



**MRV Webinar Series**  
**Measuring Methane Emissions from the Waste Sector**  
16 March 2023, Virtual Event

**Klara Zimmerman:**

Everyone, thanks for joining. We'll get started in a few minutes. Just going to wait for a few more people to hop on. Thanks.

Everyone, welcome to Measuring Methane Emissions from the Waste Sector. Thank you everyone for joining. Before we start, we're just going to go over a few webinar software tips.

So first, there are three ways to connect with the audio today. You can listen through computer speakers, use the call me feature to receive an automated call, or use the number included in the webinar invitation to connect. All participant lines are muted for the duration of the webinar, regardless of the audio method that you choose.

If you have any questions, please make sure that you select all panelists from the drop-down menu before hitting send. This will ensure that all speakers see the question. In the text of your question, it would be great if you could say which speaker the question is for. We'll be moderating those at the end of the webinar during the Q&A session. Final materials, including a recording and webinar slides, will be posted to the GMI website at [globalmethane.org](http://globalmethane.org).

You are also going to be asked some poll questions during the webinar. The slideshow panel that you can see in the little image here will appear during the first poll. And to respond, you can just click your answer and hit send. The, we'll also have some feedback questions at the end of the webinar and it would be great to get your feedback.

So, again, if you're just joining, welcome to Measuring Methane Emissions from the Waste Sector. This is part 2 of the Global Methane Initiative's webinar series.

First, let me introduce myself. My name is Klara Zimmerman and I'll be the moderator for today's webinar. I'm a program manager at the U.S. Environmental Protection Agency, where I work on climate change mitigation through reducing methane emissions from the waste sector.

With me today is Kait Siegel, a waste sector manager at Clean Air Task Force, Tom Frankiewicz, a waste methane subject matter expert at the Rocky Mountain Institute, and Mackenzie Huffman, the director of strategy and partnerships at Carbon Mapper. Thank you all so much for being here.

A brief overview of today's agenda. I'll start with the importance of measuring waste methane emissions. Then, we'll hear about some of the latest developments and technologies for

measuring those emissions. We'll hear about the Waste Methane Assessment Platform, or MAP, from Kait and Tom. And then about using satellites to measure methane from Mackenzie.

So, we'll have our first poll question coming on this screen shortly. On a scale of 1 to 5, with 5 being the highest, how would you rate your knowledge of measuring methane emissions in the waste sector? Sarah, I'm not seeing the poll.

**Sarah Chadwick:**

It should be on the right-hand side of the screen. I do see answers coming in so let me know if folks still can't see that.

**Klara Zimmerman:**

Yea, Sarah, if you could just say what the results are, and then we'll move on. That'd be great.

**Sarah Chadwick:** Sure, it looks like it's a pretty even split between 3 and 4 so closer to the high end.

**Klara Zimmerman:**

Okay, that's great. So people will have a little bit of background so hopefully there's something we can still learn and take out of today's webinar.

So, this webinar is hosted by the Global Methane Initiative or GMI. We're focused on advancing the recovery and use of methane as a valuable energy source. We have 46 partner countries, which you can see on the map, and over 700 project members. So those include partners in the private sector, NGOs, financial institutions, academic programs, and others.

As a founding member, the United States through EPA provides technical support to help deploy methane to energy projects around the world. We are focused on 3 key sectors: oil and gas, coal mines, and biogas. The biogas sector includes agriculture, wastewater, and municipal solid waste.

I'll touch briefly on the themes that we covered in our first webinar, which was on the basics of MRV. So measurement, reporting, and verification, or MRV, involves collecting and tracking greenhouse gas emissions data, reporting data in a standard format, and verifying data accuracy.

For biogas projects, it's critical for building national inventories to meet the transparency requirements of the Paris agreement. And finally, GMI is a resource hub for countries seeking assistance in developing robust frameworks that capture emissions and emissions reductions.

Measuring emissions in all sectors is extremely important for transparency and ensuring strong mitigation actions. The waste sector – including municipal solid waste and wastewater – is the third largest source of anthropogenic methane emissions globally, and to manage those emissions, we have to be able to measure them. It's also very important for meeting the goals of the Global Methane Pledge.

The Global Methane Pledge was launched in November 2021 and is now signed by 150 countries and encourages countries to take actions to reduce methane emissions by at least

30% from 2020 levels by 2030 globally. And these reductions are intended to keep our goal within reach to limit warming to 1.5 degrees Celsius.

So, methane emissions from the waste sector are emitted from dispersed and sometimes unpredictable sources, which makes them difficult to measure. The U.S. EPA has developed several tools to facilitate waste emissions tracking, including through the solid waste emissions estimation tool, or SWEET, and the Anaerobic Digestion Screening Tool. All of our tools are available for free download and use with training materials at [globalmethane.org](http://globalmethane.org).

