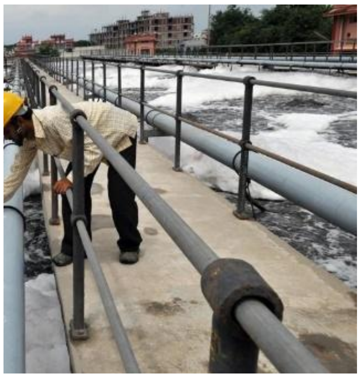

Methodology for Methane Quantification from Sanitation Service Chain

August 2025

CWAS CENTER FOR WATER AND SANITATION
CRDF CEPT RESEARCH AND DEVELOPMENT FOUNDATION
CEPT UNIVERSITY

Methodology for Methane Quantification from Sanitation Service Chain

Center for Water and Sanitation

CRDF, CEPT University

August 2025

Note

This document outlines the rationale and methodology for conducting on-field methane quantification and assessment across the sanitation service chain. It provides a comprehensive overview of current technologies and approaches available for on-field methane quantification. The document provides details related to the sampling criteria, procedures, and parameters necessary for on-field methane quantification and improving its database across the sanitation sector at local level in context of developing countries.

The quantification regime is developed based on referring the various global research efforts done by various organizations and IPCC methodology. The methodology has also been reviewed by sector experts. We gratefully acknowledge the valuable feedback provided by Dr. Devasena M. (Chief Technical Officer, Global Sanitation Center of Excellence, IIT Palakkad), Daniel Ddiba (Research Fellow, Stockholm Environment Institute), Dr. Srikanth Mutnuri (Professor, WaSH & FSM Lab ,Department of Biological Sciences, BITS Pilani, Goa), Prativa Poudel (Ph.D. Scholar, Department of Environmental Science and Engineering, Kathmandu University), Dr. Tushar Bose (Professor, CEPT University), and Dr. Dipsha Shah (Professor, CEPT University).

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1. Introduction

The water and sanitation sector is one of the most affected by climate change. A major reason for this is the rise in greenhouse gas (GHG) emissions, which contribute to ozone layer depletion and global temperature increases. At the same time, water and sanitation services also generate GHG emissions through infrastructure development, service delivery, and overall management.

Efforts to estimate GHG emissions in the WASH sector suggest that it contributes about 3% of total global emissions and 7–10% of methane emissions, making it the fourth-largest contributor to global methane (DeFabrizio et al., 2021). However, current estimation methods often rely on large-scale national or state-level data, which tend to provide inaccurate emissions from the sanitation sector. These methods also fail to capture the complexities of different sanitation systems and technologies (Lambiasi et al., 2024) in developing countries.

Most existing research focuses on developed countries and related sectors like solid waste management, with well-documented data on waste characteristics. However, there is limited data on sanitation systems in developing and underdeveloped countries. This leads to missed opportunities for mitigation and usage of these emissions as resources, as the wastewater sector is rarely considered in climate action efforts.

1.1 Project Need

This program aims to accurately measure greenhouse gas (GHG) emissions in developing countries like India by conducting on-field assessments at the city level, especially for methane emissions. By measuring emissions across the sanitation system, the project will help identify ways to reduce emissions, use methane for resource recovery in wastewater management, and lower overall direct and indirect GHG emissions.

2. Overall Approach

This project aims to measure methane emissions across the sanitation system and find ways to turn them into useful resources, making sanitation services more sustainable. The study will be conducted in urban areas of Maharashtra, India considering different demographics and sanitation services system and technologies.

The study will focus on both onsite and offsite sanitation systems. On-field GHG measurements will be taken at different points in the sanitation system using various methods, including:

- Septic Tanks (onsite systems)
- Sewer Networks (maintenance holes, offsite systems)
- Sewage Pumping Stations (offsite systems)
- Sewage Treatment Plants (offsite systems)
- Untreated wastewater disposal

After collecting data from selected samples, the results will be used to create local emission factors, which will then be applied at the city level to estimate total sanitation-related GHG emissions (Scope 1 and Scope 2). Different scenarios will be developed to better understand emissions across the sanitation system and identifying areas where these can be used as resources

2.1 Detailed methodology for different sanitation value chain components

To measure methane emissions accurately, we reviewed various methods used in sanitation, industry, and related sectors. The most common approach in the sanitation sector is the flux chamber and Gas Chromatography, which is a lab-based method as well as field-based method. Other advanced methods from different sectors include stack-based approaches, handheld sensors, fixed sensors, drone-based sensors, and optical methods. The Annexure 1 showcases the reviewed literature and methodology adopted to quantify the emission.

Based on available resources and field conditions, we have selected the following suitable approaches for on-field methane emission measurement:

- **Stack-based approach with handheld sensor –** This approach uses the industrial emission quantification methodology in which the emissions or concentration is measured based on the airflow passed through the sensor. This approach uses the point source emission approach and uses the airflow to quantify the emission using the gas analyser sensors based on electrochemical sensors having a range of 0 – 5 %. It uses the NDIR (Non-Dispersive Infrared) gas sensors with probe attached to detect gas concentration and capture the methane reading.

