# Annex D: Data collection - Service authority and service provider surveys

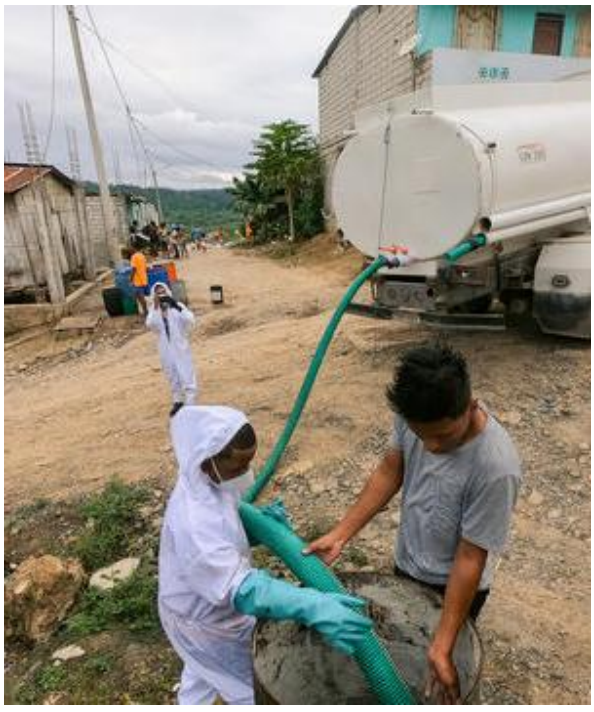
## Guidance for monitoring safely managed on-site sanitation (SMOSS)

WHO and UNICEF, 2025

**Background**

These annexes accompany the Guidance for Monitoring SMOSS to provide additional details on indicators, core and expanded questions and tools for designing monitoring systems to collect data for SDG 6.2.1. These annexes have been developed as part of the Monitoring SMOSS pilot project and are informed by the pilots conducted in ten countries as part of this project as well as other global examples of monitoring of safely managed sanitation services. The annexes are split into the following documents and are available with the main guidance at https://washdata.org/monitoring/sanitation/safely-managed-on-site-sanitation

A. Global indicators for monitoring SMOSS
B. Data collection – Household questionnaire
C. Data collection – household sanitation inspections
D. Data collection - Service authority and service provider surveys
E. Analysis to inform national estimates for SDG 6.2.1



Pit emptying Ecuador (UNICEF 2021)

**Annex D Data collection - Service authority and service provider surveys: Contents**

# D. Data collection - Service authority and service provider surveys

This annex brings together three data collection methods designed to capture information on emptying, transport and treatment services, which cannot be reliably assessed with household questionnaires or inspections. In many contexts, responsibility for sanitation regulation and service delivery is distributed among diverse actors and multiple data sources may exist across service authorities and providers, along with various approaches to generate new data. This annex presents recommended questions for three data collection methods that can be integrated into existing monitoring systems or implemented as stand alone surveys:

- Service authority surveys
- Service provider surveys: i) Emptying and transport, ii) Treatment
- Spot check or inspection of treatment

The introduction outlines the assumed roles of service authorities and service providers for the purposes of this document; these can be adapted to reflect local institutional arrangements. Administrative data typically refers to **routine** data collected by governments and service providers and may include regular reporting from authorities or providers. Currently, few examples of administrative data relevant to SMOSS indicators exist. However, once implemented on a regular basis, the surveys detailed in this guidance could form part of national administrative dataset.

This guidance proposes core questions for each method to support national monitoring and SDG reporting, optional expanded questions, examples from the M-SMOSS pilots and global practice, and brief guidance on sampling considerations.

## D.1 Introduction to service authority and service provider surveys

As outlined in the main guidance report, monitoring on-site sanitation services (emptying, transport, treatment) requires information from local authorities and service providers. A challenge to collecting this information is that there is not one standard approach to the regulation and management of sanitation services. Even within one country regulation and management of different part of the service chain can be fragmented across different actors or vary between urban and rural service provision. For this guidance, two main actors are considered key sources of data: service authorities and service providers. The following general assumptions about their expected roles in data collection were used to scope the data collection methods outlined in this Annex.