And then specific to MRV, we've developed several resources for methane management in the waste sector. The MRV handbook includes key elements of a methane measurement plan, methane quantification techniques, and key tools and resources. We also would recommend checking out the MRV resource center on [globalmethane.org](http://globalmethane.org). That's shown on the right and it includes best practices that are summarized into really quick high-level steps. It's a great beginner's guide with other links to relevant tools and resources for MRV.

So, we'll have our second poll question here. Our question is, on a scale of 1 to 5, 5 being the highest, how likely are you to visit the MRV Resource Center and the MRV Handbook for guidance on measuring methane?

We'll give people another 30 seconds to answer that. Sarah, if you wouldn't mind reading the results again.

**Sarah Chadwick:**

Sure, so we have a few responses. About 30% of folks marked 3, and about 67% marked high.

**Klara Zimmerman:**

Ok, great. Thank you.

So before we move on, we also wanted to highlight here the Global Methane Pledge Waste Pathway, which was launched at COP27, again, to emphasize that tracking waste emissions help support the pledge's ambitious methane reduction goals. Furthermore, there are new technologies, such as satellites and new data platforms that are either out now or coming online soon. And those are going to be the focus of today's talks.

So, now I'd like to welcome our first two speakers. Kait Siegel joined Clean Air Task Force in 2022 and is the Waste Sector Manager on the Methane Pollution Prevention team. She focuses on issues related to methane mitigation from the waste sector. Prior to joining CATF, Kait worked at Abt Associates as a Climate Policy Specialist where she supported the U.S. EPA, U.S. Agency for International Development, and other organizations in mitigating greenhouse gas and short-lived climate pollutant emissions from solid waste and agriculture. She also worked with clients on improving understanding of the non-climate co-benefits of mitigation and adaptation.

And then Tom Frankiewicz is a Subject Matter Expert for Waste Sector Methane in the Climate-Aligned Industries Program at RMI. He leads RMI's work on methane emissions mitigation in waste management and coordinates the organization's work with the Global Methane Hub.

Before joining RMI, Tom worked for more than 16 years in the Climate Change Division of the U.S. EPA. He led the Agency's work on waste management and climate change, spearheading technical cooperation with national and municipal governments around the world to mitigate super-pollutants like methane and black carbon from solid waste, wastewater, and agricultural waste.

And I'll turn it over to you.

### **Tom Frankiewicz:**

Thank you for the great introduction, Klara. Right, so some of this has been covered already. It's always a question really of, you know, how much context people have on that. Assuming some folks or most folks in this call are already familiar, there's just a few things I'd like to flag. You know, one is that waste, while it may not get as much attention from other sectors, it's the 3<sup>rd</sup> largest source of emissions behind oil and gas and agriculture.

And in the 20-year timeframe, of course, methane has 80 times the global warming potential compared to CO<sub>2</sub>. Why that's important is that not only is focusing on waste a critical pathway for meeting the Global Methane Pledge by 2030, but that by leaning in on methane, leaning in on methane is critical for achieving a 1.5-degree future by 2050.

Two barriers that we identified in the waste sector, and taking a look at assessing the sector for the waste MAP project is access to reliable data for waste and sharing of best practices, tools, and resources.

This has informed a two-pronged approach that we're taking for the waste methane assessment platform, or waste MAP that RMI, our partner Clean Air Task Force are undertaking with funding through the Global Methane Hub.

The platform itself brings together national, subnational inventory, site specific data, and satellite observations, as well as tools and resources, and engaging with countries at the national and sub-national level to assess interventions and provide technical assistance and capacity building at the municipal level to create a feedback loop of engagement. My colleague, Kait Siegel, will be speaking in more detail about our country engagement.

This two-pronged approach is really critical to overcoming these barriers.

So, a little bit more detail on the platform itself. Part of what makes it unique is that it's open access. One of the barriers that we identified is that many information we find are behind institutional firewall. Whether it's national inventory data that's collected and then not displayed, or tools and resources that may only be available to certain stakeholders, whether it's working with specific aid agencies, donor countries, or even sometimes, you know, NGOs will have priority countries and platforms that are only accessible to those members.

At its heart is a visibility map, which layers multiple levels of detail and types of data in year 1 with the expectation of using machine learning to stitch together the data in subsequent years, adding additional data and satellite information as it becomes available. Finally, we envision incorporating a supporting tool to help policy officials and city leaders to determine their

ambitions baseline and assess alternative treatment scenarios. So, this is just a mock-up of what we envisioned waste MAP looking like, but there's a couple things that I'd like to flag.