  The portable handheld sensor will be used for the determination of methane concentrations at the particular area at STP, pumping station, and sewer network by estimating the airflow for that particular closed space by placing a flux chamber and estimating the gas concentration in the chamber through the gas analyser.

Also, exploring the handheld sensors with airflow sensors to quantify the methane emissions at the point source by dividing the facility or emission source area into a grid of 10 sq. meter, capturing the reading for each 10 sq. meter block and map the emission over the created grid.

- **Fixed sensor (Ambient Air Quality sensor) –** This approach uses fixed sensors or ambient air quality instruments to estimate the emissions through the continuous monitoring of airflow and a particular gas analyzer sensor installed. The fixed ambient air quality sensors will be installed at the STP site to measure the methane emissions at the STP site. The sensor uses the Molecular Property Spectrometer (MPS) technology for the quantification of the methane emission. The fixed sensor will include the sensor related to the air flow measurement, temperature, humidity, precipitation, and wind direction.

- **Senor + Flux Chamber approach** – This approach uses a flux chamber is placed in the system which is connected to the sensors/ gas analyser for understanding the concentrations.
- **Lab-based testing approach –** This approach uses the existing established relationship between the biochemical and physical characteristics of the wastewater and sludge and methane emissions. The emissions will be derived from the lab results of the below-listed parameters at the interval of alternate months:

Sr. No.	Effluent Parameter	Sludge Parameter
1	BOD	BOD
2	COD	COD
3	VSS	DO
4	TSS	Temperature
5	pH	pH
6	Temperature	VSS
7	DO	TSS
8	ORP	ORP
9	Total Nitrate	Total Nitrate
10	Total Nitrogen	Total Nitrogen
11	TKN	TKN
12		Biomethane Potential (BMP)

This will help validate the emissions readings from the handheld sensors and assist in calculating the methane emissions based on the theoretical formula and existing relationship between VSS and COD.

- **Optical methods –** Through discussion with experts, we have found out that the existing satellite resolutions we are not able to track the plumes from the sanitation value chain due to diffusion of methane in the atmosphere. To overcome this challenge, we are currently exploring different available optical methods such as the infrared, optical sensors, hyperspectral imaging approach, and drone-based sensors for estimating the GHG emissions.

Based on the available resources and access to the technology and implementation feasibility at the location, below are the approaches selected for the different sanitation value chain components.

- **Septic Tank (Onsite System)** – Using the portable gas analyser and airflow sensor, flux chamber and sensors/ gas analyser, and testing the effluent
- **Sewer Network (Maintenance hole)** (Offsite System) - Using the portable gas analyser and sensors and testing the effluent
- **Sewage Pumping Station (Offsite System)** – Using the fixed air quality ambient sensor for methane with air suction mechanisms and lab-based biophysical and chemical parameter testing.
- **Sewage Treatment Plant (Offsite System)** - Using the flux chamber with the portable gas analyser, using the Arduino based sensor for methane, and lab-based biophysical and chemical parameter testing.
- **Untreated disposal of wastewater** - Through the COD relationship with GHG emissions

These approaches will help us measure methane emissions more accurately and identify potential sources of methane emissions and explore pathways to reduce or enhance resource recovery in sanitation systems through exploring different capturing mechanisms and transforming methane emission into useful resource.

3. Sampling Methodology

To measure methane emissions, we have selected cities in Maharashtra based on their different demographics, and types of sanitation systems. The cities represent different sanitation models to ensure a diverse and comprehensive study. The section below provides the basic details of the selected cities.

Table 1 City details

Sr. No	Parameter	Ichalkaranji	Pimpri Chinchwad
1	Population	368k	2.8 million
2	Household	67.8k	0.66 million
3	Area (Sq.Km.)	10.55	181
4	IHHT coverage	70 %	97 %
5	Wastewater generated	36 MLD	332 MLD
4	Sanitation system	Partially on sewered (60 %) and rest on onsite system (40 %)	95 % Sewer system and 5 % onsite system
5	Sanitation treatment facility type	STP: SBR (Sequential batch reactor) (Aerobic)	STP: SBR, ASP, extended aeration and biotower
6	Reuse of used water	No reuse	31 MLD

Selected Cities and their Sanitation Systems:

- Ichalkaranji – Mixed sanitation system (both septic tanks and sewer networks).
- Pimpri Chinchwad – Mixed sanitation system (both septic tanks and sewer networks).

The samples for each sanitation component are carefully chosen within these cities to capture variations in sanitation infrastructure, operation, and maintenance. This approach ensures a realistic assessment of methane emissions across different urban settings.

