

Resonant bodies of evidence: DEQ's Pre-Enforcement Notice, Maul Foster Alongi's letter questioning the accuracy and intent of Applicant's odor model input, and Carbon Mapper's observation-based landfill gas emissions data

Ken Eklund
February 3, 2026

Chair Malone, Commissioners Wyse and Shepherd:

I am submitting this testimony in response to the letter submitted by Maul Foster Alongi (MFA) in response to DEQ's Pre-Enforcement Notice, both having been admitted into evidence in the matter of LU-24-027, the application to expand Coffin Butte Landfill. The MFA letter is [BOC4 BC0025](#), and the DEQ Notice is [BOC4 BC0022](#).

As you know, DEQ's Pre-Enforcement Notice announces that a multi-year investigation of the landfill has now resulted in an initial substantial enforcement action, with citations for seven Class 1 categories of violations occurring over multiple years. In addition, DEQ has laid out requirements that may lead to further enforcement actions. The current slate

of violations focus on excessive releases of landfill gas. Per DEQ's Notice, Republic Services has: failed to create an effective landfill gas collection system, leading to excessive leakage; failed to operate their existing system properly, leading to more leakage; failed to maintain the landfill cover, leading to even more leakage; failed to monitor the entire landfill area for leaks, allowing leaks to continue undetected and uncorrected; failed to implement corrective action to eliminate discovered leaks; purposely avoided methane monitoring for much of the landfill surface. As MFA notes, these determinations of violations by EPA and DEQ invalidate Applicant's modeling of the interference effects of landfill gas, because the model *assumes* compliant operations. MFA also calls into question Applicant's input parameters, which Applicant did not justify.

As stated in the final third-party review letter, “MFA agrees that improving the landfill gas (LFG) collection efficiency will help control LFG emissions and reduce the potential for offsite odors, while implementing enforceable mitigation measures via monitoring will help reduce and/or remedy nuisance conditions offsite...” MFA believes this is still true. However, issuance of the PEN letter and the violations noted therein provide support for the opposite statement. Specifically, that an undersized gas collection and control system, failure to operate the control system at all times when the gas is collected and routed to the system, degradation of the landfill cover, and failure to conduct monitoring as required can and would likely result in the increased potential for offsite odors that are both more frequent and greater in intensity. – Maul Foster Alongi letter, p. 2. Underline mine.

NOTE: The opposite statement, that the DEQ Notice supports, is this:
“MFA agrees that improving the landfill gas (LFG) collection efficiency will not help control LFG emissions and will not reduce the potential for offsite odors, while implementing enforceable mitigation measures via monitoring will not help reduce and/or remedy nuisance conditions offsite”

“The inputs to the dispersion model (particularly emission rates) assumed the existing and future landfill operations are currently and would, in the future, be in full compliance” – MFA Letter, p. 2. So the Applicant’s odor study fails to meet the Burden of Proof regarding the health and interference effects of landfill gas.

Besides the assumption of compliance, MFA identifies four other issues raised by the DEQ Notice

that impact the validity of Applicant’s odor model:

- (1) actual fugitive gas rates higher than modeled;
- (2) captured gas actually not controlled as modeled;
- (3) fugitive gas leaks not evenly distributed over the dump surface as modeled (i.e., no high-volume leaks);
- (4) actual leakage, especially at volume, occurring in ways other than modeled and/or in areas other than the one assumed by the model; i.e., “incomplete understanding” of the dump’s emissions.

The PEN letter raises the question of whether the Odor Study provided accurate data based on reasonable assumptions given the documented violations. The PEN letter calls into question whether the inputs to the dispersion model used as the basis of the Odor Study were correct. The Applicant did not acknowledge the known issues that would later be identified in the PEN letter, or make an effort to justify the selected inputs (e.g., 75% collection efficiency, well maintained landfill cover with evenly distributed emissions, control devices working 100% of the time that landfill gas is collected, etc.) in light of the cited issues.

– MFA Letter

As you Commissioners are undoubtedly aware, and as the MFA letter spells out, because “the Applicant did not acknowledge the known issues that would later be identified in the PEN letter, or make an effort to justify the selected inputs (e.g., 75% collection efficiency, well-maintained landfill cover with evenly distributed emissions, control devices working 100% of the time that landfill gas is collected, etc.),” the results presented in its June 2025 Odor Study cannot be considered accurate and reliable. Applicant has therefore not met its Burden of Proof regarding the serious interferences from landfill gas on its neighbors and the surrounding area, and its Application must be denied for cause.

But that’s not what this testimony is about; this testimony is to establish there is separate, objective and strong evidence pertaining to the five

issues that MFA has identified as crucial to the Applicant’s 2025 Odor Study: the independent aerial surveys of Coffin Butte Landfill being conducted by Carbon Mapper.

As you may remember, Carbon Mapper (CM) is a climate science non-profit that surveys the globe for large-scale releases of greenhouse gases (methane, carbon dioxide). Its technology can pinpoint the source of leaks, so that the leak can be fixed. Carbon Mapper first surveyed Coffin Butte Landfill in July 2022; since it found many large-volume leaks, it placed the dump on its list of polluters to be monitored and now regularly surveys the dump from space. At this point CM is monitoring the dump much more frequently than the dump monitors itself, and of course it looks objectively at the whole picture – there are no areas “exempt” from

Carbon Mapper is a nonprofit organization with a mission to deliver actionable and transparent methane and CO₂ emissions data that can be used to inform and accelerate emissions mitigation. Our work to use remote sensing to detect and quantify localized methane emission sources is grounded in over a decade of methane research conducted through NASA's Jet Propulsion Laboratory as well as published in the science-based literature.

– Carbon Mapper testimony on SB 726

satellite observation.

Carbon Mapper is deemed a reliable partner by the State of California (working with California DEQ, CM created a greenhouse gas map for the entire state) and by the EPA (it was while doing a national survey of landfills for the EPA that Carbon Mapper first surveyed Coffin Butte Landfill). Carbon Mapper is qualified in Oregon, especially regarding Coffin Butte Landfill, because Carbon Mapper is one of the “advanced technology” candidates that SB 726 is requiring Republic to use to monitor the dump. I'll attach the neutral, informative testimony about Carbon Mapper and its capabilities that Dr. Tia Scarpelli, Waste Sector Lead, delivered during the SB726 Hearings, to the end of this PDF.

It's worth noting that Carbon Mapper does its surveying and releases its data publicly, for free – precisely so that decisionmakers such as yourselves can benefit from that data. I know County Sustainability Coordinator Sean McGuire has corresponded with Dr. Scarpelli (as have I) and Sean has spoken highly of Carbon Mapper's ability to deliver reliable, actionable data.

Let's revisit the five issues that MFA identified as crucial Odor Study parameters that Applicant asserted but did not justify, and the DEQ Notice has highlighted as questionable:

30

Number of Plumes

- (1) **actual fugitive gas rates higher than modeled;**
- (2) **captured gas actually not controlled as modeled;**
- (3) **fugitive gas leaks not evenly distributed over the dump surface as modeled** (i.e., the model assumes no high-volume leaks);
- (4) **actual leakage, especially at volume, occurring in ways other than modeled and/or in areas other than the one assumed by the model** (a catchall for evidence of “incomplete understanding” of the dump’s emission profile);
- (5) **landfill operations actually non-compliant, not compliant as assumed by the model.** The model’s core rules can only simulate a compliant landfill. Both the Study and the proposed Conditions of Approval as a means of mitigation rely on this.

The evidence in Carbon Mapper’s surveys of the landfill independently verify that the non-compliant conditions listed in DEQ’s Pre-Enforcement Notice do indeed exist in reality. The evidence in Carbon Mapper’s surveys of the landfill establish that MFA’s criteria for confidence in the Odor Study have not been met, independent of the DEQ Notice. Any one of the three documents – the DEQ Notice, MFA’s letter about issues with the Applicant’s Odor Modeling, and the Carbon Mapper data – is sufficient to refute the Applicant’s Burden of Proof; together, reinforcing each other, they constitute more than a preponderance of evidence and of persuasion.

A breakdown of Carbon Mapper’s evidence applied to MFA’s criteria follows, including 30 plume surveys from Carbon Mapper’s data portal.

1.8K +/- 0.6K

Source Emission Rate
(kg CH₄/hr)

MFA Criteria 1: if actual fugitive gas rates are higher than modeled (25%), then the Applicant’s Odor Study should not be considered reliable and accurate.

If Carbon Mapper collects enough data on a source to clear its confidence threshold, then it calculates and publishes a Source Emission Rate for that facility. It adjusts that rate as new data comes in. For Coffin Butte Landfill, that rate is currently 1.8 metric tons of methane per hour.

We can compare that to the most recent data that Applicant submitted to the EPA, which is from 2023. Applicant reported that it recovered and destroyed 15,158.11 metric tons of methane in 2023. By doing the appropriate conversions, we can convert this “metric tons per year” number to a “metric tons

per hour” number, which is 1.78. If Coffin Butte Landfill is leaking about 1.8 metric tons of methane per hour, and collecting 1.78 metric tons of methane per hour, then its gas collection efficiency isn’t 75%, as Applicant asserted. It’s around 49%. The corresponding fugitive gas rate is not 25%, as Applicant asserted; it’s around 51%.

Carbon Mapper calculates its Source Emission Rates based on its observations of landfill emission behavior from hundreds of landfills nationwide. Some of them, such as Republic’s Forward Landfill and Sunshine Canyon Landfill in California, have been surveyed hundreds of times over seven years or more. CM therefore has independent, science- and observation-based assessments that support DEQ’s Pre-Enforcement Notice as evidence of excessive landfill gas emissions at the dump.

VLI has failed to operate components of the GCCS consistent with the Subpart AAAA and Division 239 requirements described above. Specifically, VLI has reported extensive downtime events for its flares. For example, in the first half of 2022 there were eight events where flare #1 was down for more than 100 hours during each event, with one of the events extending over 428 hours. The collection system was only down for an hour and thirty minutes during that same six-month time period in 2022. During the first six months of 2025, the new enclosed flare was offline intermittently for a total time period that adds up to over 15 calendar days. The collection system was only down for approximately 17 hours during that same six-month time period in 2025.

– DEQ Pre-Enforcement Notice

MFA Criteria 2: if captured landfill gas is actually not controlled as modeled, then the Applicant’s Odor Study should not be considered reliable and accurate.

Carbon Mapper’s focus is to identify the origin point of megaleaks, so that operators can quickly find and remediate them (or so enforcement agencies can quickly act as necessary to compel mitigation). CM’s surveys publish their data as imaging of methane plumes, each with a distinct origin point.

It’s possible that Applicant may claim that their practice of venting collected landfill gas into the atmosphere on occasion is actually the *only* problem at the landfill. By this logic, promising to fix this one practice will be sufficient to resuscitate the now-discredited 2025 Odor Study.

Carbon Mapper’s data has already established a counternarrative to that argument. The CM plume maps show a continuous presence of large-scale leaks, often more than one active at a time, polluting at various levels from various spots all over the landfill surface and beyond. CM’s Source Emissions Rate is derived from these “upstream” megaleaks, not from any “downstream” venting of landfill gas.

100 % Source Persistence

MFA Criteria 3: if fugitive gas leaks are not evenly distributed over the dump surface as modeled, the reliability and accuracy of the Applicant’s Odor Study should decrease proportionately.

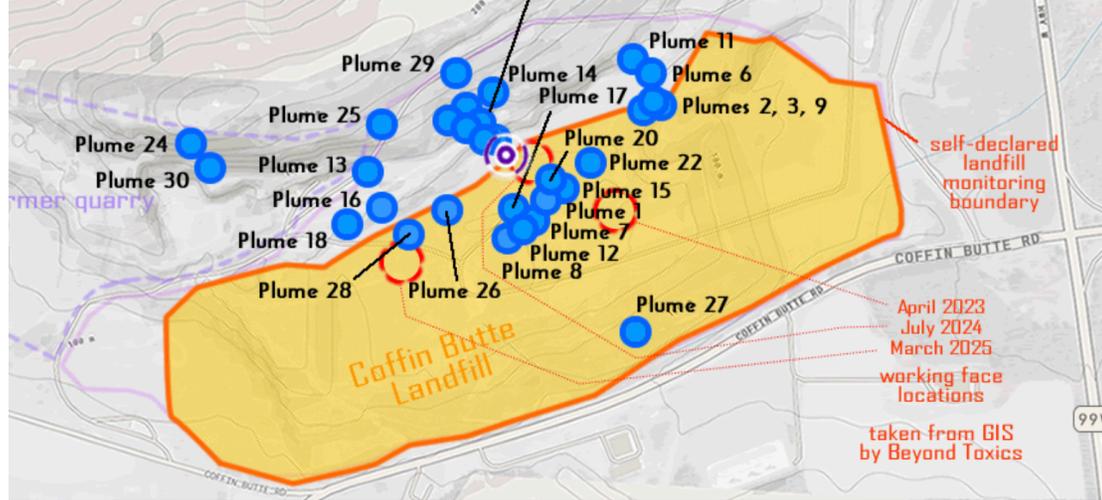
MFA is noting that the Applicant’s model depends on the assertion that the dump’s fugitive landfill gas emerges from a scattering of low-volume leaks across the landfill surface – and that evidence of high-volume point-source leaks would work to invalidate the model’s conclusions.

While large numbers of low-volume leaks *have* been found at the dump – over 100, during one inspection in 2022 – Carbon Mapper has established that high-volume megaleaks also prevail: every Carbon Mapper survey has revealed at least one

active megaleak, and often two or three venting gas at the same time. The surveys also show these megaleaks often persist over time, for months or years.

According to the Applicant’s input, there aren’t *any* plumes from super-emitting origin points at Coffin Butte Landfill. However, Carbon Mapper has imaged 30 such plumes, and was able to estimate super-emissions leak rates for most of them; those plume images follow in this testimony. The Applicant offers no counterevidence save various vague assurances of its compliance.

Carbon Mapper's data-driven visualizations of dump emissions support and are supported by matching findings by the EPA ground inspections that escalated into the emissions violations detailed in the DEQ Pre-Enforcement Notice.



MFA Criteria 4: if actual leakage is occurring in ways other than are modeled, or from points in places other than that specified by the model (especially if these leaks are high-volume), the reliability and accuracy of the Applicant’s Odor Study has not been sufficiently demonstrated.

In this criteria, MFA is noting that the integrity of the Applicant’s model depends on the Applicant having a suitably “complete understanding” of the dump’s emission profile, and also that Applicant used that understanding to set the parameters used in the model. In short, MFA is saying the inputs to the model must be reality-based.

Carbon Mapper supplies the real-world data that demonstrates Applicant’s assertions about the dump’s emissions profile are not reality-based.

Carbon Mapper’s surveys depict conditions where two, three and even four super-emitting leaks join to form a single large plume; conditions where landfill gas at super-emissions levels are kept at ground level for miles; super-emitting leaks that emerge not from the landfill surface, but from the fractured rock face the landfill abuts. The model accounts for none of these conditions, so its accuracy and reliability have not been established and the Applicant has failed its Burden of Proof regarding the interference effects of landfill gas.

Carbon Mapper’s data corresponds with the dump’s complaint history, especially the over 800 complaints in the Community Concerns Annual Reports compiled by the County’s Disposal Site Advisory Committee, which Applicant excluded from consideration without comment or justification.

MFA Criteria 5: if landfill operations are actually non-compliant, then both the Study and the proposed Conditions of Approval for landfill gas are not credible, because both of them were predicated upon an assumption of compliant operations in the status quo.

During one of the investigations that led to the DEQ Pre-Enforcement Notice, an EPA Air Enforcement team discovered an uncapped well; it was leaking landfill gas into the atmosphere at levels of about 11% methane (an explosive level for methane). Two significant events preceded this: (1) the EPA/DEQ team noted a strong smell of landfill gas as soon as they arrived at Coffin Butte Landfill, and (2) Applicant's operators told the EPA and DEQ officers "the gas collection system is operating normally."

(EPA Inspection Report, June 2024)

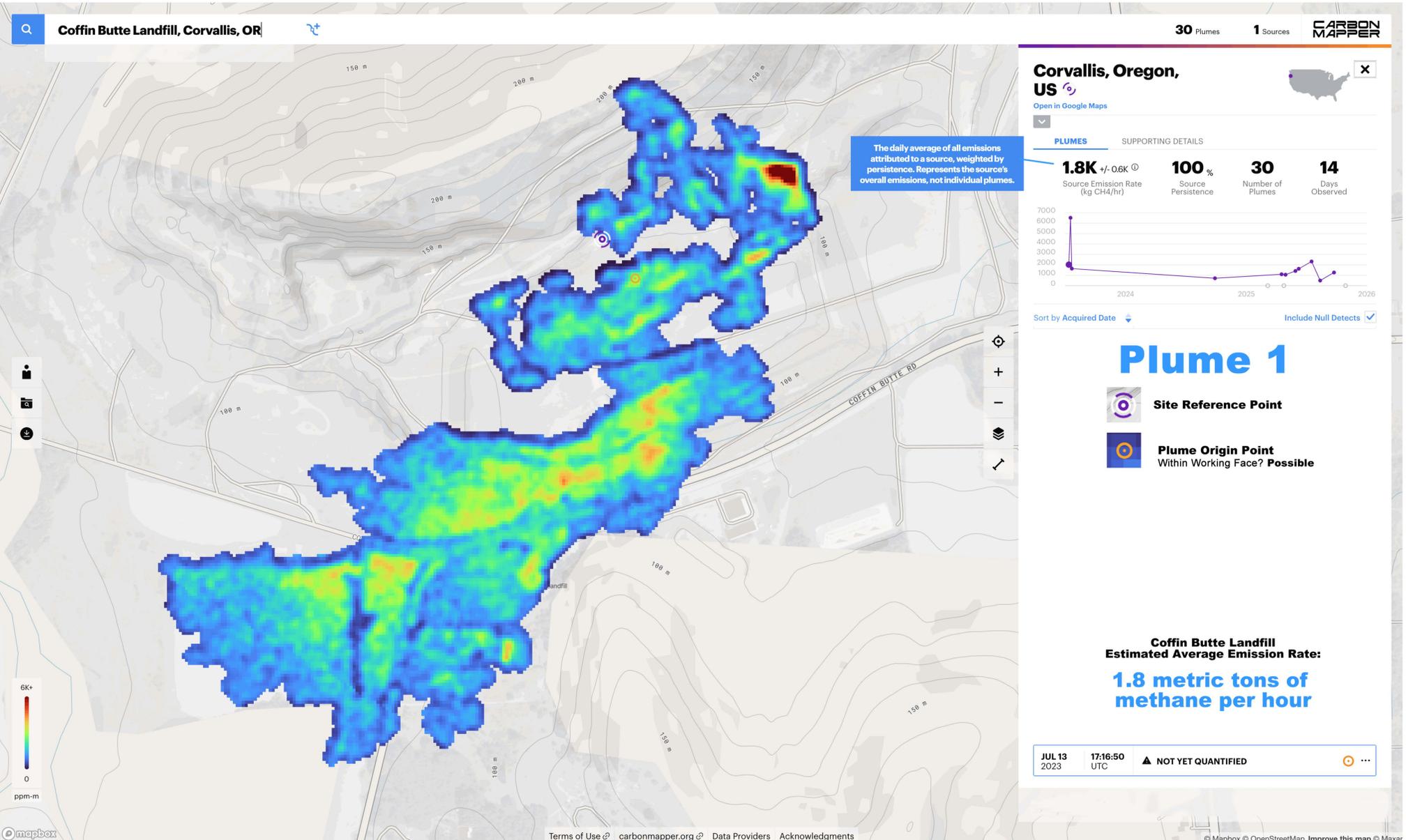
Carbon Mapper orbited its Tanager-1 satellite a few months later, and the satellite surveys established that, rather than improving, landfill emissions are worsening. The dump's Source Emissions Rate initially was 1.1 metric tons of methane per hour, then 1.2, but soon rose to 1.6, then 1.7, then 1.9 before settling back to 1.8, the current level. This is a rise of over 60% in less than two years. CM's estimates of fugitive gas emissions support and are supported by the numerous public testimonies entered into the LU-24-027 Hearing, which describe worsening impacts and concerns from increasing exposure to landfill gas, and by the rising levels of concerns about landfill gas documented in the Community Concerns Annual Reports.