You know, at the heart of this is the visibility map itself, which brings together multiple sources of national, sub-national inventory, site-specific, municipal-level detail, as well as a range of satellite data that's becoming increasingly available, as well as, in some countries, enhanced and automated monitoring. But we also expect users to engage with this platform in a number of ways. So, beyond the data, there's a number of tools and resources that will be available. Our citizens' waste champion community, as well as the strategic playbooks, a global strategic playbook for deploying various interventions. And also, a way for stakeholders, whether from our deep dive countries, or from other stakeholders in the waste community to bring them together to engage directly.

One of the ways that we've identified to gauge more deeply at the municipal level is to work directly with local citizens. As part of the platform deployment, we will be piloting a tool that allows local citizens to take a picture of wild dumpsites and upload it to our platform by hitting a submit button. It'll become automatically geo-tagged and then log the dumpsite location and any additional information that people are able to provide directly to the platform. This is something we'll be rolling out on a pilot basis and as we see how it's deployed and how people engage with it, then update it and continue to refine it as it's more widely adopted.

To provide some greater detail of our country engagement, I'm going to hand it off next to my colleague Kait Siegel from the Clean Air Task force.

**Kait Siegel:**

Thanks, Tom. So, as I mentioned, we have this two-pronged approach and waste MAP. The high-level platform, which will house all of our data and case studies and resources, but then we really wanted to pair that with country engagement.

Because we know that we need to really be improving data on the ground for this platform to be meaningful and to, like, move data forward in terms of the gaps that we have, in terms of availability, in terms of people, like, folks around the world being able to access more data that's currently behind firewalls, or you know, in people's inboxes and folders on their computers.

So, at the country-level, we plan to work with both national and sub-national governments. And at the national-level, we would like to work with policy-makers and decision-makers to increase understanding of waste methane and the solutions to mitigate it, help them set waste methane reduction targets, and work those targets into other national climate goals that they might have—NDCs, climate strategies and so on and so forth.

And at the sub-national level, we want to work with government officials, waste officials, and other key stakeholders to also build capacity and understanding, but then allow them to speak to each other.

So, we've seen a lot of success with peer-to-peer outreach within the space, where a city in 1 country is able to talk to a city in their country or a city halfway across the world about the successes they've had, the challenges that they faced, and sort of the ways in which they found to overcome them.

It really can spark a lot of great ideas and south-to-south collaboration. So, in addition to that capacity building, we also plan to provide targeted technical assistance to help improve site-specific data and understanding a few key cities within each country that we work with. So, Tom, can you go to the next slide?

So those countries are, um there are 6 in our first year. So Clean Air Task Force is going to be working in Latin America, primarily in Mexico, Colombia, and Ecuador, but, you know, partnering with other organizations working on waste methane throughout the region. RMI is going to be working in Nigeria, India, and the United States in our first year. And we're hopeful that we'll be able to continue this work after 2023 and be able to expand our reach into additional countries and additional regions across the world. Next slide I think, Tom.

So, here are just some key milestones and tentative timelines for you to understand sort of what our work plan looks like. So, right now, we're in a period of very rapid scale-up and assessment, so we are talking to folks on the ground to find local partners that we want to work with to identify the cities that we want to engage with and start speaking with government officials.

We're conducting landscape assessments to understand the regulatory framework in places where we haven't yet worked in. And then use that data to help shore up the work that we plan to do for the rest of the year.

Once that's all in line, we hope to start conducting national and sub-national level workshops in the summer for the fall. Just depending on scheduling and travel, and all the rest. Throughout this whole time, RMI is going to be developing a beta tool of the platform and then begin testing that tool with users in the late summer, early fall timeframe.

Our goal is to really be able to launch the first version of waste MAP and provide a lot of information on what we've been up to over the past year at COP in November, and then spending the rest of the year documenting and reporting, and making sure that we were able to put all of our, load all of our information into waste MAP, communicate with others about why it's important that they also do the same, and hopefully be preparing for years 2 and 3.

Next slide. So we also wanted to give you a flavor of what we've gotten done in these first couple of months. So I was in Mexico about a month ago now, doing some strategic planning, meeting with stakeholders. And we met with the municipality of Naucalpan, who the US EPA and CCAC have provided support to in the past.

So, Naucalpan has been trying to get a mechanical biological treatment facility with an anaerobic digester of the ground for a number of years now because of a number of political reasons. That project has, you know, still needs a bit of a push. And so we met with them, we toured their landfill, we talked with the operators, and some of the, you know, director of public utilities for the municipality, while we were there about how we could support them. And so, right now, we are planning to help them update the waste characterization that EPA did with them 5 years ago. Because they're being asked for new updated information by banks and other private sector partners that they might bid on the project and support the municipality in that. And then with the updated data, help them update their 10-year climate action plan for the city to include everything that they want to be working on in the waste sector. And so, Tom, I think I'll pass it back to you to talk about India.