- **Service authorities** are usually **local governments** (or municipalities) responsible for oversight of sanitation service provision by service providers. In some cases, they may also act as service providers. Local authorities are generally expected to routinely collect and store data on sanitation services within their administrative jurisdiction (e.g. district, city or province). National ministries or regulatory authorities may require periodic reporting on key performance indictors through sector information management system. Line ministries, including those responsible for local government, infrastructure, health and environment, may also periodically issue surveys on specific topics. For the core questions, it is assumed that service authorities can report updated data every 1-2 years on the main types of services available and the populations served, although may require adapting existing data collection systems.
- **Service providers** deliver sanitation services and may be public or private, formal or informal, and of varying scale. In some countries, providers operate under licenses or permits, although unlicensed providers may also operate. Licensed providers may be required to routinely report data to the issuing

authority. Authorities and regulators may also conduct random spot checks to assess compliance with service standards. For the core questions, it is assumed service providers can routinely report annual data on the quantity and quality of services they deliver (e.g. populations served, containments emptied, sludge treated), and describe the type, function and performance of services provided.

Although survey questions are grouped into these two categories, who completes them and how may vary. Some authorities maybe be able to complete service provider questions using routinely collected data, others may oversee data collection or require service providers to respond directly. As observed during the M-SMOSS pilot activities, stakeholder mapping and analysis of existing regulations and responsibilities across the service chain are important initial steps and can inform how data collection from service authorities and service providers could be integrated in national monitoring systems.

The suggested core questions may be integrated into existing national or local reporting mechanisms or used as a dedicated survey. For example, in the Ecuador pilot, 15 SMOSS related questions were added to the existing National System for Municipal Information (SNIM), a digital platform collecting information on the management of municipalities annually (see section D6.1). Where no routine data collection systems exists, dedicated surveys can provide a baseline dataset and demonstrate how such information could later be integrated into regular monitoring systems. This approach was used in Serbia's pilot, where no national agency held responsibility for sanitation and no regular data collection mechanisms existed (see section D6.2).

## D.2 Service authority survey

### D.2.1 Service authority core questions

This section presents a set of core questions for sanitation service authorities to report on emptying, transport and treatment services within their administrative area. These questions may be implemented through a dedicated survey or integrated into an existing data collection system.

The core questions in Table D 1 represent the minimum information needed to inform global SMOSS indicators and to identify the population to which the data applies, essential for accurate analysis and interpretation. Table D 3 integrates these questions into a survey format that can be used for service authority surveys or integrated into existing data collection tools. Table D3 presents optional expanded questions on broader aspects of sanitation service performance that may be useful for national monitoring but are not required for global SDG reporting. Many service authority data collection tools include questions on regulation, finance and other institutional aspects; however, these are not included here as they do not directly relate to monitoring service delivery outcomes for SDG indicator 6.2.1. Other tools, such as the GLAASS reporting[1] and FSM service delivery assessments[2] provide guidance for monitoring these dimensions.

[1] UN-Water global analysis and assessment of sanitation and drinking-water (GLAAS) includes tools for regularly capturing comprehensive data on water, sanitation and hygiene (WASH) systems, including on governance, monitoring, human resources and finance. https://glaas.who.int/

[2] Blackett, I. and Hawkins, P. 2019: City Service Delivery Assessment (CSDA) for Citywide Inclusive Sanitation. Is an example of a tool for assessing the enabling environment of sanitation service delivery.

**Table D 1. Core questions for service authorities and additional questions for analysis**

| Indicator | Core question | Additional questions for analysis |
|---|---|---|
| S9 - Percentage of **population with on-site sanitation emptied in the past yea**r | SA20. How many households on-site systems were emptied in the past year? | a. What proportion of the population uses on-site sanitation (not sewered)?<br>b. What is the required or standard emptying frequency for pits and tanks? |
| S12 - Percentage of **emptied excreta discharged to treatment** or disposal site | SA30. What proportion of emptied OSS were discharged to treatment or approved disposal sites? | a. List all faecal sludge treatment or disposal sites<br>b. What is the average annual inflows to each faecal sludge treatment or disposal site?<br>c. What is the average volume of excreta (sludge) emptied from septic tanks and pit latrines? |
| S13 - Percentage of excreta discharged **receives both solid and liquid treatment** | SA40/SA41. What proportion of flows discharged to faecal sludge treatment receives both solid and liquid treatment? | a. What is the type of treatment at each treatment or disposal site (indicating both solid and liquid treatment)? Or for discharge to wastewater treatment, at least secondary treatment?<br>b. What proportion of inflows receive treatment as intended (i.e. not overflow, bypass, treatment not functioning)? |
| SDG6.3 - Percentage of excreta discharge to **treatment that meets discharge standards.** | SA04. What proportion of treated sludge that meets national discharge standards (solid and liquid)? | a. Do national standards exist for faecal sludge treatment or wastewater treatment?<br>b. What proportion of annual samples met discharge standards? |

