

# India Safe Water Pilot - MLE Overview

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## Background and Pilot Objectives

In 2022, Evidence Action was approached to support Jal Jeevan Mission (JJM) in their intention to ensure appropriate drinking water quality through household taps through their goal to provide universal access to water to all of India by 2024. Evidence Action first supported JJM to conduct a landscape assessment of water source infrastructure in November and December 2022, surveying 152 sites across ten states to better understand common types of water points in India. Simultaneously JJM conducted a technology assessment to shortlist to determine the best-fit water quality technologies.

Based on this assessment, Evidence Action is planning an operational pilot of in-line chlorination technologies to assess the feasibility of various technologies in several already-existing water system/source contexts. These contexts include single-village water schemes (SVS), multi-village schemes (MVS) at the village level, and MVS at the intermediary level (upstream from multiple villages), all of which serve water collection points (WCPs) in villages. The specific objectives of this pilot are to:

1. Assess installation feasibility regarding complexity and amount of effort and time required for installation of devices
2. Assess operational feasibility in terms of operating, refilling, and maintaining devices
3. Assess efficacy in terms of the devices completing the designated task, e.g. water is correctly and consistently dosed with chlorine
4. Understand financial implications of the devices, including costs of installation and operation of devices, and costs per person with access to chlorinated water per year
5. Understand the scalability of devices in various types of water systems and contexts

Evidence Action is proposing that this pilot take place across three states in India, at approximately 18 water systems/tanks in total. The states selected are being prioritized based on JJM recommendation as well as under-5 all cause mortality, enteric infection DALYs, and diarrheal DALYs.

**Importantly, as this pilot is designed to measure operational applicability of these mechanisms, it will not be designed to extensively evaluate the seriousness of operational and maintenance issues or community experience and buy-in to consume chlorinated water. Similarly, the data collected through various mechanisms in this pilot will not provide state-level or broadly representative data for indicators such as baseline water treatment, but will be representative only of the water sources included in the pilot and the communities that they serve.**

**Note:** Certain aspects of this MLE design are subject to change based on changes to pilot design or considerations during start-up and implementation of the pilot. This may include, among others:

- Aspects and indicators collected during mid-pilot and endline monitoring
- Use and reliability of IoT chlorine dose sensors
- Use and tracking day-to-day information with operational trackers

## MLE Objectives

The principal objectives of the India Safe Water Pilot monitoring and survey tools are to provide the India Safe Water team with insight to better understand and assess the key outputs of the pilot. The following include the key pilot objectives that will be measured with KPIs collected through MLE activities based on the objectives of the pilot. This MLE design will seek to better understand:

- Device installation at selected water sources in terms of complexity, as well as effort and time required for device installation; high-level information including:
  - Time required for installation
  - Expertise required for installation
  - Complexity of installation and steps required to install a device
  - Adherence to installation protocol
- Operation of devices at selected water sources in terms of operating, refilling, and maintenance; high-level information including:
  - Device refill rate
  - Expertise required for normal operation and preventative maintenance
  - Ease of sourcing consumable material and preventative maintenance parts
  - Device company's performance under warranty
  - Likelihood of corrective maintenance required
  - Performance of device chlorine sensors and provided supplementary tools by device supplier
- Efficacy of the devices as the right-fit technology to correctly and consistently dose water with chlorine; high-level information including:
  - Dosing consistency and dose reach to locations in water system
  - Dosing at appropriate levels
  - Rates of treated water systems at baseline
  - Efficacy of provided supplementary tools by device supplier
- Cost effectiveness and implications of device use, including the costs per person with access to treated water; high-level information including:
  - Device cost effectiveness
  - Device personnel requirements and personnel costs per year
  - Device maintenance and repair costs per year
  - Device consumables cost per year

See more information on specific KPIs in the Analysis and Reporting section.