**Tom Frankiewicz:**

Great. Thank you, Kait. Similarly, we undertook a similar scoping mission just a few weeks ago to India, where we also in working our way, starting in Delhi and ending up in Chennai, engaged with national-level, sub-national, and local stakeholders.

India, is I think unique both in terms of their Swachh Bharat or Clean India Initiative. And we really use that as a launching pad for city identification, and also kind of focusing in on national-level priorities. We worked with the and are working with the state of Tamil Nadu. There's a number of key stakeholders, including the Tamil Nadu green climate company, which is a board of stakeholders from the public and private sector. We are currently assessing the value chain of organic waste to identify areas of assistance. But some of the things that we're seeing already is that there's national-level initiatives to require bulk waste or institutional commercial organic waste generators to treat on site or to pay a vendor to treat, but there's a lot of kind of gaps in terms of understanding and policy implementation, whether it's bulk waste generators being unwilling to pay, or being insufficient vendors available to treat. And so we're looking at ways to build capacity in that area and then identifying specific projects for assistance.

One of the ones that has caught our attention is the Koyambedu fresh food market generates a significant amount of organic waste per day. Previously, there was an anaerobic digester that treated the waste. It's no longer functioning because of operational and contractual issues. And so, we're going to be assessing the technical and financial case for alternative treatment, whether it's a new facility or adding to existing facilities so that waste is no longer a stranded asset. And we also see that there's a significant amount of additional organic waste where there's currently no treatment options. So we are going to be doing kind of an end-to-end value assessment of the waste flow for Chennai, looking at specific projects to demonstrate implementation of their organic waste treatment policies, and then also building capacity at a regional level by bringing in other tier 2 cities to have peer-to-peer information sharing. I think that's the last slide. Thank you everyone.

**Klara Zimmerman:**

Thank you so much, Kait and Tom. It's really exciting to hear about Waste MAP and also the on-the-ground work that you're doing. So, thank you so much. I'll see you again at the end for questions.

Our next speaker is Mackenzie Huffman. Mackenzie is the director for strategy and partnerships for Carbon Mapper, responsible for advancing opportunities that maximize impact and build meaningful partnerships. Prior to joining Carbon Mapper, she was vice president for sustainability at JP Morgan Chase, where she worked to develop and advance their firm's climate and sustainability strategy. There, she led the firm's climate and resilience grant making and reporting, monitored industry and policy trends, and led stakeholder engagement on climate policy, risk, and opportunities. Mackenzie also previously served as the deputy chief of staff at the White House Council for Environmental Quality and then several roles at the Department of Energy, where so focus on policies relating to climate and energy finance. Welcome, Mackenzie.

**Mackenzie Huffman:**

Thanks so much for having me. It's good to be here. And so, after the Global Methane Pledge waste first announced, the focus really shifted from setting ambition to the question of how you achieve ambition, which is a lot of why we're here today to talk about measurement and monitoring. And RMI and Clean Air Task Force's work is really critical for driving that tangible action. But, as they mentioned, you know, a really key element in taking that action is the data and making it useful for decision-makers and finding ways to feed it in to the efforts on the ground. And so at Carbon Mapper, that's really what we're focus on—this data question and especially for the waste sector. And where we kind of focus is using some of these advanced technologies to bring more visibility to mapping emissions.

And so I thought I would just give some brief context on the landscape of monitoring technologies. And I know there's a lot to this, so I'll just hit the night notes, but there's a lot of emerging tools in the monitoring space, and a lot of them are addressing different parts of this methane measurement and monitoring question, and they are becoming incredibly useful for all sorts of sectors, especially the waste sector.

So, on kind of one hand, you have monitoring that supports aggregate accounting and inventory development. And on the other hand, there is measurement and monitoring tools that can support direct mitigation guidance. And so this is really at the local and facility level. And to address both of these different types of monitoring questions, you need this portfolio of technologies and approaches. And these can range from ground-based sensors to airborne satellites. Because, as we all know, there's not 1, sadly, magical technology that can answer all of the questions or see all of the mapping.

But these technologies are really starting to work together to support kind of tiered observing strategies to provide more insight on methane emissions overall, which is really, really important and especially important for the waste sector to kind of bring more understanding to those emissions. Though despite this really exciting emerging ecosystem of technologies and actors, there are a number of gaps and barriers. And so there always needs to be noted. One, trust in the data is still coming along. Capacity to use the data is a really big one. And then finally, and this is always the big one, is implementing and scaling these solutions.

They take a lot of financial and people resources and so that's always a huge barrier, especially when you think about a global context. Where Carbon Mapper comes along and where we're focused is that we are really built to address a number of these gaps. And primarily in the context of providing data to guide direct mitigation on the ground at the local level in the waste sector is a particular focus for us.