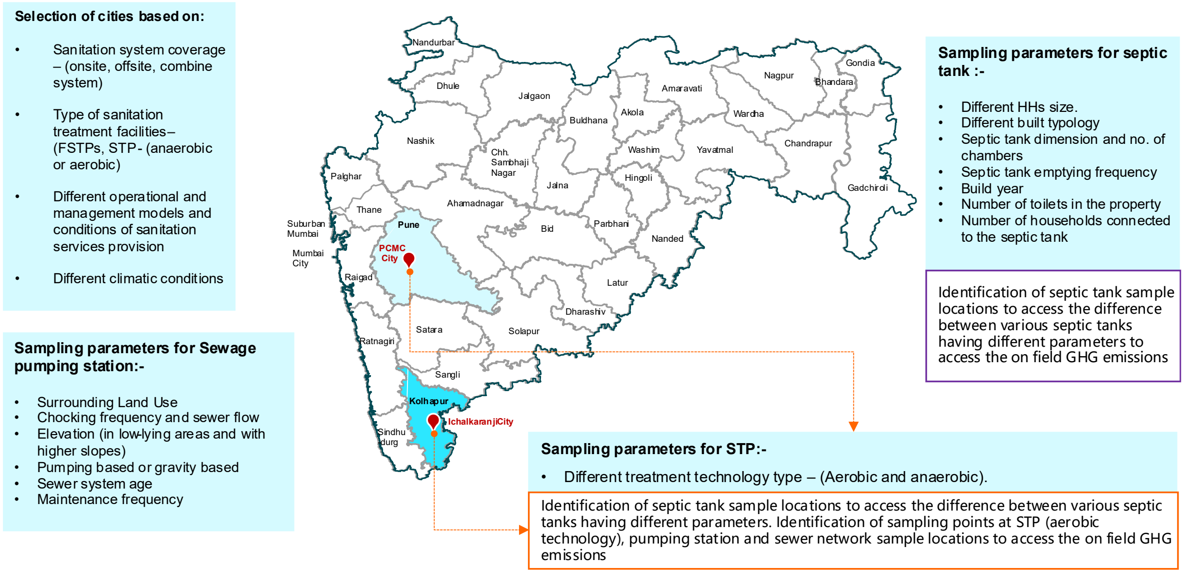

Figure 1 Cities identified for On-field emission quantification

3.1 A. Septic tank – Quantification of Methane through the handholding instrument

To quantify the methane emissions at the septic tanks, the following steps will be followed

Step 1: Selecting Sample Septic Tanks in the cities of Ichalkaranji :

1. To identify the samples for on-field emission quantification, different parameters are selected, and samples are stratified based on the below-listed parameters*:*

1.1. location (slum and non-slum) household.
1.2. emptying frequency
1.3. septic tank size
1.4. Property sub-type (Bungalow, Row house, Apartment, chawl and other) and Hotels and restaurants
1.5. Family size
1.6. Inlet to septic tank: blackwater or both black and greywater

The septic tank inventory will include various datasets about the sample, such as demographics of selected households, type of toilet, septic tank outlet connection and conveyance, groundwater level, lined or unlined, sealed or with access cover, sludge depth, and scum layer availability

2. Selection of all types of toilet facilities – 1. Household level & 2. City level or community level.

3. Identification of around 40 septic tanks will be a mix of residential, commercial, institutions, community/ public toilets with variable seats and sizes. This activity will be carried out in the city of Ichalkaranji.

Step 2: Arrangement for taking samples (plumbing requirement):

- **Selection of different types of septic tanks** based on key characteristics.
- **Modifying the vent pipe** to allow accurate methane readings (see Figure 2 A for plumbing arrangement).
- **Sealing the pipe joints** with M-seal or white cement to prevent gas leakage
- **For septic tanks where flux chamber will be immersed for readings, an accessible cover is being replaced by a fixed cover which will be easy to open and close**

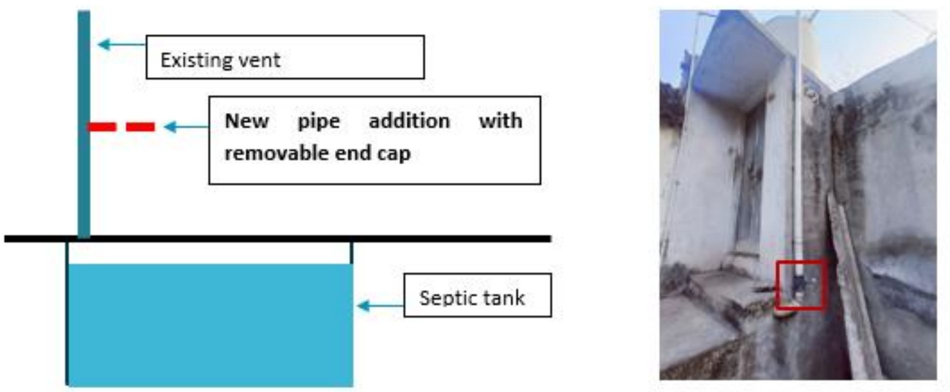

Figure 2 A: Details of the plumbing arrangement carried out for on-field emission quantification

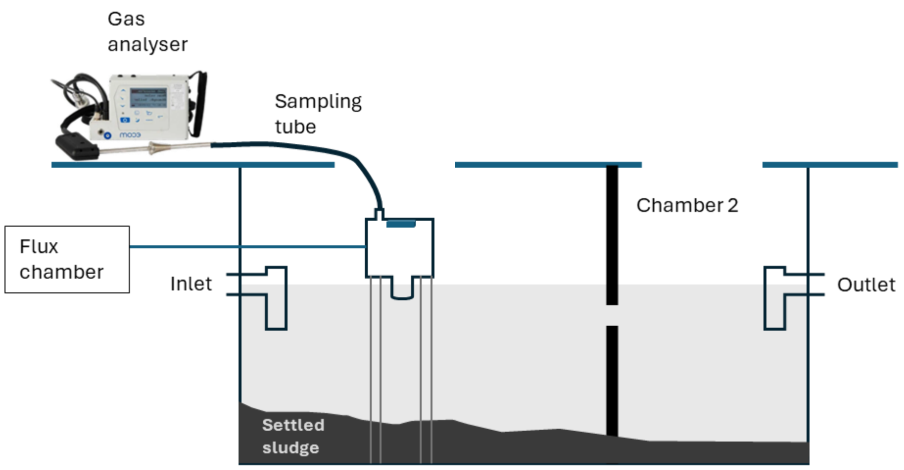

Figure 2 B: Flux chamber placement and sampling from the septic tank

Step 3: Sampling timings:

- The readings will be taken at 2-hour intervals from 7 AM to 7 PM for 14 days daily and from 3 AM to 6 AM for 7 days for the selected septic tanks.
- Exploring the implementation of 24/7 monitoring through the Arduino-based methane sensors and flux chamber at selected septic tanks.
- Based on the data received for all septic tanks for 14 days, further analysis will be carried out, and the peak hours for emissions will be identified.
- Later peak hours will be monitored for all the septic tanks for duration of nine months, along with mapping of the seasonal variability in the emissions.

Step 4: Measuring Methane Levels:

- Turn on the instrument.
- Ensure it showcases the zero value.
- Please note the temperature and humidity of the day you are measuring also for the septic tank reading showcased on instrument screen.
- Close the vent pipe above the cover and create an air-tight environment.
- Then open the perpendicular pipe end cap and then insert the unit into the pipe and hold the unit for 1 minutes and note the constant value that is highlighted on the unit.
- Once the value is constant, note it down and then remove the unit from the pipe.
- Close the end cap of the pipe.
- Repeat the same process for the next sample selected.

Step 5: Database recording:

- The database will be recorded in the template provided below:

Table 2 Hourly emission database recording format

		Time												
Unique ID	**Parameter**	**7:00**	**8:00**	**9:00**	**10:00**	**11:00**	**12:00**	**13:00**	**14:00**	**15:00**	**16:00**	**17:00**	**18:00**	**19:00**
ST 1	**Reading Type (after toilet usage or lean period)**													
	Methane Reading Value													
	Range Variation													
	Humidity (%)													
	Temperature (Celsius)													
	Air Flow													

		Time												
Unique ID	**Parameter**	**7:00**	**8:00**	**9:00**	**10:00**	**11:00**	**12:00**	**13:00**	**14:00**	**15:00**	**16:00**	**17:00**	**18:00**	**19:00**
ST 2	**Reading Type (after toilet usage or lean period)**													
	Methane Reading Value													
	Range Variation													
	Humidity (%)													
	Temperature (Celsius)													
	Air Flow													

- Each property's septic tank will be maintained with a unique ID.
- The inventory details collection related to septic tanks is attached in Annexure 2.

Lab-based validation for Septic tank

The wastewater sample will be collected at the septic tank outlet into the drain. Biological and chemical testing of the samples will be carried out at the lab. The composite sampling will be carried out over the day. This sampling will be carried out at an interval of every 15 days for 4 months, spreading over different climate conditions.

Samples will be collected for wastewater as well as raw and treated sludge. The testing will be carried out for the following parameters.

Sr. No.	Effluent Parameter	Sludge Parameter
1	BOD	BOD
2	COD	COD
3	VSS	DO
4	TSS	Temperature
5	pH	pH
6	Temperature	VSS
7	DO	TSS
8	ORP	ORP
9	Total Nitrate	Total Nitrate
10	Total Nitrogen	Total Nitrogen
11	TKN	TKN
12		Biomethane Potential (BMP)

3.2 Sewer network and Sewage Pumping Stations (SPSs) – Using the handholding sensors and lab-based approach

The location for recording the emission quantification across the sewer network will be maintenance holes across the sewer network in Ichalkaranji. The location of 8 maintenance holes will be finalized based on the operation of the sewer network (i.e. 4 samples from the area with low lying level; with flowing sewer and with different surrounding land use and 4 samples from the area at a higher elevation; with flowing as well as sewer section facing blockage issue and with different landuse). For pumping station selection, as there are two pumping stations available in Ichalkaranji, the quantification will be carried out at both pumping stations, as both have different characteristics.

Step 1: Selecting the sample sewer network and SPSs in the city of Ichalkaranji and Pimpri Chinchwad:

1. To identify the samples for on-field emission quantification, different parameters are selected, and samples are stratified based on the following parameters for the sewer network*:*
   - *1.1.* *Surrounding Land Use*
   - *1.2.* *Choking frequency and sewer flow*
   - *1.3.* *Elevation (in low-lying areas and with higher slopes)*
   - *1.4.* *Pumping-based or gravity-based*
   - *1.5.* *Sewer system age*
   - *1.6.* *Maintenance frequency*

Based on the above parameters, 5 maintenance holes across the city of Ichalkaranji will be identified. For the Pimpri Chinchwad city, the sample number will be determined based on the sewer network length, households connected to the maintenance hole, and total maintenance holes.

Step 2: Arrangement for sample taking:

- A closed environment will be required for the quantification of methane emissions in the sewer network. A closed environment will be created by dropping the flux chamber in the maintenance hole and the outlet of the flux chamber will be connected to the gas analyser sensor.