## Activities Overview

Pilot monitoring will take place during three general phases of the pilot including baseline and installation monitoring (phase 1), ongoing monitoring throughout pilot (phase 2), and endline monitoring (phase 3). Each phase of monitoring will include multiple data collection activities in order to collect information on key aspects of pilot process and performance.

At a high level, the MLE data collection activities at water sources will include:

1. **Phase 1:** Baseline and Installation monitoring - prior to device functioning at each water source/system, data collection will take place to establish baseline rate of water source treatment and to monitor installation processes:
  - a. Baseline surveys - Survey to collect baseline characteristics of the water source/system, including baseline water treatment/chlorination rates at both the source and at WCP/household connections in the village(s) served.
  - b. Installation monitoring surveys - Survey during installation to collect key information on aspects of device installation, including whether installation

followed protocol, what materials were required, and challenges encountered during installation.

2. **Phase 2:** Mid-pilot monitoring - after device installation and functioning at each water source/system, information will be tracked on operation of the devices, functionality, dose accuracy and consistency, maintenance, and stakeholder feedback:
  - a. Device function and operator surveys - Occasional surveys throughout the pilot to collect information on device functioning, maintenance, chlorine stock, and issues through device inspection and interviews with device operators.
  - b. Chlorine dosage tracking - Routine checks of chlorine dosage in water systems throughout the pilot:
    - i. Automated dose sensors - IoT chlorine sensors will be installed along with the water treatment devices that will provide real-time information on chlorine dosing in each system. These sensors will feed data into a dashboard and will track chlorine dosage throughout the pilot.
    - ii. Initially, manual dose checks - routine surveys at the device and randomly selected WCPs/household connections to test for presence of chlorine residual during the first weeks of the pilot. Once the dose sensors are in place, dose check surveys will be used as a back-up in case of any issues with dose sensors.
3. **Phase 3:** Endline monitoring - at the end of the pilot period, final surveys will take place with stakeholders and at water source/systems to collect final information on operation, dosing, and maintenance of the devices:
  - a. Device function and operator surveys - Endline surveys at the pilot sites to collect information on a final check of device functioning, maintenance, stock, and issues. The survey will also include collecting information on perception of the device from operator and community member perspectives, recommendation of the devices, and attempt to evaluate community ownership.
  - b. WCP dose check surveys - Endline surveys at the device and randomly selected WCPs/household connections to test for presence of chlorine residual.
  - c. Evidence Action staff endline interviews - Endline interviews with state and national pilot staff regarding staff experience interacting with communities, government representatives, water source operators, and contractors to best understand the operational experience of EA staff.

In addition to the data collection activities that will take place at the water sources and in the field, MLE will also facilitate the tracking and recording of key activities by Evidence Action staff throughout the pilot. These will primarily be completed by Safe Water state Regional Coordinators (RCs) and other EAll staff, and will be used to evaluate the pilot and support operational considerations throughout the pilot. These will be used because some of the key operational aspects of the pilot that will be important to understand and evaluate success will be carried out internally, which requires data collection and tracking by our staff. These include:

1. Installation and Operational tracker - This tracker will be used to track each of the water points at which device installations take place.
2. Maintenance and repairs tracker - This tracker will be used to note and track any and all maintenance or repair activities that take place during the pilot.
3. Chlorine supply, procurement, and refill tracker - This tracker will be used to track all chlorine supply, procurement, and refill activities that take place during the pilot.
4. Dose tracker - This tracker will be used to keep track of dosage at all pilot WPs and locations of dosage sensors throughout the pilot period.

After each phase of data collection, the MLE-S and MLE-D teams will receive the survey data from the data collection firm. MLE-D will be responsible for conducting data quality checks and data cleaning, including coordinating with the data collection firm to resolve any issues. The processed data will then be analyzed to extract key insights based on the pilot objectives and integrated into activity results reports for each phase of the pilot.

## Sampling

Data collection during each of the three pilot phases will take place at all water points/systems, due to the small number of devices that will be installed during the pilot, meaning that sampling of water sources and devices will not be needed.