And so just a little bit about Carbon Mapper if you're familiar with us. We're a non-profit that is focused on making methane and CO<sub>2</sub> data actionable and accessible. We are specifically focused on using remote sensing technology to detect, pinpoint, and quantify methane and CO<sub>2</sub> point sources, so at the scale of individual facilities. And a really important element of the work that we are doing is that all of the data that we collect and analyze will be publicly available on our public data portal, which is, you can access via our website.

Because, as was mentioned, having access to this data is really, really critical to action, and it's also why we're really focused on working with organizations, like RMI, Clean Air Task Force, and



others as part of the Global Methane Initiative to get this data into the hands of those who can use it.

So, to do all of this work, we actually lead a really unique public-private partnership that was powered by philanthropy, and it brings together expertise across policy, science, and technology. It includes partners at NASA jet propulsion laboratory, the Commercial Company Planet Labs, the California Air and Resources Board, as well as RMI, among many others.

And one of the main goals of the coalition is to develop and deploy a constellation of methane detecting satellites. And so, right now, we are focusing on, we're working to launch 2 satellites by later this year and early next. But the goal is to try to expand those capabilities to allow more frequent measurement and monitoring. At Carbon Mapper, we also conduct a number of aerial methane surveys using a similar instrument that's on the satellites, but instead is on an airplane. And today, we've largely focused on the U.S. and Canada, but we are actually currently in the middle of a campaign in South America, which is really exciting and we've seen a ton, especially in the waste sector.

And so, with that background, you know, I mentioned that our, where we are mostly focused is on data gaps at the direct mitigation level. And so, what that looks like for remote sensing, is that means that we're focused on what we call high emission point sources. That's really where we are optimized to see emission events. And you can see an example here of a plume at a landfill, and this is kind of, you know, very similar to what we tend to observe using remote sensing tools that we have.

And so, generally, you know, there are 2 types of these types of sources that make up emissions. So, there's point sources, which are large high emission events that are at the level of individual facilities, and then area sources, which are more diffused sources of methane over larger areas. And the reason we focus on high emission point sources is when we were optimized for it in part because studies have shown that a handful of high emission methane point sources in some regions can contribute between 20 to 60 percent of regional methane emissions. And what that means is that if you are able to identify these emissions and then work to address those sources, it can lead to some real impacts on reducing regional emissions.

But the key is that we need to be able to see them. And we see high emission sources across a number of major sectors, which I don't need to tell everybody here, but oil and gas, ag, coal, and waste. And then, obviously, addressing methane in these sources leads to a lot of community benefits in terms of air quality and public health.

And so, this is a bit of why we're focused on getting more data about these sources, and especially bringing more visibility to the waste sector, which can help support major emissions reductions through a lot of these great initiatives that are ramping up and getting underway.

You know, as we all talked about the waste sector has been under emphasized for too long. And so, and one of the biggest challenges that we do have around waste methane is that we have limited information globally about, you know, where are the emissions generally, as well as, kind of getting more information on their root causes. But these advanced technologies, as more and more of them come online and more of that data is made publicly available, we're beginning to fill more of those gaps and especially help inform improvements and prioritize investments on

the ground. And especially in this, something we're really excited about with once the satellites launch, and the global visibility, is supporting countries who don't have access to this kind of data today or it's really, really hard to get, as Kait mentioned. You know a lot of times it's behind paywalls, or hard, just harder to access.

And so our approach for the satellites has been informed by a lot of ongoing work, using aerial methane surveys that have driven mitigation. And so just, this is one kind of real-world example of where this type of data helped reduce emissions. And so, this was at Sunshine Canyon landfill in California. And so between 2016 and 2017, research scientists conducted an airborne methane survey over the Sunshine Canyon landfill in California using a NASA imaging spectrometer, which is what allows us to detect these emissions. And the survey identified a number of methane plumes above a thousand kilograms an hour. That data was shared with operators and regulators, and they worked together to identify the root causes of the emissions and then target improvements and implement those improvements.

And we continue doing aerial overflights, which helps to inform as the improvements were being implemented, and then also to validate emission reduction efforts. And so you can kind of see the before and after to the right, as they were actually, in practice, updating and mitigating some of these emissions. The community also experienced the benefits. So, this graph is really tiny and hard to see, but essentially it shows that the reductions in methane also correlated with a reduction in odor complaints, which was one of the driving factors in kind of pushing for more mitigation at this particular site. And so just to, this just tries to illustrate how it's really helpful to be able to see how these improvements helped to reduce methane. But as we all know, these waste sites are really dynamic and new emission events can continually occur in new places, or in the same places. And so what's equally important is to sustain monitoring and to make sure that emissions stay down and we can catch events as they occur to really try to keep our methane budget in line.