Step 3: Sampling timings:

- The readings will be taken at 1-hour intervals from morning 7 AM to Night 7 PM over one week in different seasons. Further, based on the findings from recorded readings, the sampling timing will be further enhanced and improved.

Step 4: Measuring the Methane Levels and database recording:

- Turn on the instrument.
- Ensure it showcases the zero value.
- Please note the temperature and humidity of the day you are measuring.
- Open the maintenance hole.
- Insert the flux chamber unit into the maintenance hole and attach the probe of the gas analyser to the outlet tube. And the reading will be recorded at the desired interval in the unit.

Lab-based validation for the Sewer network and Sewage pumping station

The wastewater sample will be collected at two points, i.e., at the maintenance hole and at the outfall at the wet well. Biological and chemical testing of the samples will be carried out at the lab. The composite sampling will be carried out over the day, and samples will be collected. This sampling will be carried out at an interval of every 15 days for 3 months, i.e., summer, winter, and monsoon months.

Samples will be collected for wastewater as well as raw and treated sludge. The testing will be carried out for the following parameters.

Sr. No.	Effluent Parameter		
1	BOD	7	DO
2	COD	8	ORP
3	VSS	9	Total Nitrate
4	TSS	10	Total Nitrogen
5	pH	11	TKN
6	Temperature		

3.3 Sewage treatment plant – Using the Flux chamber method

Step 1: Selecting Sample STPs in the cities of Ichalkaranji and Pimpri Chinchwad:

The sampling for the STPs is carried out based on the different treatment technologies and capacity of the wastewater treatment facility. The sample comprises different types of wastewater treatment technologies, i.e., Aerobic, Anoxic, and Anaerobic treatment technologies. The selected samples comprise listed technologies - Sequential Batch Reactor, Activated Sludge Process, Anoxic-Oxic Process, Moving Bed Biofilm Reactor, Upflow Anaerobic Sludge Blanket, and Oxidation Pond. The STPs in Ichalkaranji and Pimpri Chinchwad will be considered for the installation of fixed ambient air quality sensors.

Step 2: Arrangement for taking samples

Through the flux chamber and portable gas analyser:

A unit area will be covered using the flux chamber and will be placed over the different STP components, and the gas concentration will be measured using the NDIR portable gas analyser. Following a similar approach, multiple readings will be taken across the STP units and overall gas emission rates will be derived for the STP plant.

Exploring Fixed Ambient Air Quality Sensor:

One unit of ambient air quality sensor will cover a 300-meter radius from the installation point, and the point location for installation of the sensor will be identified based on the following points:

- Wind direction and flow
- 5 to 10 meters away from the emission point source.
- Availability of Power supply source
- Have 360° barrier-free environment for recording reading
- Coverage of the entire treatment facility

The installation of the sensor unit requires 10 to 12 feet above the built surface to capture the overall air quality situation in the facility and its vicinity.

Limitations in installation of Fixed Ambient Air Quality Sensor:

In Indian context, considering the situation of in small and medium, most of sewage treatment plants are collocated near the SWM sites (which also emits methane due to waste decomposition). This placement provides a challenge of dilution emissions. Other simplified technologies that can be adopted in methane monitoring at the STP sites can be explored further.

Step 3: Sample timing and Database recording

For the flux chamber and portable gas analyser

The activity will be carried out once a month at selected STPs in cities of Ichalkaranji and Pimpri Chinchwad. The flux chamber will be set up at different components of STPs and emissions readings will be recorded at an interval of every 30 minutes. In addition to an Arduino sensor-based flux chamber will also be set up for continuous monitoring of the changes in the emission rate from the STP component. This comprehensive approach ensures accurate measurement of methane emissions across different sanitation components.

Figure 3 Flux chamber placement and sampling at different STP components

Lab-based validation for the Sewage treatment plant

The wastewater sample will be collected at three points, i.e., at the inlet, intermediate, and outlet discharge, and biological and chemical testing of the samples will be carried out at the lab. The composite sampling will be carried out over the day, and samples will be collected. This sampling will be carried out at an interval of every 1 month.

Samples will be collected for wastewater as well as raw and treated sludge. The testing will be carried out for the following parameters.

Sr. No.	Effluent Parameter	Sludge Parameter
1	BOD	BOD
2	COD	COD
3	VSS	DO
4	TSS	Temperature
5	pH	pH
6	Temperature	VSS
7	DO	TSS
8	ORP	ORP
9	Total Nitrate	Total Nitrate
10	Total Nitrogen	Total Nitrogen
11	TKN	TKN
12		Biomethane Potential (BMP)

3.4 Discharge of effluent into water bodies

Step 1: Selecting the samples discharge point in the cities of Ichalkaranji and Pimpri Chinchwad:

The water bodies will be selected based on the kind of physical properties and characteristics of the water body, i.e., whether the treated or untreated wastewater or effluent is discharged in the water body.

Step 2: Arrangement for taking samples

For taking the samples and analyzing the methane concentration from the treated or untreated effluent discharge in water bodies. The water body will be divided into a grid, and two floating flux chambers will be placed on the water body surface, one will be placed upstream to capture the sample from clean water body section and one at the downstream to capture the sample or GHG concentration from polluted or section where the discharge is carried done. The reading will be carried out for 3 seasons, with readings will be collected daily for 2 weeks during each season.