However, certain aspects of data collection will all involve conducting surveys and chlorine testing at WCPs and/or household connections (referred to generally as WCPs) that are connected to the main water source/system. Selection of WCPs will be conducted as follows:

*SVS and MVS at village level:*

- Village/community selection: For SVS or MVS at the single village level, only one village will be serviced, and therefore will be surveyed.
- WCP selection: For each SVS or village-level MVS device that is installed during the pilot, three WCPs will be selected for dose checks and chlorine testing. This will include the WCP nearest to the source, the WCP furthest from the source, and one additional WCP will be randomly sampled from the remaining intermediary points.
  - If the village/community has three or fewer WCPs, all will be selected for surveys.

*MVS at intermediary level:*

- Village/community selection: For MVS at the intermediary level that serve multiple villages, three villages will be selected for dose checks and chlorine testing. This will include the village nearest to the source, the village furthest from the source, and one additional village will be randomly sampled from the remaining villages.
  - If the MVS serves three or fewer villages, all will be selected for surveys.
- WCP selection: For each selected village/community that is serviced by an MVS device that is installed during the pilot, WCPs will be selected for surveys similarly to SVS, three WCPs will be selected for dose checks and chlorine testing. This will include the WCP nearest to the source, the WCP furthest from the source, and one additional WCP will be randomly sampled from the remaining intermediary points.
  - If the village/community has three or fewer WCPs, all will be selected for surveys.

## Analysis and Reporting

MLE Delivery, India will lead the analysis of pilot data, in close collaboration with MLE Strategy and the SW India team. The primary analysis methods used for this exercise will be descriptive analytics of quantitative variables, such as summaries and tabulations, as well as qualitative analysis of free response questions. All KPIs will be reported in aggregate, as well as disaggregated by state, water system type, and device type. For an overview of the key indicators to be analyzed and how they are calculated, please see the table below.

Objective	Sub-objective	Indicator(s)	Survey
Installation Feasibility	Time required for installation	Average (mean) time required for device installation	Installation
		Median and range of time required of installation	

	Expertise required for installation	Types of training/experience of installation technician	
		Types of training/experience of water source operator (if any)	
		Additional/new training/expertise acquired for installation by installation technician	
	Complexity of installation	Proportion of devices with issues/challenges that arose during installation process as reported by installation technician	
		Proportion of devices with issues/challenges that arose during installation process as reported by water source operator	
		Proportion of installations with issues/challenges that were not able to be resolved during the installation process	
		Proportion of installations with issues/challenges resolved by installation technician	
		Proportion of installations with issues/challenges resolved by operator	
	Adherence to installation protocol	Proportion of installation checklist adhered to by installation consultant	
		Key installation steps not adhered to	
Operational Feasibility	Device refill rate	Number of refills reported over the pilot period by water source operator	Operational trackers and Device function and operator surveys
		Number of refills reported over the pilot period through purchases/deliveries by EA	
		Number of refills reported per week by water source operator	
		Number of refills reported per week through purchases/deliveries by EA	
	Expertise required for normal operation	Types of training/experience of water source operator for normal operation	
		Additional training/expertise conducted or acquired for normal operation	
		Incidence of issues/challenges in normal operation of the device	
	Expertise require for preventative maintenance	Training/experience of water source operator for preventative maintenance	
		Additional training/expertise conducted or acquired for preventative maintenance	
		Incidence of specific issues/challenges in preventative maintenance	
		Proportion of preventative maintenance issues challenges adequately addressed by the operator	
	Ease of sourcing consumable material	Average time required to procure chlorine consumables for device consumption by EA	
		Incidence of chlorine consumables procured by operator (if any)	