**Table D 2. Detailed questionnaire for service authorities**

| | Overarching question | Sub-questions | Response categories |
|---|---|---|---|
| **Background questions** | | | |
| SA10 | Population of the administrative unit | What is the name of this administrative unit? | |
| SA11 | | What is the population of this administrative unit? | Pp<br>Year of data: |
| SA12 | | What is the total number of households in this administrative unit? | Households:<br>Year of data: |
| SA13 | What proportion of the population uses on-site sanitation? | How many households (in this administrative unit) are connected to sewerage? | Households:<br>Year of data: |
| SA14 | | What kind of sanitation facilities are used by population without sewer connections? | Indicate the population using each of the following types of non-sewered sanitation:<br>12. Flush to septic tank<br>13. Flush to pit latrine<br>14. Flush to open drain<br>(15. Flush to covered drain)<br>18. Flush to don't know where<br>21. Ventilated improved pit latrine (with slab)<br>22. Single pit latrine with slab<br>23. Twin pit latrine with slab<br>24. Pit latrine without slab /Open slab<br>31. Composting toilet<br>(32. Container based sanitation)<br>41. Bucket<br>51. Hanging toilet/hanging latrine<br>95. No facility/bush/field<br>96. Other (specify) |
| **Core questions for indicator S9** | | | |
| SA20 | Proportion of the population using on-site sanitation | Q – How many households (in this administrative unit) received emptying services in the last year? | Number of containments emptied in last year:<br>a. Septic tanks :<br>b. Pit latrines (dry and wet): |

| | Overarching question | Sub-questions | Response categories |
|---|---|---|---|
| | that were emptied in the last year<br><br>*Assume 1 containment per household* | (Reported per sanitation facility type) | c. Other latrines (specify):<br>d. Total latrines (if not disaggregate by facility type):<br>96. Don't know: _____ |
| SA21 | | Q - What is the typical (or standard) frequency of emptying for the containments in this administrative area? (Reported by sanitation type) | Emptying frequency:<br>a) Septic tanks: Every xxx years<br>b) Pit latrines: Every xxx years<br>96. Don't know |
| **Core questions for indicator S11 and S12 and S13** | | | |
| SA30 | Transport of emptied excreta from on-site pits and tanks | What proportion of emptied containments are discharged at the following sites?<br><br>*(Note: Consider emptying by all service providers. Proportion can be based on volume delivered, number of containments or households emptied, population served. Sum of all responses should equal 100%)* | Proportion discharged at:<br><u>Off-site discharge site</u><br>a) Faecal sludge treatment plant<br>b) Wastewater treatment plant<br>c) Sewer line<br>d) Composting plant<br>e) Landfill with treatment of FS<br>f) Landfill without treatment of FS<br>g) Covered pit/trench<br>h) Designated waste pond<br>i) Other designated disposal site (specify)<br><u>Disposed safely in-situ</u><br>j) Covered pit at household<br><u>Delivered elsewhere</u><br>k) Surface environment (includes agriculture, field, waterway, unprotected landfill)<br>l) Don't know |
| **Core questions for indicator S11 and S12 and S13** | | | |
| SA40 | Treatment of excreta emptied from on-site pits and tanks | For faecal sludge discharged to a faecal sludge treatment (SA30=a), what level of treatment is provided?<br><br>*(Note: Given some administrative areas have multiple treatment plants, indicate the proportion of emptied excreta receiving the following level of treatment – sum of all treatments should equal 100%)* | Proportion of emptied faecal sludge delivered to a FSTP receiving the following level of treatment:<br>a) Treatment of solid and liquid fraction<br>b) Dewatering and/or stabilisation of solid fraction and treatment of liquid fraction<br>c) Solid liquid fraction separation only<br>d) Other<br>e) No treatment<br>f) Don't know |
| SA41 | | For faecal sludge delivered wastewater treatment plant or into a sewer line connected to WWTP (SA30 b+c), what level of treatment does the WWTP provide?<br><br>*(Note: Given some administrative areas have multiple treatment plants, indicate the proportion of emptied excreta receiving the following level of treatment – sum of all responses should equal 100%)* | Proportion of emptied faecal sludge delivered to a WWTP or sewer receiving the following level of treatment:<br>a) Tertiary or higher<br>b) Secondary<br>c) Primary<br>d) Other (specify)<br>e) No treatment<br>f) Don't know |