4. Database Generation and Analysis

4.1 Septic tank

Converting reading into meaningful insights

The readings from the gas analyser in ppm can be converted to gas concentration in g/m^3 using the equation below.

Gas concentration (g/m^3) = $\frac{\left(C_{ppm}/10^6\right) \times M_{gas})}{\frac{R \times T}{P}}$

Where;

C_{ppm} - is equal to the concentration in ppm that you get from the readings on the gas analyser.

M_{gas} - is the molecular weight of the gas under consideration (g/mol). In this case, the molecular weight of methane is 16.04 g/mol. Nitrous oxide would be 44.013 g/mol.

R - is the gas constant (0.000082057 atm·m^3/mol·K). The value here can also be different if you use other units in the rest of the equation e.g. using pascals instead of atmospheres for pressure.

T - is the temperature (K)

P - is the pressure of the gas (atm).

So, to get a mass flow of the gas, you would need the air flow rate in the vent pipe first. This can be calculated using the equation below.

Flow rate (m^3/d) = $V \times \pi r^2$

Where;

V - is the velocity inside the vent pipe in metres/day. You would need to have measured the air velocity in the vent pipe e.g., using a hot wire anemometer.

R - is the radius of the pipe in metres.

The mass flow of the gas can then be calculated using the equation below.

Mass flow of gas (g/day) = Gas concentration (g/m^3) X Flow rate (m^3/d)

The mass flow of the gas can be converted into other preferred units for mass (mg, kg, tonnes, etc) and time (seconds, years etc). It is also the basis for then normalizing the emission factor based on the characteristics of the septic tank and its users i.e. from mg/day to mg/capita/day depending on how many people use the septic tank and how often, or something of the sort. It can also be normalized based on the influent organics concentration (e.g. kg CH_4/kg BOD or kg CH_4/kg COD).

4.2 Sewer Network, SPSs and STPs

The reading through the sensors used for quantification of the emissions will provide the emissions values in % ranging from 0 to 100 % (50 – 10,00,000 PPM) and by integrating the airflow sensor, the quantity of methane will be estimated. The fixed sensor, i.e., the Ambient air quality sensor, will provide the final reading of the methane concentration at the STPs with a buffer of 300 meters with source flow direction. Further, the NDIR portable sensor will provide the emissions values in %, ranging from 0 to 5 % (0 – 50,000 PPM).

4.3 Conversion of reading to the Emission factors

Based on readings derived for different sanitation value chain components, the reading will be converted to the emission factors based on the rate at which the component will generate the methane emissions and further through using statistical methods to identify relationships by considering different operational parameters and factors impacting on the emissions and its scale. Further, overall city level sanitation emission will be derived by applying the process emission factors derived for each component of sanitation value chain and the city level database available related to the quantum, operation and maintenance of sanitation value chain component.

5. Outcome

The generated database will provide the methane emissions concentration for the local context, and then, using these emission levels, the local emission factor will be derived for different components of the sanitation system that can be used as localized factors (tier 3 emission factor) for cities with similar sanitation systems. Further, based on the generated database, different relationships will be explored with the physical, chemical, and operational conditions of the sanitation system and the emission levels. Based on the diverse sample size, the database will be scaled up for emission quantification of the entire sanitation value chain at the city level. Further, the city level emission quantification will be compared with the estimates derived using existing IPCC emissions factors. The result variation will be analysed, and insights will be drawn. Based on this emission quantification, the potential for resource recovery will be estimated, and different mitigation strategies and operational enhancement opportunities will be explored for the overall sanitation value chain.