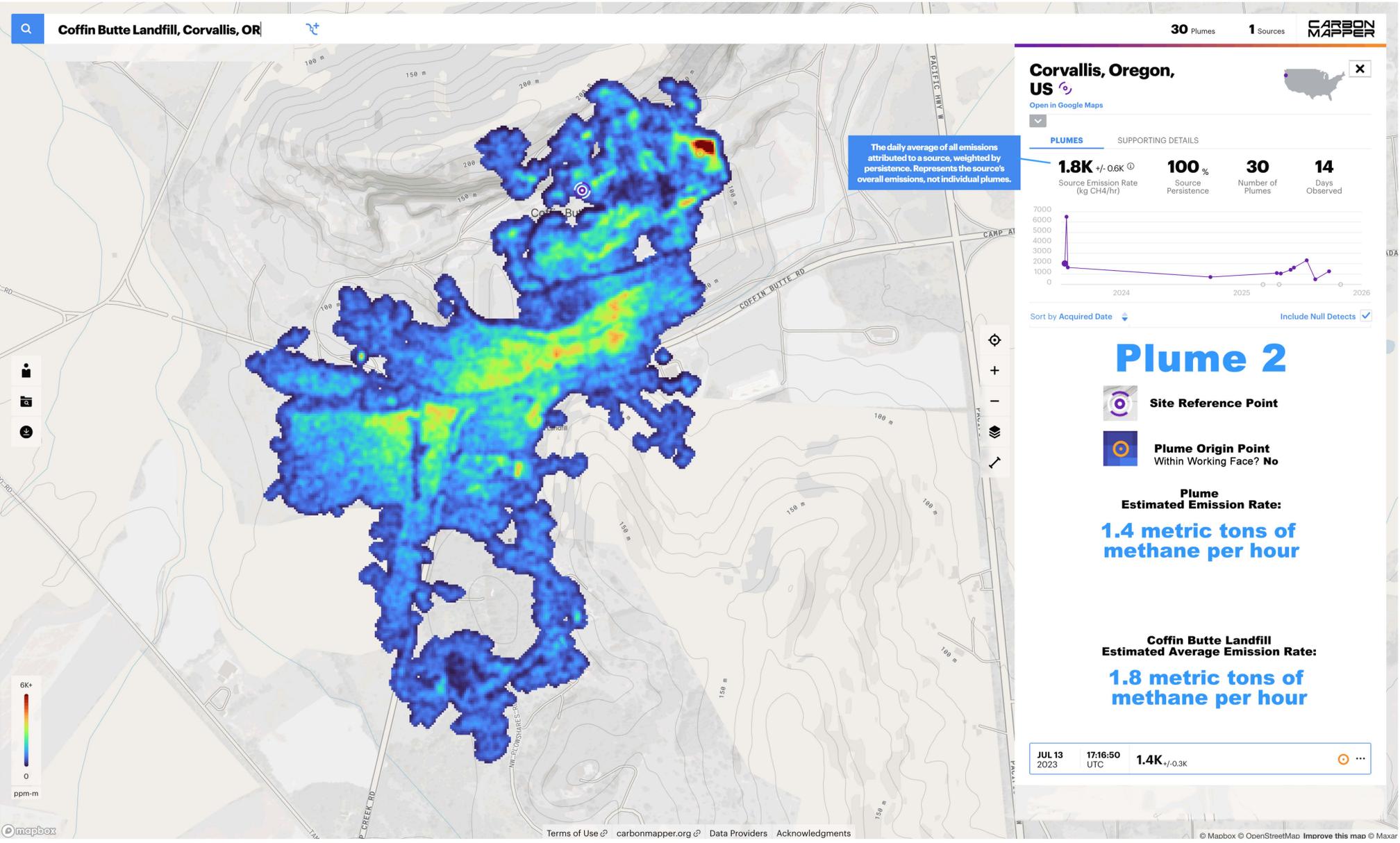
Thus, as stated before, Carbon Mapper's dump surveys are sufficient evidence that Applicant has not met MFA's criteria for confidence in the Odor Study, based both on accuracy of Applicant's input and questions about Applicant's intent. This evidence stands independent of the DEQ Notice, but both supporting and supported by the content of the DEQ Notice.

Let's look at the Carbon Mapper data. The following 30 pages are taken from Carbon Mapper's data portal (data.carbonmapper.org), and recreate in paper form the key information that's available in that portal, captured in screenshots. Please note: the portal has a depth of additional data and supporting documentation that is impossible for me to capture here.

Each page is a record of a single plume of landfill gas that Carbon Mapper's scientists obtained through remote imaging. Each plume has an identified Origin Point. On some pages, the plume may look similar to a plume on another page: this is because the plume is composed of landfill gas leaking from different sources at the same time.

It's important to relay information from Carbon Mapper about a common misperception when viewing these plumes: they do NOT correlate to landfill gas odor. Carbon Mapper is focused on finding the source of plumes, not on tracking where they go. The plume images can be understood to represent the area where the plume origin could conceivably be. In any case, methane (which is what Carbon Mapper is tracking) behaves differently from other gases when released into the atmosphere; as a light gas, it rises, whereas other gases settle.





Coffin Butte Landfill, Corvallis, OR

30 Plumes 1 Sources CARBON MAPPER

Corvallis, Oregon, US

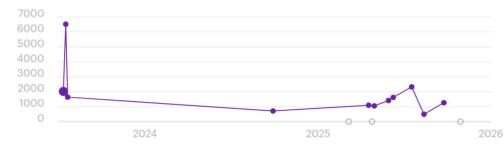
PLUMES SUPPORTING DETAILS

1.8K +/- 0.6K [Ⓢ] Source Emission Rate (kg CH4/hr)

100% Source Persistence

30 Number of Plumes

14 Days Observed



Sort by Acquired Date Include Null Detects

Plume 2

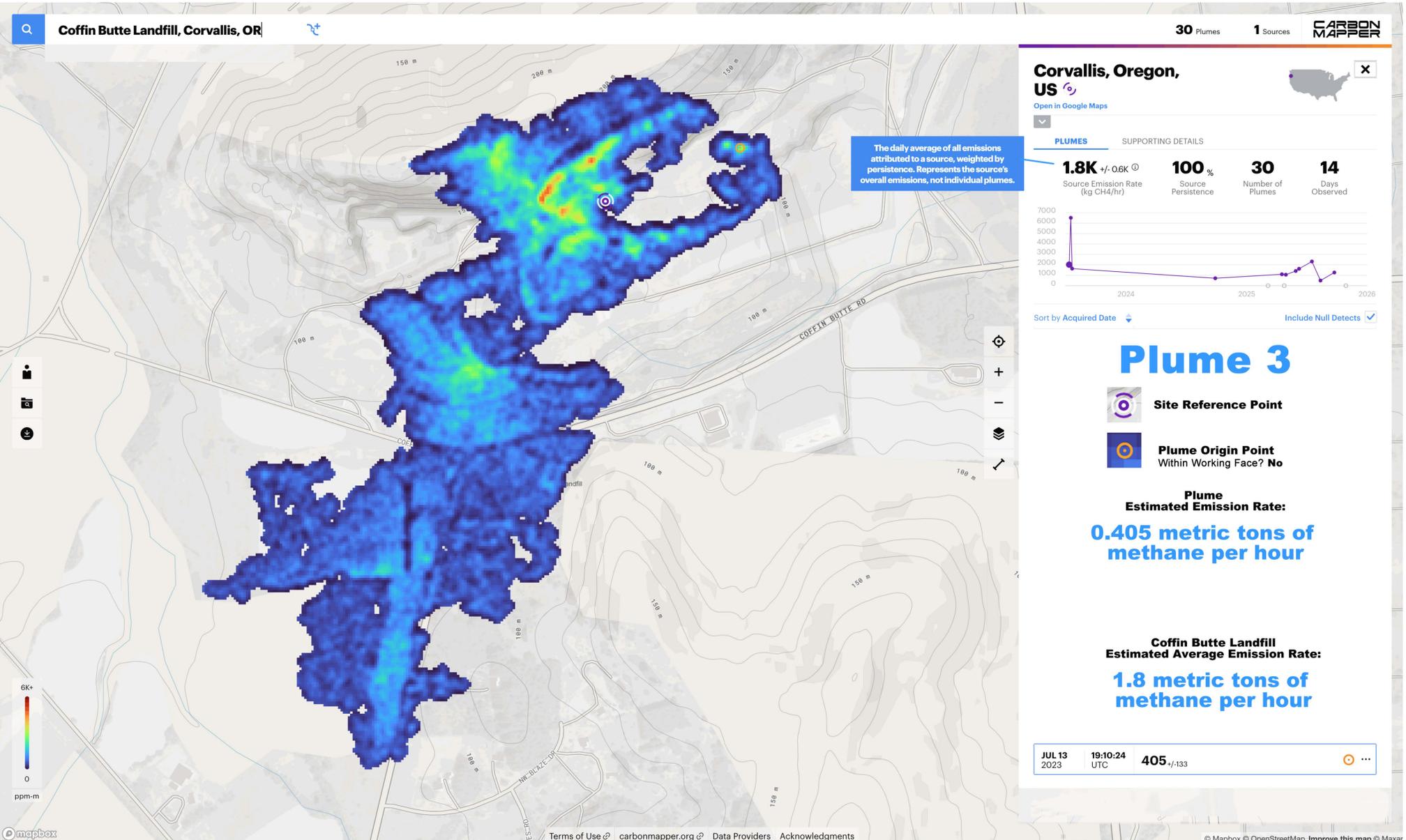
- Site Reference Point**
- Plume Origin Point**
Within Working Face? No

Plume Estimated Emission Rate:
1.4 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

JUL 13 2023	17:16:50 UTC	1.4K +/- 0.3K	📍
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The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.



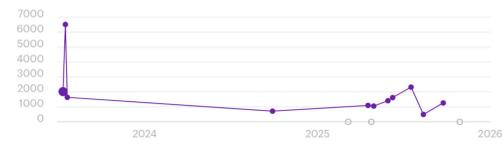
Coffin Butte Landfill, Corvallis, OR

30 Plumes 1 Sources CARBON MAPPER

Corvallis, Oregon, US

PLUMES SUPPORTING DETAILS

1.8K +/- 0.6K $\text{kg CH}_4/\text{hr}$ **100%** Source Persistence **30** Number of Plumes **14** Days Observed



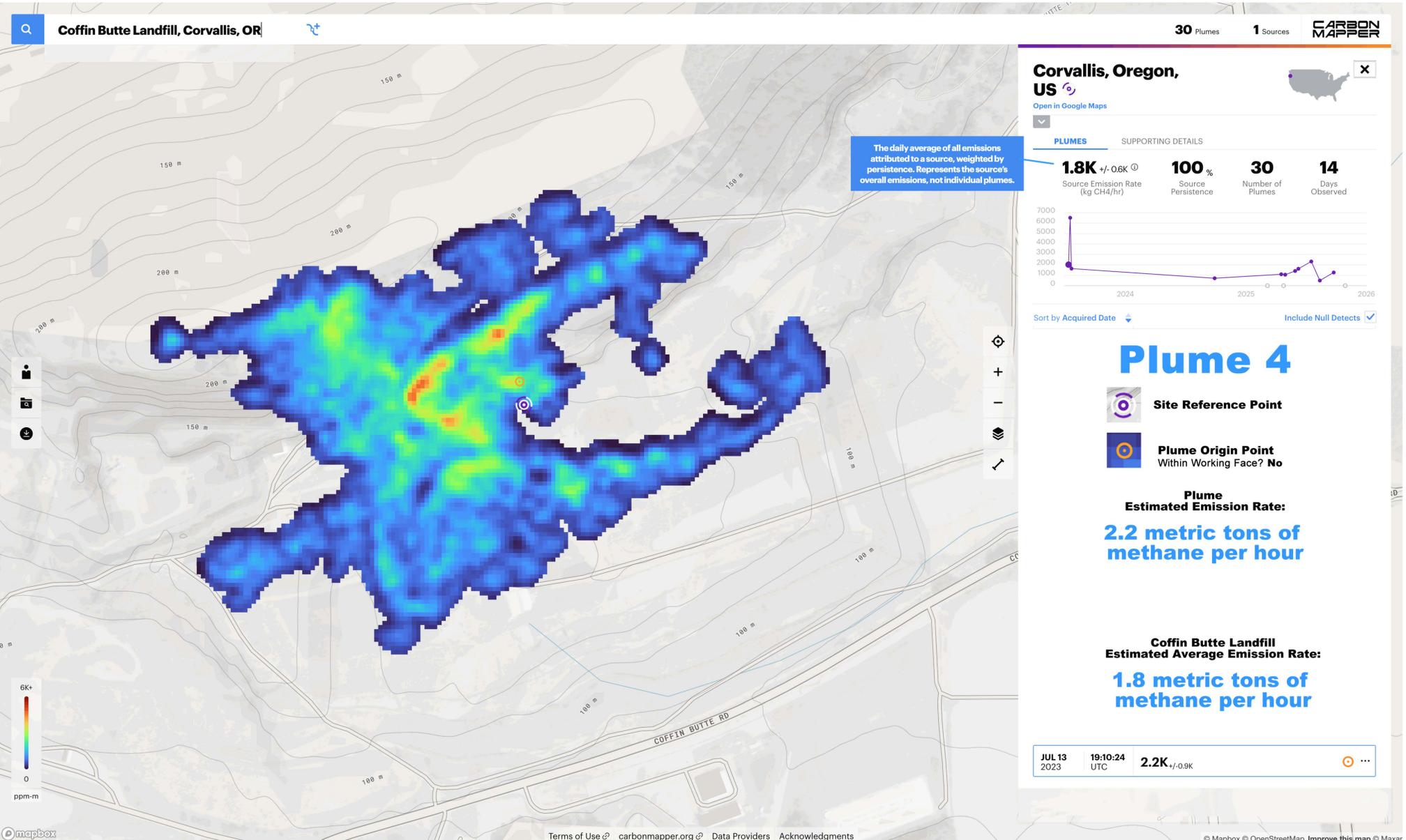
Plume 3

- Site Reference Point**
- Plume Origin Point**
Within Working Face? **No**

Plume Estimated Emission Rate:
0.405 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

JUL 13 2023	19:10:24 UTC	405 +/- 133	
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The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.

30 Plumes 1 Sources CARBON MAPPER

Corvallis, Oregon, US
 Open in Google Maps

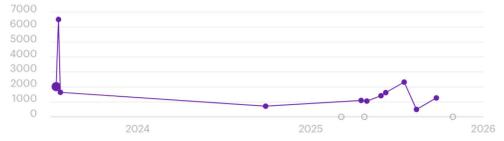
PLUMES SUPPORTING DETAILS

1.8K +/- 0.6K [Ⓢ]
 Source Emission Rate (kg CH4/hr)