**Box D1. Aligning Administrative data with global indicators**

**Data sources for emptying**

A range of administrative data sources and reporting units may be available for monitoring the emptying of on-site sanitation systems. The global indicator S9 requires data on the proportion of the population that has **ever emptied** their pit latrine or septic tank. However, administrative data are typically reported on an annual basis and may use units such as number of trucks or volume of sludge collected rather than population served. The examples below describe how different types of administrative data can be aligned with indicator S9 and identify supplementary data that may be needed. Suggested survey

questions are provided for different data sources: the core questions use the number of households or containments, while expanded questions offer equivalent formulations using volume or other units. Selection of the appropriate question depends on data available.

- **Annual number of households or containments emptied**: Not all containments are emptied annually, therefore reported annual data needs to be converted to population estimates based on expected emptying frequency. For example, if septic tanks are emptied every 3 years, the annual proportion of the population emptied is calculated as the number of containment emptied divided by one-third of the population. While indicator S9 is ideally based on household reporting of "ever emptied", long term administrative rarely exist, therefore the annual proportion of population emptied may be used as the best available proxy for S9.
- **Volumes of sludge emptied**: Some administrative sources, such as truck logs or treatment plant records, report monthly or annual volume of sludge emptied or delivered. These data should be converted to population equivalents using supplementary information on the average containment volume and number of users per containment. Because faecal sludge removed from wet containments includes both the settled solids and liquid, conversions should use the containment volume rather than sludge accumulation rates. Containment volumes may be obtained through household inspections or service providers surveys.

Other units or sources may also exist, such as revenue from emptying services where local governments act as service providers. Disaggregation data between residential containments and those service public toilets, institutions and commercial properties is advisable, as the volumes and costs of differ and SDG estimates are based on residential data. Service authorities should seek data from all service providers, including informal or unregulated operators. During analysis, an assessment of whether service authority data are representative of the entire administrative area may be required. This could be done by comparing administrative data with household survey results or through follow up interviews with a sample of service authorities.

**Data sources for transport and treatment**

Administrative data on faecal sludge treatment remain limited, and existing records often do not adequately inform indicator S13, which tracks the proportion of faecal sludge delivered to treatment and the proportion that receive treatment of both solid and liquid phases.

- **Number of trucks or volume discharged at treatment:** Treatment plants may maintain administrative records or logbooks documenting the monthly or annual number of trucks received or the volume of sludge discharged. If these units cannot be directly compared with emptying data, they should be converted to a population equivalent based on containment volumes and emptying frequencies. Reported data on safe delivery from service providers may need to be cross checked with treatment facility log book data or verified through spot checks.
- **Treatment capacity:** Administrative records may include the design capacity and treatment level of faecal sludge treatment plants, or the volume that wastewater treatment plants can receive. Although treatment capacity is not required for core indicators, it can help estimate the maximum proportion of the administrative area that the treatment could serve, which is particularly relevant where treatment facilities operate at a pilot scale and cannot accommodate full population demand. As with emptying data, containment size and emptying frequency are required to convert capacity into a population equivalent estimate. Treatment capacity does not indicate the actual proportion of sludge that is delivered and treated but providers an upper limit for assessing potential safe treatment.

## D.2.2 Service authority example expanded questions

As mentioned above the expanded questions presented below are examples of alternative approaches to collect data on emptying, transport and treatment service outcomes and some additional questions relating to the level of service provided that may inform local indicators. These are not a complete list and also do not include questions relating to the enabling environment that is outside the scope of monitoring for SDG indicator 6.2.1.

