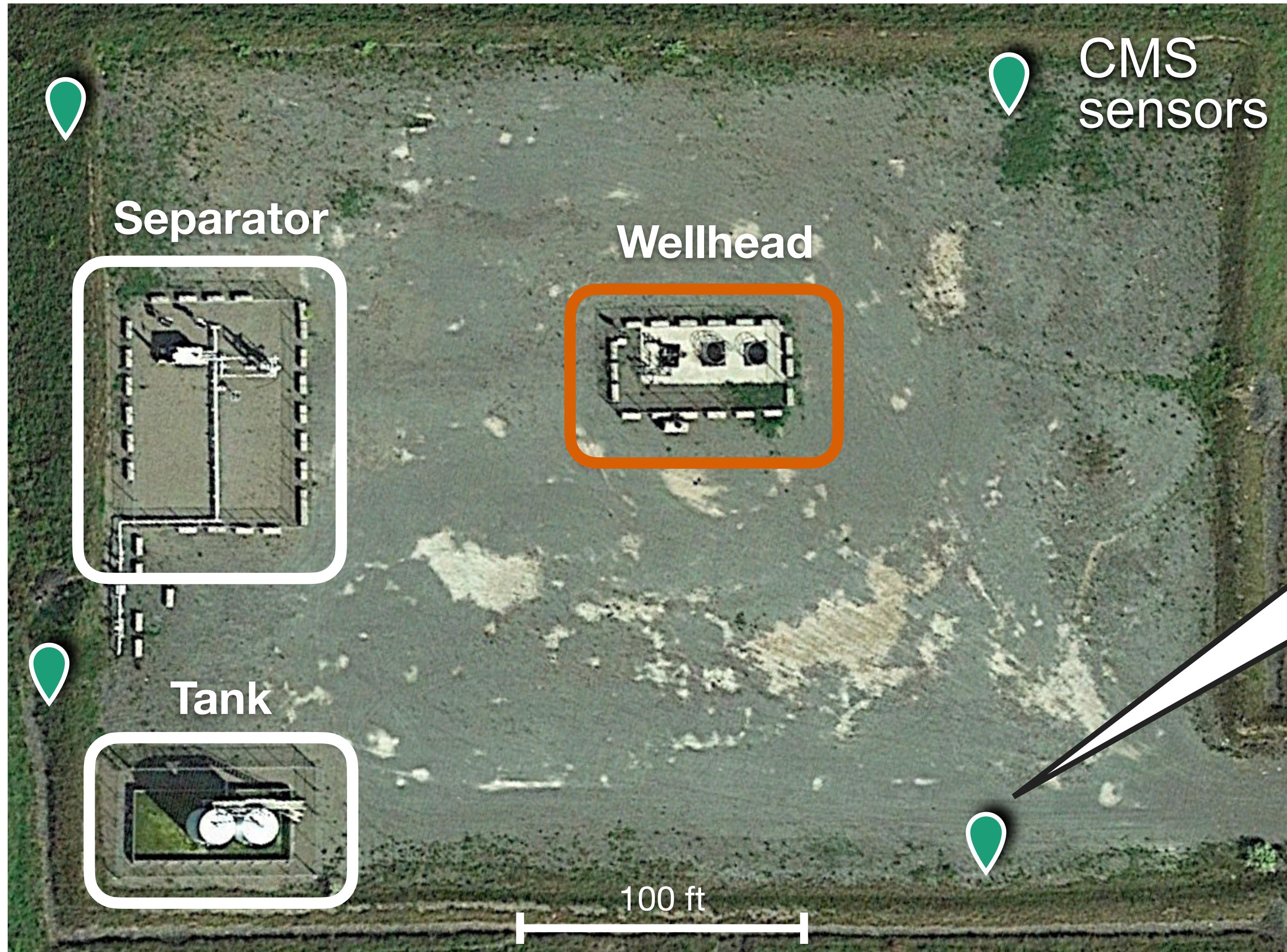


Wellhead emission:

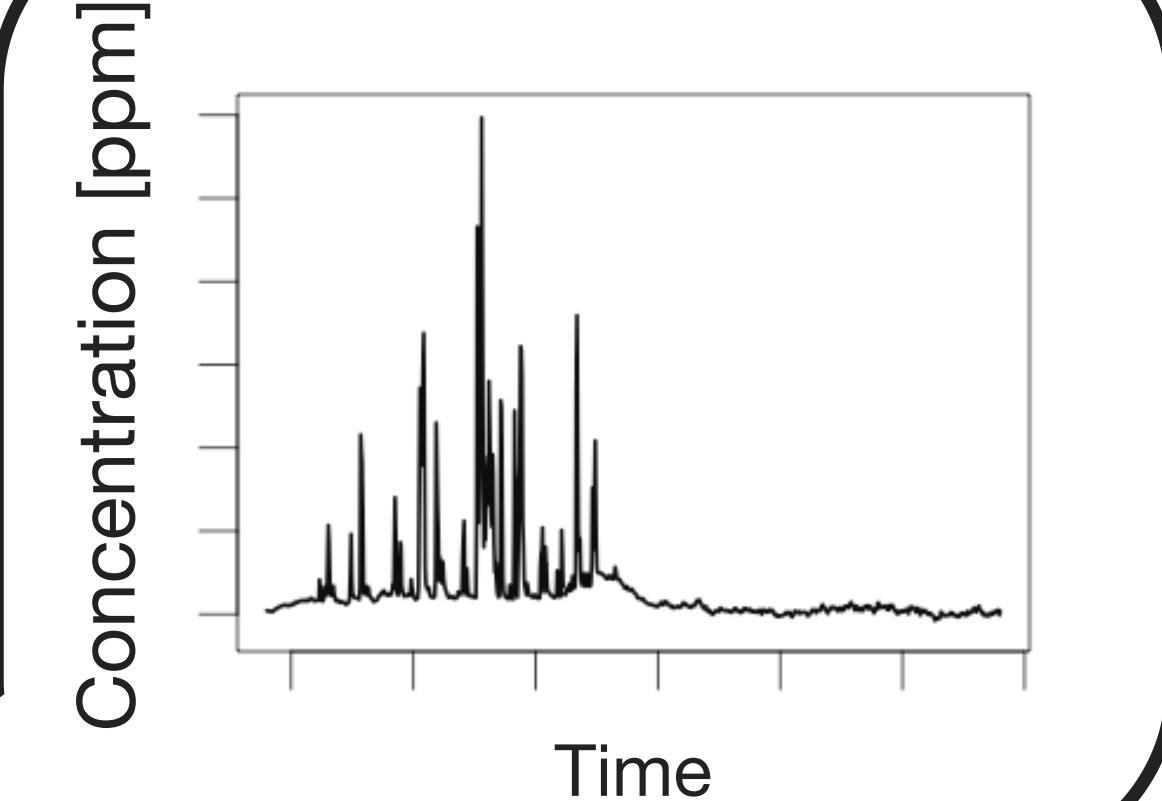
View from an aerial
measurement
technology



Example oil and gas production site

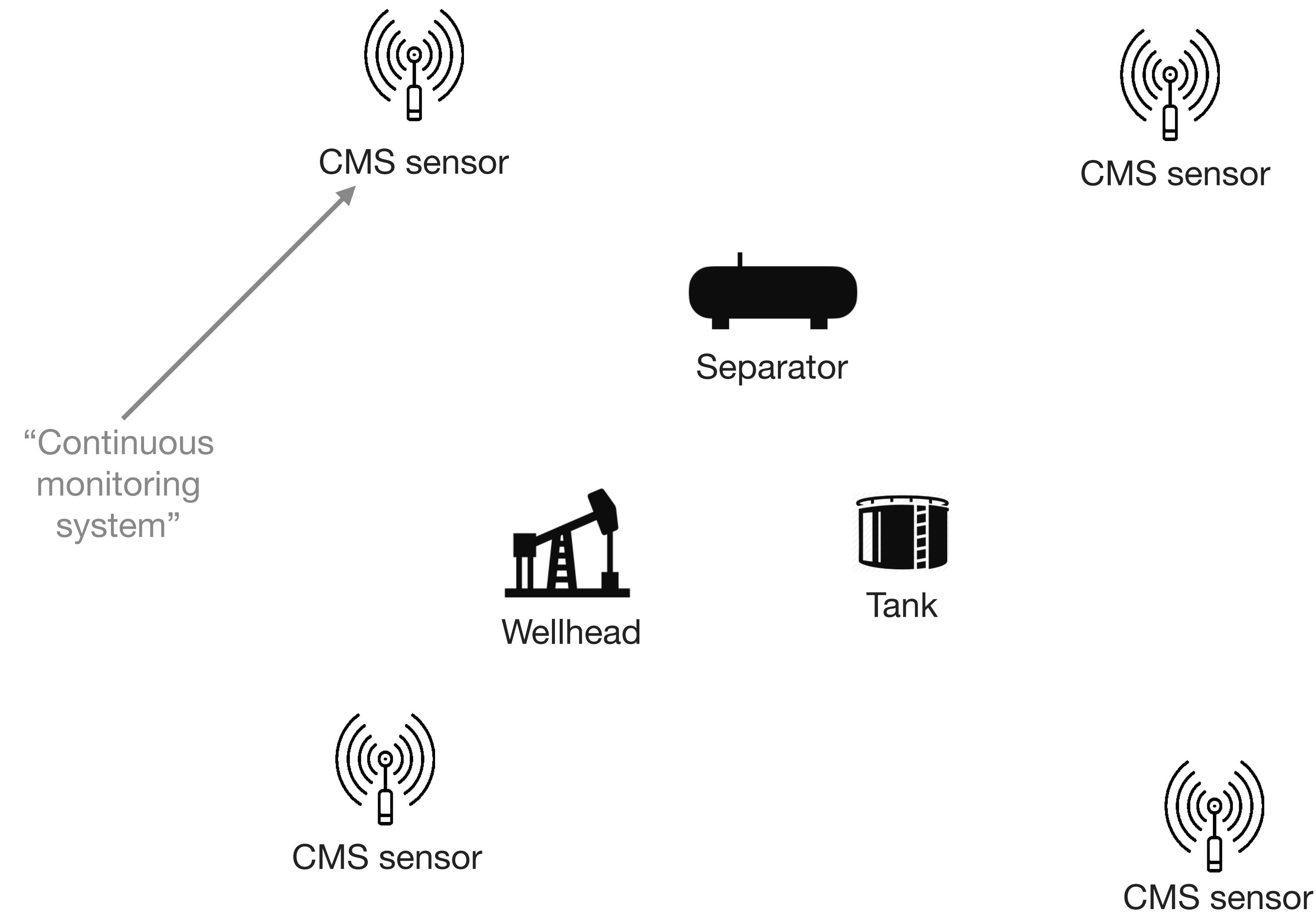


Wellhead emission:

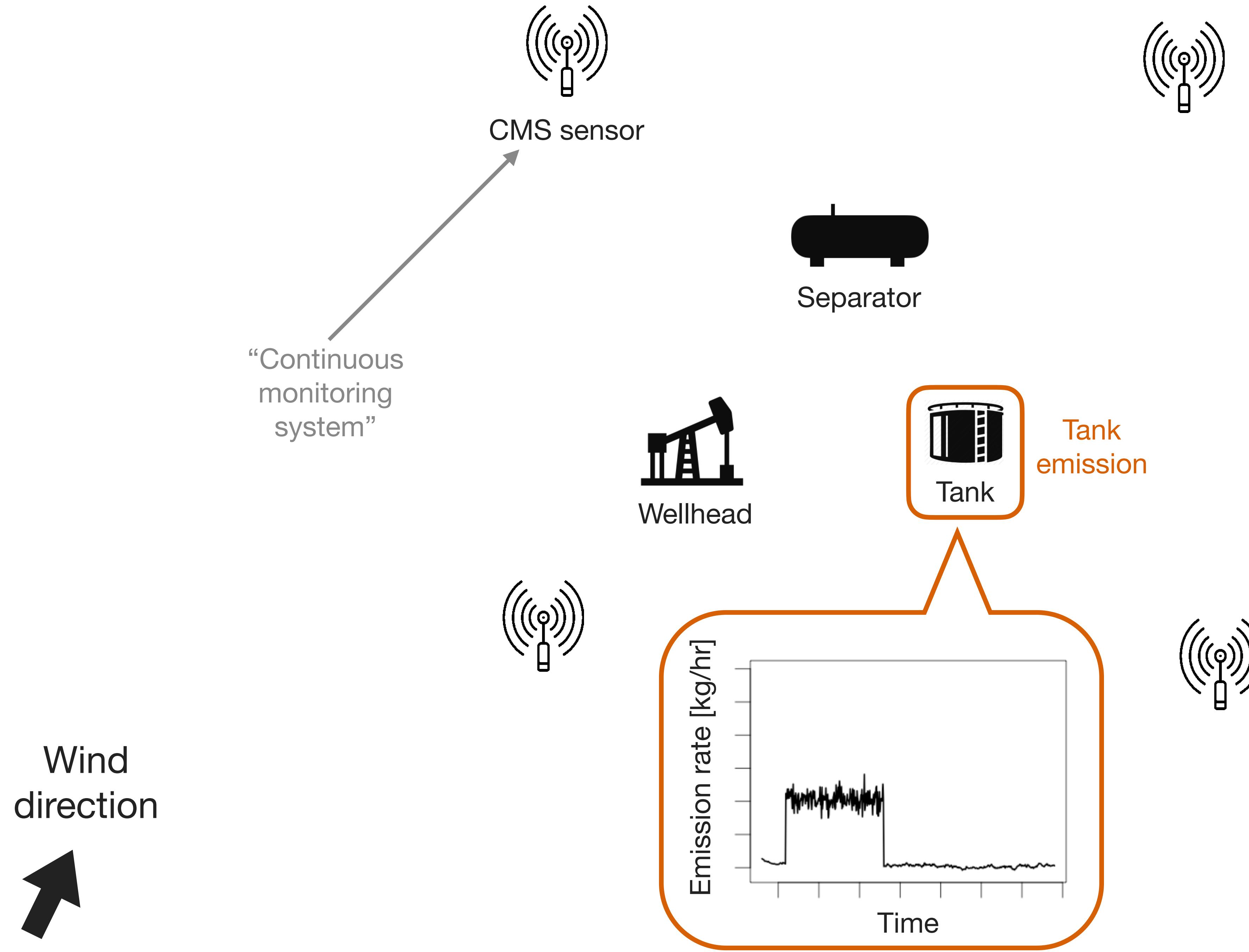


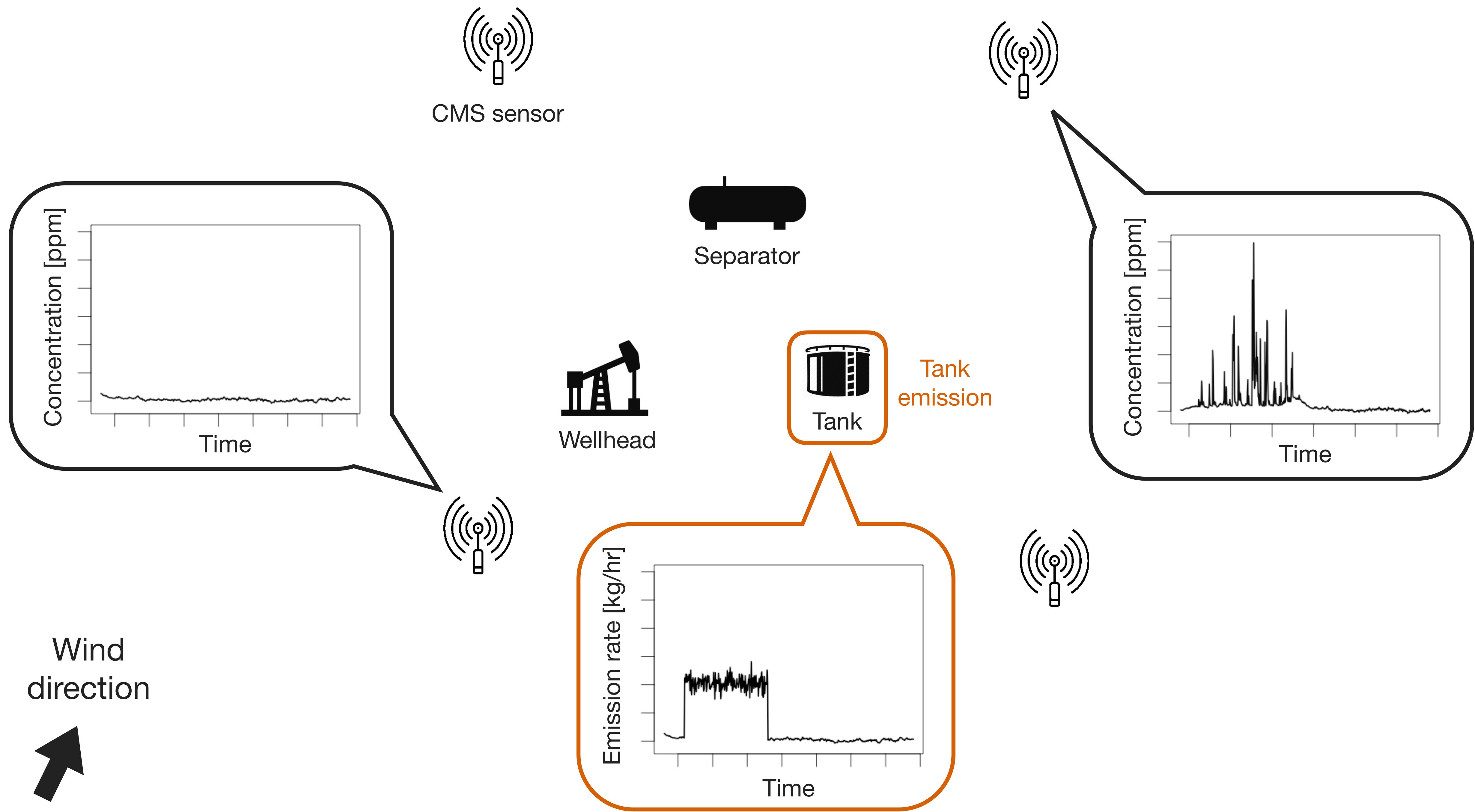
View from a continuous monitoring system (CMS)