100%
 Source Persistence

30
 Number of Plumes

14
 Days Observed



Sort by Acquired Date Include Null Detects

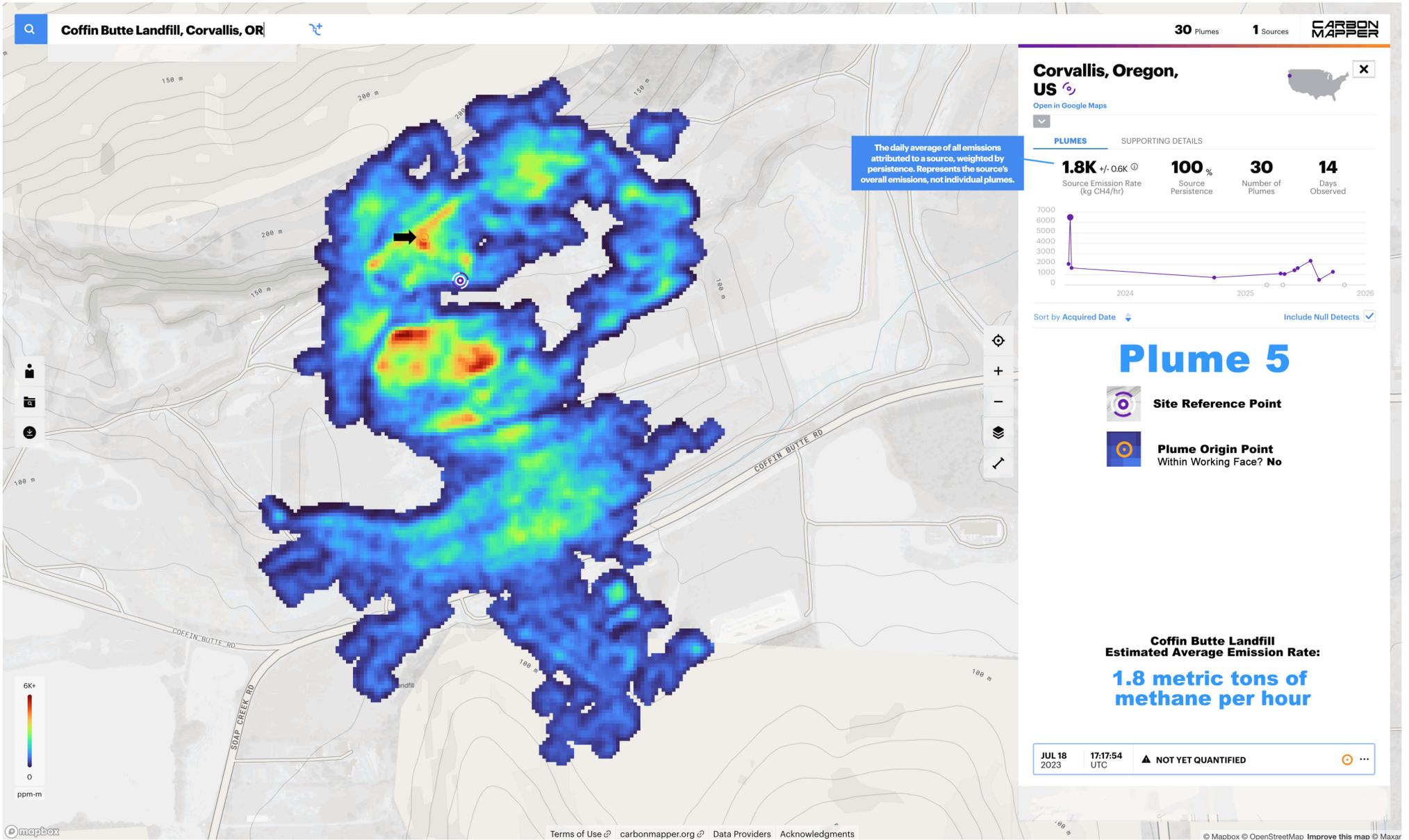
Plume 4

- Site Reference Point**
- Plume Origin Point**
 Within Working Face? **No**

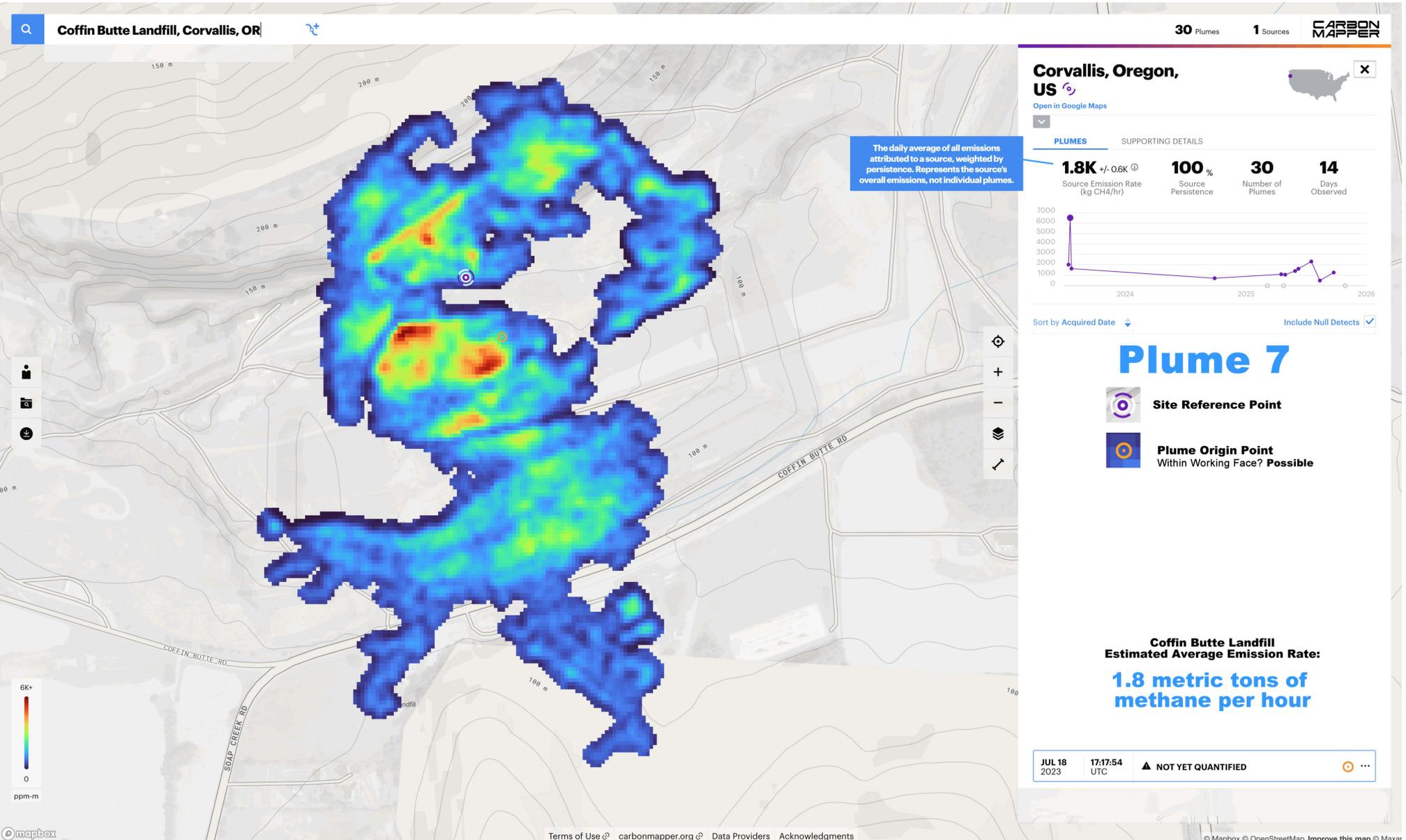
Plume
Estimated Emission Rate:
2.2 metric tons of methane per hour

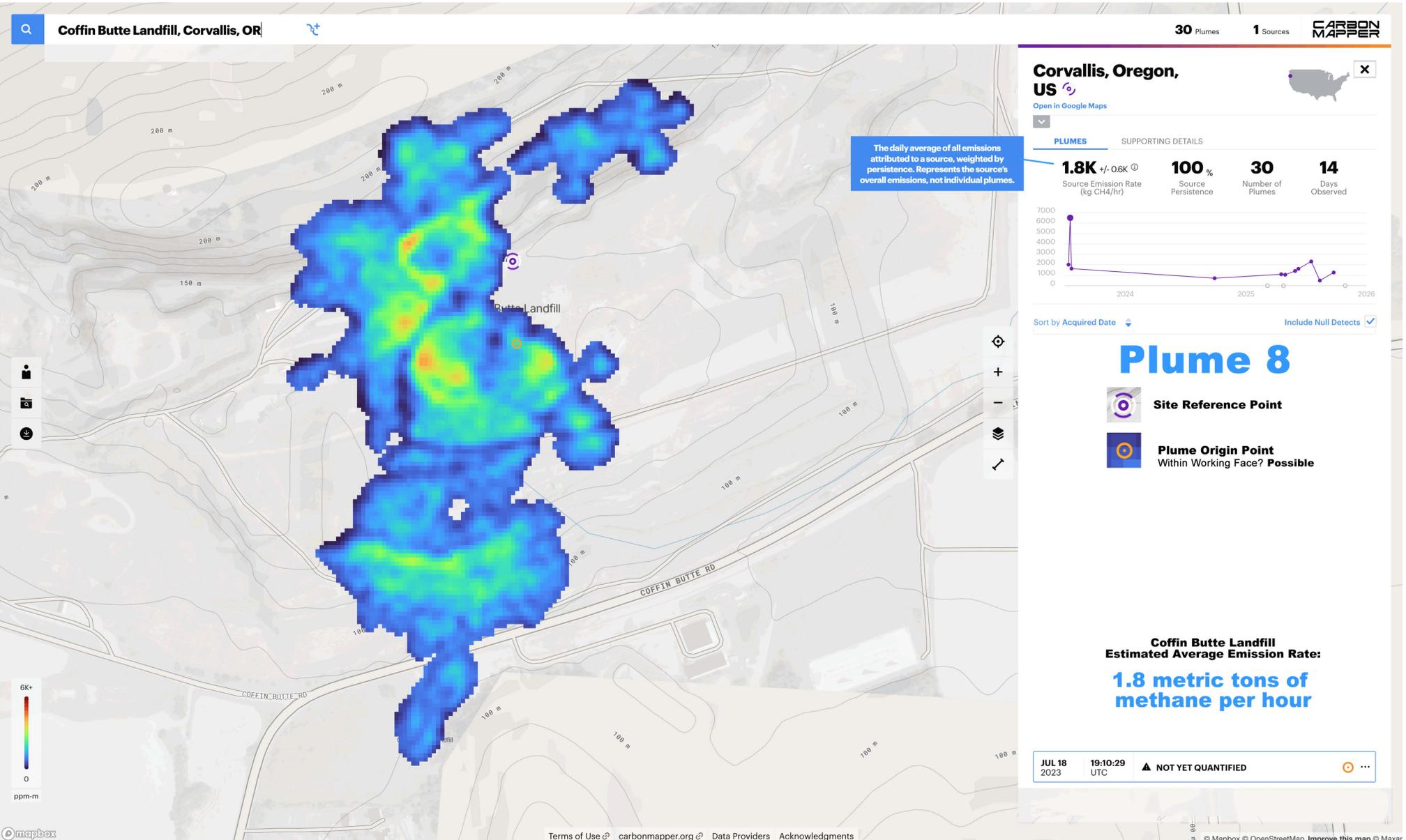
Coffin Butte Landfill
Estimated Average Emission Rate:
1.8 metric tons of methane per hour

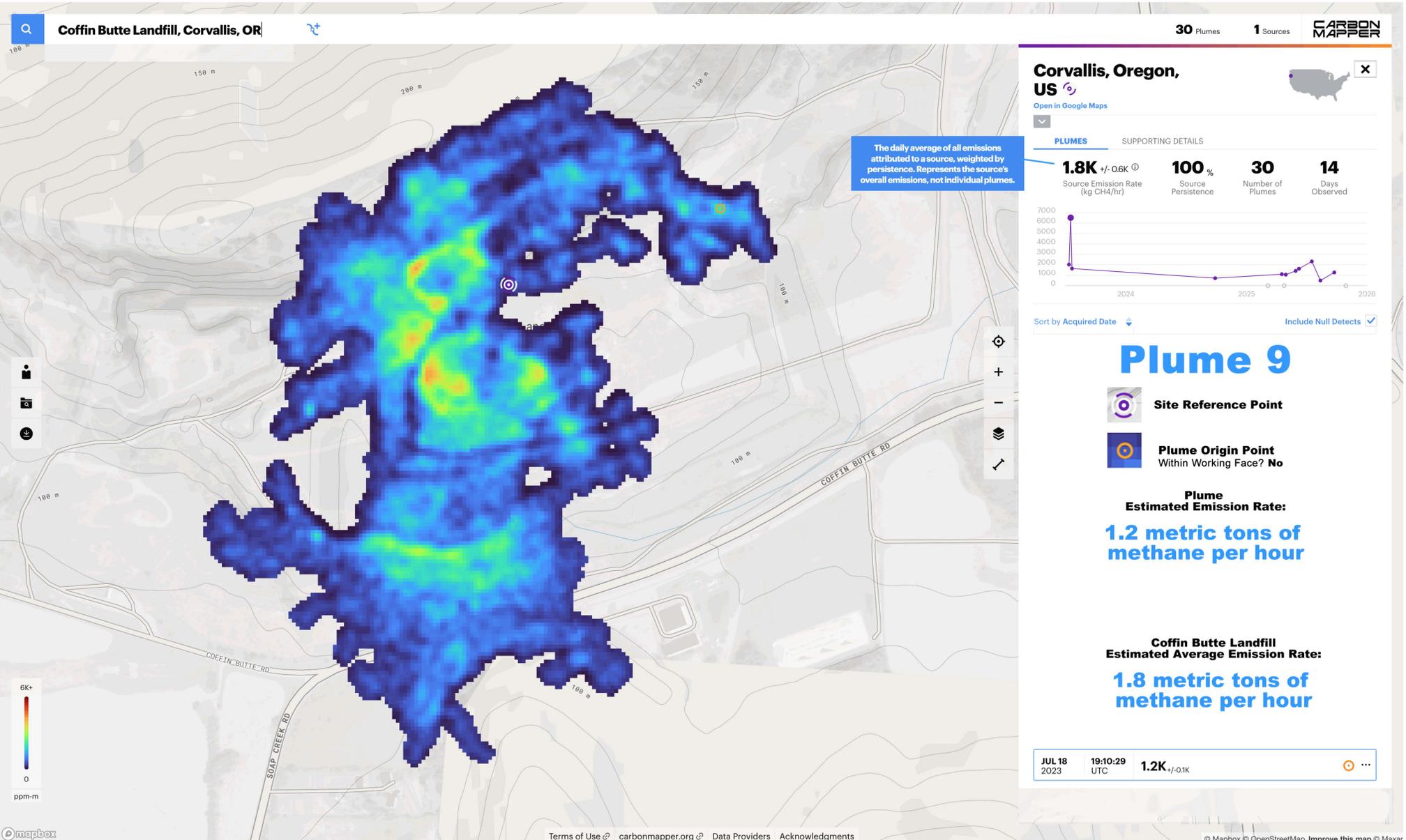
JUL 13 2023	19:10:24 UTC	2.2K +/- 0.9K		...
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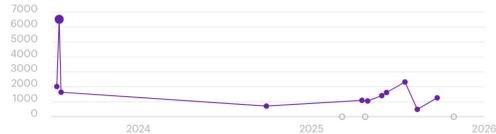




The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.

Corvallis, Oregon, US

PLUMES	SUPPORTING DETAILS		
1.8K +/- 0.6K	100%	30	14
Source Emission Rate (kg CH4/hr)	Source Persistence	Number of Plumes	Days Observed



Sort by Acquired Date | Include Null Detects

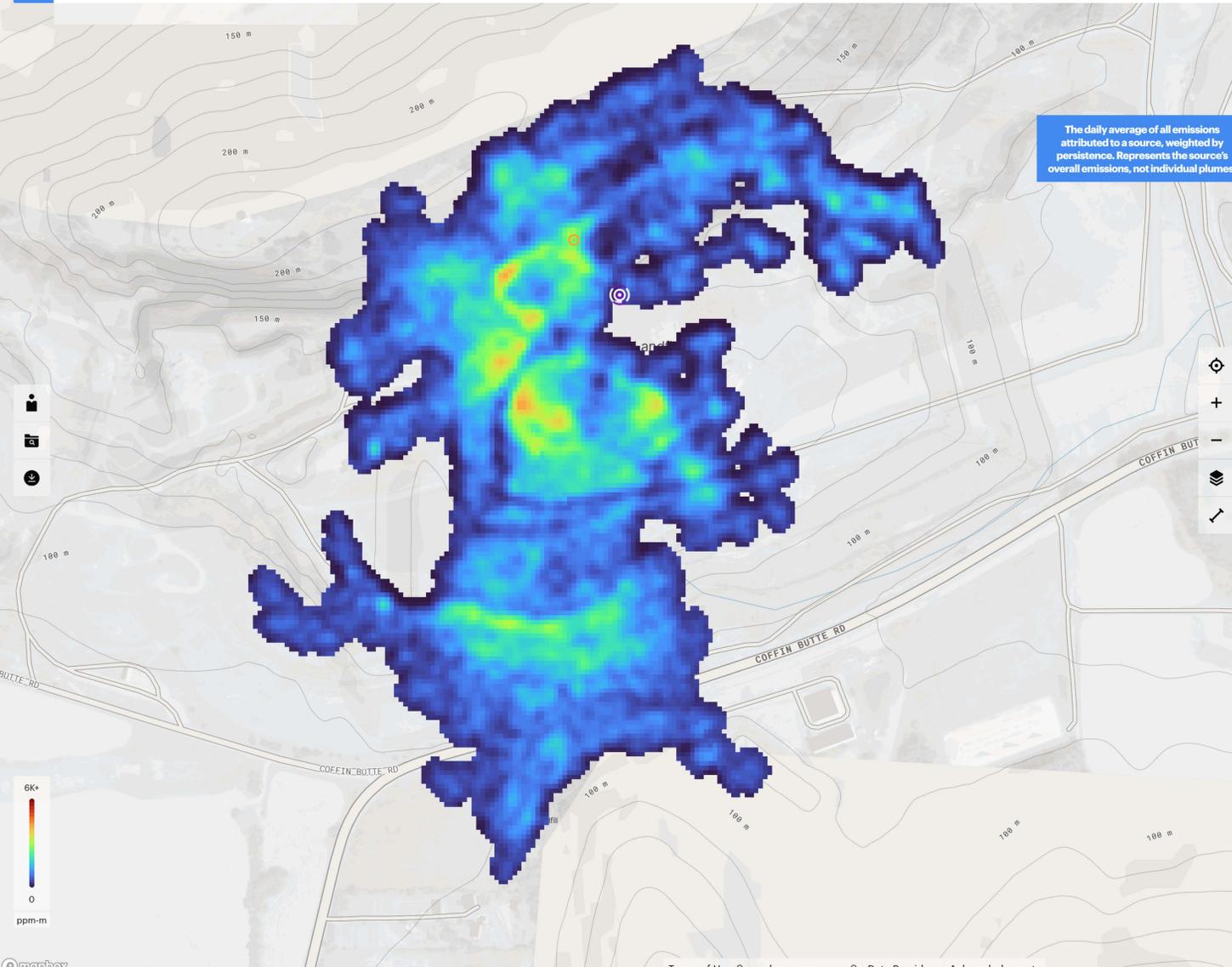
Plume 9

- Site Reference Point**
- Plume Origin Point**
Within Working Face? No

Plume Estimated Emission Rate:
1.2 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

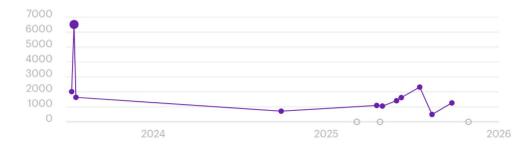
JUL 18 2023	19:10:29 UTC	1.2K +/- 0.1K	...
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The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.

Corvallis, Oregon, US

PLUMES	SUPPORTING DETAILS		
1.8K +/- 0.6K	100%	30	14
Source Emission Rate (kg CH4/hr)	Source Persistence	Number of Plumes	Days Observed



Sort by Acquired Date | Include Null Detects

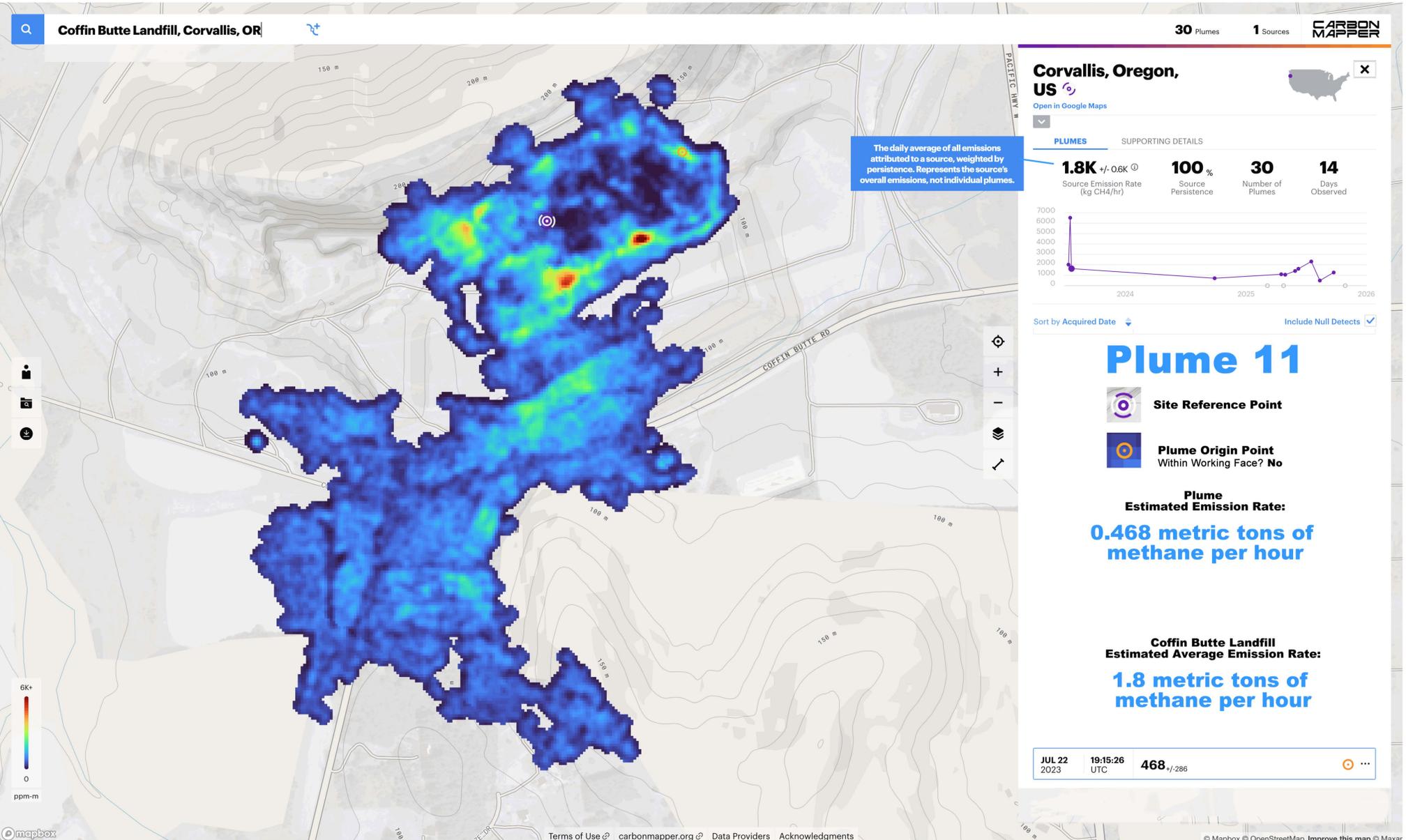
Plume 10

- Site Reference Point**
- Plume Origin Point**
Within Working Face? No

Plume Estimated Emission Rate:
5.3 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

JUL 18 2023	19:10:29 UTC	5.3K +/- 1.6K	
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Coffin Butte Landfill, Corvallis, OR

30 Plumes 1 Sources CARBON MAPPER

Corvallis, Oregon, US

The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.