**Table D 3. Example expanded questions for service authority surveys**

| | Overarching question | Sub-questions | Response |
|---|---|---|---|
| **Background questions** | | | |
| E-SA10 | Population sharing sanitation facilities | How many people use shared sanitation facilities? | People<br>Year of data:<br>Source of data: |
| E-SA11 | | On average, for households that share sanitation facilities, how many people use each shared sanitation facility? | People<br>Year of data:<br>Source of data: |
| **Indicator S9 - Emptying** | | | |
| E-SA20 | Proportion of the population using on-site sanitation that have ever emptied their containment by type of service provider | What proportion of households are served by each emptying provider?<br><br>(Note: for each provider indicate the % household in this administrative area that are served. This may require converting data from customer numbers or geographical areas served by each provider. Attempts should be made to understand non-formal market share.) | Proportion of population served by each:<br>a) Public /municipality/ government<br>b) Private enterprise/ company/ NGO<br>c) Informal emptier (e.g. unlicensed)<br>d) Other (specify)<br>e) No emptying services (e.g. households self-empty or pit latrines not emptied) |
| E-SA21 | | How many households have the following service providers emptied in the last year?<br><br>(Note: for each provider the data may be in different units (household, residential containments, all containments – need to remove non-residential). Attempts should be made to collect data from non-formal service providers). | Household emptied by each provider:<br><br>a) Public/municipality/ government<br>b) Private enterprise/company/ NGO<br>c) Informal emptier (e.g. unlicensed)<br>d) Other (specify)<br>e) No emptying services (e.g. households self empty or pit latrines not emptied)<br>f) Don't know |
| E-SA22 | Volume of sludge emptied in the last year | What volume of sludge was emptied in the last year? | M3<br>96. Don't know |
| E-SA23 | | What is the average size/volume of household containments?<br>(Reported per sanitation facility type) | Average volume:<br>a) Septic tank xx m3<br>b) pit latrine xx m3<br>96. Don't know |
| E-SA24 | Income from emptying services in the last year | What is the annual income from emptying residential containments? | (Annual) Total income |
| E-SA25 | | What is the average cost / rate charged for emptying one standard residential containment?<br>(Alternative: cost per containment type, or m3 emptied) | Average cost/tank or pit<br>(or indicate if alternative unit) |
| **Transport to treatment - expanded questions** | | | |
| E-SA30 | Service provider background | How many formal and informal emptying & transport service providers operate in this administrative area? | Provide the number of providers:<br>a) Public/municipality/government:<br>b) Private enterprise/company/NGO:<br>c) Informal emptier (e.g. unlicensed): |

| | Overarching question | Sub-questions | Response |
|---|---|---|---|
| | | (*Note: Identifying the number of providers will inform the sample size for the service provider survey)* | d) Other (specify):<br>Or indicate:<br>e) No emptying services (e.g. households self empty or pit latrines not emptied)<br>f) Don't know |
| E-SA31 | | How are service providers organized or regulated, if at all?<br>*(Note this informs how data could be or is being collected from these providers)* | a) through an association<br>b) licenced by the municipality<br>c) other formal arrangements<br>d) no organization<br>e) Don't know |
| E-SA32 | Alternative sources of emptying and transport data by service provider | What proportion of containments are emptied by each of the following service providers?<br>(*Note: please consider all emptied containments, not only those by government or formal emptying providers. Sum of all responses should equal 100%)* | Proportion of containments/households emptied by:<br>a) Public/municipality/government<br>b) Private enterprise/company/NGO<br>c) Informal emptier (e.g. unlicensed)<br>d) Other (specify)<br>e) No emptying services (e.g. households self empty or pit latrines not emptied)<br>f) Don't know |
| E-SA33 | | For **Public/municipality/ government** service providers, what proportion of excreta do they discharge at the following sites?<br>(*Note: Sum of all responses should equal 100%)* | What proportion of emptied containments are discharged at:<br><u>Off-site discharge site</u><br>a) Faecal sludge treatment plant<br>b) Wastewater treatment plant<br>c) Sewer line<br>d) Composting plant<br>e) Landfill with treatment of FS<br>f) Landfill without treatment of FS<br>g) Covered pit/trench<br>h) Designated waste pond<br>i) Other designated disposal site (specify)<br><u>Disposed safely in-situ</u><br>j) Covered pit at household<br><u>Delivered elsewhere</u><br>k) Surface environment (includes agriculture, field, waterway, unprotected landfill)<br>l) Don't know |
| E-SA34 | | For **Private enterprise/company/ NGO,** what proportion of excreta do they deliver to following sites?<br>*(Note: Sum of all responses should equal 100%)* | What proportion of emptied containments are discharged at:<br><u>Off-site discharge site</u><br>a) Faecal sludge treatment plant<br>b) Wastewater treatment plant<br>c) Sewer line<br>d) Composting plant<br>e) Landfill with treatment of FS<br>f) Landfill without treatment of FS<br>g) Covered pit/trench<br>h) Designated waste pond<br>i) Other designated disposal site (specify)<br><u>Disposed safely in-situ</u><br>j) Covered pit at household<br><u>Delivered elsewhere</u><br>k) Surface environment (includes agriculture, field, waterway, unprotected landfill)<br>l) Don't know |
| E-SA35 | | For **informal emptiers**, what proportion of excreta do they discharge to following sites? *(Note: Sum of all responses should equal 100%)* | Proportion of emptied containments discharged at:<br><u>Off-site discharge site</u><br>a) Faecal sludge treatment plant<br>b) Wastewater treatment plant<br>c) Sewer line |