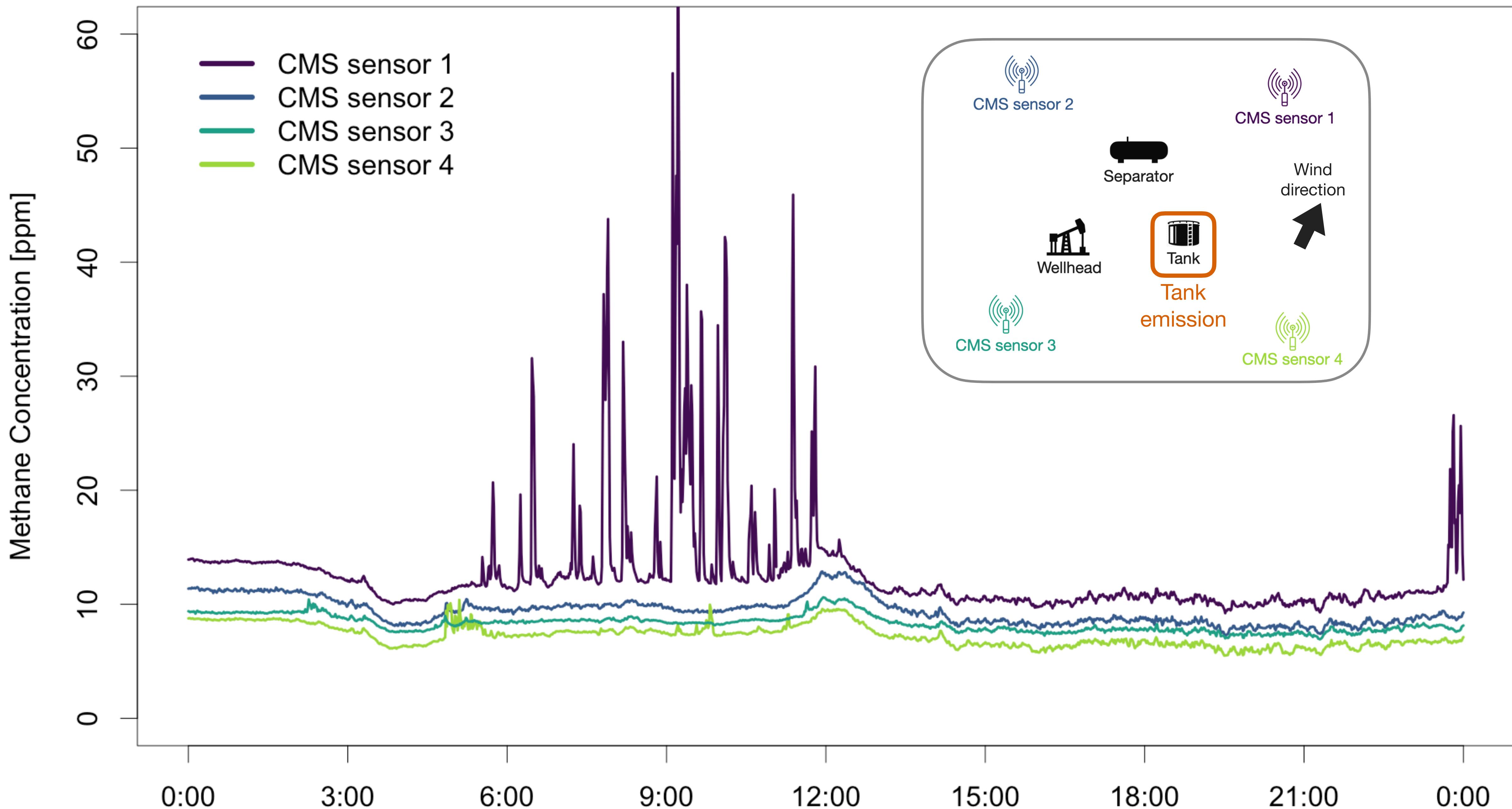


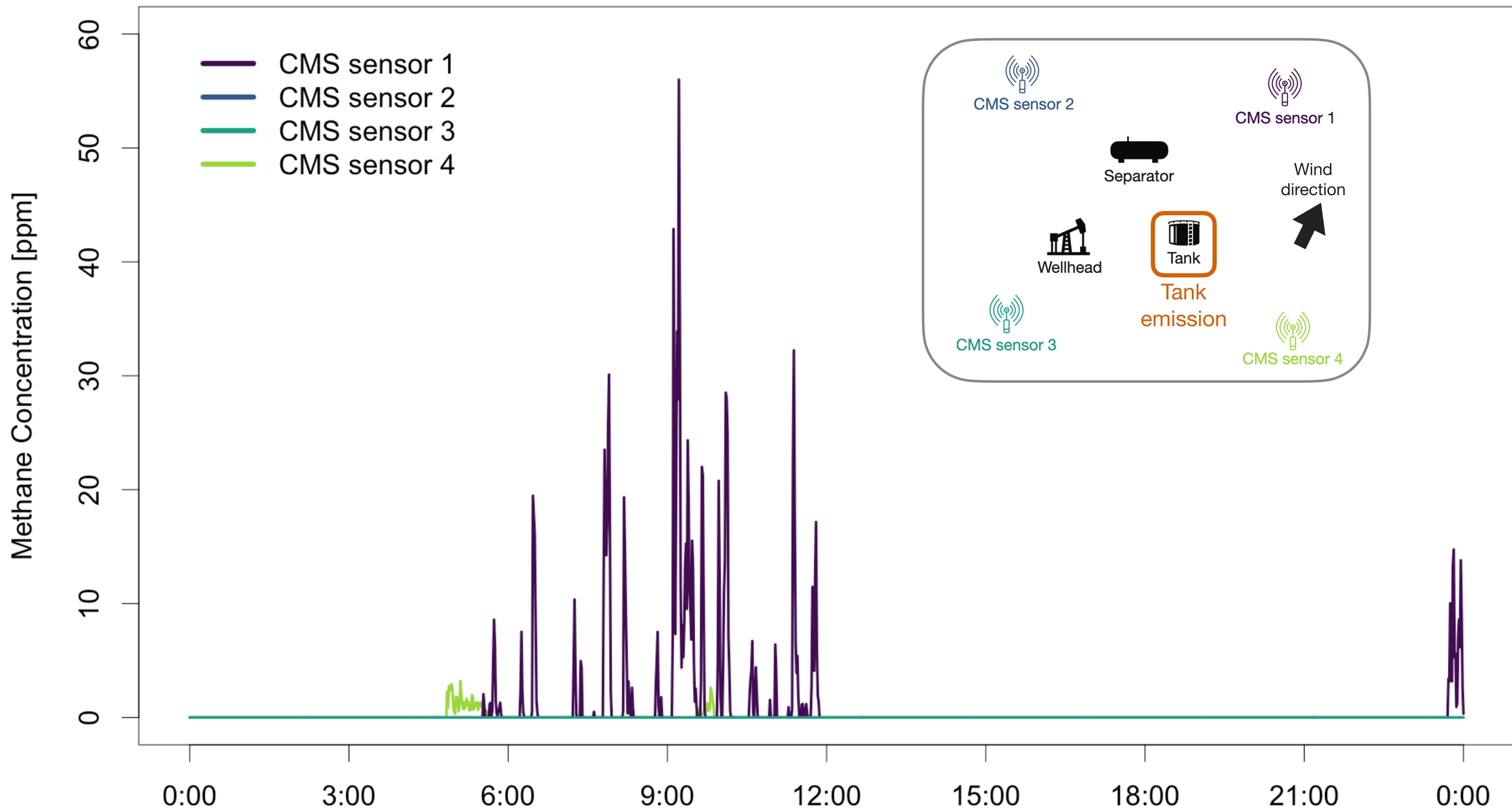


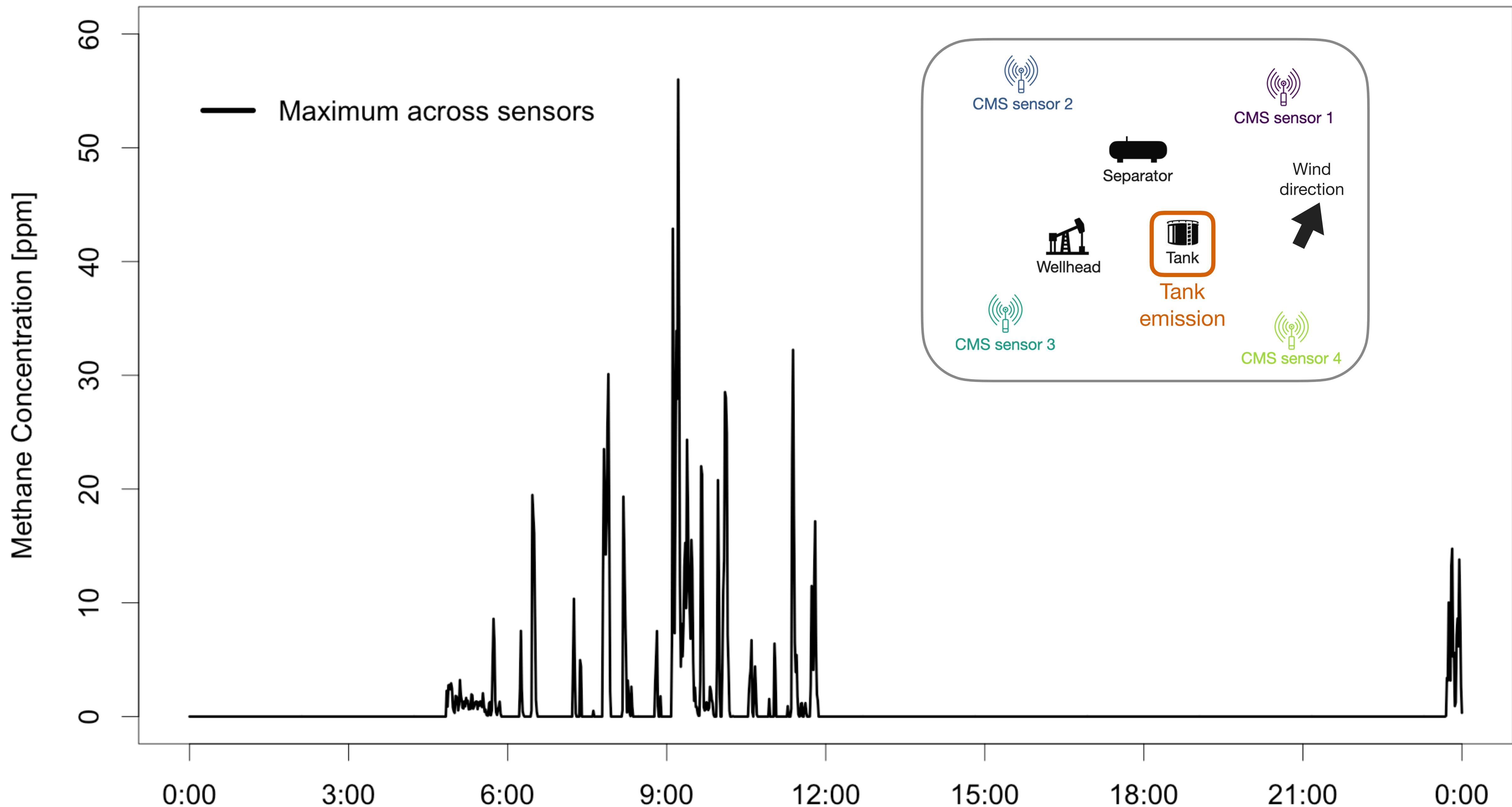
The “naive” method for estimating durations