And so building on the work that we have done with our airborne surveys last year, we announced a new waste methane initiative. As part of this effort, we will be working to develop a global baseline assessment of high emission waste sites. And so to do this, we will be leveraging our regional airborne campaigns that are underway currently as well as leveraging satellite data. This is a 2-year initiative. So, this year, well, like I said, we'll be using, we'll be analyzing detections from our airborne campaign as well as from the NASA instrument EMIT, which is an instrument that's currently on the International Space Station, but it has the capabilities to detect methane point sources. And then, next year, we will be leveraging detections from our coalition satellites.

Once they've launched and this work will dramatically scale-up insight into methane emissions of upwards to 10,000 waste sites globally. So providing a lot of really granular data for a lot of new sites, which is great. And our goal is to really build on and complement the work that is part of the Global Methane Pledge Waste Pathway and to help support and drive get this data into the hands of those who, who can use it, which is really, really critical. And so we've been doing a lot of work to engage and help inform, you know, policies, operational monitoring, and investments for waste sites. And, most importantly, we are working very closely with our

partners to do that. And so, my final note, this is kind of just gives you a good sense of the kind of coverage that we'll have, and where we're planning to target our observations.

You can kind of see that, you know, to date, regional surveys have been really informative, but they offer really limited coverage. And this is where global visibility of satellites can provide some game changing visibility into methane emissions. And the Carbon Mapper coalition satellites are specifically designed to optimize for global point sources and so to really give us visibility into as many of these sources as possible all around the world at a really granular level. And so it really is going to help identify prime targets for mitigation and help to drive action on the ground and we're working really closely with partners like RMI and Clean Air Task Force, as well as other groups like C40 and Global Methane Hub, to make sure that key regions in the waste sector, and that are a focus of our NGO partners, and others will be included in these observations to just make sure that the data we're collecting can actually feed into efforts that are ongoing and on the ground.

And I didn't include an image of it, but we do have a data platform and all of the data that we collect and analyze will be available on the platform. So, to date, it's really just our aerial surveys, but we will slowly be filling it up with our analysis of EMIT data, which is very exciting. And we're also in the process of updating that portal to make it a little more user friendly. So that's actually really exciting. And those will be coming kind of later this summer and early fall. So a lot of great ongoing work to make this data more user friendly and a little bit more actionable and so really looking forward to taking questions. Thanks everyone.

**Klara Zimmerman:**

Thanks so much, Kenzie. That was great. I just want to encourage the audience to keep posting questions in the chat. Before that, I will summarize some key takeaways just before we get to the Q&A. So first, to summarize, the Global Methane Initiative has some great resources on measurement, reporting, and verification that we encourage you all the access. Waste MAP will highlight, when it launches, emissions reduction opportunities and best practices to accelerate achieving the Global Methane Pledge goals. And finally, satellites detection capabilities like Carbon Mapper will enable identification of persistent high emitting sources globally. So, also, please just want to mention please stay tuned for our next webinar in the series, where we'll explore best practices and case studies.

Okay, now I will open up the Q&A. So, the first question e received is for Kait and Tom. Will waste MAP be expanded to more countries other than those shown in the presentation? And what will be the timeline?

**Kait Siegel:**

Yea, and we've been asked this similar question in the past so, the launch of the platform, which Ton can talk a little bit more about will have a global coverage. And we'll be pulling in, you know, open-source data from inventories and what, you know, we are able to gather at its launch. Our in-country work will be in those 6 countries in year 1, and then with additional funding, we would like to expand into other countries in year 2. But all of this is to say, if, you know, you're in Brazil, for example, you want better data on Brazil, and you have it, you know, within your grasp, and you want to see it in the platform, please send it to us and we will upload it so that others are

able to, you know, get access and see your contributions. But, for the first year, the in-country engagement will just be in those 6 countries. Tom, anything to add there?

**Tom Frankiewicz:**

No, I think that covers it. I mean, we are going to be doing our best to get global data. We're reaching out to stakeholders, we're starting, we're kind of working our way up the pyramid, starting with the kind of globally available information that may be less detailed and working our way up to more detail, but then, with less coverage. So, part of the reason why we're participating in webinars like this is to really get the word out about the platforms so stakeholders know that they can engage with us directly to start sending us information because, you know, recognizing that, as we get more granularity, we may not have national coverage, it's still really helpful to have representative data from 2 or 3 cities that can be modeled up, rather than just national inventories that we then apply down.

**Klara Zimmerman:**

Great, thank you so much for the updates. Kenzie, a few people have asked how Carbon Mapper is quantifying emission rates and the limit detection. I don't know if you could speak to that.