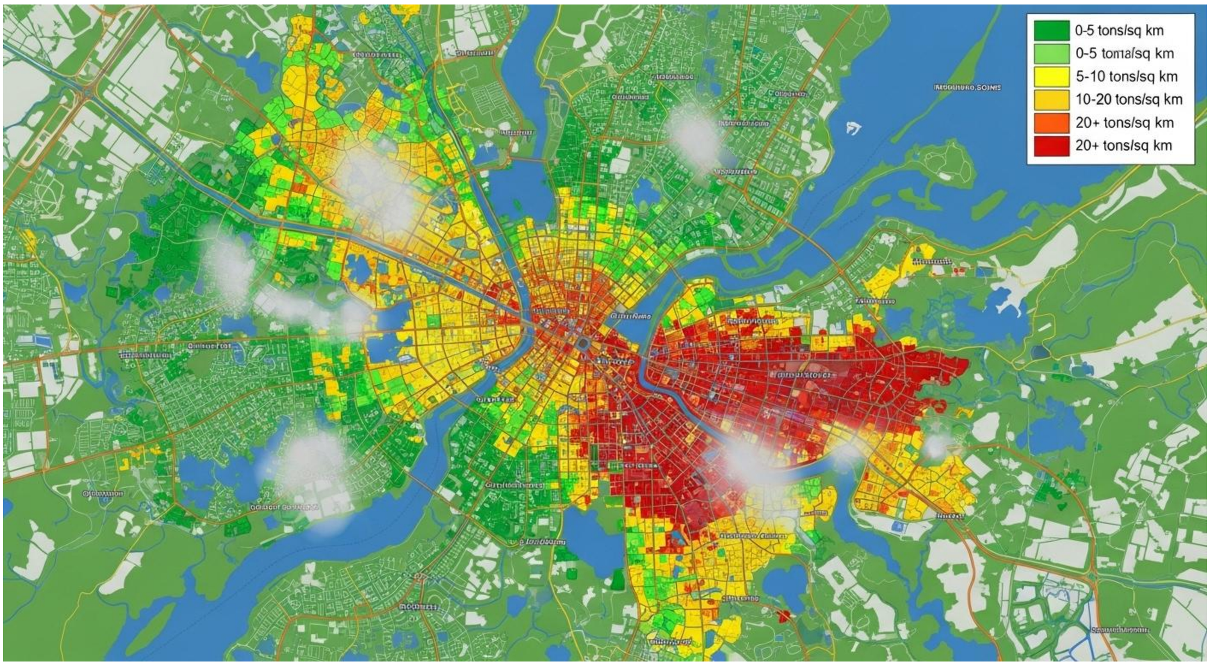

Figure 4 Modelling results based on the localized emission factor visualization generated using Google Whisk AI. Image generated by Google Whisk AI (2025).

Annexure 1

Sr. No	Name of study	Country	Study on what aspect Septic tank/ Sewer/ etc.	Methodology/ Approach	Limitation in our case
1	Greenhouse Gas Emissions from Blackwater Septic Systems	Vietnam	Septic tank	Floating chamber (10 ST samples)	Requires transport of samples from site to lab or sensor for continuous monitoring
2	Emissions from onsite sanitation system in USA	USA	Septic tank	Field-based calculation using the flux chamber	Can be prepared but requires sample shifting to lab
3	Spatial and temporal variation of GHG emission for onsite sanitation system	Ireland	Septic tank	Gas chromatography (headspace method)	Private labs (contacted) are not providing the service
4	Assessment of Sanitation GHG emissions in Senegal	Senegal	On site system	IPCC empirical estimation	-
5	Greenhouse gas fluxes from human waste management pathways	Haiti	On site system	Customized Flux chamber	Less technical expertise and labs are available for carrying the test at the septic tank level. (majority of labs are willing to provide services in industrial emissions quantification)
6	Methane Emissions from Municipal Wastewater Collection and Treatment Systems	USA	Sewer Line	Empirical estimation based on HRT; TDM; IR; Chamber	
7	Methane monitoring system for continuous multi-channel sampling	Japan	Anaerobic systems	Sensor based system (Lab scale)	-
8	Whole-system analysis reveals high greenhouse gas emissions, Kampala	Uganda	On-site system	Lab scale prototype	

Annexure 2

Septic Tank Profiling Inventory

City - Choose

Ward Number - Your answer

Area or locality - Your answer

Settlement type – 1. Slum 2. Non - Slum

Type of Property

- Residential
- Commercial
- Mix (Commercial and Residential)
- Institutional
- Public sanitation facility

Type of Residential Property

- Row House
- Bungalow
- Hut
- Chawl
- Apartment
- Other:

Type of Commercial Property

- Hotels and lodging
- Restaurant

Type of Institutional Property

- School
- College
- Anganwadi
- Hostels

Type of Public Sanitation Facility

- Community Toilet
- Public Toilet

Household Profile - capture the demographic details

Owner name - Your answer

Household Size

- 1
- 2-4
- 5-8
- 8-10
- above 10

If apartment mention total households and average family size

Format to enter - 8, 4.5 (total households, average family size) - Your answer

Number of Floors - Your answer

Number of Female members - Your answer

Number of Male members - Your answer

Number of members going to school or college -

Number of working member - Your answer

Number of house member remain at home over day -

Age of building

- new construction (0-1 year)
- 2 - 5 years
- 5 - 10 years
- 10 - 15 years
- 15 - 20 years
- 20 - 25 years
- 25 - 30 years
- More than 30 years

Groundwater level in meters

- 0 - 5 Meters
- 5 - 10 Meters
- 10 - 15 Meters
- 15 - 20 Meters
- 20 - 30 Meters
- 30 - 40 Meters
- 40 - 50 Meters
- Above 50 Meter

Does Property have a borewell

- Yes
- No

Depth of Borewell - Your answer

Containment Details (Septic tank details)

Type of toilet – 1. Indian Toilet 2. Western Toilet

Toilet Connected to

- Septic tank
- Single Pit
- Twin Pit
- Sewer Network
- Open Discharge
- Water Body