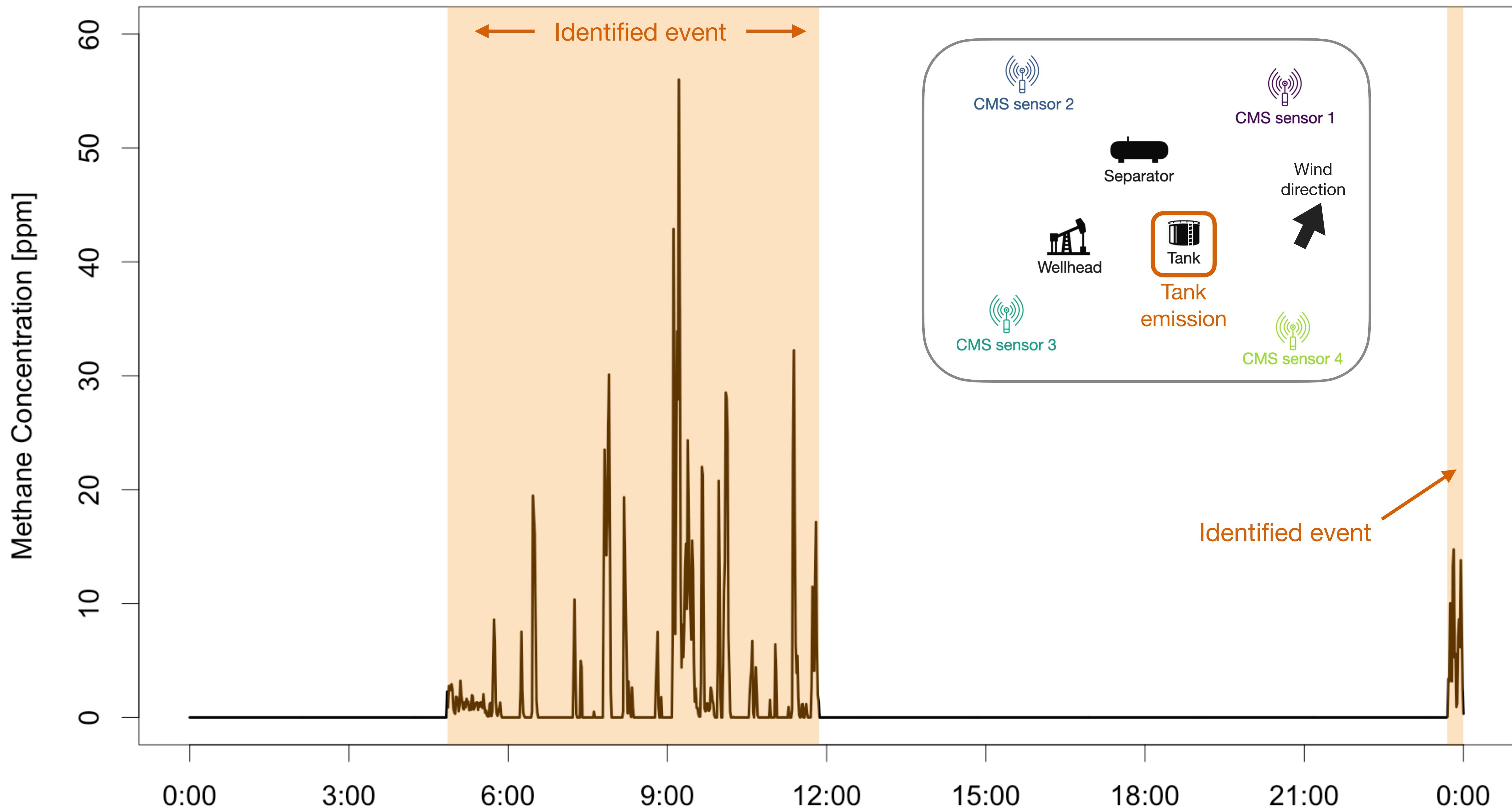




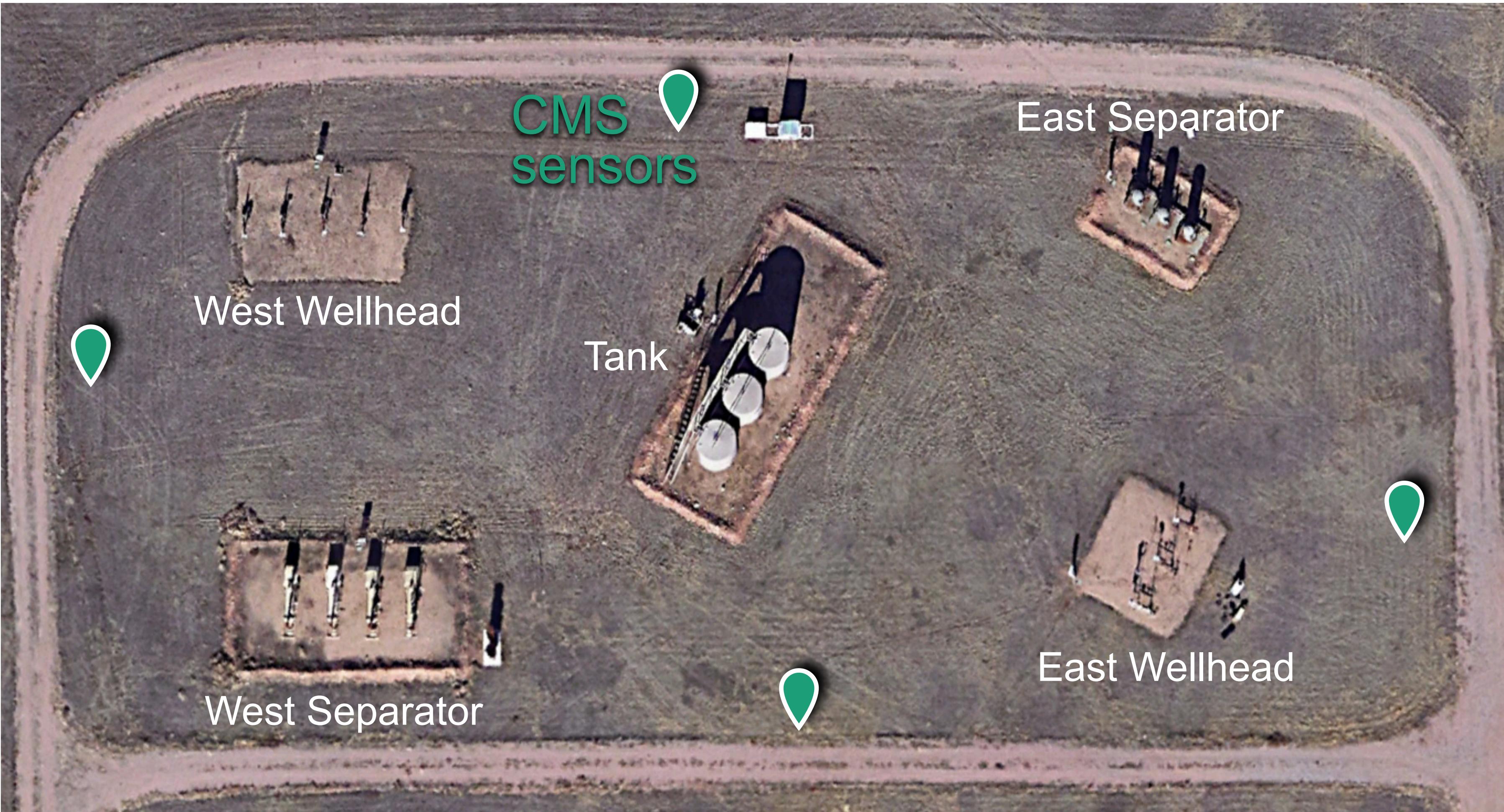






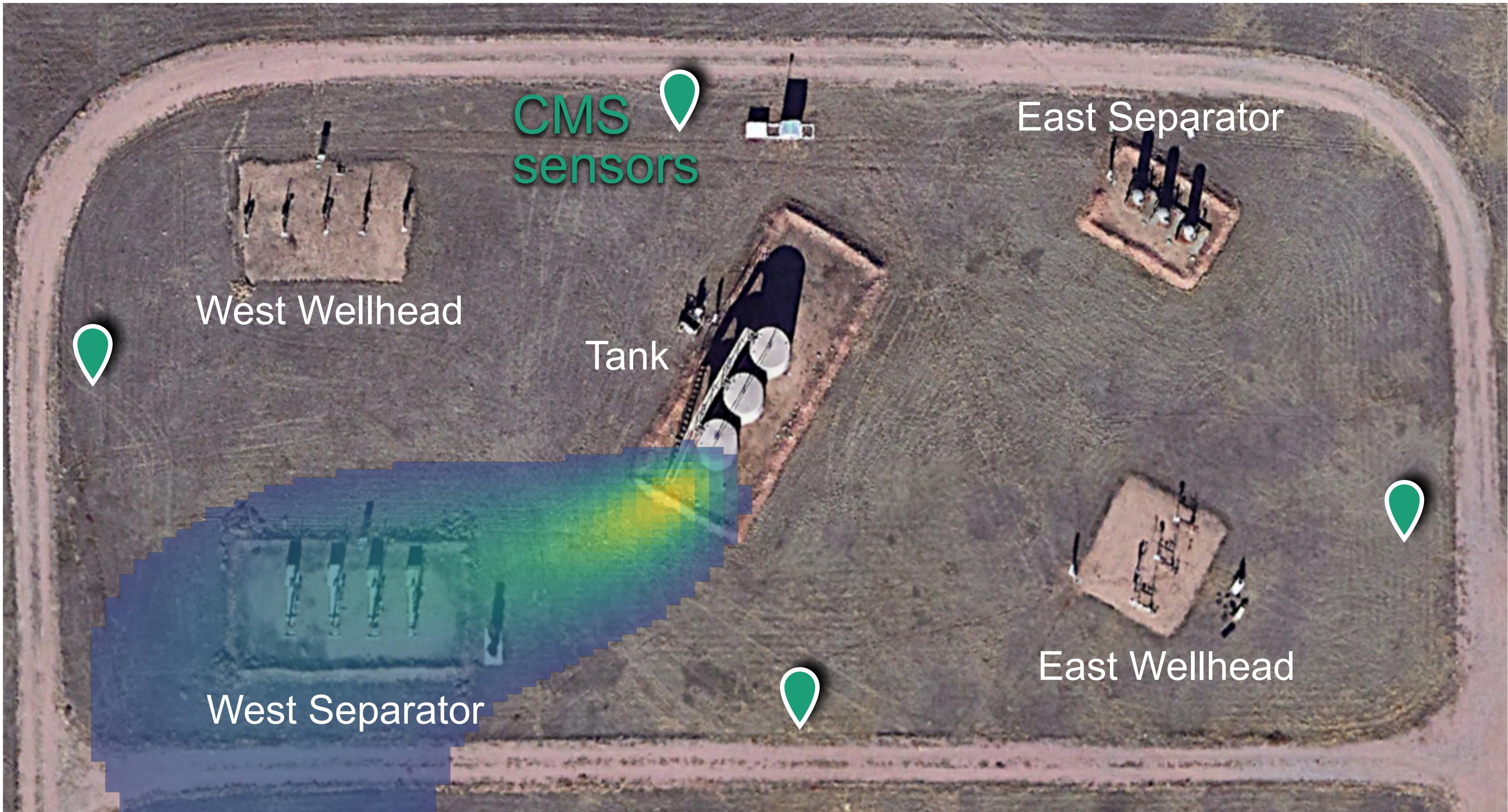


One problem... incomplete sensor coverage



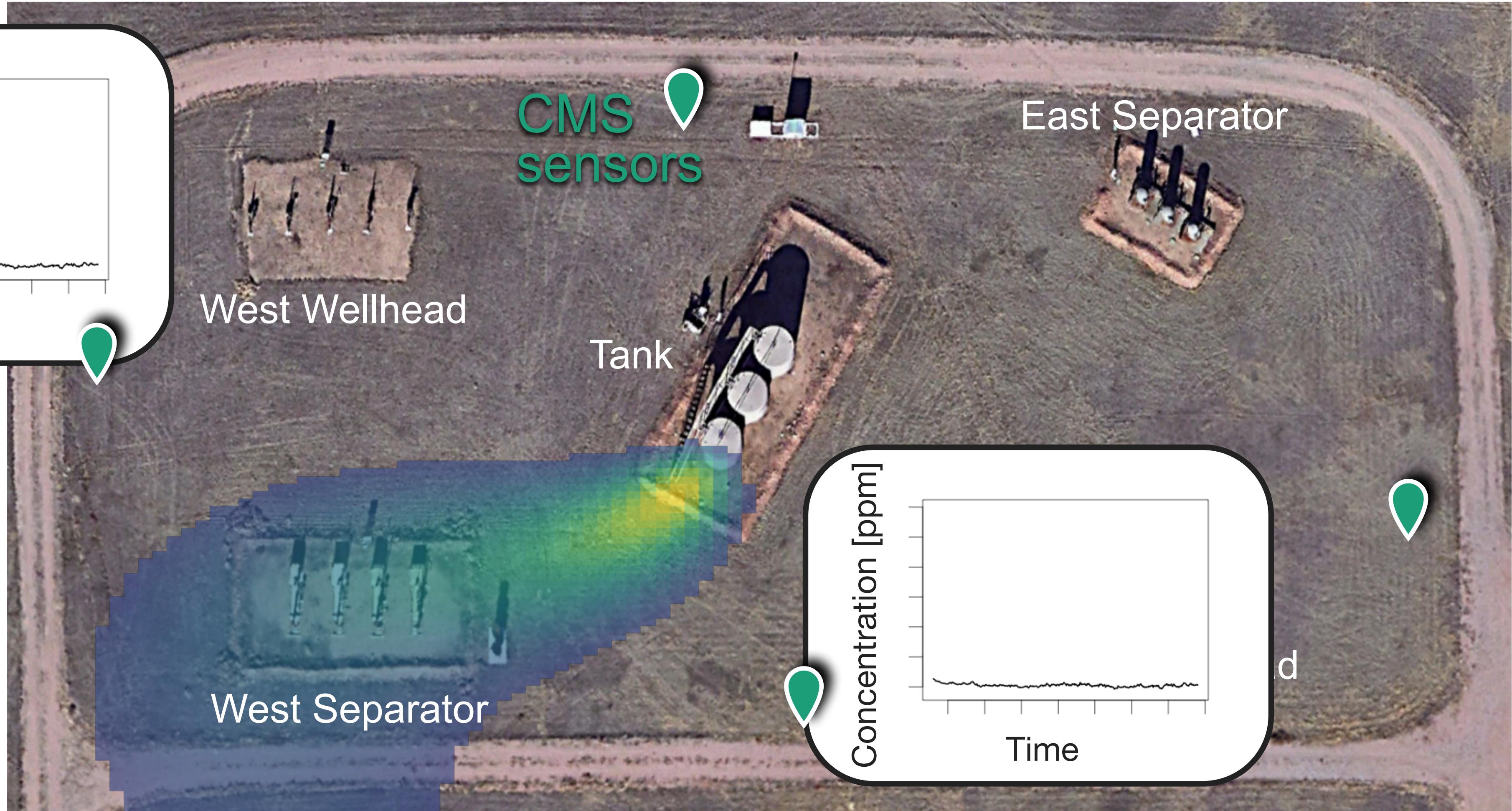
One problem... incomplete sensor coverage

Wind direction
↙



One problem... incomplete sensor coverage

Wind direction



CMS do not provide emission information when the wind blows between sensors

One problem... incomplete sensor coverage

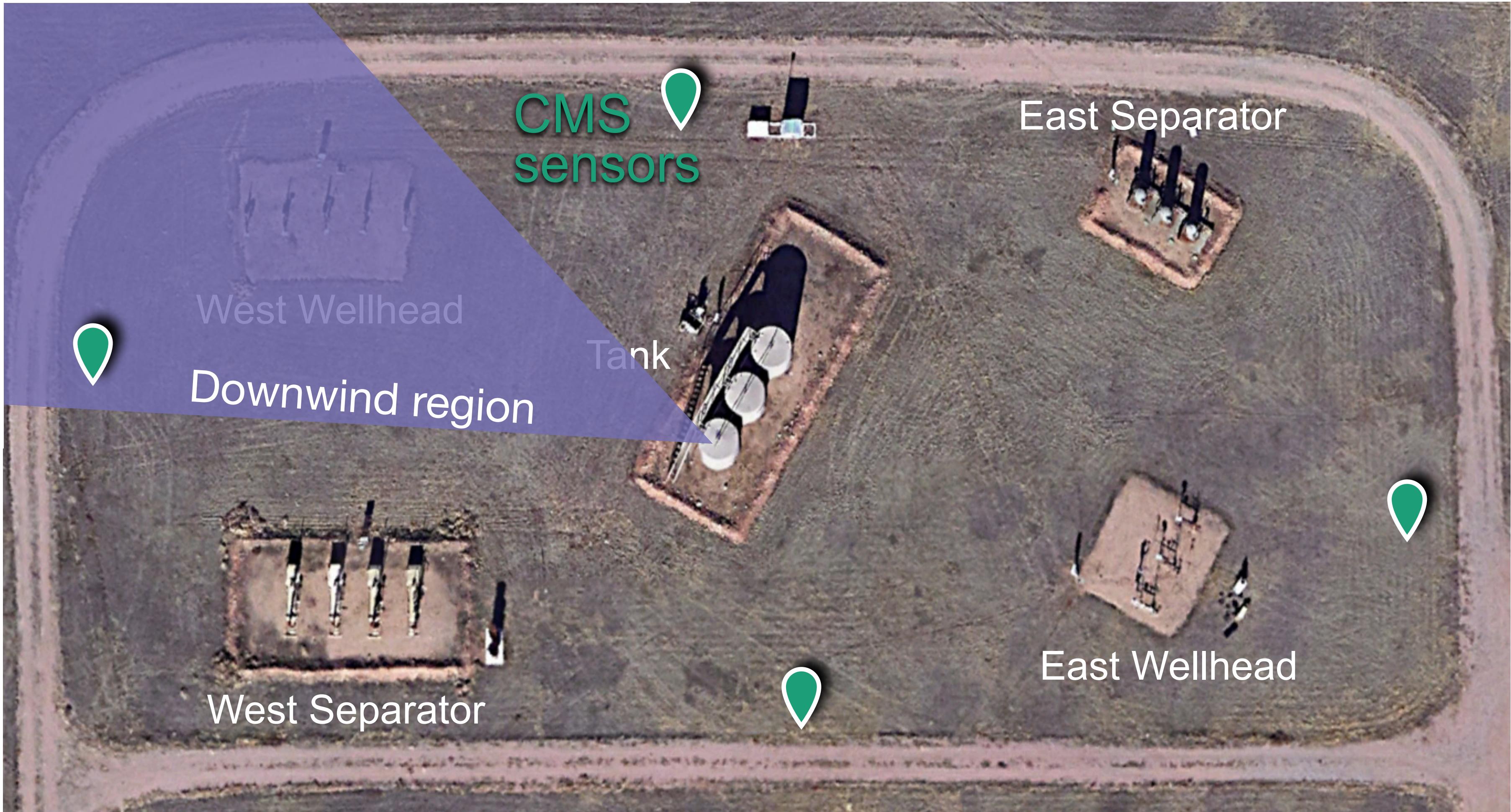
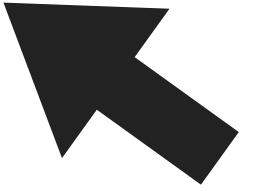
Wind direction
↗