		Proportion of chlorine consumables needed procured by operator (if any)		
		Types of challenges in procurement of chlorine consumables required		
	Ease of sourcing maintenance parts	Average time required to procure maintenance parts by EA		
		Average time required to procure maintenance parts by operator		
		Proportion of maintenance parts required procured by operator		
		Types of challenges in procurement of maintenance parts required		
	Company performance under warranty	Incidence of EA contacting device company for performance issues		
		Incidence of operator contacting device company for performance issues		
		Proportion of company contacts resulting in issue resolution		
	Likelihood of corrective maintenance required	Incidence of corrective maintenance/repairs required during the pilot		
		Proportion of devices with corrective maintenance/repairs required during the pilot		
		Proportion of successful corrective maintenance/repairs by device company		
		Proportion of successful corrective maintenance/repairs by operator		
		Average length of time device was out of operation due to corrective maintenance/repair requirement		
	Performance of device sensors	Proportion of chlorine sensors with functionality issues during the pilot		
		Average length of time sensor was out of operation due to functionality issues		
		Proportion of chlorine sensors with accuracy issues during the pilot		
		Average difference in chlorine sensor readings and manual chlorine testing		
	Performance of provided supplementary tools by device suppliers	Incidence of use of provided supplementary tools		Operational Trackers and device function and operator surveys
		Accuracy of use of provided supplementary tools		
Efficacy	Dosing consistency	Consistency at which devices are dosing water with chlorine throughout the pilot, at source (range)	Automated dosing sensors and dose check surveys	
	Dose reaching selected location in water system	Proportion of devices that are dosing water with chlorine throughout the pilot, at device		

		Proportion of devices that are dosing water with chlorine throughout the pilot, at all WCPs		
		Proportion of devices that are dosing water with chlorine throughout the pilot, at each WCP		
		Proportion of devices that are dosing water with chlorine throughout the pilot, by distance from source		
	Dosing at appropriate levels	Average dosing level (TCR and FCR) at device		
		Average dosing level (TCR and FCR) at WCPs		
		Proportion of devices that have an acceptable chlorine level (0.2-2.0 ppm)		
		Proportion of WCPs that have an acceptable chlorine level (0.2-2.0 ppm)		
		Incidence of dosage outside preferred chlorine level range (0.2-2.0 ppm)		
		Average amount of time dosage is outside preferred range (0.2-2.0 ppm)		
	Rates of treated water sources prior to device installation	Rate of water systems being treated with chlorine at source level prior to our device installation, as reported by operators		Baseline surveys
		Rate of water systems being treated with chlorine at source level prior to our device installation, as determined by chlorine testing (TCR and FCR)		
		Rate of water systems being treated other treatment at the source level prior to our device installation, as reported by operators		
		Rate of water systems being treated with chlorine at WCP level prior to our device installation, as reported by operators		
Rate of water systems being treated with chlorine at WCP level prior to our device installation, as determined by chlorine testing (TCR and FCR)				
Efficacy of provided supplementary tools by device suppliers	Experience of use of provided supplementary tools, as reported by operators	Operational Trackers and device function and operator surveys		
Cost Effectiveness and Implications	Device cost effectiveness	Average number of households per water source/system	Baseline and DHS and Census	
		Average number of people per household with access to a treated water source	DHS and Census	
		Number of water sources with functioning treatment devices present	Operational trackers and Endline device function and operator surveys	
		Average cost of chlorine for a device throughout the pilot per household served		

	Device personnel requirements and personnel costs per year	Incidence and time of outside personnel needed for operation, maintenance, repair over the pilot period	Operational trackers and Endline device function and operator surveys
		Average cost of outside personnel needed for operation, maintenance, repair over the pilot period	
	Device maintenance and repair costs per year	Incidence of normal device operation and preventative maintenance by device required over the pilot period	
		Average cost of normal device operation and preventative maintenance by device over the pilot period	
		Incidence of corrective maintenance/repair by device required over the pilot period	
		Average cost of corrective maintenance/repair by device over the pilot period	
	Device consumables cost per year	Average amount of chlorine consumed per device over the pilot period	
		Average cost of maintenance parts per device over the pilot period	