**Mackenzie Huffman:**

Yea, so what I will say is, there are a number of studies that provide the detailed methodology of the quantification on our website that I can share. But we have a science team that is actually, that does that analysis. And I am not a scientist and so cannot speak to it in the most appropriate way, but I will say that it is definitely, definitely we have a number of efforts underway that really work to validate those quantifications. So doing controlled release studies, as well as some blind studies using the airborne survey, or aerial surveys, through different operator as well to make sure that those quantification estimates are as accurate as possible. We also do include a number of uncertainty rates so it kind of can better inform that. But I can send some materials that will answer those questions a little bit more effectively than I can.

In terms of detection limit for the satellite, so that's a great question because that is what's really important. So, as I mentioned, we specialize in point sources. And so, we do need kind of high emission events at a very localized scale. And so, for the airborne surveys, the detection threshold is around 10 kilograms per hour, and then for the satellites, it's about 100 kilograms per hour. So, what we'll be able to detect with the satellites is, is most of these high emission sources. What we can't detect is anything below that, which is why I was really emphasizing the need for a tiered observing system. Because there a lot of methane in that "in between" where other sensors and other monitoring tools are definitely needed to be able to really see where the methane is coming from and what it is. But by being able to kind of identify the low-hanging fruit in a sense and the big emission events can help to target and give us a better sense. And there's a number of other initiatives, methane satellite initiatives underway, where we're really also hoping to build together. So we work, you know, there's TROPOMI, which is a global mapper and helps to really identify huge, huge, huge sources and that can help to tailor where satellites like ours, which focus on more point sources can look to better target specific areas. But then there's also MethaneSAT, which is coming online as well.

**Klara Zimmerman:**

Thanks. And then another question that came up that's interesting is, let's say there's something like the Sunshine Canyon that you showed, where the facility operators are actually working to mitigate the event, is that something that they can share with Carbon Mapper? Like kind of include that event as report?

**Mackenzie Huffman:**

I think I'm tracing the full question, but I saw another question in the chat about kind of how many operators tend to report mitigation of events that we've seen as well. And so, what I'll say is so we actually did a full survey in California. So some of the insights that we have is, we did, so there's been this effort to really concentrate effort working with the California Air and Resources Board and others in California over many years called the California Methane Survey. And in that, a lot of this data was collected and then shared with the operators. And the operators themselves, in that kind of study, about half of the operators took a voluntary action to mitigate those initiatives. And so that was actually really great to see. And so now that's studies spanned more than just waste. So it included landfills, and crude oil and gas, and feedlots, and waste. But that's really what we have seen. And then the Sunshine Canyon case study is actually featured in our RMI waste methane report, best practices report, so there's a lot more detail there, especially on waste quantification, that I would encourage folks to take a look at, because it's a really good overview of how this type of quantification can actually support waste methane best practices in the waste sector.

**Klara Zimmerman:**

Great, thank you. I'm going to take 1 of the questions quickly. There's a question to all panelists on if there's any guidance on pilot-level field quantification of biogas emissions from landfill sites that don't have an established collection network and resources for that.

So, one resource that I know of is the U.S. EPA's Landfill Methane Outreach Program, which is all about encourage gas capture and so it is U.S.-based. But there's a project development handbook that talks about, all about, you know, how to capture and store gas, and what it can be used for. I don't know if anyone had anything else to add to on that question.

**Tom Frankiewicz:**

I think that's really helpful, Klara. And, you know, I would just add, right now, and this is the kind of, one of the challenges I think, the type of enhanced monitoring that Mackenzie mentioned is really trying to get out is, you know, when you don't have a collection system, then you're really relying on modeling. And you know, without kind of sidestepping the debate about models, they're only as good as the waste characterization data that you have. And so, in situations where you don't have very good data on the site, either the model becomes increasingly inaccurate. And so there really needs to be a combination of both modeling to fill these gaps, but then also satellite, aerial drone, variety of measurement technologies that are increasingly doing a much better job at quantification beyond just leak detection. And so, that's one of the challenges that this is trying to get at.

**Kait Siegel:**

I'll just add, I read that question a little bit differently, talking about, like at the site. So, in the U.S. landfill operators are required to do, like surface emissions monitoring with, like a handheld gas analyzer. So, there, that does happen, whether or not you consider that to be very effective or efficient is another question. But, RMI guide that they put out last summer actually as a good description of all the different ground-level, like measurement and monitoring devices that could be and are being tested for landfill use, but I don't think that there are any, there are no resources that I know that are a guide to, like, how to actually go about using those materials to measure emissions at landfills. But as Tom and Kenzie mentioned, this is what people are, this is what many in the field are thinking about and trying to understand right now. So it's an area of, like, active research and I'm sure things will be coming out.

**Klara Zimmerman:**

Great, thank you. Okay, let's go look at the questions then. So, Kait and Tom, one question that came up is how your data collection is going to be documented.