Downwind region **does not** overlap with CMS sensors = period of “**no information**”

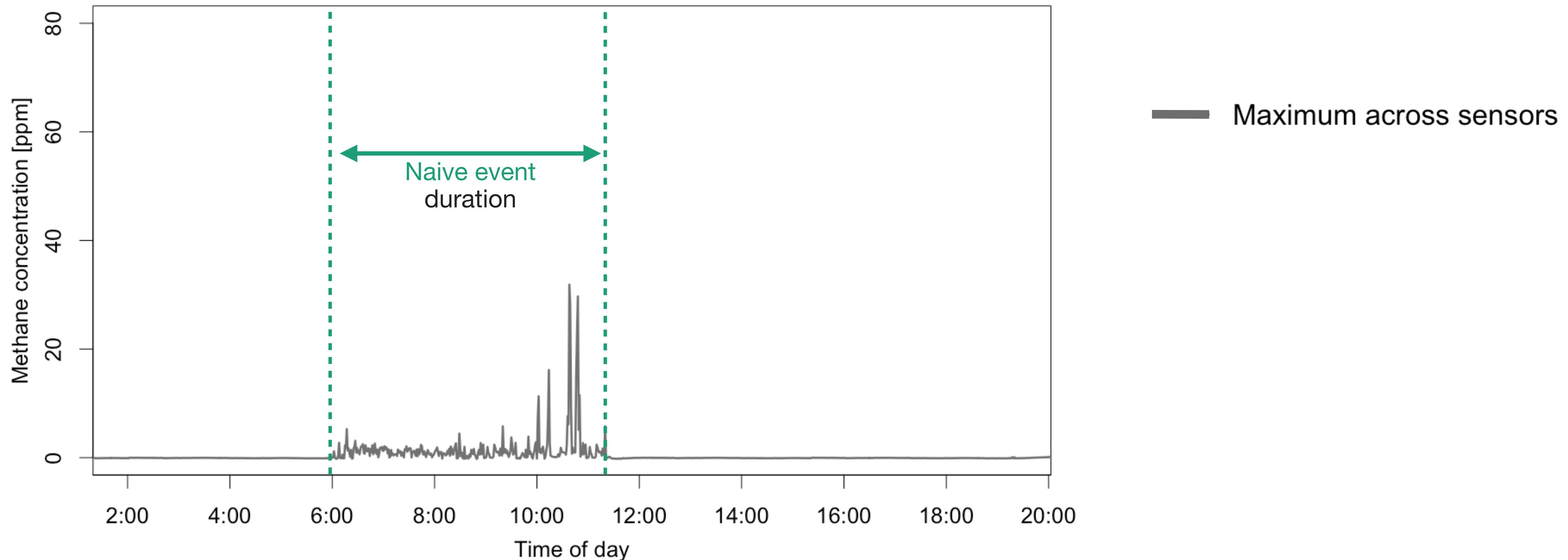
One problem... incomplete sensor coverage

Wind direction

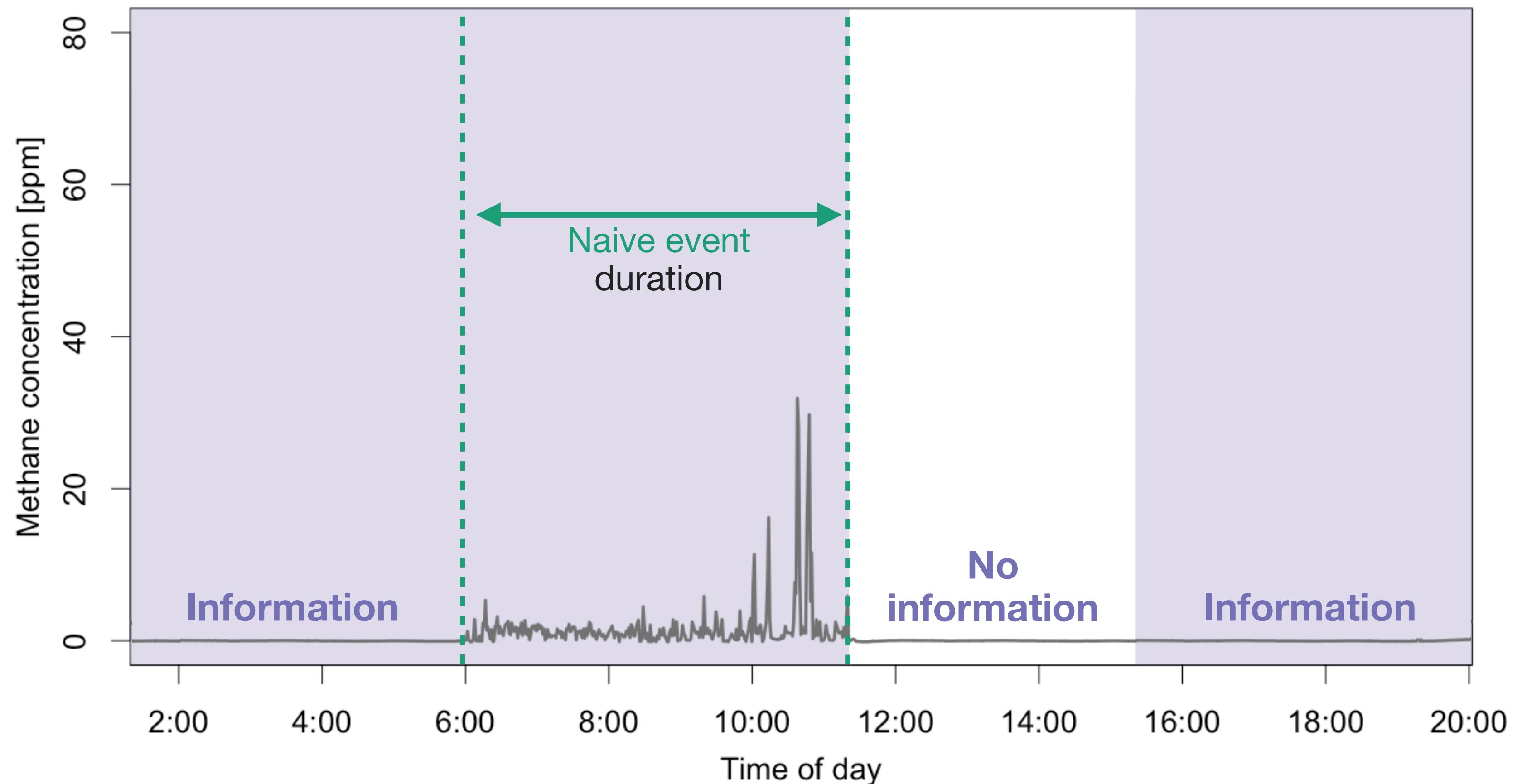


Downwind region **does** overlap with CMS sensors = period of “**information**”

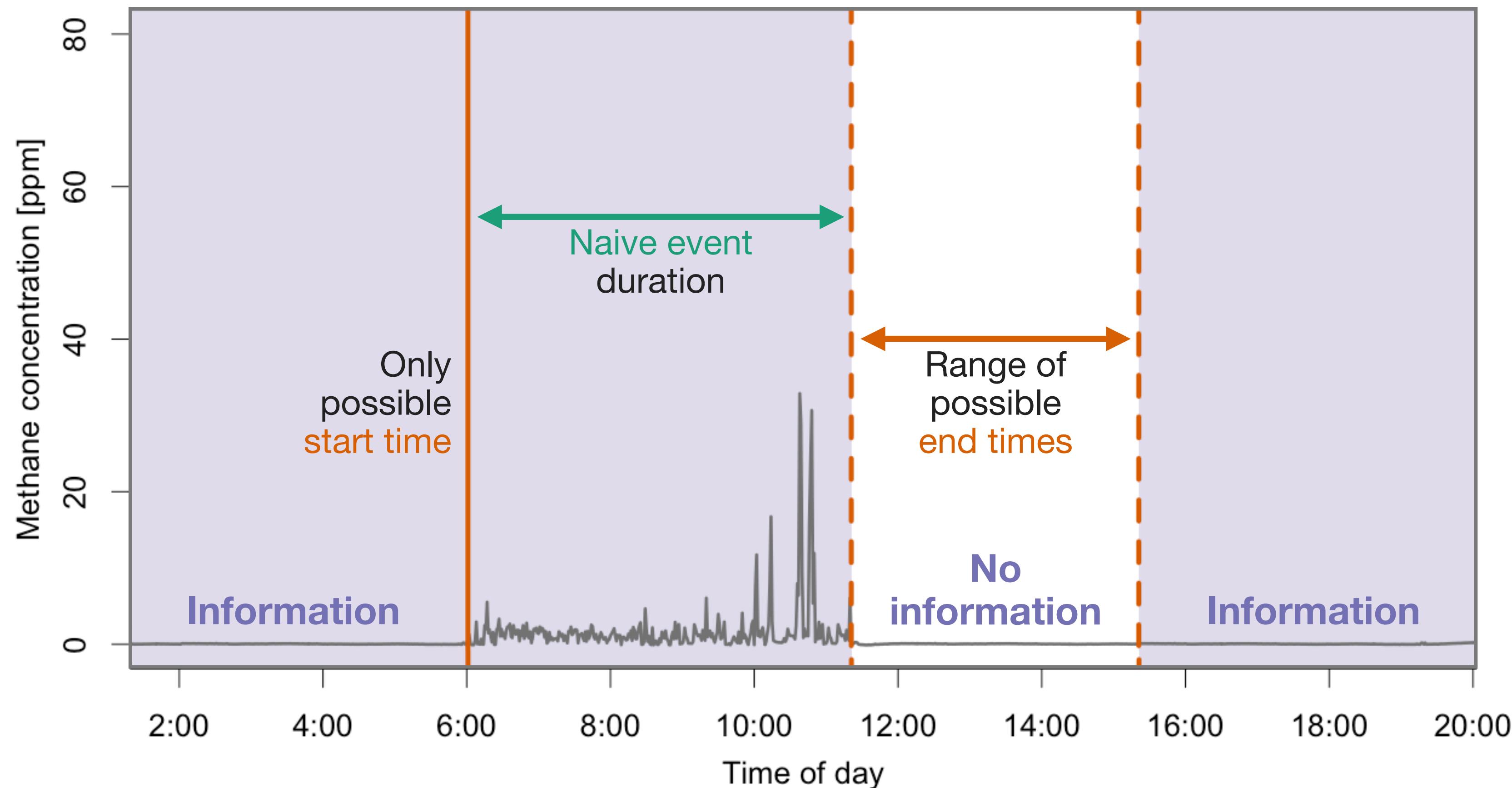
How does incomplete coverage present itself in the data?