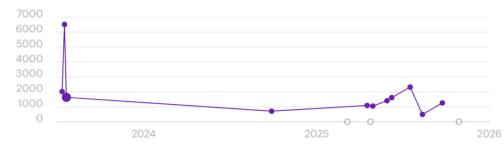
PLUMES SUPPORTING DETAILS

1.8K +/- 0.6K [Ⓢ] Source Emission Rate (kg CH4/hr)

100% Source Persistence

30 Number of Plumes

14 Days Observed



Sort by Acquired Date [⌵] Include Null Detects

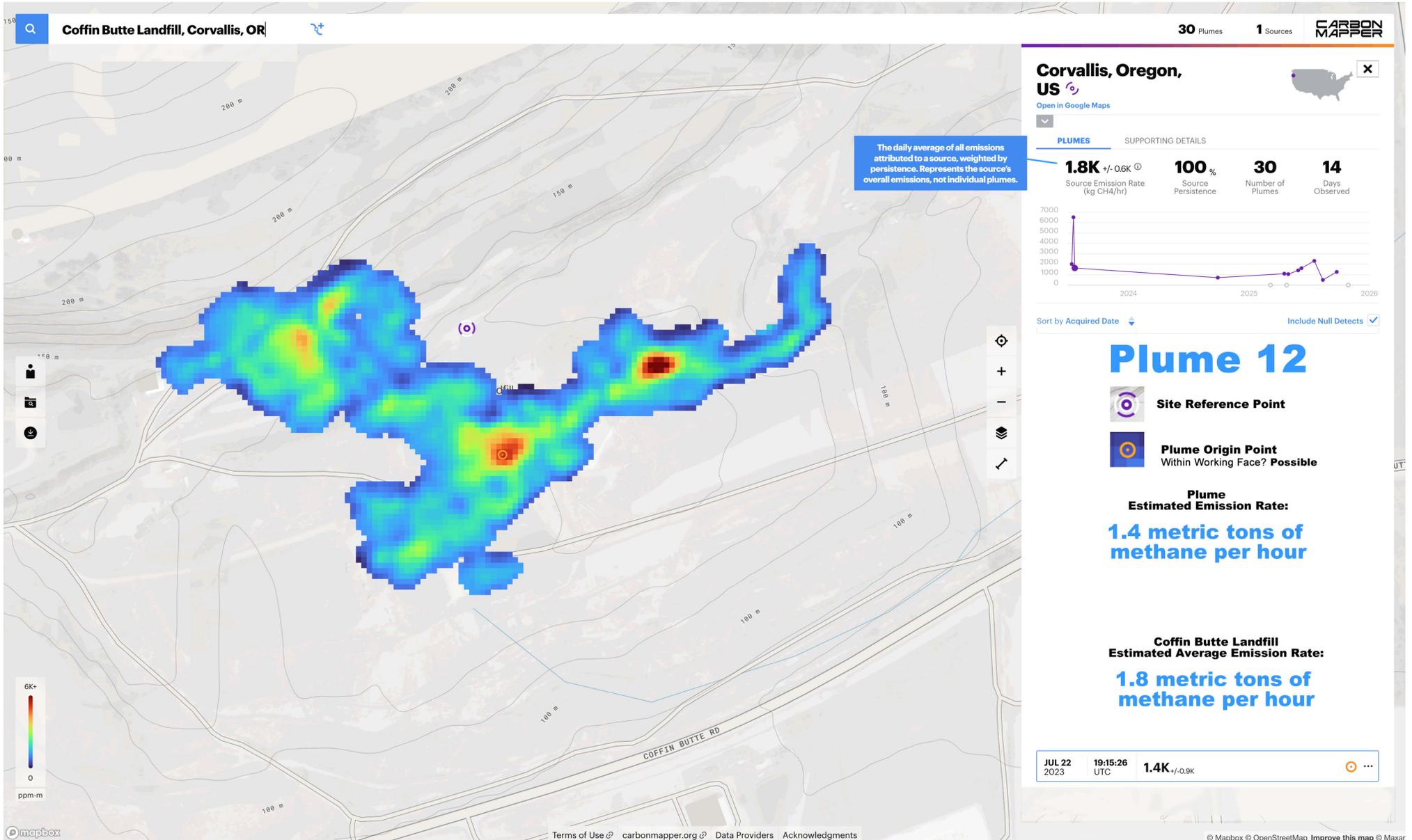
Plume 11

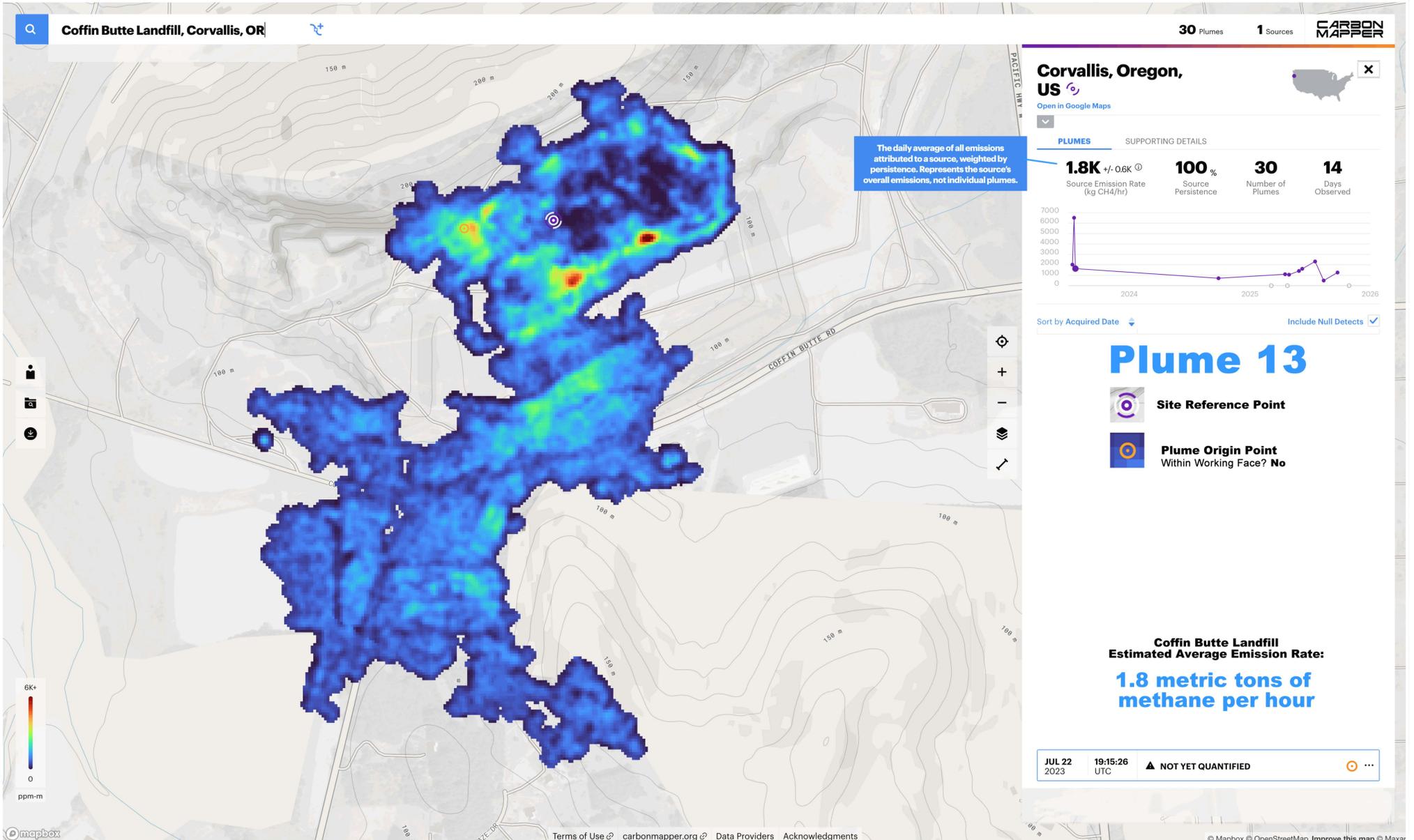
- Site Reference Point**
- Plume Origin Point**
Within Working Face? **No**

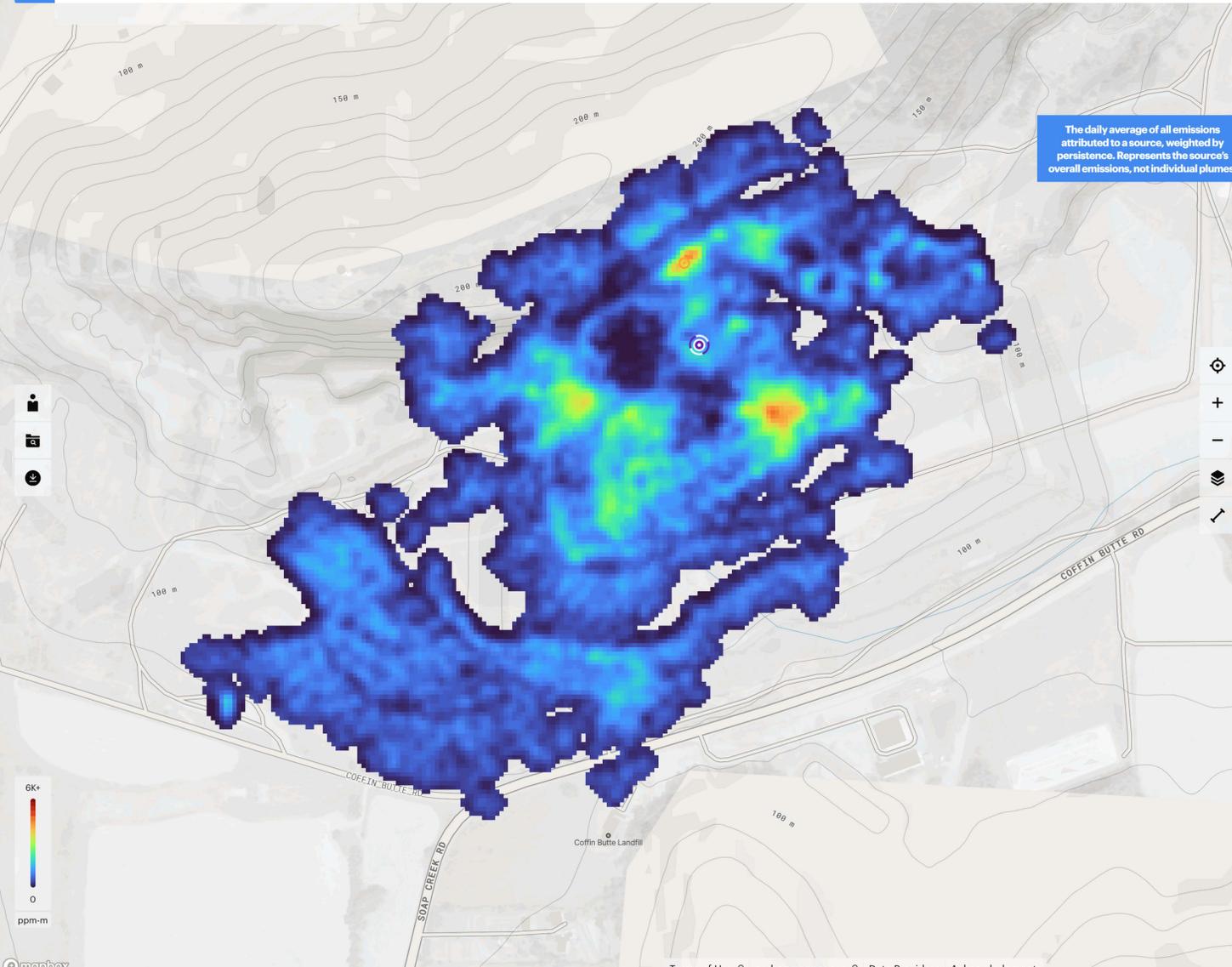
Plume Estimated Emission Rate:
0.468 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

JUL 22 2023 19:15:26 UTC **468** +/- 286



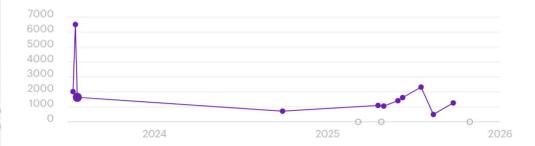




The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.

Corvallis, Oregon, US
 Open in Google Maps

PLUMES	SUPPORTING DETAILS		
1.8K +/- 0.6K	100%	30	14
Source Emission Rate (kg CH4/hr)	Source Persistence	Number of Plumes	Days Observed



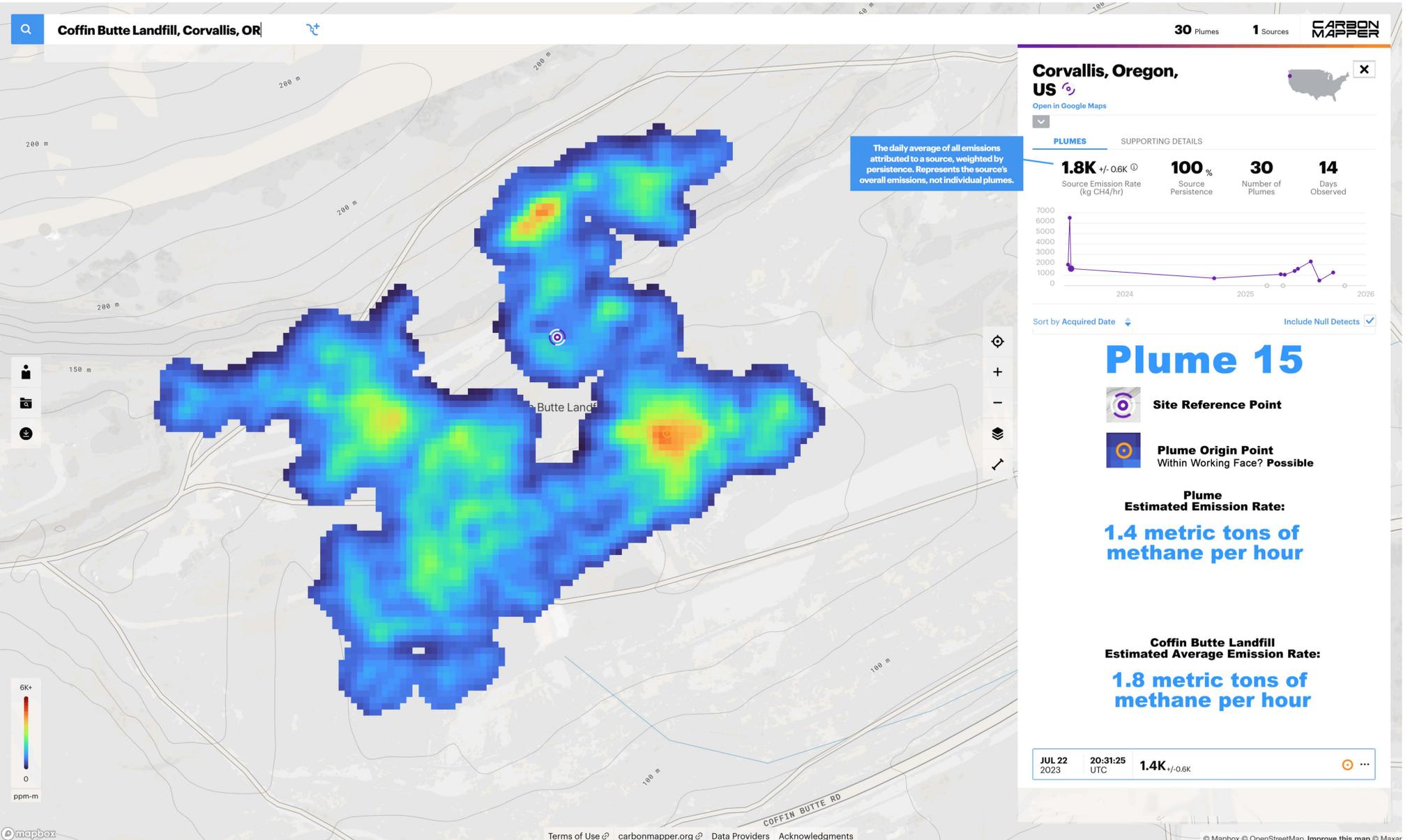
Sort by Acquired Date Include Null Detects