**Tom Frankiewicz:**

Thank you. I'm trying to track these questions and prioritize them, but it's a little hard to follow them as they're coming up. So, if I think I understand that, quickly in terms of the methodology for data collection, there's maybe, you know, I guess two kinds or two buckets of methodology. I mean, there's the actual firsthand data collection. So you know, we were working with groups like, you know, UNEP, and their Waste Wise Cities tool, which has really, you know, some of the best, I think, documented methodology for data collection. But it can also be labor intensive or expensive to implement. And so we're trying to encourage the use of that methodology and partner with first hand data collection, but also recognizing we're mostly collecting existing data at this point, you know, with the exception of some of the first hand data collection that we're doing through our country engagement. So, for that part of the kind of this open platform approach that we're taking is any data that is incorporated into the platform, we'll be both documenting the source obviously providing kind of the full dataset. And also kind of trying to highlight some of the distinctions in the methodologies used and the fields included so we're really trying to, you know, again, I mean, I think it's really important to flag because I think sometimes people just expect these platforms to just show them everything and have it be brilliant, but part of the value proposition of this platform is bringing together all these different sources and being really clear about where the data's coming from, what's included, and what's not, because as many of you in the waste sector know, we're big proponents of recycling. But, unfortunately, the data is highly recycled, and oftentimes a variety of reports are still coming from just, you know, two or three main sources of data. And so, we're trying to be very clear about where our data's coming from.

**Klara Zimmerman:**

Thanks, Tom. And I guess, not from the chat, but 1 of the other questions we thought might come up kind of on the note of the data is are there any best practices for dealing with missing data. So, what I'll say on that is there's IPCC guidelines for national greenhouse gas inventories

that have methods for resolving data gaps, like overlap, surrogate data, interpolation, and trend extrapolation. But you know, project developers have to use methods that they think are reasonable and supported by data during the measurement period and are conservative in nature. It is definitely a trick question. And if there's any substitution method, it should always be noted and articulated. I don't know if you all have anything else to add on that. I'll take a quick look at the question box again.

So, there's one question, is the data verified and used in permitting and compliance by regulators. And I think that remains to be seen for all of the technologies. Like these are really new and coming online. So, TBD on that one.

**Tom Frankiewicz:**

So Klara, I have a question that popped into my Q&A box.

**Klara Zimmerman:**

Oh yea, it's possible. I meant to ask you all if people had sent ones directly to you. Yea, go ahead Tom.

**Tom Frankiewicz:**

Okay, I was a little confused about that, so I'm going to, I'll go ahead and read the question then as well. This is from Javier. So North America and Europe are considered good at mitigating emissions from the waste sector. Every landfill collects biogas and burns it or uses it to generate electricity, or RNG, or biomethane. In other areas of the world, Asia, Africa, South America, gas collection is not that common. Correct? If so, what is the main effort we can do to mitigate emissions in the waste sector outside of Europe and North America? Is it to regulate gas collection systems?

So, I'll reframe that a little bit. I mean, yes, there is, you know, different parts of the world, there's going to be different approaches just based on current landfill gas treatment. You know, I think in Western Europe and North America, you know, Australia, Japan, well I would say Australia, I think that rely heavily on landfilling and gas collection is required or implemented to some degree. In the US because we do have extensive landfill systems and with the, you know, with the introduction of the low carbon fuels standard, renewable portfolio standard, you're seeing an increasing amount of landfill gas energy projects that are using RNG as the, you know, kind of the off take. Although electricity is still the dominant, just in terms of numbers. But, I think one thing that, you know, initiatives like Carbon Mapper are identifying is that there's still a significant amount of leaks coming out of them. So, I mean, one landfill gas collection is not required for all landfills. It's above a certain size and after a certain amount of waste is in place and so there's a lot of emissions coming out of those sites. But even the ones with gas collection systems, efficiency is not as good as I think it previously anticipated, so there's a lot more that can be done there. And that's where enhanced mitigation, enhanced monitoring really comes into play.

In countries where gas is not required, a different approach does have to be taken. So there's still definitely a role for better data and monitoring. But then, you know, that's where things like organic diversion and, you know, avoidance of the waste from going to the dump sites really

becomes a factor. I guess, you know, just to kind of fully kind of circle around on this, you know, in countries with more extensive gas collection, it's still real because collection efficiency is much lower than previously assumed, so organic waste diversion is still a priority and in some ways, it's even harder to introduce in countries with well established treatment systems because there's so much investment already made in infrastructure. So it's still, you know, one way or the other. It's a combination of improving monitoring, promoting gas collection, but really leaning in on organic diversion.

**Klara Zimmerman:**

Yea, definitely, thanks Tom for bring in that end-to-end approach in there and for pulling out that question. I think this is a good place to close this out. So, I want to thank all of you again so much for speaking and thank you everyone for joining. If you have time, please, it would be great if you could submit the feedback form that's going to come up on the screen. Thank you so much.