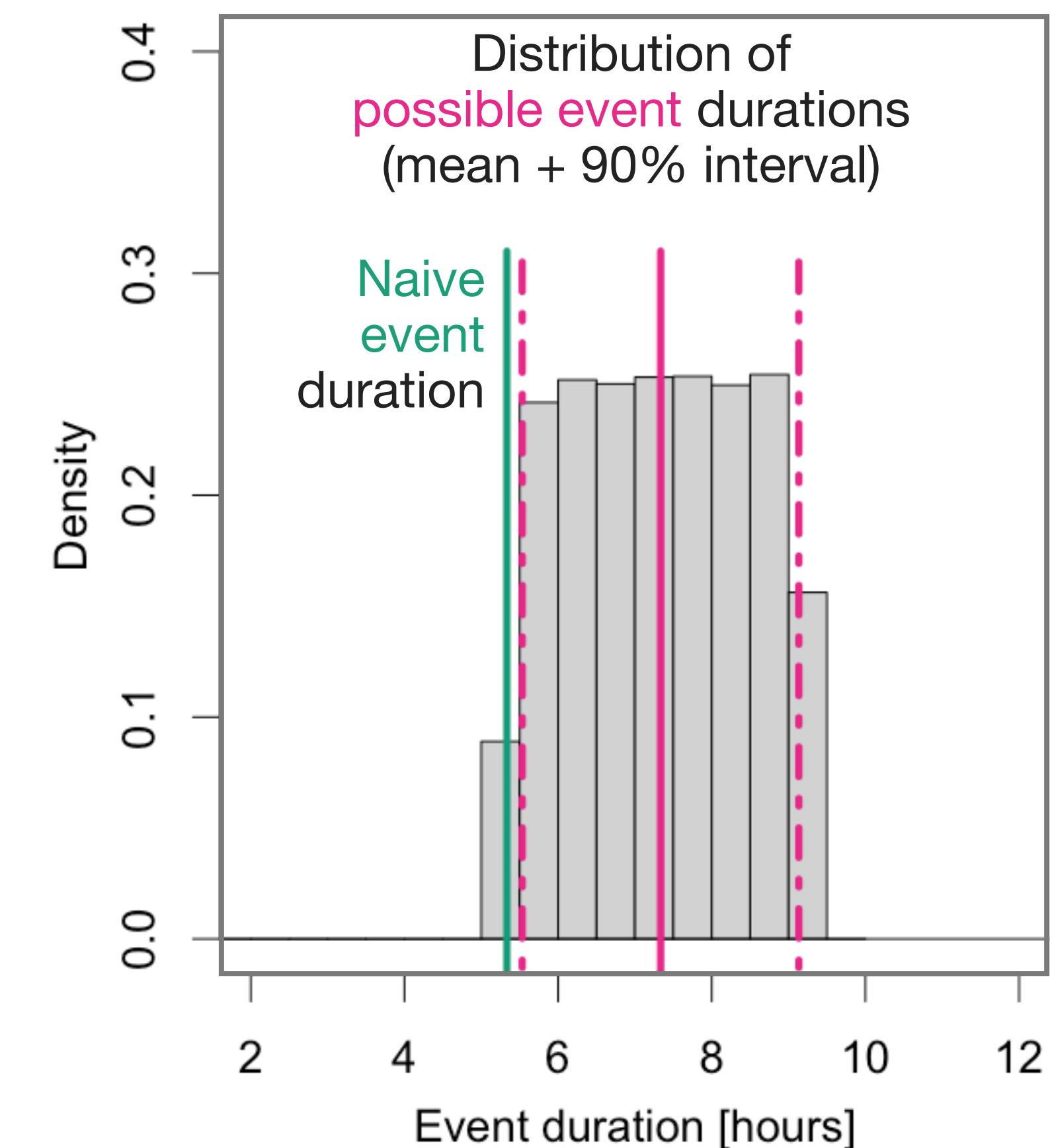
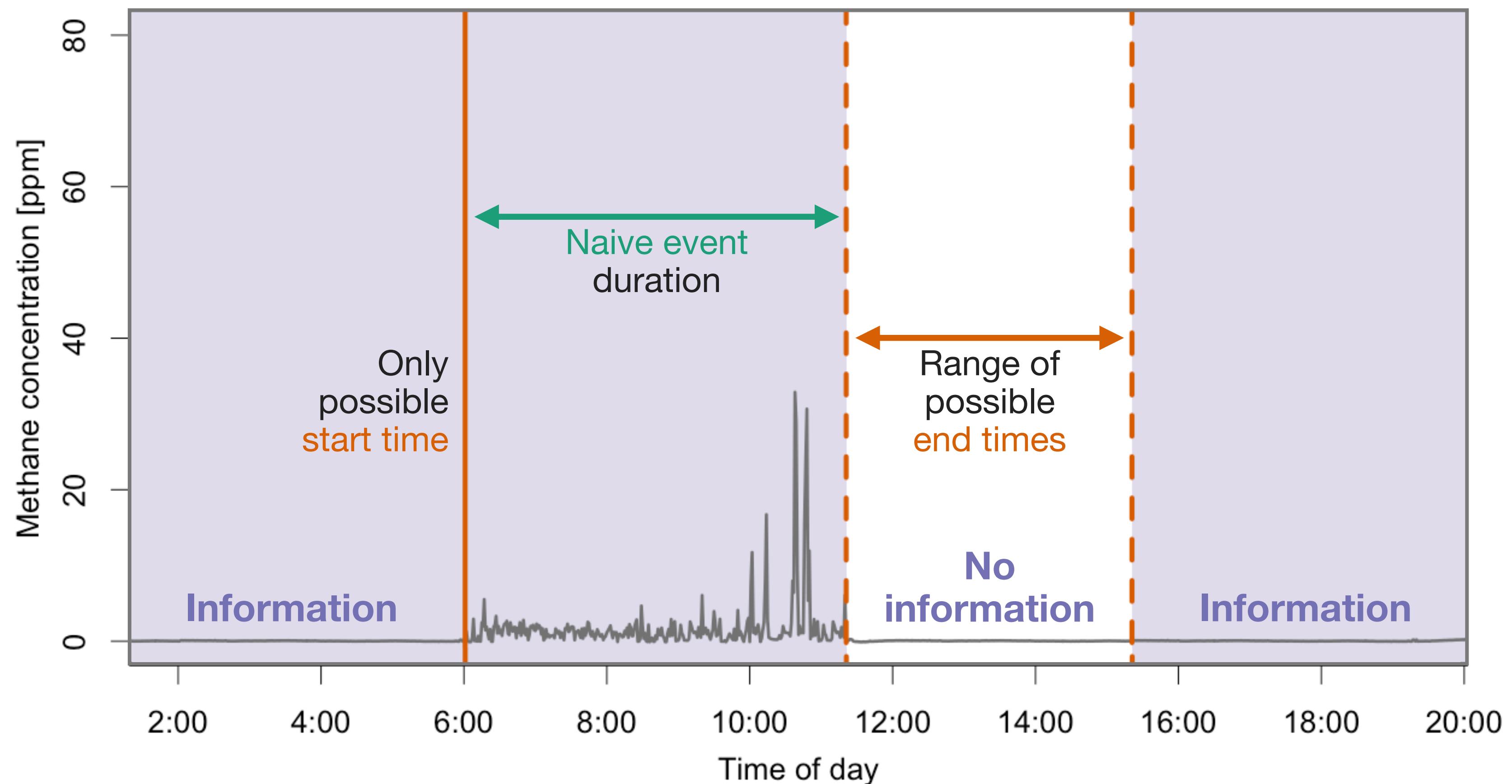
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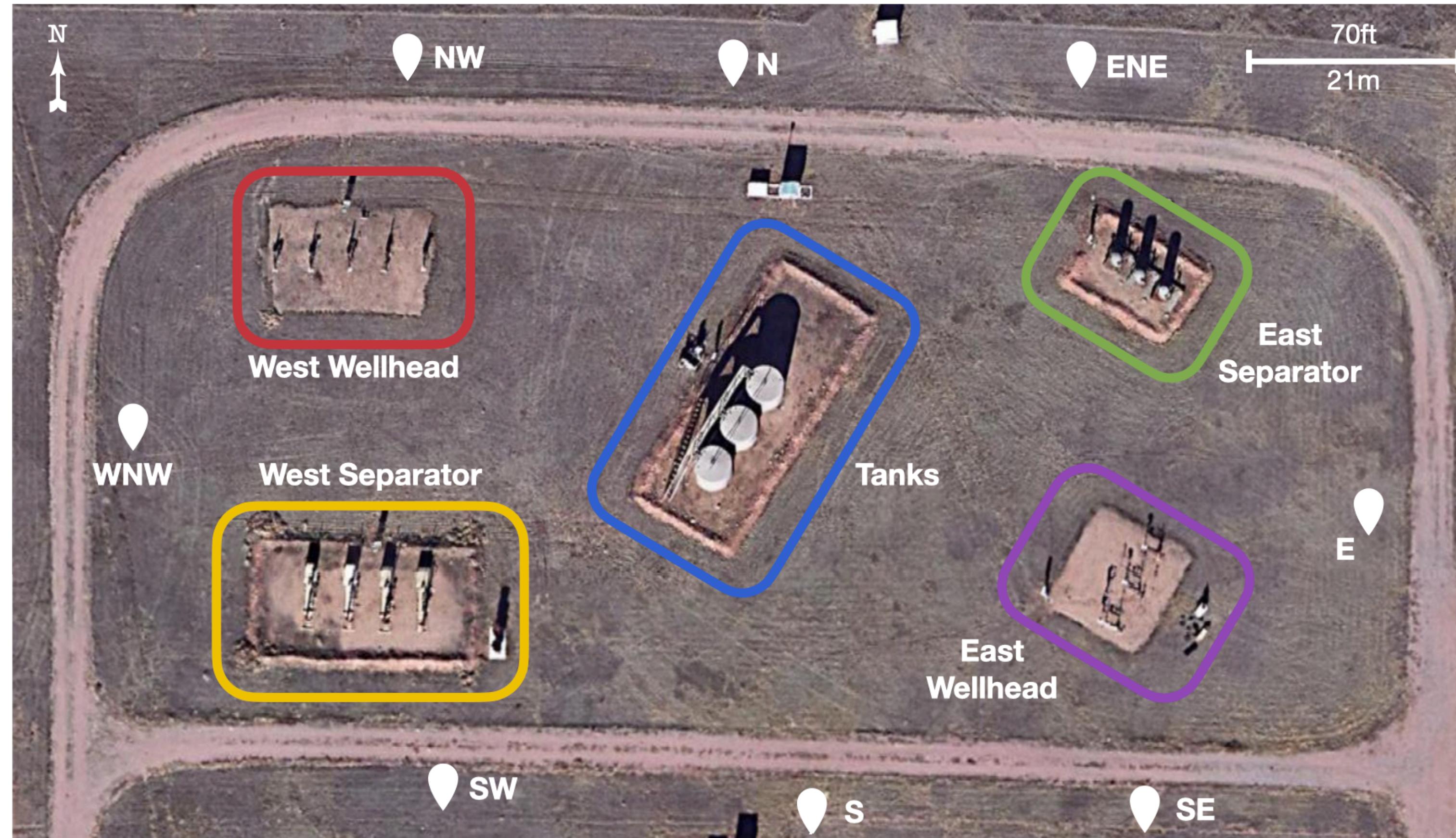
How does incomplete coverage present itself in the data?



How does incomplete coverage present itself in the data?



Evaluate proposed method on single-source controlled releases

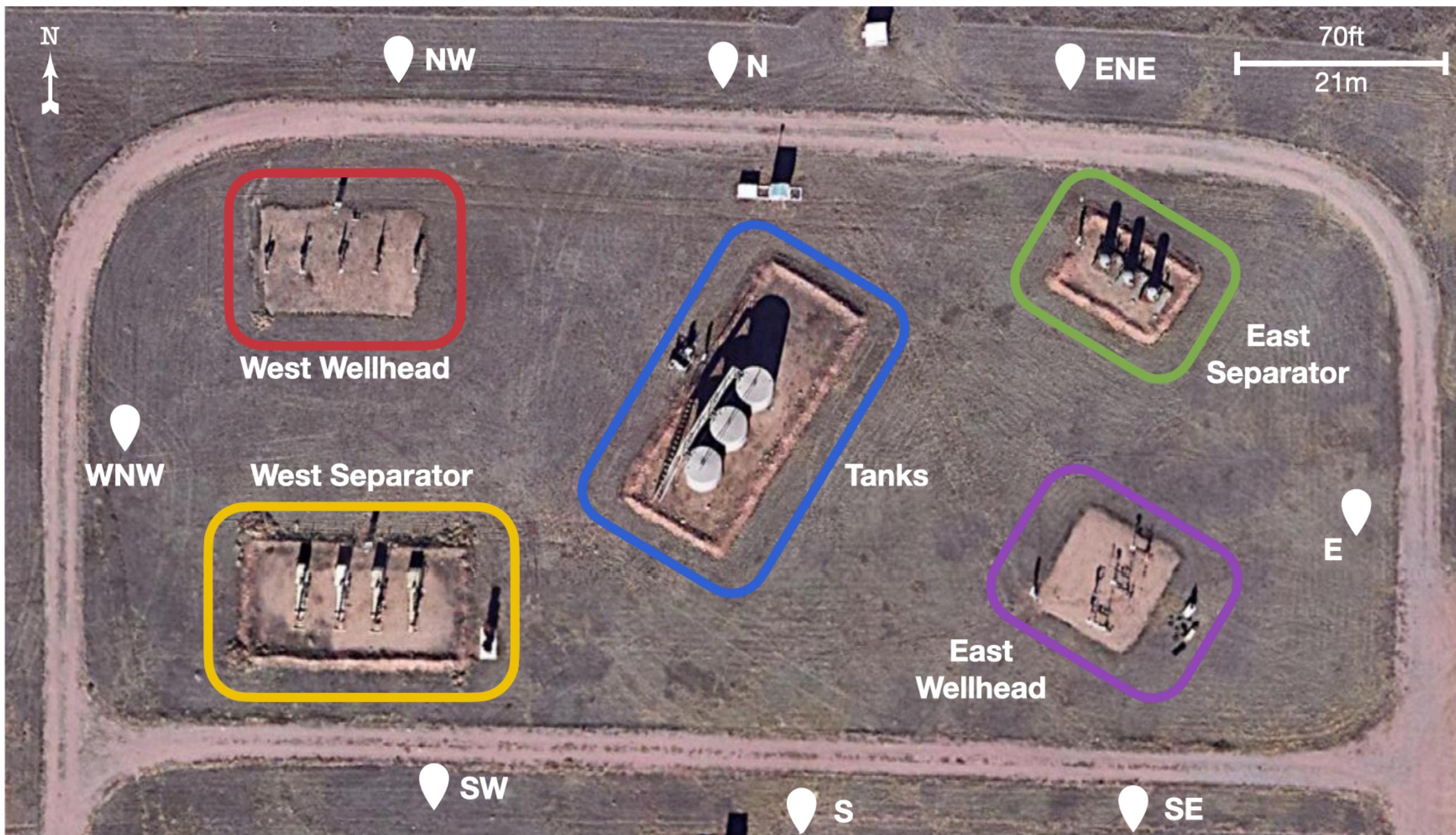


46 single-source controlled releases

Emission rates range from
1.0 to 6.4 kg/hr

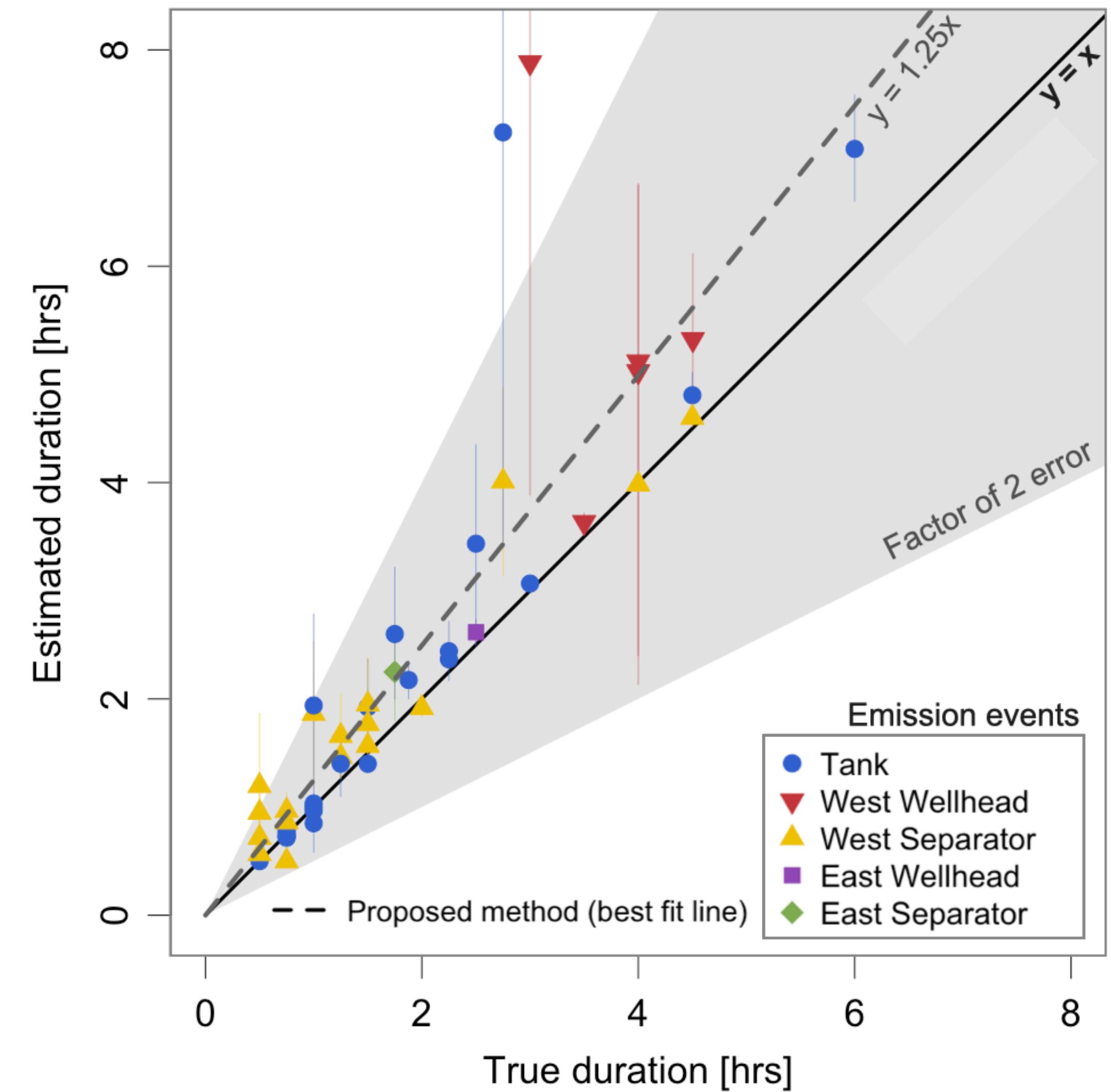
Emission durations range from
0.5 to 6.0 hours

Evaluate proposed method on single-source controlled releases



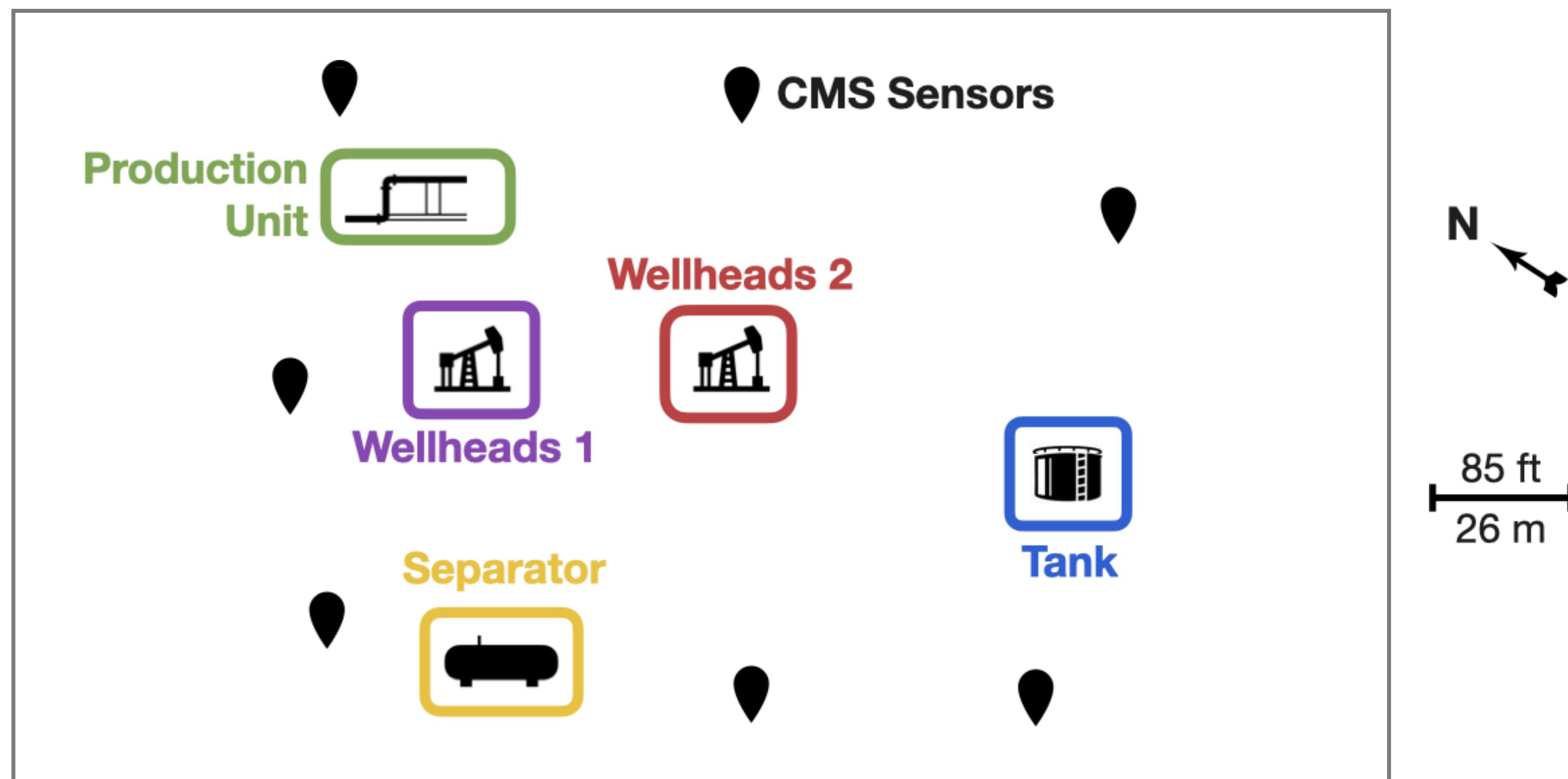
93.6% of estimates within a factor of 2 error