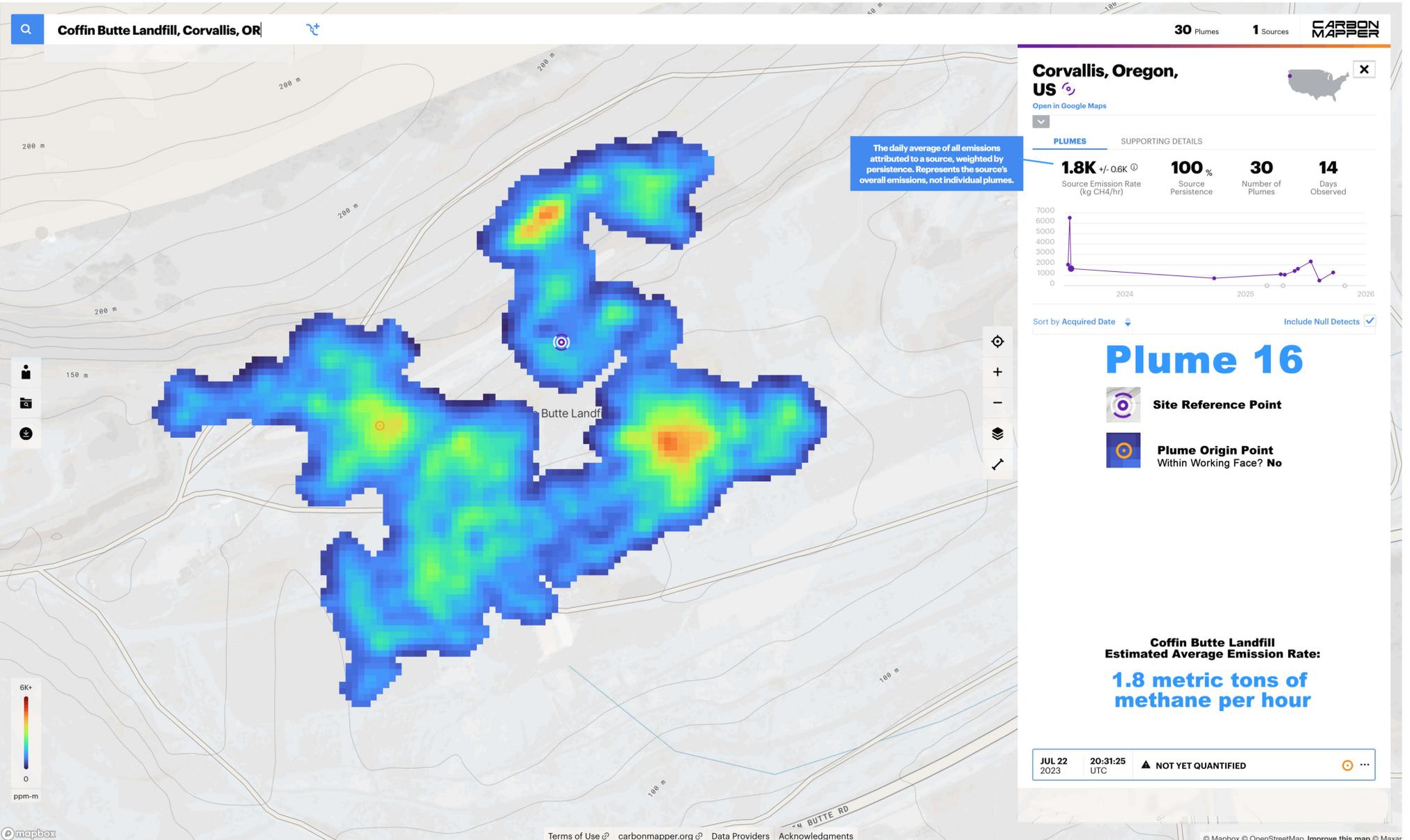
Plume 14

- Site Reference Point**
- Plume Origin Point**
Within Working Face? **No**

Coffin Butte Landfill
 Estimated Average Emission Rate:
1.8 metric tons of methane per hour

JUL 22 2023 20:31:25 UTC NOT YET QUANTIFIED







Coffin Butte Landfill, Corvallis, OR



30 Plumes

1 Sources

CARBON MAPPER

Corvallis, Oregon, US

Open in Google Maps



PLUMES

SUPPORTING DETAILS

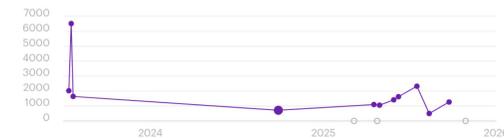
1.8K +/- 0.6K
Source Emission Rate (kg CH4/hr)

100%
Source Persistence

30
Number of Plumes

14
Days Observed

The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.



Sort by Acquired Date

Include Null Detects

Plume 17



Site Reference Point



Plume Origin Point
Within Working Face? Possible

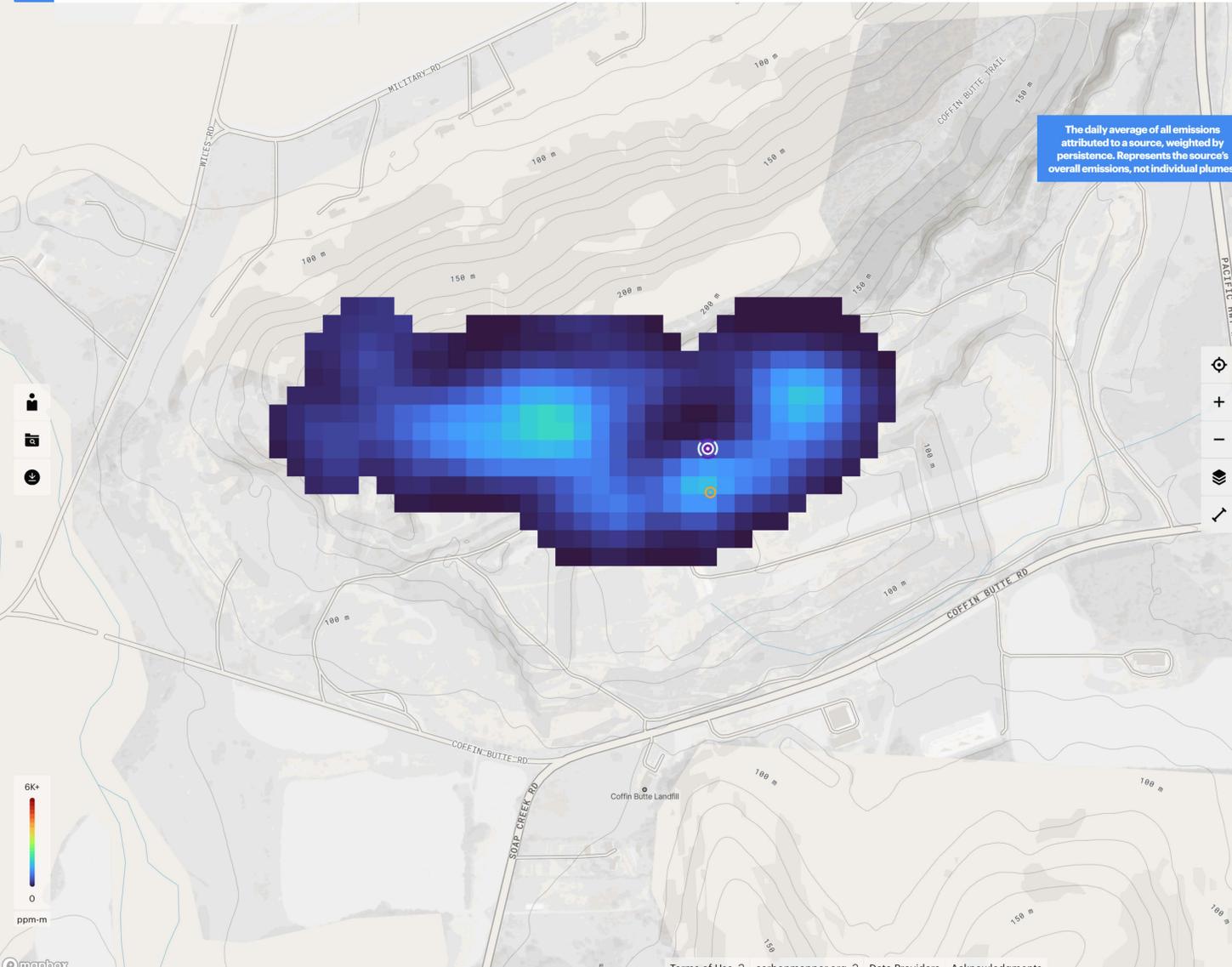


Wind Estimate
2.3 m/s from 233.0°

Plume
Estimated Emission Rate:
0.71 metric tons of methane per hour

Coffin Butte Landfill
Estimated Average Emission Rate:
1.8 metric tons of methane per hour

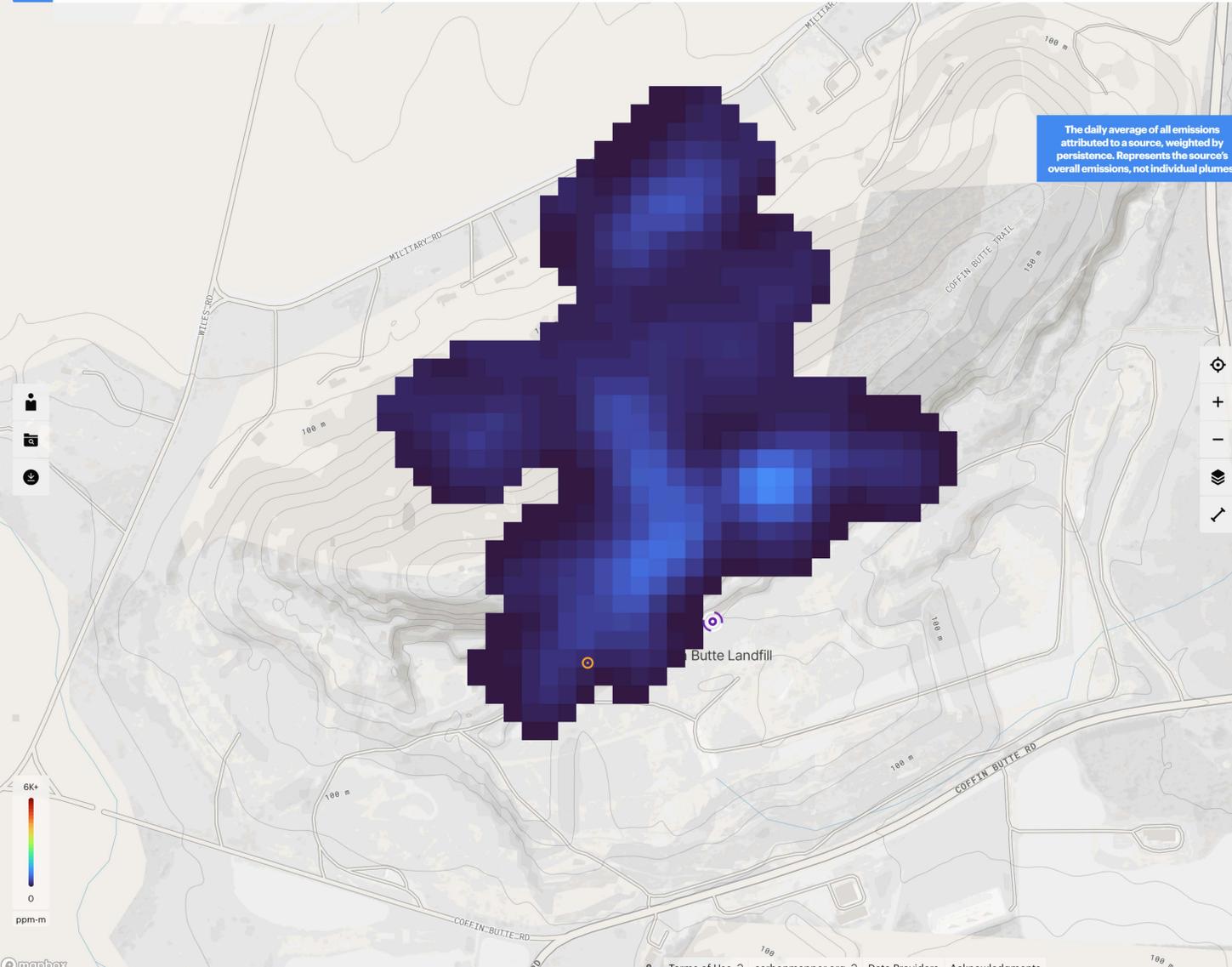
SEPT 28 2024 19:35:29 UTC 713 / 390



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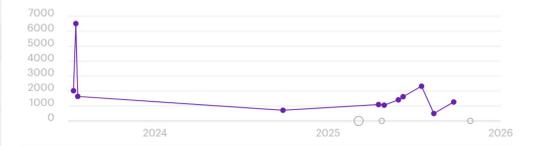
© Mapbox © OpenStreetMap Improve this map © Max



Corvallis, Oregon, US

Open in Google Maps

PLUMES	SUPPORTING DETAILS		
1.8K +/- 0.6K	100%	30	14
Source Emission Rate (kg CH4/hr)	Source Persistence	Number of Plumes	Days Observed



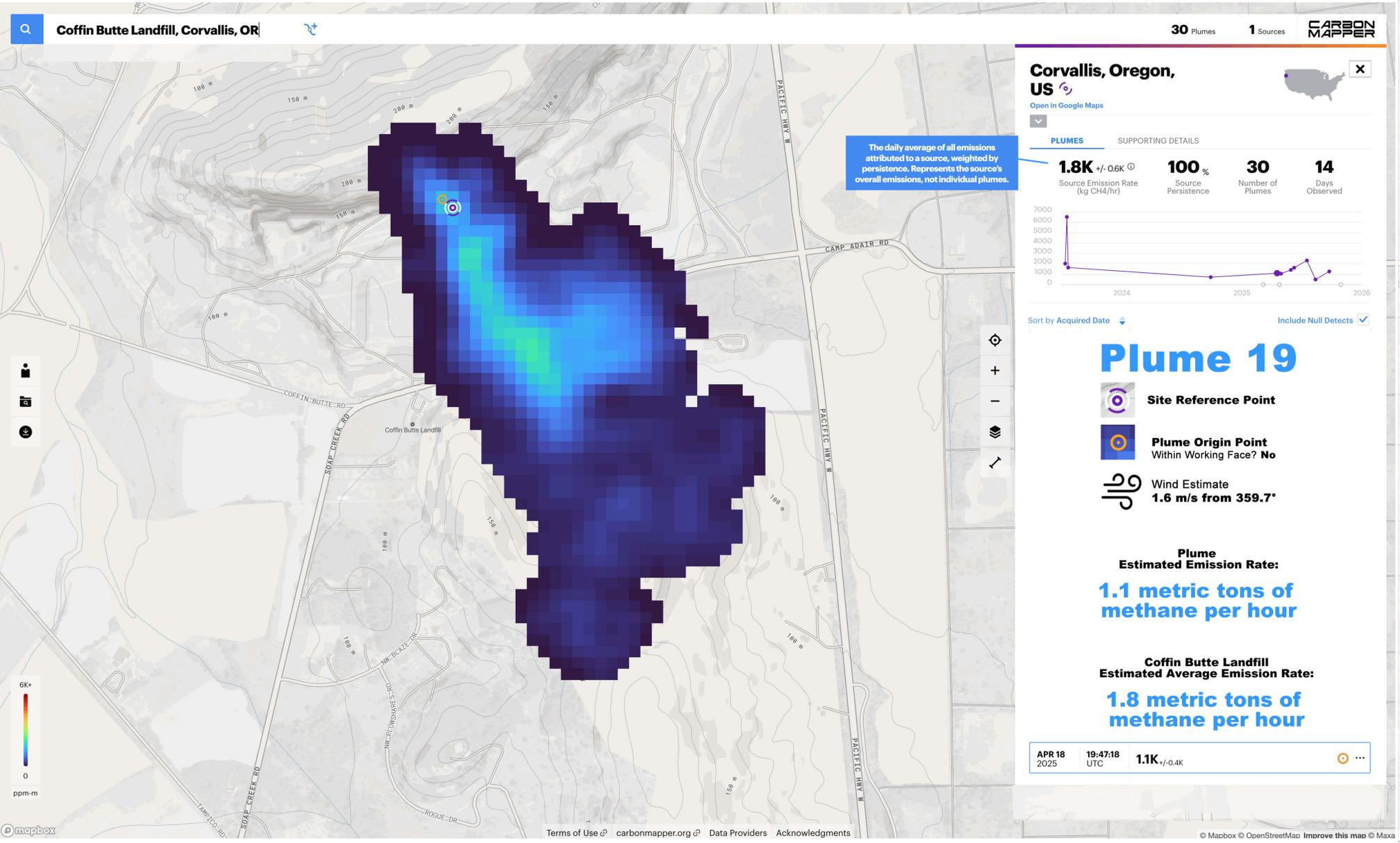
Sort by Acquired Date Include Null Detects

Plume 18

- Site Reference Point**
- Plume Origin Point**
Within Working Face? **No**
- Wind Estimate**
2.1 m/s from 189.5°

Coffin Butte Landfill
Estimated Average Emission Rate:
1.8 metric tons of methane per hour

MAR 07 2025 19:42:13 UTC **▲ NOT YET QUANTIFIED**



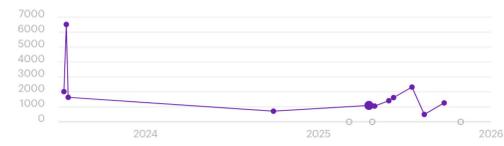
Coffin Butte Landfill, Corvallis, OR

30 Plumes 1 Sources CARBON MAPPER

Corvallis, Oregon, US

PLUMES SUPPORTING DETAILS

1.8K +/- 0.6K $\text{kg CH}_4/\text{hr}$ **100%** **30** **14**
 Source Emission Rate (kg CH4/hr) Source Persistence Number of Plumes Days Observed



The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.

Sort by Acquired Date Include Null Detects

Plume 19

- Site Reference Point
- Plume Origin Point Within Working Face? No
- Wind Estimate 1.6 m/s from 359.7°

Plume Estimated Emission Rate:
1.1 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

APR 18 2025 19:47:18 UTC 1.1K +/- 0.4K



Coffin Butte Landfill, Corvallis, OR



30 Plumes

1 Sources

CARBON MAPPER

Corvallis, Oregon, US



Open in Google Maps

PLUMES

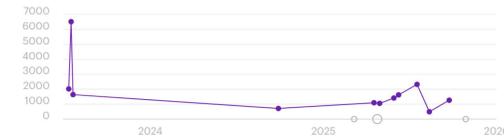
SUPPORTING DETAILS

1.8K +/- 0.6K
Source Emission Rate (kg CH4/hr)

100%
Source Persistence

30
Number of Plumes

14
Days Observed



Sort by Acquired Date

Include Null Detects

Plume 20



Site Reference Point



Plume Origin Point
Within Working Face? Possible



Wind Estimate
0.7 m/s from 283.5°

Coffin Butte Landfill
Estimated Average Emission Rate:

1.8 metric tons of methane per hour

APR 25 2025

19:48:12 UTC

NOT YET QUANTIFIED



The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.



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Coffin Butte Landfill, Corvallis, OR



30 Plumes

1 Sources

CARBON MAPPER

Corvallis, Oregon, US

Open in Google Maps



PLUMES

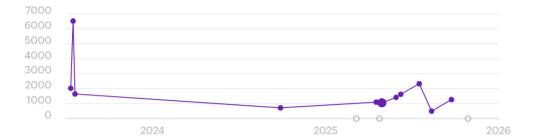
SUPPORTING DETAILS

1.8K +/- 0.6K
Source Emission Rate (kg CH4/hr)

100%
Source Persistence

30
Number of Plumes

14
Days Observed



Sort by Acquired Date

Include Null Detects

Plume 21



Site Reference Point



Plume Origin Point
Within Working Face? No



Wind Estimate
3.1 m/s from 18.1°

Plume
Estimated Emission Rate:
1.1 metric tons of methane per hour

Coffin Butte Landfill
Estimated Average Emission Rate:
1.8 metric tons of methane per hour

APR 30 2025

19:35:30 UTC

1.1K +/- 0.1K



The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.