Septic tank sharing status

- Individual; Shared

If shared, how many households are connected -

Number of Toilet connected to Septic tank - answer

Is greywater connected to septic tank

- Yes, No

Septic tank connected to

- Soak pit
- Closed drain
- Open drain
- Sewer network
- Open Discharge

Dimension of septic tank

1. Length (in meter) –
2. Width (in meter) –
3. Depth (in meter) –

Septic tank is

- Lined, Un lined

Septic tank cover is

- Accessible and Removable
- Accessible but Not Removable
- Not accessible

Septic tank Size

- 0-3000 liters
- 3000 - 5000 liters
- 5000 - 10000 liters
- Above 10000 liters

Vent Pipe availability

- Yes, No

Number of times septic tank have been emptied

- 1, 2, 3, 4, 5, More than 5

Last emptied interval

- 0 - 1 year ago
- 1 - 3 year ago
- 3 - 5 year ago
- 5 - 7 year ago
- 7 - 10 year ago
- 10 - 15 year ago
- never emptied

if emptied 0 - 1 year ago, mention details

- 1 month ago
- 2 - 4 month ago
- 4 - 6 month ago
- 6 - 8 month ago
- 8 - 12 month ago

Number of chambers

- 1 Chamber
- 2 Chambers
- 3 Chambers

If Commercial buildings

Number of Customers daily - Your answer

Number of rooms

- 0 - 5
- 5 - 10
- 10 -15
- 15 - 20

Toilet Connected to

- Septic tank
- Single Pit
- Twin Pit
- Sewer Network
- Open Discharge
- Water Body

Septic tank Size

- 0-5000 liters
- 5000 - 10000 liters
- 10000 - 15000 liters
- Above 15000 liters

Dimension of septic tank

1. Length (in meter) –
2. Width (in meter) –
3. Depth (in meter) –

Number of times septic tank have been emptied

- 1, 2, 3, 4, 5, More than 5

Last emptied interval

- 0 - 1 year ago
- 1 - 3 year ago
- 3 - 5 year ago
- 5 - 7 year ago
- 7 - 10 year ago
- 10 - 15 year ago
- never emptied

Vent Pipe availability

- Yes, No

Septic tank cover is

- Accessible and Removable
- Accessible but Not Removable
- Not accessible

Number of chambers

- 1 Chamber
- 2 Chambers
- 3 Chambers

Greywater and kitchen outfall connected to

- Septic Tank; Directly to Drain

Is grease trap installed

- Yes, No

If Institutional building

Number of students or population

- 0 - 500
- 500 - 1000
- 1000 - 2000
- 2000 - 3000
- More than 3000

Number of Toilets blocks in premises - Your answer

Number of urinal blocks in premises - Your answer

Number of bathing facilities - Your answer

Toilet Connected to

- Septic tank
- Single Pit
- Twin Pit
- Sewer Network
- Open Discharge
- Water Body

Number of rooms
- 0 - 5
- 5 - 10
- 10 -15
- 15 - 20

Septic tank Size
- 0-7500 liters
- 7500 - 15000 liters
- 15000 - 30000 liters
- Above 30000 liters

Dimension of septic tank
1. Length (in meter) –
2. Width (in meter) –
3. Depth (in meter) –

Number of times septic tank have been emptied
- 1, 2, 3, 4, 5, More than 5

Last emptied interval
- 0 - 1 year ago
- 1 - 3 year ago
- 3 - 5 year ago
- 5 - 7 year ago
- 7 - 10 year ago
- 10 - 15 year ago
- never emptied

Vent Pipe availability
- Yes, No

Septic tank cover is
- Accessible and Removable
- Accessible but Not Removable
- Not accessible

Number of chambers
- 1 Chamber
- 2 Chambers
- 3 Chambers

Greywater and kitchen outfall connected to
- Septic Tank
- Directly to Drain

Public Sanitation Facility Details

Age of Public sanitation facility
- new construction (0-1 year)
- 1 - 5 years
- 5 - 10 years
- 10 - 15 years

Is bathing facility available
- Yes, No

Number of urinals
- 1 – 3
- 3 - 5
- 5 - 10
- 10 - 15
- More than 15

Number of toilet seats
- 1 – 3
- 3 - 5
- more than 5

Number of Daily users
- 0 - 10
- 10 - 30
- 30 - 50
- 50 - 80
- 80 - 100
- More than 100

Toilet Connected to
- Septic tank
- Single Pit
- Twin Pit
- Sewer Network
- Open Discharge
- Water Body

Septic tank Size
- 0-3000 liters
- 3000 - 5000 liters
- 5000 - 10000 liters
- Above 10000 liters

Dimension of septic tank
1. Length (in meter) –
2. Width (in meter) –
3. Depth (in meter) –

Number of times septic tank have been emptied
- 1, 2, 3, 4, 5, More than 5

Last emptied interval
- 0 - 1 year ago
- 1 - 3 year ago
- 3 - 5 year ago
- 5 - 7 year ago
- 7 - 10 year ago
- 10 - 15 year ago
- never emptied

Vent Pipe availability
- Yes
- No

Septic tank cover is
- Accessible and Removable
- Accessible but Not Removable
- Not accessible

Number of chambers
- 1 Chamber
- 2 Chambers
- 3 Chambers

Septic Tank Location

Google location link –

Location-enabled photo of septic tank-

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CENTER FOR WATER AND SANITATION

The Center for Water and Sanitation (CWAS) is a part of CEPT Research and Development Foundation (CRDF) at the CEPT University in Ahmedabad, India. CWAS undertakes action-research, implementation support, capacity building and advocacy in the field of urban water and sanitation. Acting as a thought catalyst and facilitator, CWAS works closely with all levels of governments - national, state and local to support them for delivery of water and sanitation services in an efficient, effective and equitable manner.

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