100% of estimates within a factor of 3 error



Case study:

Bounding the duration of a methane emission
detected by an aerial measurement

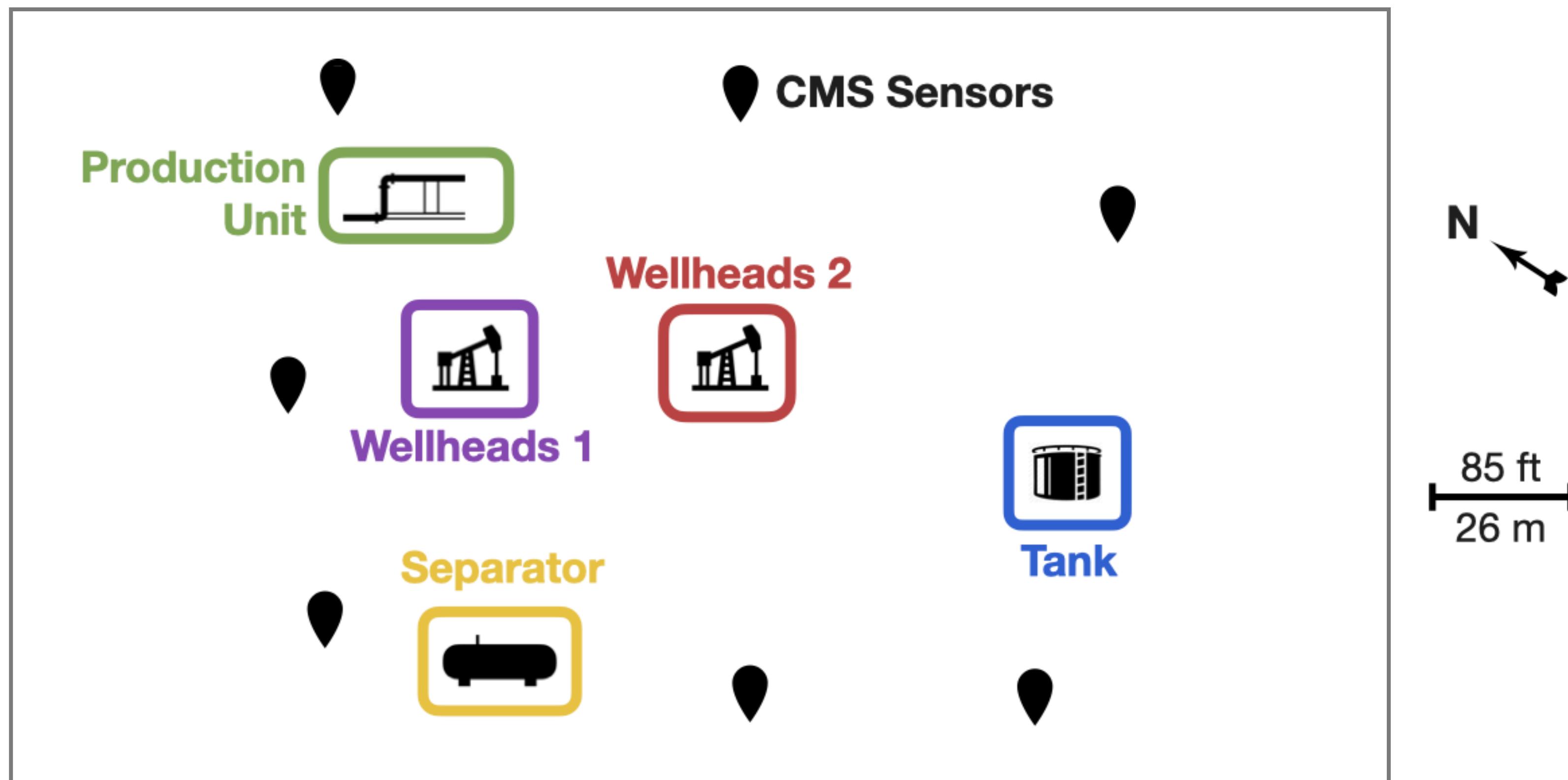


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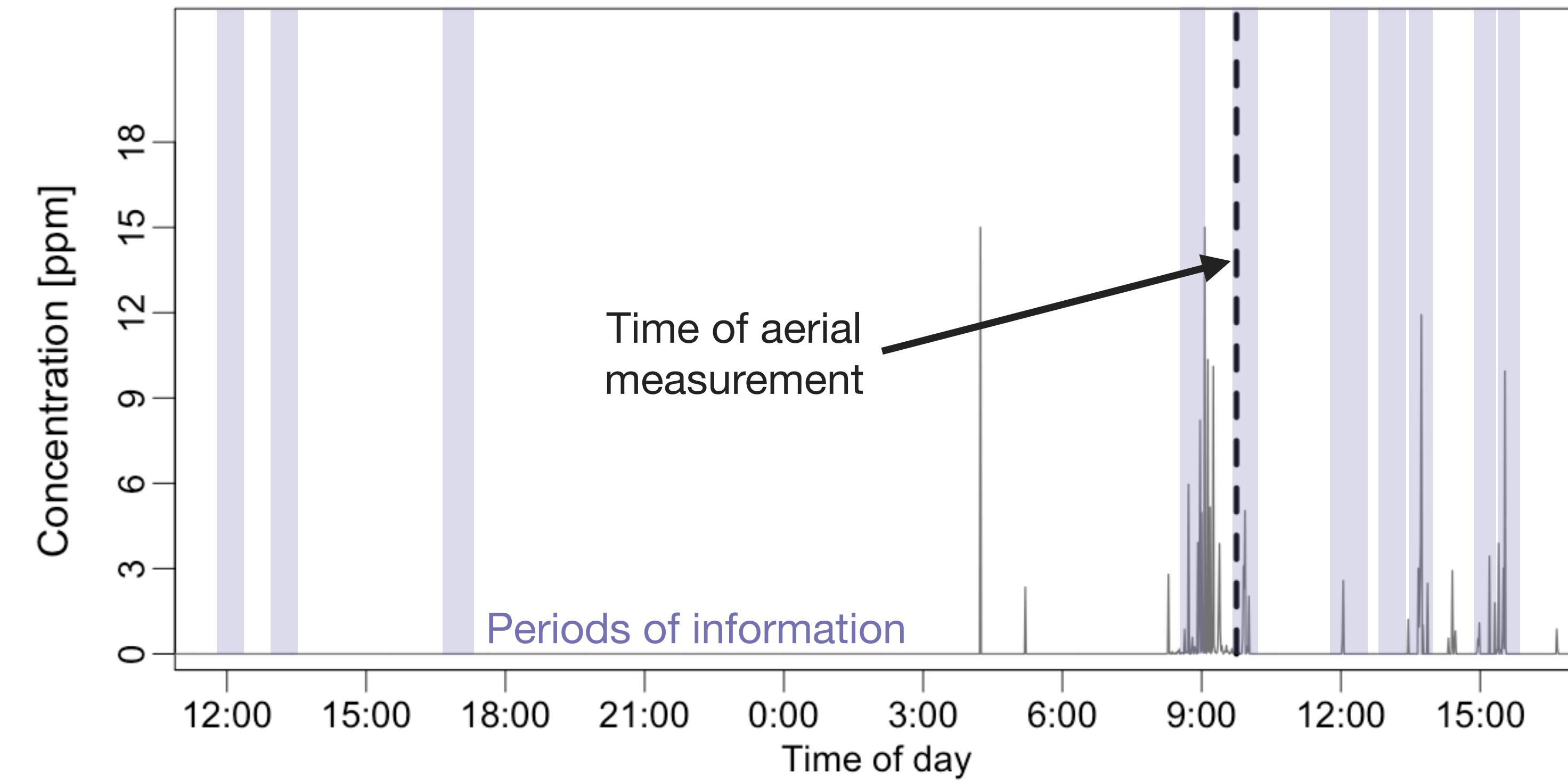
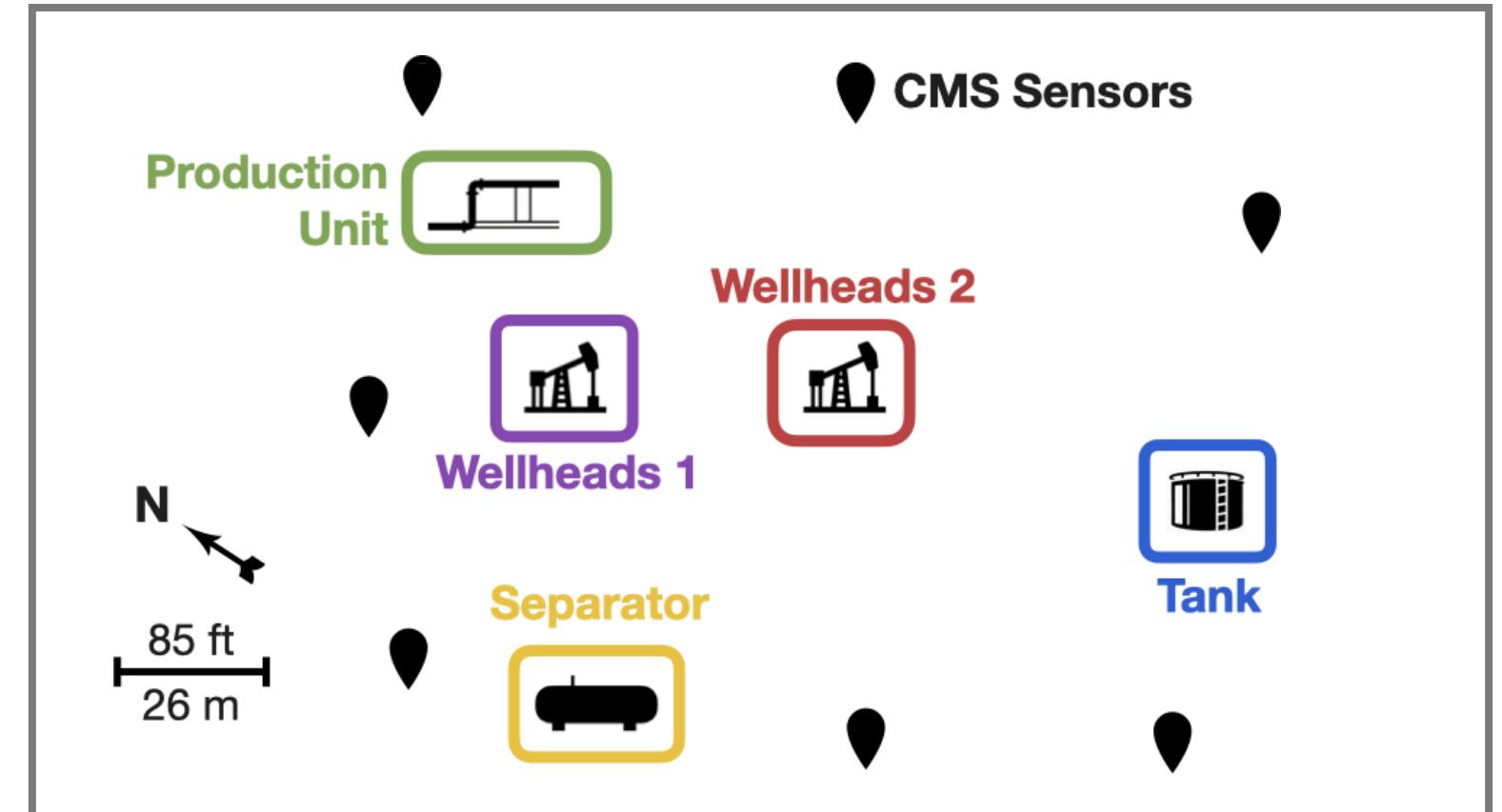