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Coffin Butte Landfill, Corvallis, OR



30 Plumes

1 Sources



Corvallis, Oregon, US

Open in Google Maps



PLUMES

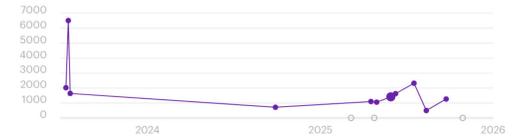
SUPPORTING DETAILS

1.8K +/- 0.6K
Source Emission Rate (kg CH4/hr)

100%
Source Persistence

30
Number of Plumes

14
Days Observed



Sort by Acquired Date

Include Null Detects

Plume 22



Site Reference Point



Plume Origin Point
Within Working Face? Possible



Wind Estimate
3.1 m/s from 5.2°

Coffin Butte Landfill
Estimated Average Emission Rate:

1.8 metric tons of methane per hour

MAY 30 2025

19:52:57 UTC

▲ NOT YET QUANTIFIED



The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.



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Coffin Butte Landfill, Corvallis, OR



30 Plumes

1 Sources



Corvallis, Oregon, US

Open in Google Maps



PLUMES

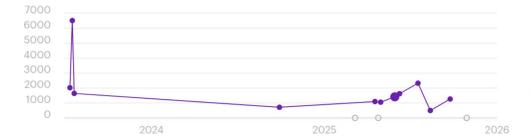
SUPPORTING DETAILS

1.8K +/- 0.6K
Source Emission Rate (kg CH4/hr)

100 %
Source Persistence

30
Number of Plumes

14
Days Observed



Sort by Acquired Date

Include Null Detects

Plume 23



Site Reference Point



Plume Origin Point
Within Working Face? No



Wind Estimate
3.1 m/s from 5.2°

Plume Estimated Emission Rate:
1.4 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

MAY 30 2025 19:52:57 UTC 1.4K +/- 0.1K

The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.



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Coffin Butte Landfill, Corvallis, OR



30 Plumes

1 Sources



Corvallis, Oregon, US

Open in Google Maps



PLUMES

SUPPORTING DETAILS

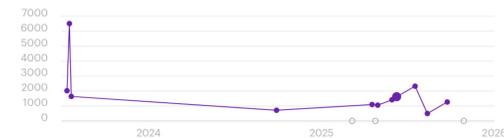
1.8K +/- 0.6K
Source Emission Rate (kg CH4/hr)

100%
Source Persistence

30
Number of Plumes

14
Days Observed

The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.



Sort by Acquired Date

Include Null Detects

Plume 24

Site Reference Point

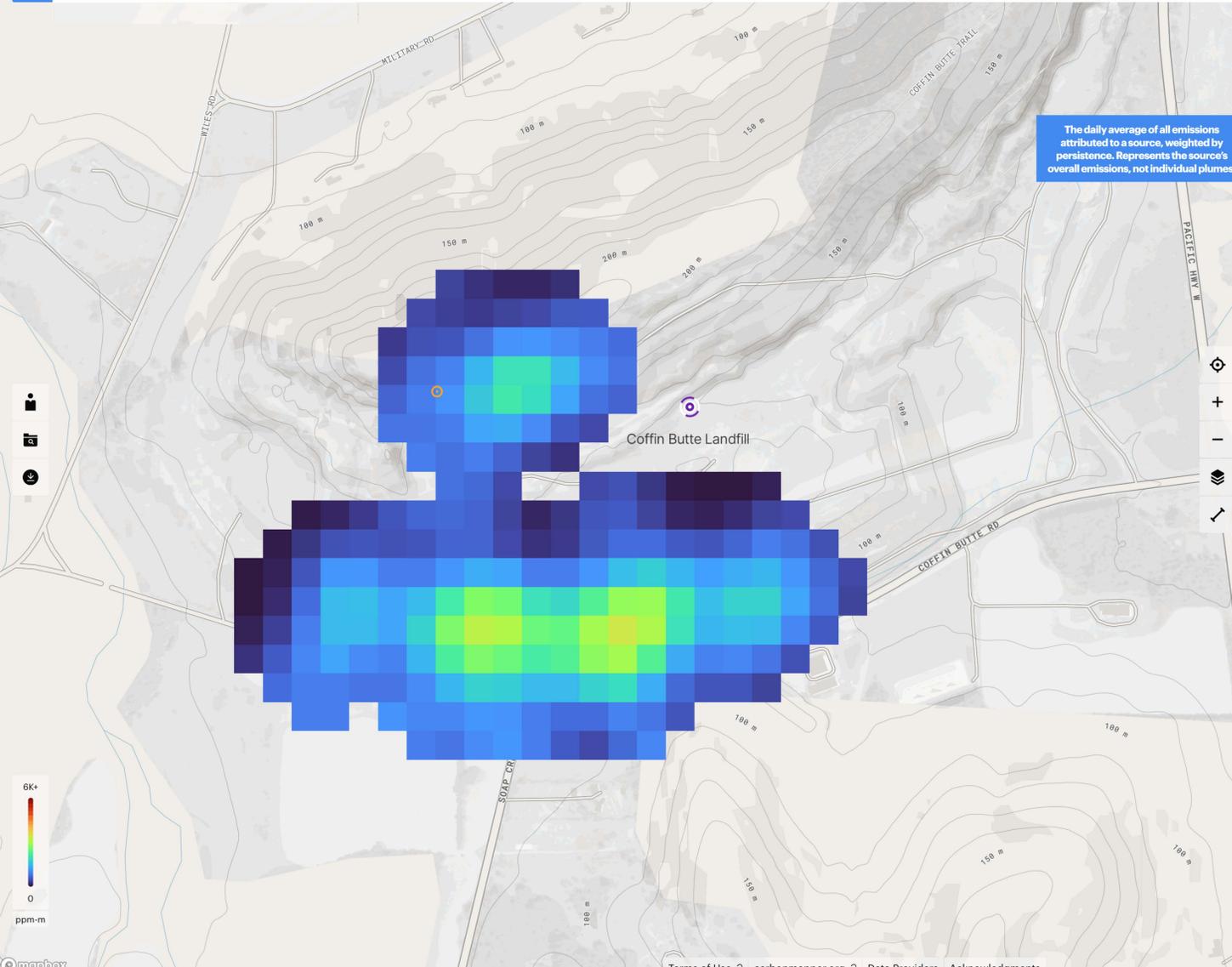
Plume Origin Point
Within Working Face? No

Wind Estimate
3.0 m/s from 305.5°

Plume Estimated Emission Rate:
1.6 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

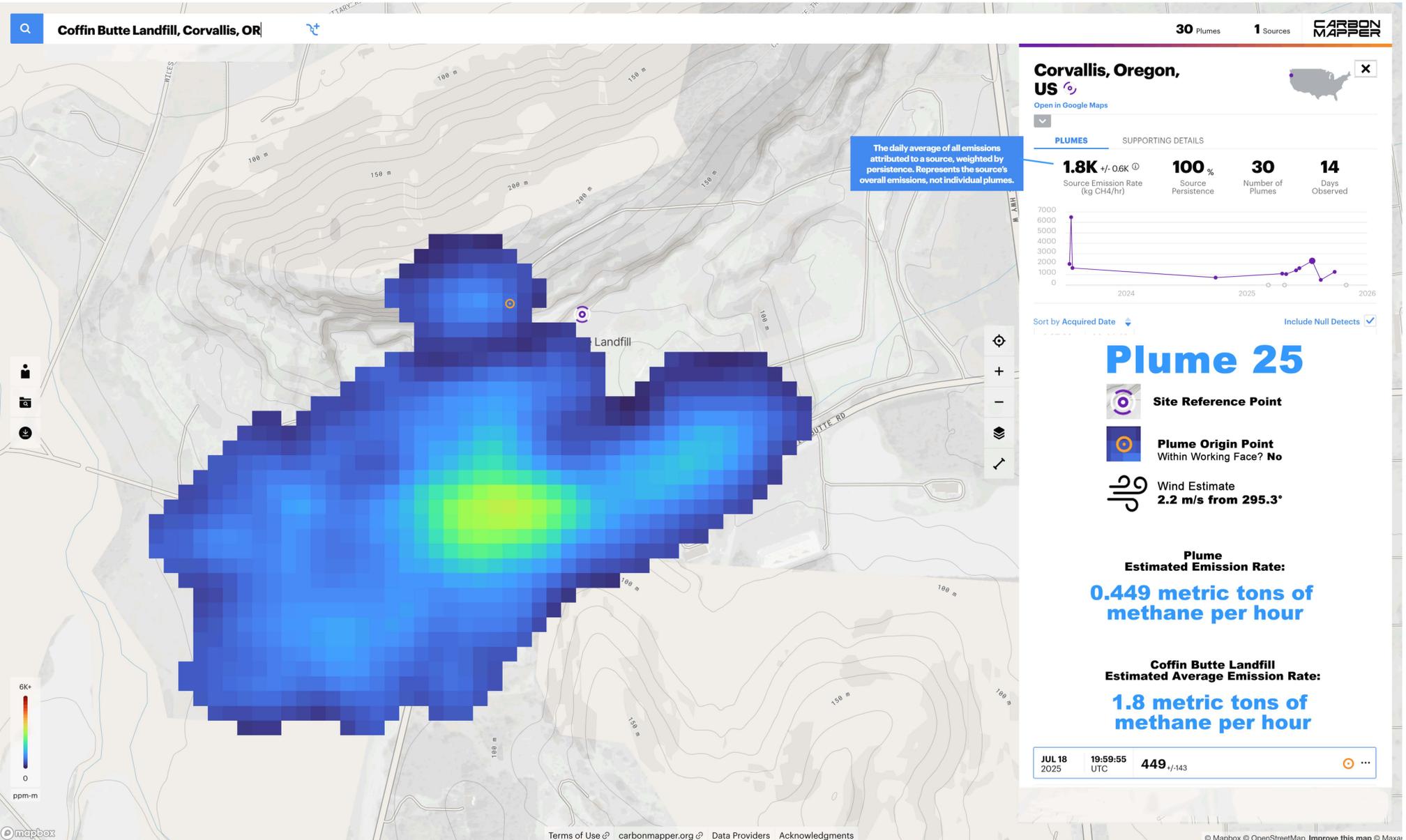
JUN 09 2025 22:26:16 UTC 1.6K +/- 1.1K



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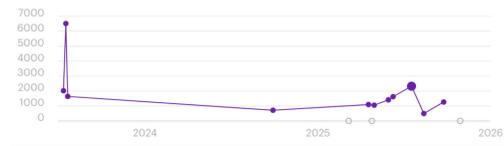
Coffin Butte Landfill, Corvallis, OR

30 Plumes 1 Sources CARBON MAPPER

Corvallis, Oregon, US

The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.

PLUMES SUPPORTING DETAILS
1.8K +/- 0.6K Source Emission Rate (kg CH4/hr)
100% Source Persistence
30 Number of Plumes
14 Days Observed



Sort by Acquired Date Include Null Detects

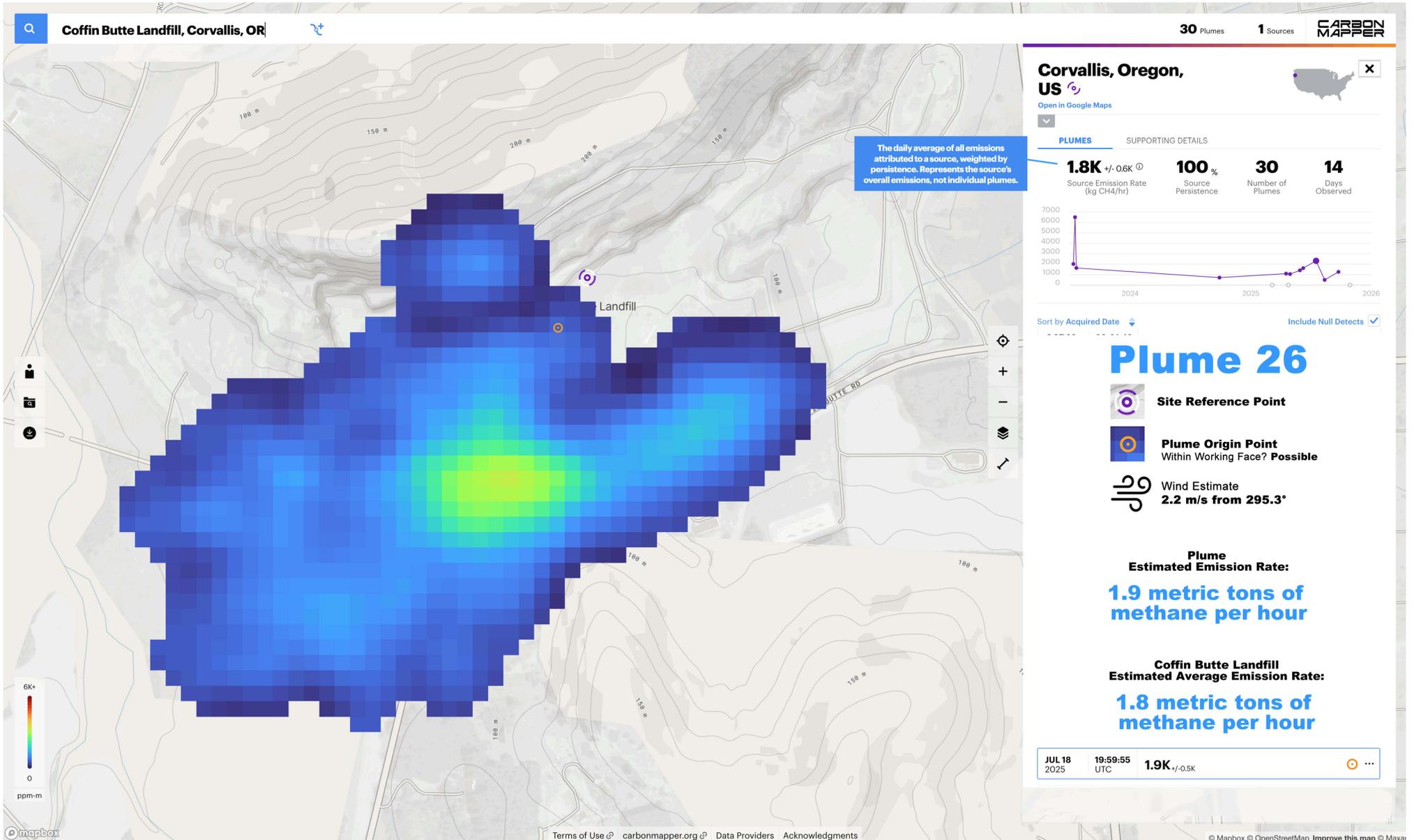
Plume 25

- Site Reference Point
- Plume Origin Point
Within Working Face? No
- Wind Estimate
2.2 m/s from 295.3°

Plume Estimated Emission Rate:
0.449 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

JUL 18 2025 19:59:55 UTC **449** +/- 143



The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.

30 Plumes 1 Sources CARBON MAPPER

Corvallis, Oregon, US

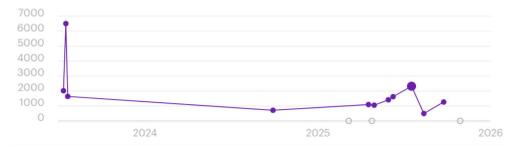
PLUMES SUPPORTING DETAILS

1.8K +/- 0.6K [Ⓢ] Source Emission Rate (kg CH4/hr)

100% Source Persistence

30 Number of Plumes

14 Days Observed



Sort by Acquired Date Include Null Detects

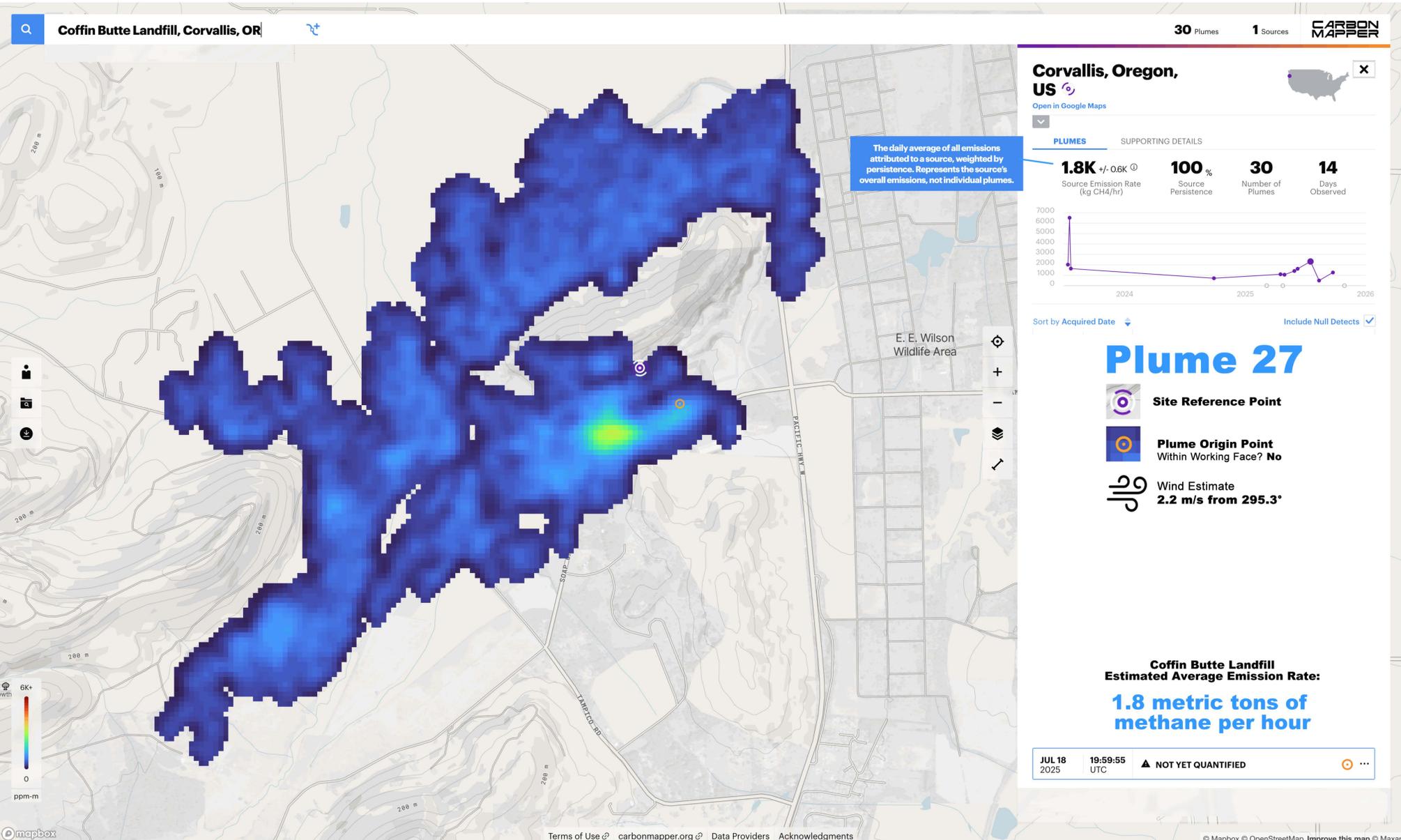
Plume 26

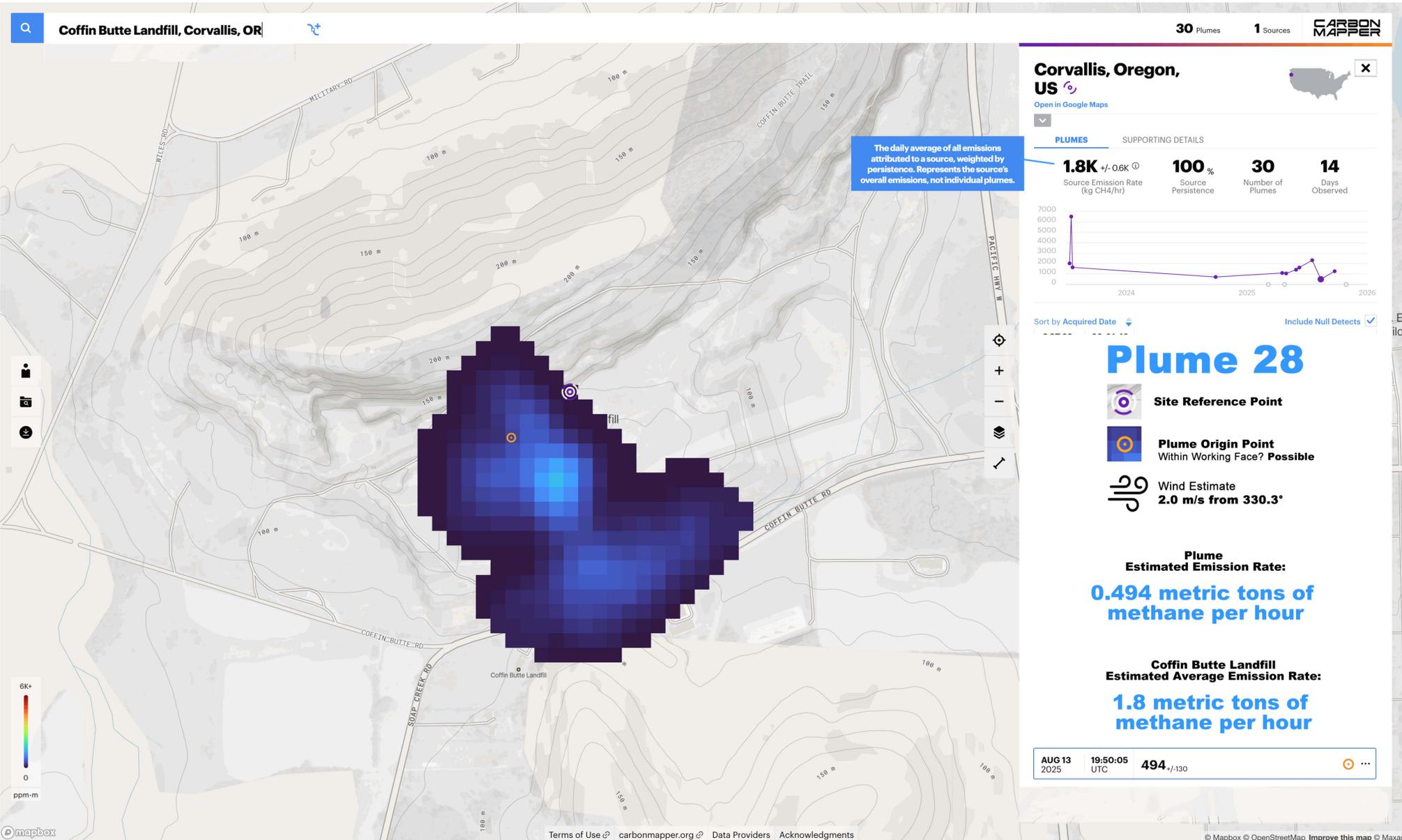
- Site Reference Point**
- Plume Origin Point**
Within Working Face? **Possible**
- Wind Estimate**
2.2 m/s from 295.3°

Plume Estimated Emission Rate:
1.9 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

JUL 18 2025	19:59:55 UTC	1.9K +/- 0.5K		...
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Corvallis, Oregon, US

Open in Google Maps

PLUMES

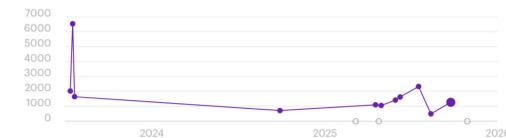
SUPPORTING DETAILS

1.8K +/- 0.6K
Source Emission Rate (kg CH4/hr)

100%
Source Persistence

30
Number of Plumes

14
Days Observed



Sort by Acquired Date

Include Null Detects

Plume 29



Site Reference Point



Plume Origin Point
Within Working Face? No



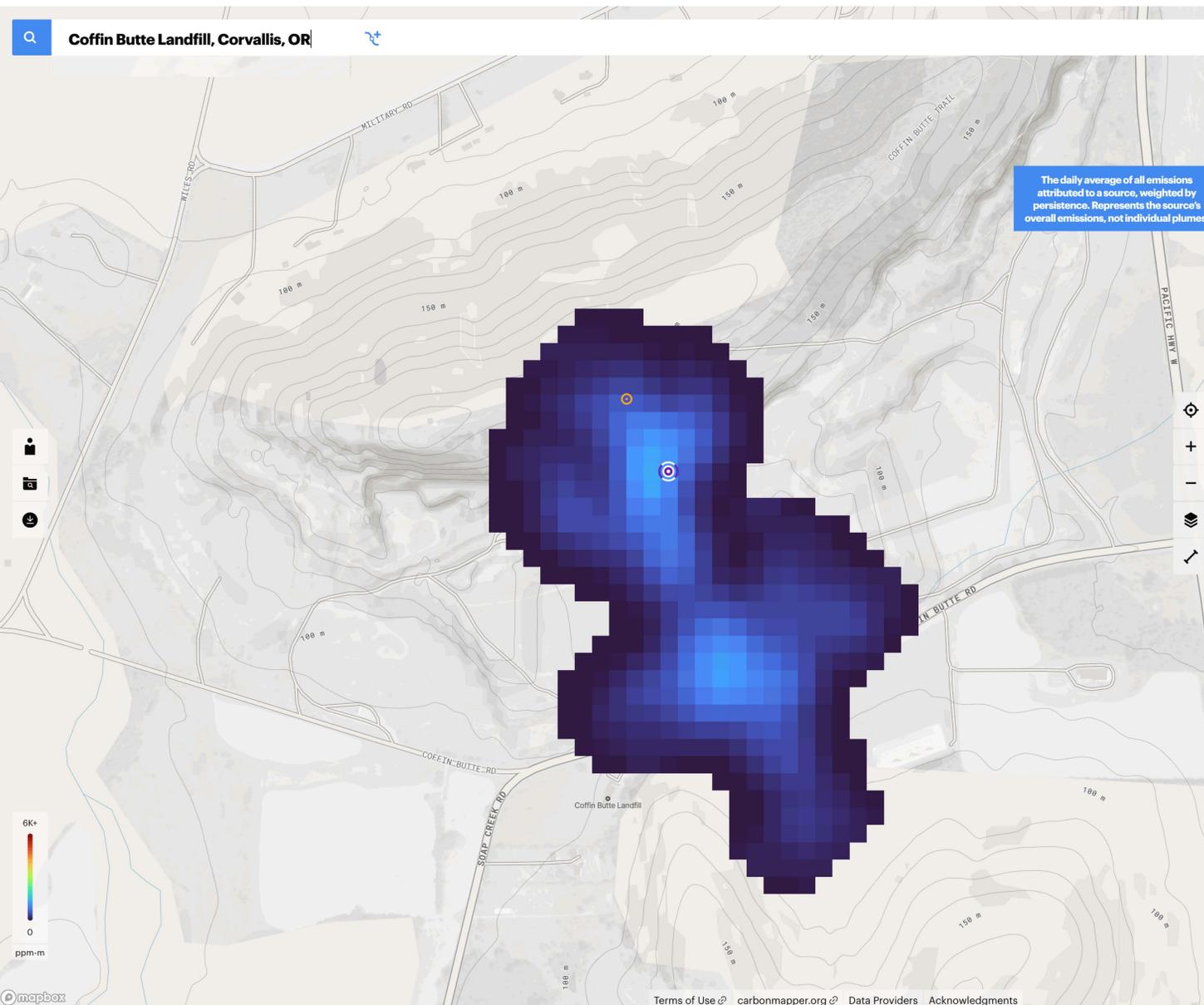
Wind Estimate
4.2 m/s from 14.3°

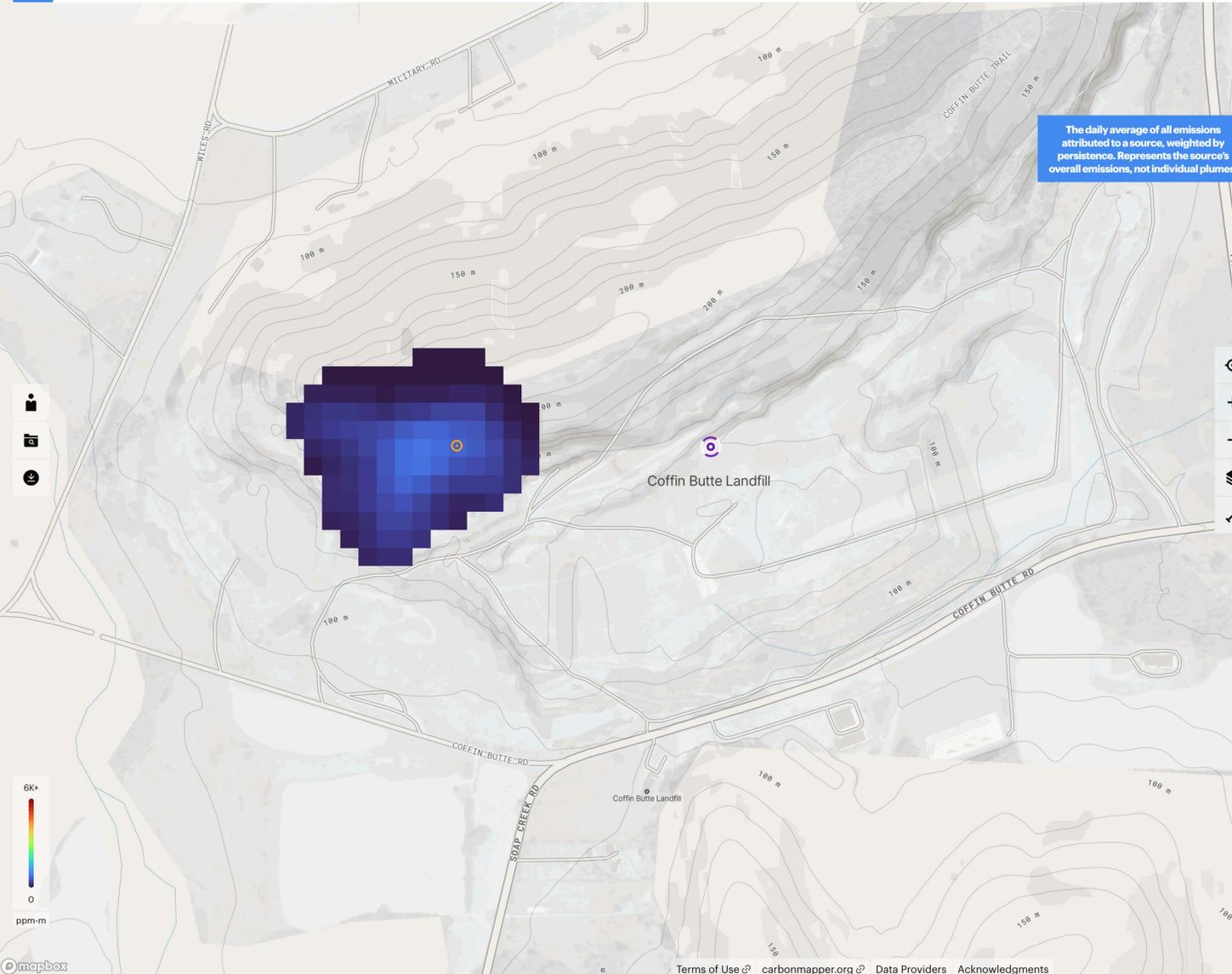
Plume Estimated Emission Rate:
1.3 metric tons of methane per hour

Coffin Butte Landfill Estimated Average Emission Rate:
1.8 metric tons of methane per hour

SEPT 24 2025 19:56:03 UTC 1.3K +/- 0.2K

The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.





The daily average of all emissions attributed to a source, weighted by persistence. Represents the source's overall emissions, not individual plumes.

Corvallis, Oregon, US
 Open in Google Maps

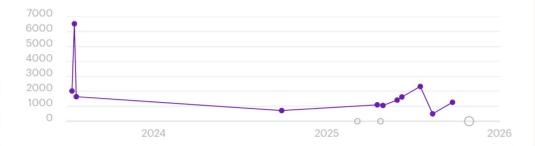
PLUMES SUPPORTING DETAILS

1.8K +/- 0.6K
Source Emission Rate (kg CH4/hr)

100%
Source Persistence

30
Number of Plumes

14
Days Observed



Sort by Acquired Date Include Null Detects

Plume 30

- Site Reference Point**
- Plume Origin Point**
Within Working Face? **No**
- Wind Estimate**
3.3 m/s from 39.3°

Coffin Butte Landfill
Estimated Average Emission Rate:
1.8 metric tons of methane per hour

OCT 29 2025 20:01:42 UTC NOT YET QUANTIFIED



Quick answers to commonly asked questions:

- The first 16 plumes were mapped from aircraft; the succeeding 14 plumes were mapped from space. That's why there's a difference in resolution and why wind data is only supplied for the last 14 plumes, etc.
- "Not Yet Quantified" means that Carbon Mapper's algorithm for establishing the plume leak rate does not yet produce a result above their confidence threshold. This is likely to change as the algorithm "gets smarter." The other data about the plume is accurate.
- The plumes are at different scales. (Sorry about that, that's the way they come from Carbon Mapper)
- These images are two-dimensional representations of three-dimensional plume data.

Commissioners, Carbon Mapper's data is strong evidence (if any evidence is needed) that the impending substantial enforcement actions laid out in DEQ's Pre-Enforcement Notice is warranted by conditions on the ground at Coffin Butte Landfill. As I laid out in preceding pages, the data is also strong evidence that the cautions MFA listed about the Applicant's odor study all apply, and that study is invalid on multiple levels. Thirdly, the CM data is strong evidence that the Applicant is using significant misrepresentations of conditions at the landfill in its Application. Any one of these is cause for the Benton County Commissioners to deny that Application.

The Plume Origin Point Map (following page)

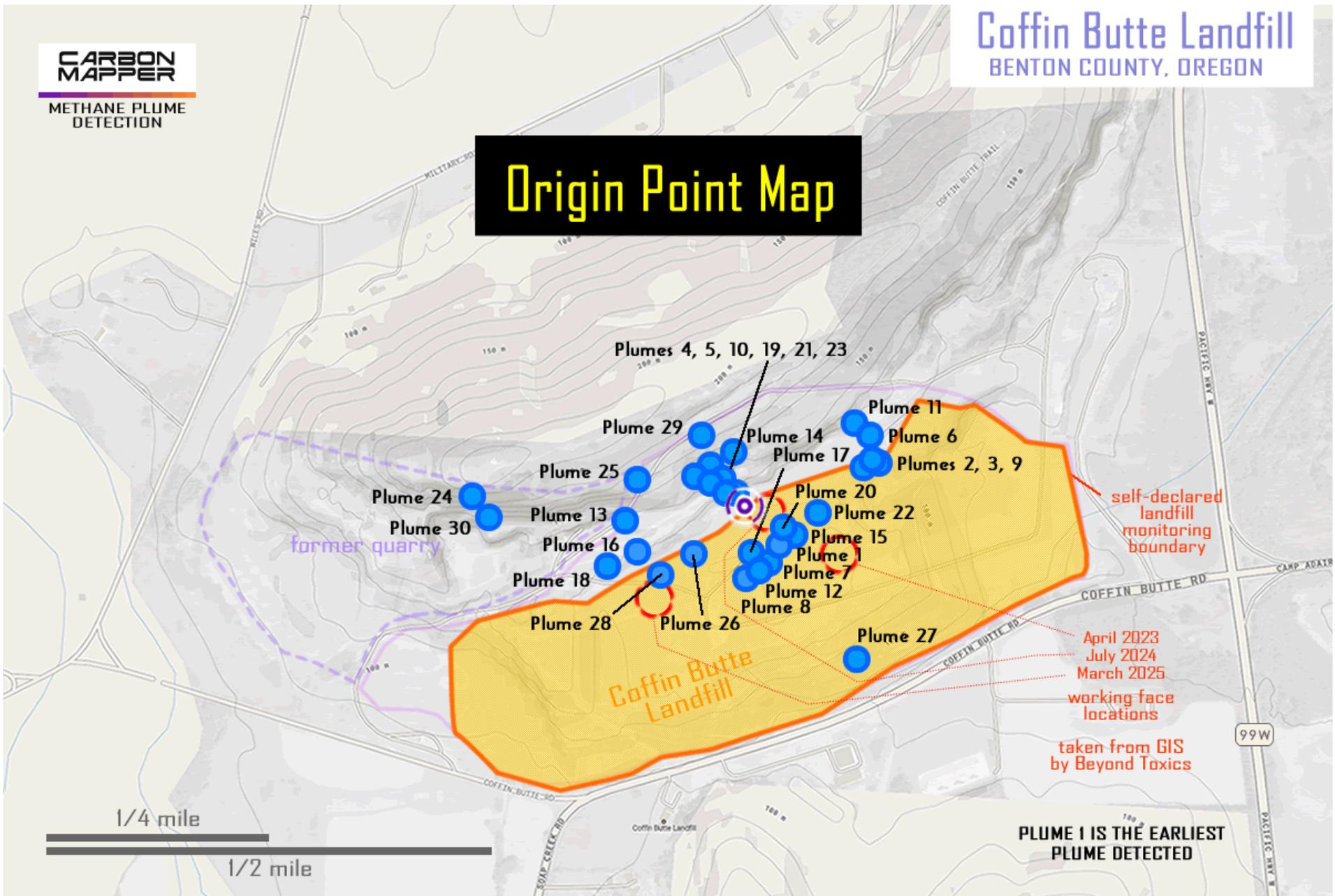
It is illuminating to see the origin points for the dump's plumes gathered onto one map, so I have done that on the page following this one. This map tells a story.

You may notice right away that over half the plumes originate from points that are not within the landfill's (self-designated) monitoring boundary. This means they will never be discovered through the prescribed inspection regimen.

You may also notice right away that there are two clusters of plumes with numbers that run from low to high. These clusters represent focal origin areas where super-emitting leaks have persisted for years, unremediated by Applicant.