Tank emission:
9.6 kg/hr



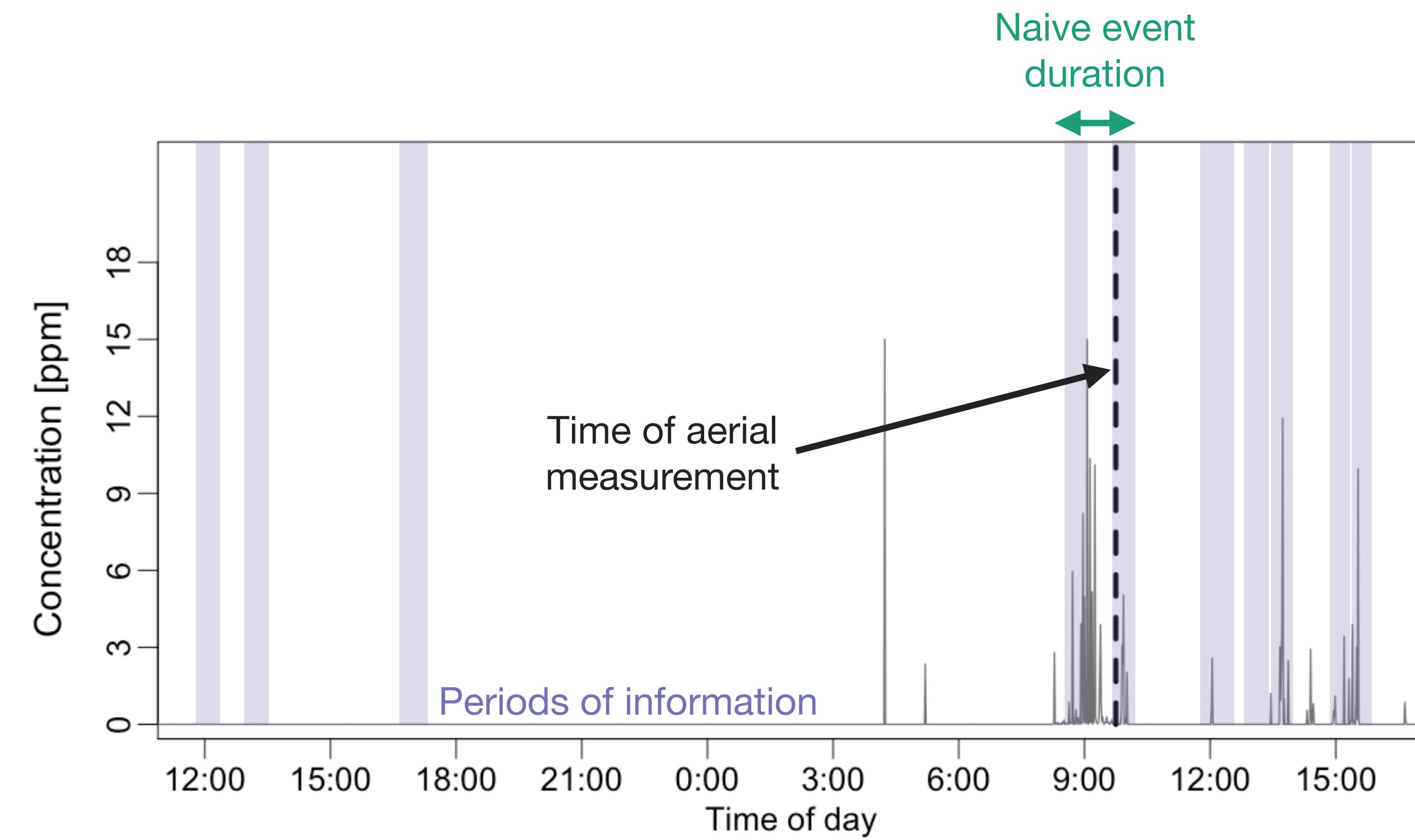
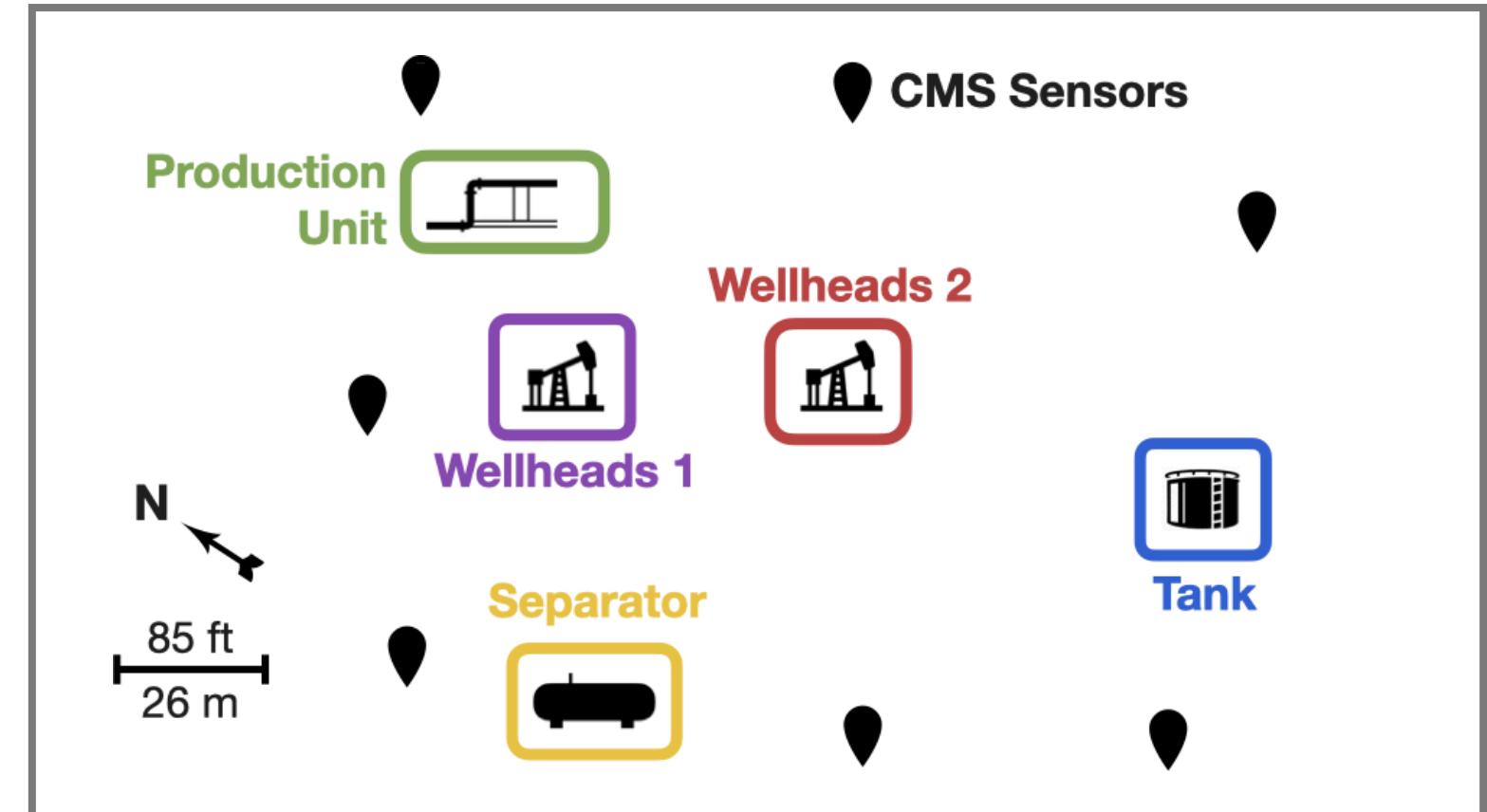
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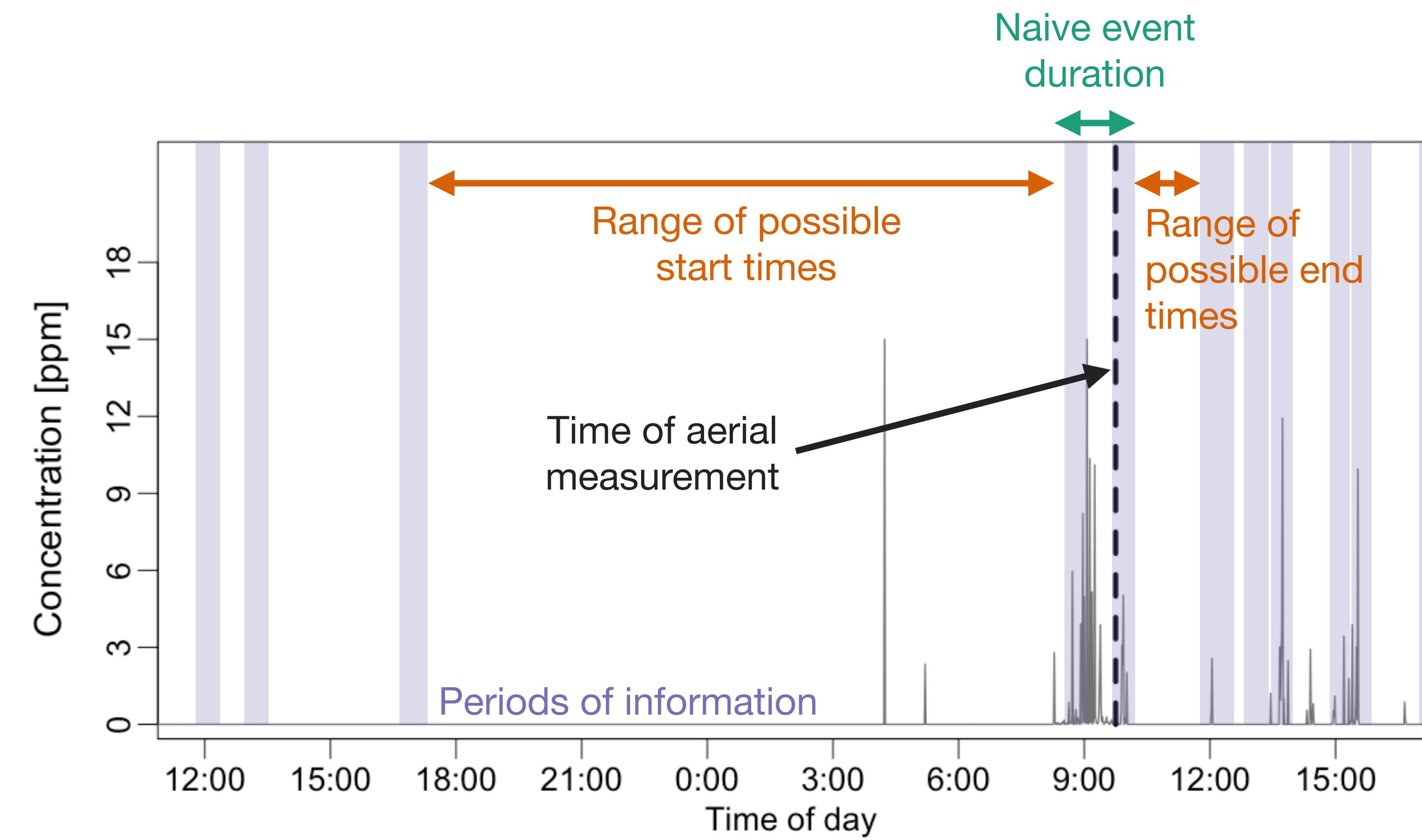
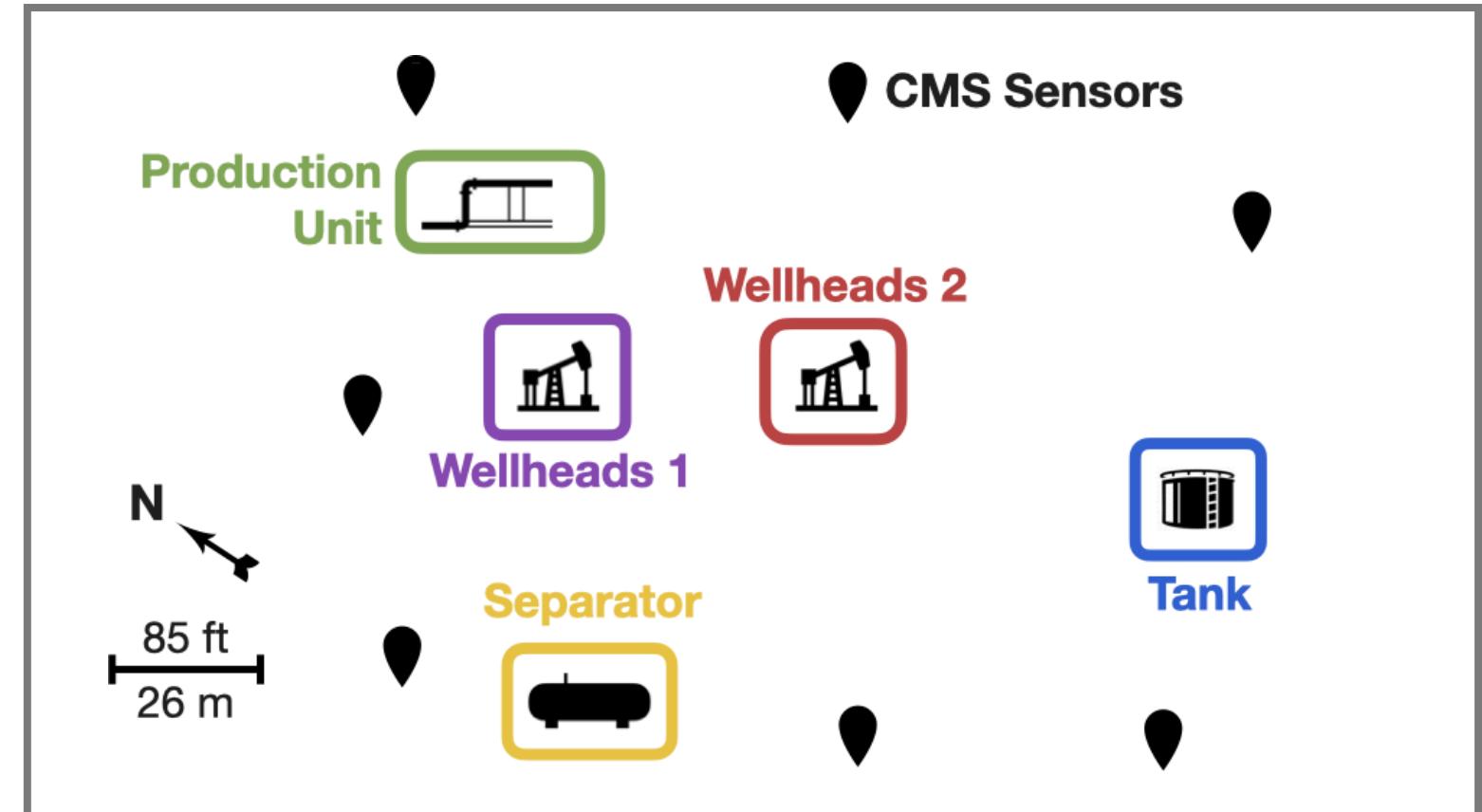
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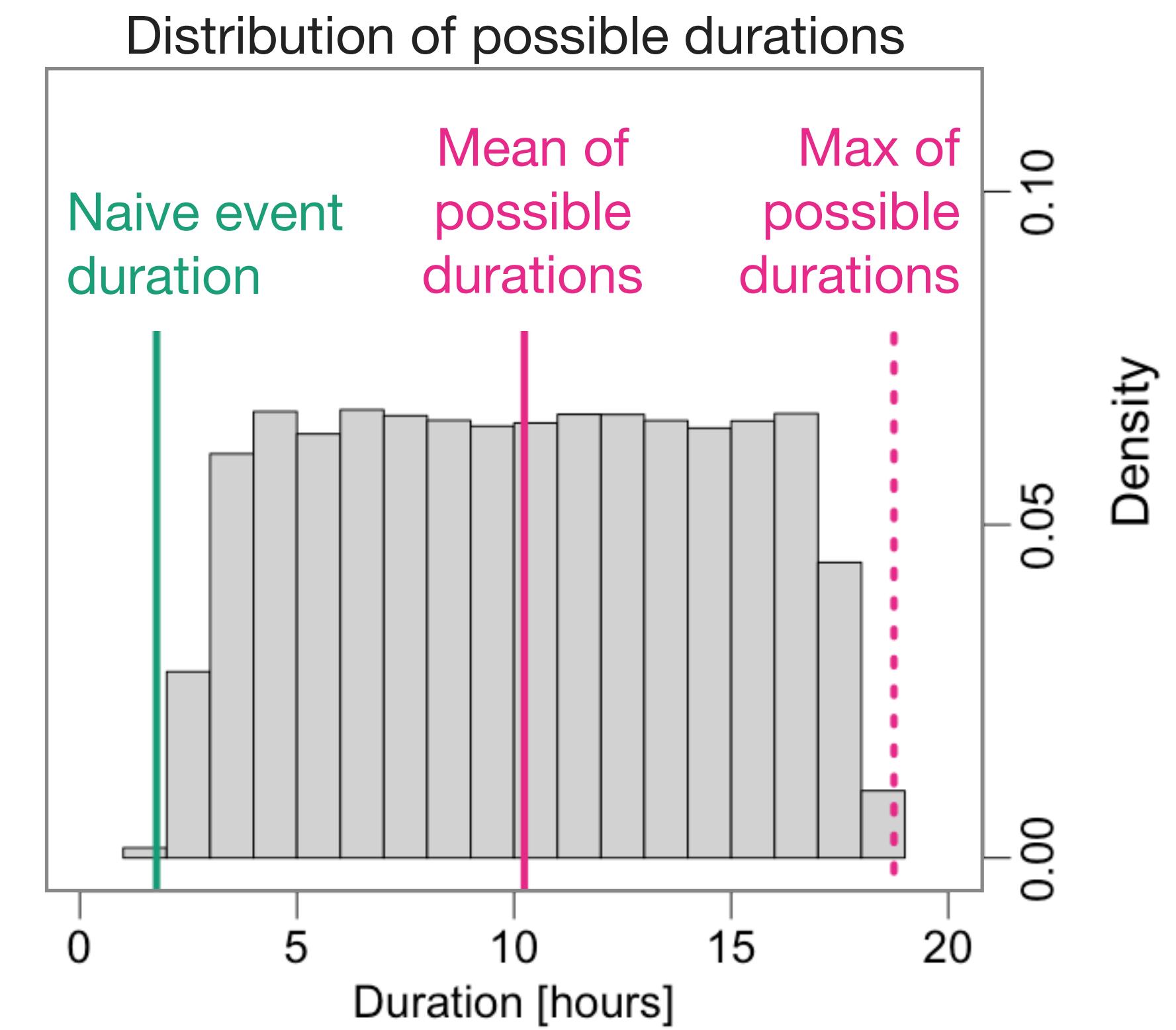
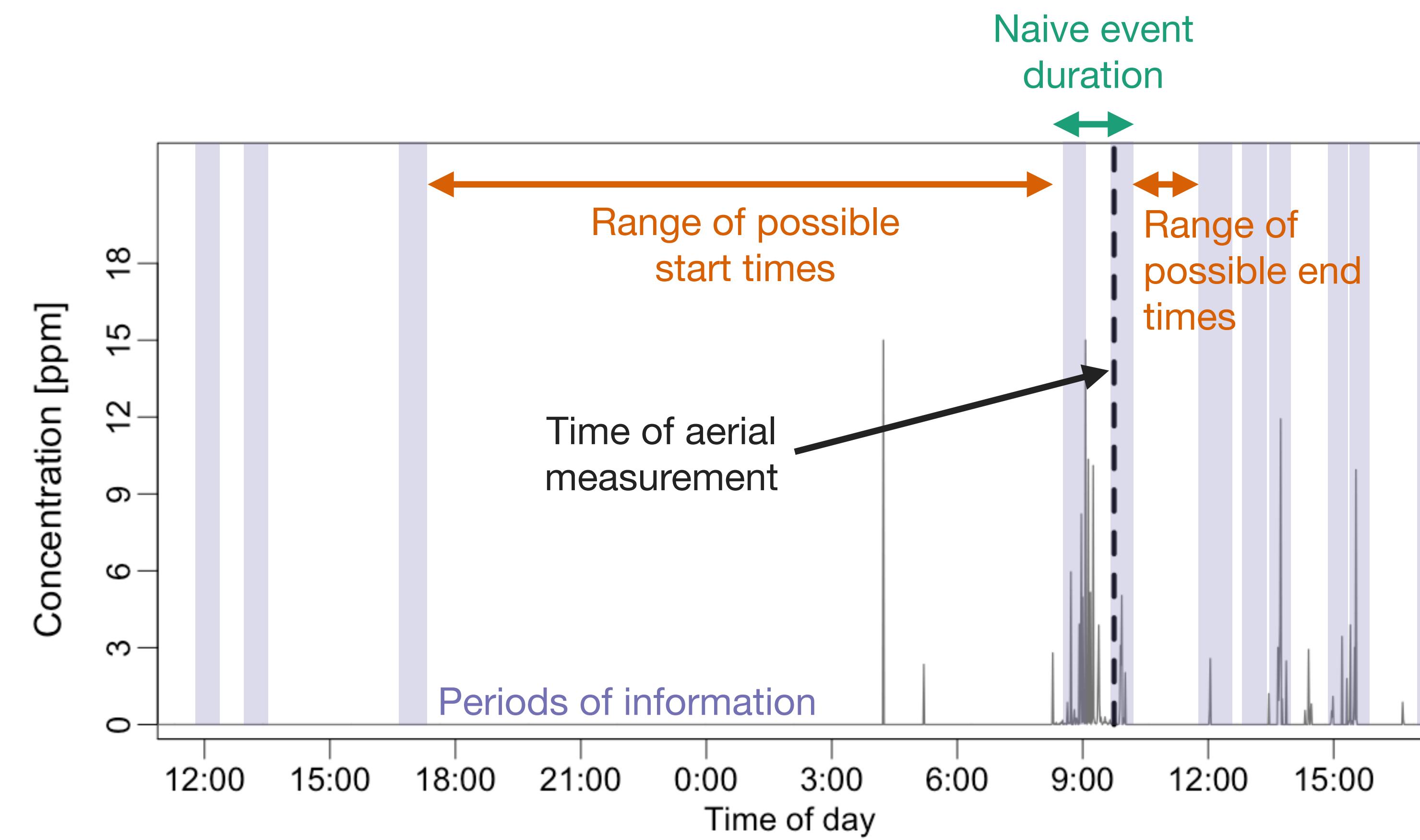
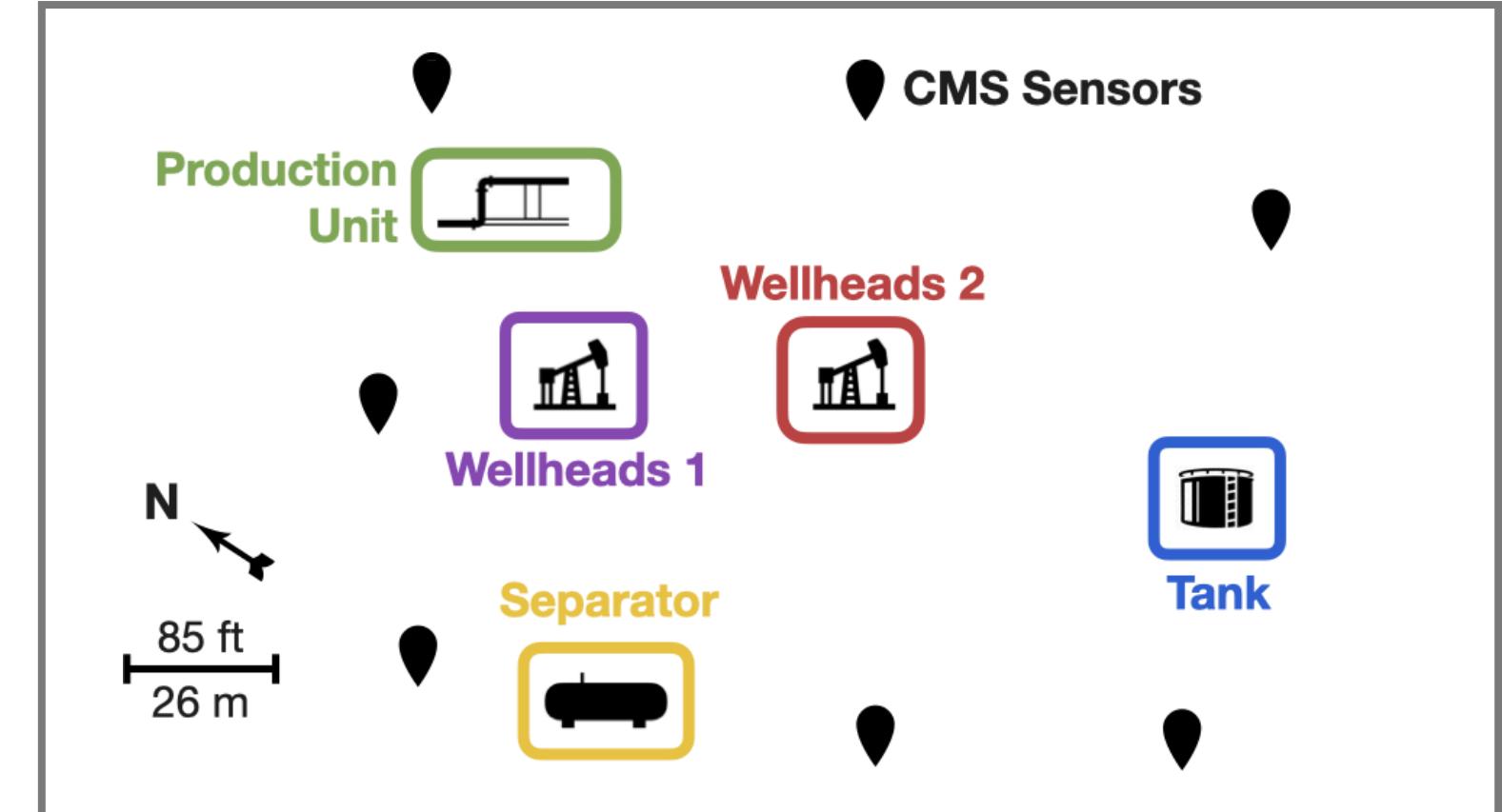
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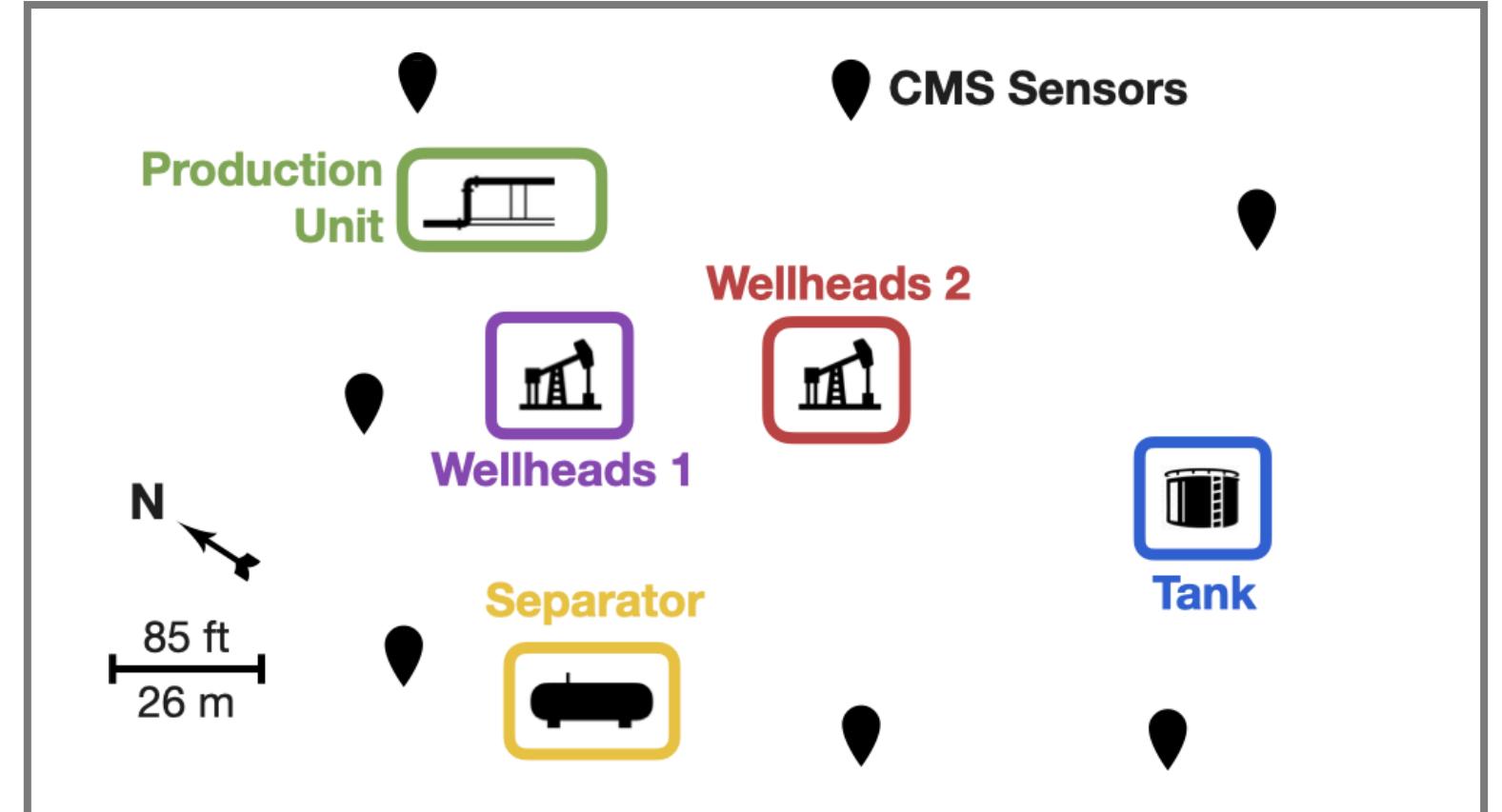
Case study:

Bounding the duration of a methane emission detected by an aerial measurement



Case study:

Bounding the duration of a methane emission detected by an aerial measurement



9.6 kg/hr

X

naive duration: 1.78 hours

mean of possible durations: 10.2 hours

max of possible durations: 18.8 hours

Detected
emission rate

Potential duration estimates

17.1 kg

=

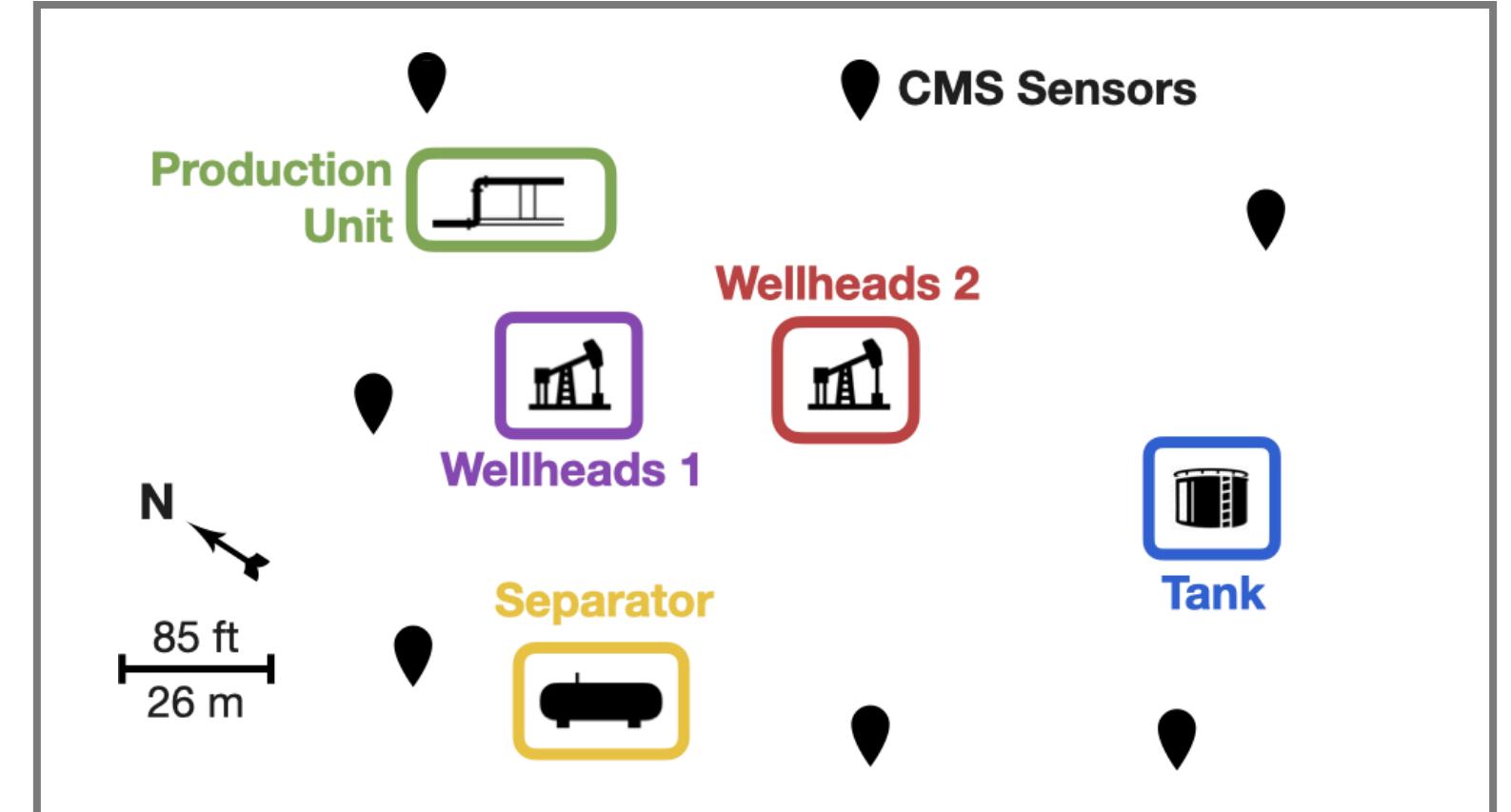
97.9 kg

180.5 kg

Total emitted
methane

Case study:

Bounding the duration of a methane emission detected by an aerial measurement



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mean of possible durations: 10.2 hours

max of possible durations: 18.8 hours

17.1 kg

=

97.9 kg

180.5 kg

9.6 kg/hr

X

time since previous aerial survey: 3 months

=

21,024 kg

Detected
emission rate

Potential duration estimates

Total emitted
methane

Dorit Hammerling



Spencer Kidd



Olga Khaliukova



Meng Jia



Ryker Fish



Cal Richards-Dinger

Troy Sorensen

Kellis Ward

Michael Basanese

Dishita Sharma

Check out the rest of the presentations from our group!



Spencer Kidd



Olga Khaliukova



Meng Jia



Ryker Fish



Cal Richards-Dinger

Troy Sorensen

Kellis Ward

Michael Basanese

Dishita Sharma

Thank you!

Questions?

wdaniels@mines.edu



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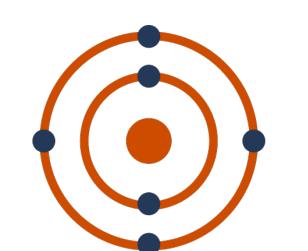


TEXAS

The University of Texas at Austin



**COLORADO STATE
UNIVERSITY**



EEMDL

Energy Emissions Modeling and Data Lab

*The
Payne Institute
for Public Policy*

Case study:

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