If you track the plume numbers in ascending order, you can re-create how the plumes progressed through time. You may notice that many of the most recent plumes – 24, 25, 29, and 30 – are appearing in places a distance away from the landfill mass itself. This appears to show that landfill gas is escaping the landfill mass underground and moving into the fractured basalt of Coffin Butte itself, to emerge at points in the exposed rock wall. This phenomenon has been documented at landfills that “lean” on fractured rock. Which is a matter of significant concern, as the proposed new landfill would similarly “lean” on the fractured basalt of Tampico Ridge, and Applicant has not acknowledged this problem, no Conditions of Approval address it (and indeed it's not clear that mitigation is even possible.)

Origin Point Map



Plume origin points compiled from prepared from Carbon Mapper data; boundary from Republic reports to DEQ; working face locations from Beyond Toxics

Questions about Applicant's unchallenged assertions and the review process

MFA's letter, and the DEQ Notice before it, raise questions about the County review process.

Extensive testimony in the Record challenged the Applicant's unsubstantiated assertions about model parameters not only in their odor study, but in their fire analysis, groundwater analysis, and so on down the list. It's not clear if the County's Special Staff, Winterbrook, responded to those challenges after they entered into evidence, but according to MFA their instruction from Special Staff did not include examining the Applicant's assertions.

What this means is that a significant number of Applicant's assertions have apparently not been adequately addressed by Special Staff and in effect have been kicked upstairs to you, Commissioners.

First unsubstantiated assertion:

First among these has to be the Applicant's assertion that landfill gas emissions are an odor problem – i.e, that landfill gas is a “nuisance.” While landfill gas does contain some odiferous gases, when it comes to interference with land uses, their significance is dwarfed by the toxics present in landfill gas. This is commonsense: it is one thing to smell an unpleasant smell, *but it is entirely another thing to smell a gas that has (or may have) negative health effects*. They are entirely different perceptual standards. It's one thing to be asked if I can smell if someone passed gas, and another to be asked if I can smell the scofflaw chemical plant. The former is a nuisance; the latter is a threat to health and safety, and people respond to it as such.

A prime reason that humans have a sense of smell, and object to smelling some odiferous gases,

Odor impacts vs. uses on adjacent properties and character of the area

Table 1. Odor Index Examples¹

Odor Unit or D/T	Odor Description
1,000,000	Rendering plant uncontrolled exhaust
100,000	Venting anaerobic digester gases
10,000	Sludge centrifuge vent
1,000	Primary clarifier weir cover exhaust
500	Dewatering building exhaust
100	Multistage scrubber exhaust
50	Carbon filter exhaust
30	Ambient odor adjacent to biosolids land application
15	Ambient odor adjacent to aeration basin
10	Design value sometimes used in odor modeling
7	Ambient odor level sometimes considered a nuisance
5	Design value sometimes used in odor modeling
4	Ambient odor level common in a city
2	Ambient odor level usually considered "just noticeable"
1	Ambient air in a community with "no odor" noticeable

Reference
⁽¹⁾ McGinley, Charles & Michael McGinley. (2006). An Odor Index Scale for Policy and Decision Making Using Ambient and Source Odor Concentrations. Proceedings of the Water Environment Federation. 2006. 244-250. 10.2175/193864706783791696.

July 8, 2025 | LU-24-017

from the Staff Report, July 8, 2025. Special Staff has copied Table 1 from the Applicant's Odor Study. It's about wastewater gas emissions, not landfill gas

is because sensing smells is useful to avoid taking hazardous chemicals into the body through the lungs. Yet somehow the Applicant was able to assert, unchallenged, that a “nuisance” study would address the interference effects of landfill gas upon residents and visitors to the area. It’s up to you, Commissioners, to decide whether you agree with that or not.

A second unsubstantiated assertion: Applicant was able to follow up this unsubstantiated assertion with another: that the odor impacts of the

wastewater industry can be used as a yardstick for landfill gas. In its odor study, Applicant asserted that a D/T number of 7 was necessary for the odor to be considered a “nuisance” and as evidence, entered into the record a chart that lists D/T values for wastewater treatment plants. Again, different perceptual standards apply, and more to the point: why did Applicant do so? Surely Applicant has charts that pertain to landfill gas – why did Applicant not use them? This is another question that Special Staff has kicked upstairs to you, Commissioners, to address.

Now we come to matters brought up in testimony, but apparently Special Staff never referred them to Applicant, because the Applicant never addressed them:

A third unchallenged assertion: By its silence, Applicant asserted that the presence of PFAS in landfill gas was not relevant to its interference effects.

Commissioners, there are multiple scientific studies in the record that establish that the PFAS class of toxic chemicals are transported by landfill gas, and multiple scientific studies identifying PFAS as chemicals with known health hazards at tiny doses that are emerging as more hazardous than previously thought (some of these delivered by the OSU researchers themselves). If you search the record of

public testimony for occurrences of the acronym “PFAS,” you will see close to five hundred hits. The reason is, the people of Benton County are concerned that landfill smell is warning them not to take this neurotoxin into their bodies through their lungs, and they do not wish for Benton County to approve an expansion that will inevitably bring more PFAS that will end up in the area’s environment. PFAS are extremely durable – they readily pass straight through the engines in the power generation plant, and through the dump’s flare, to settle into the surrounding environment, where they bio-accumulate. Similarly, they come out of the dump in leachate and bio-accumulate in the environment that way.

These are incendiary findings and so perhaps it’s not surprising that Special Staff, as paid

consultants, have passed the decision about it up to you Commissioners. I would advise you to read the testimony about the emerging harms of PFAS carefully, and consider the long-term implications. Because PFAS are extremely long-lived artificial chemicals, and build up in the environment they're released into, and the ramifications of this are unique and largely unknown but established as potentially severe, and because they will not be remediated by any Condition of Approval (only rerouted) and may not in reality be mitigable, your decision will have profound consequences. There's common acceptance that the lawsuits over PFAS contamination will only continue to increase.

A fourth unchallenged assertion: By its silence, Applicant asserted that the high level of climate

damage caused by landfill gas emissions was not relevant to its interference or burdensome effects.

This section expands upon MFA's Criteria 1 (page 6) and DEQ's Notice, but also responds to (and amplifies) Paul Nietfeld's January 27 testimony, [BOC4_T0783](#).

As established earlier, the Applicant's representations of its gas collection efficiency at the dump are being overthrown by real-world evidence, and this has profound consequences to the dump's interference effects.

I've already related how the Applicant's assertion of 75% gas collection efficiency is rendered untenable given the double-barrel counterevidence from DEQ and Carbon Mapper. Let's bring in more evidence to establish that further, and to quantify its impact upon the climate.

I quoted earlier the Source Emission Rate determined by Carbon Mapper for the dump: it's 1.8 metric tons of methane released per hour. (For this and following, note that Carbon Mapper includes a "plus or minus" confidence window to each parameter.) Note that Carbon Mapper derives this rate from observing and quantifying a source's "super-emitting" leaks (defined by the EPA as methane leakage above 0.1 metric tons of methane per hour). Carbon Mapper does not concern itself with leaks below 0.1 metric tons of methane an hour. CM's Source Emission Rate is therefore not an estimate of total fugitive methane emissions at the dump; total methane emissions will include an approximation of methane that escapes in the dump's myriad small leaks.

Paul Nietfeld's calculations from Applicant data supplied to DEQ gives us an approximation we

can work from: using LandGEM, he arrives at a gas collection efficiency of around 45%. That translates roughly to an estimated additional 0.1 metric tons per hour of methane, so large leaks plus small leaks equals roughly 1.9 metric tons of methane per hour being released into the atmosphere.

A total leak rate of 1.9 metric tons of methane per hour – 16,644 metric tons per year – is a *huge* number. In terms of climate damage, it's around 1.43 *million* metric tons of carbon dioxide equivalent (mtCO₂e) annually, depending on which GWP₂₀ you use for methane. That makes the dump the fourth-largest climate polluter in Oregon, exceeded only by the state's largest power-generating stations (2023 EPA greenhouse gas inventory). Note that those facilities literally power the state, whereas the dump powers less than 1/16th of Corvallis.



Coffin Butte
Landfill working
face on a Sunday

The Applicant is silent about the interference effects that this climate damage has upon the landfill's neighbors and the character of the area, and also about the burden this climate damage may impose upon public resources available to the area. But they cannot be ignored. To do so would be to tear at the social fabric that links our communities with other communities and with the world.

To cite just two examples that are relevant to the land use criteria: our community depends on the cooperative network of firefighters. If there is a wildfire in our area, we can count on responses from other firefighters in the region, elsewhere in Oregon and surrounding states, or elsewhere in the country or the world, depending on the fire's severity. Those are public resources that are available to our community, but which cannot be counted on to

respond if they are too busy fighting fires in their own community or elsewhere. Which is the effect that an expanded dump would have – because, as the DEQ Notice makes plain, putting more trash into Coffin Butte Landfill is the most climate-damaging thing you can do with it.

The second example is about the character of our community. "Character" is first and foremost a word about human values – good character promotes the social fabric, bad character tears it apart. I don't think it's possible for the proposed landfill expansion to be promoted as good for the character of the area, and Applicant certainly didn't try. It's possible, however, to imagine that it would be bad for the character of the area. The Commissioners are aware I'm sure of the studies done about the long-term effects that operations such as prisons have upon

their communities. It doesn't take much imagination to foresee similar effects here. Already the community is dealing with the burden that we have unknowingly become the fourth largest climate polluter in the state; what's being proposed is that we *knowingly* encourage growth to move into the third position, or second, or first. Human effects such as these can seem hard to express in legal language, but they are very real, and of course, they can win. (One can even argue: *inevitably* they win, as each small effort bends the arc of the universe toward justice.)

For the good cause stated here and by many others, please deny LU-24-027, the application to expand Coffin Butte Landfill.

Ken Eklund
37340 Moss Rock Drive
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Ken Eklund's credentials

I am a professional writer, futurist, game designer and narrative designer. I have led teams that have created educational and artistic work honored with a Legacy Peabody Award, two Webby nominations for Best of the Internet, a top award at SXSW, and others. I have worked with educational teams at Columbia University, Montana State University, the Open University at Oxford University, and Arizona State University, where I was a Resident Artist in Game Design at the School for the Future of Innovation in Society, part of ASU's Center for Global Futures. I work with museums such as The Exploratorium and the San Diego museums in Balboa Park. I connect at a deep level with the forests and other natural places around my home north of Corvallis, Oregon.

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Subject: Carbon Mapper Testimony on SB 726, Methane Emissions from Landfills and the Role of Remote Sensing in Mitigation Efforts

The Honorable Senator Janeen Sollman
Chair, Oregon Senate Committee on Energy and Environment

The Honorable Senator David Brock Smith
Vice-Chair, Oregon Senate Committee on Energy and Environment

Senate Committee on Energy and Environment
Oregon State Capitol
900 Court St. NE S-421
Salem, OR 9730

Dear Chair Sollman, Vice-Chair Smith, and Members of the Senate Committee on Energy and Environment,

On behalf of Carbon Mapper, thank you for the opportunity to offer testimony on Senate Bill 726, legislation that would mandate owners and operators of municipal solid waste landfills to conduct surface emissions monitoring for methane gas.

Carbon Mapper is a nonprofit organization with a mission to deliver actionable and transparent methane and CO₂ emissions data that can be used to inform and accelerate emissions mitigation. Our work to use remote sensing to detect and quantify localized methane emission sources is grounded in over a decade of methane research conducted through NASA's Jet Propulsion Laboratory as well as published in the science-based literature.

Methane is an especially powerful greenhouse gas with more than 80 times the heat-trapping ability of CO₂ over a 20-year time period – making mitigation not just an urgent issue but an effective way to deliver swift climate benefits. In 2022, U.S. landfills released an estimated 119.8M metric tons of methane into the atmosphere, accounting for 17.1% of the country's total anthropogenic methane emissions¹. This can be attributed to the breakdown of organic material within landfills which produces methane, and if not captured or destroyed, it escapes into the atmosphere - further accelerating climate change. Landfill gas emissions also pose significant public health risks,

¹ U.S. Environmental Protection Agency. (2024). *Inventory of U.S. greenhouse gas emissions and sinks: 1990–2022*. U.S. Environmental Protection Agency.

https://www.epa.gov/system/files/documents/2024-04/us-ghg-inventory-2024-main-text_04-18-2024.pdf

including contributing to regional air pollution and exposing frontline communities to harmful co-emitted gases and odors.

Practices like installation of gas capture systems, early expansion of gas collection, and waste diversion programs are all effective pathways to reduce landfill emissions. Making informed mitigation decisions based on sound science and data collection is essential to ensuring their efficacy and maximizing returns on both public and private climate investments. Conducting emissions monitoring through a combination of satellites, drones, and ground-based measurements can help stakeholders shift from a reactive to a proactive paradigm while better prioritizing efforts surrounding leak detection, repair, and long term mitigation strategies.

The multi-faceted nature of landfill emissions requires a similarly multi-faceted monitoring regime. Landfills are complex, engineered systems with various potential methane sources. Emissions can either be from diffuse sources, where smaller amounts of methane are released from multiple locations spread over a wide-area, or from point sources, where large amounts of methane come from a single concentrated area. Additionally, landfills are dynamic and the operations change over time leading to changes in methane emission sources. Currently, quarterly walking surveys are conducted using handheld methane detectors. However, these conventional surveys only cover part of the landfill and exclude hazardous areas, such as the landfill work face—the location where new waste is added. As a result, significant methane emission sources could be overlooked.

Tools are needed that can comprehensively monitor landfill methane sources at different granularities. Point source imaging instruments deployed on airplanes and satellites are important tools capable of filling monitoring gaps. These instruments are designed to detect and quantify methane point sources, enabling the identification of facilities with large localized emissions, and in some cases attribution of emissions to specific activities and infrastructure at the landfill. The methods underpinning detection and quantification of emissions have been validated through controlled release tests² and inter-comparison with other technologies, including at landfills³. Over several years of methane surveys across key regions in the U.S., Carbon Mapper has observed about 1/3 of the US's approximately 1,200 open landfills, identifying major methane emission sources at more than 200 of these sites, indicating that there are significant methane mitigation opportunities at US landfills⁴.

There is no one-size-fits-all solution for emissions monitoring at landfills, and point

²Examples: Ayasse, A. K., et al. (2023): Performance and sensitivity of column-wise and pixel-wise methane retrievals for imaging spectrometers, *Atmos. Meas. Tech.*, 16, 6065–6074.

<https://doi.org/10.5194/amt-16-6065-2023>; Thorpe, A.K., et al. (2016): Mapping methane concentrations from a controlled release experiment using the next generation airborne visible/infrared imaging spectrometer (AVIRIS-NG), *Remote Sens. Environ.*, 179, 104–15. <https://doi.org/10.1016/j.rse.2016.03.032>

³Cusworth, D.H., et al. (2024): Quantifying methane emissions from United States landfills, *Science*, 383, 6690. <https://doi.org/10.1126/science.adi7735>; Duren, R.M., et al. (2019): California's methane super-emitters. *Nature*, 575(7781), pp.180-184. <https://doi.org/10.1038/s41586-019-1720-3>

⁴ Example study demonstrating point source emissions at US landfills: Cusworth et al., 2024.

source imaging instruments on satellites and airplanes complement other monitoring tools when used to guide follow-up monitoring by operators with drones and ground-based sensors, paving the way for direct mitigation.

Remote sensing technologies are a useful tool to help facility operators develop and implement mitigation solutions. Through airborne surveys done in collaboration with state agencies in California and Pennsylvania, remote sensing data was shared with landfill operators, guiding follow-up investigation and prioritization of mitigation action. For example, in collaboration with the California Air Resources Board (CARB), airborne surveys of potential methane emitting facilities were done in 2020, 2021, and 2023 in California⁵. During the surveys, methane plume detections were shared with CARB and CARB notified facility operators, including just under 100 incidents at landfills. The plume data guided voluntary follow-up by operators, and in about 40% of cases led to direct mitigation of methane emissions across the oil/gas and waste sectors. These efforts show that when provided with timely information, operators can be proactive in taking corrective actions voluntarily – recognizing that comprehensive monitoring means maximizing gas collection efficiency, making more informed decisions on best practices, and offsetting costs.

Additionally, the identification of high-emitting facilities and attribution of emissions to sources can inform decision-making regarding the implementation of effective best practices and regulatory frameworks. For example, the information gathered through the surveys done in collaboration with CARB allowed methane monitoring data to be connected with operational practices at facilities with landfill operators identifying the landfill work face, malfunctioning gas collection systems, cracks in landfill cover, and construction activities as causes of detected emissions. Building on these findings, Carbon Mapper and collaborators used airborne remote sensing data collected in 2023 at over 200 US landfills to attribute airborne detected emissions to specific sources at the landfill, identifying the landfill work face as a major source of methane. In the study, landfills with work face emissions were responsible for 75% of the total methane emissions quantified, highlighting a substantial opportunity for mitigation⁶.

By linking operational practices to methane point source detections, data can guide mitigation and verify success. For example, large methane emissions were detected with airborne remote sensing at the Sunshine Canyon Landfill in California, and the data were used by local regulators and site operators to guide follow-up investigation⁷. They identified the causes of emissions on-site and took mitigation action—such as installing additional gas collection pipes and improving cover practices.

⁵California Air Resources Board. (2023). *Summary report for the 2020-2021 and 2023 airborne methane plume mapping studies*. California Air Resources Board.

<https://ww2.arb.ca.gov/resources/documents/summary-report-2020-2021-and-2023-airborne-methane-plume-mapping-studies>

⁶Scarpelli, T. R., et al. (2024). Investigating major sources of methane emissions at US landfills. *Environmental Science & Technology*, 58(49), 21545-21556. <https://doi.org/10.1021/acs.est.4c07572>

⁷Cusworth, D.H., et al. (2020): Using remote sensing to detect, validate, and quantify methane emissions from California solid waste operations. *Environmental Research Letters*, 15(5), p.054012.

<https://iopscience.iop.org/article/10.1088/1748-9326/ab7b99>

Further remote sensing surveys verified that methane emissions were reduced, corresponding to a decrease in odor complaints from the surrounding community.

Conclusion

As the monitoring ecosystem grows, the data will continue to inform effective mitigation strategies and best practices, ensuring decision-making is guided by sound science and data-driven transparency. This approach allows for more cost-effective, proactive emissions management, helping to prevent methane loss while guiding stakeholders, ranging from state regulators to industry, toward the most efficient methods for maximizing mitigation potential. As the committee considers SB 726, there are some key takeaways we encourage you to consider, namely...

1. Existing monitoring is not comprehensive, and our scientific research has shown large, persistent point sources at landfills across the US, including emissions from the landfill work face which is left out of traditional walking surveys.
2. We see opportunities for improving methane collection through best practices including the use of advanced technology, much of which is already being used voluntarily by industry, to fill existing monitoring gaps.
3. It takes a combination of tools to paint a clear picture of landfill emissions. Satellite and airborne remote sensing can provide geographic coverage and identify those largest emitters that can be prioritized for follow-up by complementary near-ground methods like drones.

Thank you for the opportunity to testify and we are available to answer any questions or offer additional testimony at your convenience.

Dr. Tia Scarpelli
Research Scientist and Waste Sector Lead
Carbon Mapper