| | Overarching question | Sub-questions | Response |
|---|---|---|---|
| | | | d) Composting plant<br>e) Landfill with treatment of FS<br>f) Landfill without treatment of FS<br>g) Covered pit/trench<br>h) Designated waste pond<br>i) Other designated disposal site (specify)<br><u>Disposed safely in-situ</u><br>j) Covered pit at household<br><u>Delivered elsewhere</u><br>k) Surface environment (includes agriculture, field, waterway, unprotected landfill)<br>l) Don't know |
| E-SA36 | Alternative sources of data on transport based on records at treatment plant | In this administrative area, how many of the following facilities exist that receive faecal sludge emptied from on-site sanitation?<br>(*Note: this question can be used to reduce this list of delivery sites to only those that exist for the following questions. Identifying the number of disposal sites will also inform the sample size for the service provider and inspection surveys)* | Indicate how many of each type of facilities that receive excreta emptied from OSS exist:<br>a) Faecal sludge treatment plant<br>b) Wastewater treatment plant<br>c) Directly into sewer<br>d) Composting<br>e) Landfill with treatment of FS<br>f) Landfill without treatment of FS<br>g) Buried in covered pit not at household<br>h) Other disposal site (specify)<br>Don't know |
| E-SA37 | | What **volume of excreta emptied from on-site containments (faecal sludge)** was delivered to/received by each site (alt. in the last year)? | Proportion of emptied containments discharged at:<br><u>Off-site discharge site</u><br>a) Faecal sludge treatment plant<br>b) Wastewater treatment plant<br>c) Sewer line<br>d) Composting plant<br>e) Landfill with treatment of FS<br>f) Landfill without treatment of FS<br>g) Covered pit/trench<br>h) Designated waste pond<br>i) Other designated disposal site (specify)<br><u>Disposed safely in-situ</u><br>j) Covered pit at household<br><u>Delivered elsewhere</u><br>k) Surface environment (includes agriculture, field, waterway, unprotected landfill)<br>l) Don't know |
| E-SA38 | | What proportion of excreta **delivered to the FSTPs** is delivered by each operator?<br>*(Note: This can be answered based on volume delivered or number of containments or trucks. Sum of all responses should equal 100%)* | Indicate the proportion delivered by each of following to the FSTP:<br>a) Public/municipality/government<br>b) Private enterprise/company/NGO<br>c) Informal emptier (e.g. unlicensed)<br>d) Other (specify)<br>e) Don't know |
| E-SA36 | | What proportion of excreta **delivered to the WWTPs or sewers** is delivered by each operator?<br>*(Note: This can be answered based on volume delivered or number of containments or trucks. Sum of all responses should equal 100%)* | Indicate the proportion delivered to each of following:<br>a) Public/municipality/government<br>b) Private enterprise/company/NGO<br>c) Informal emptier (e.g. unlicensed)<br>d) Other (specify)<br>e) Don't know |
| | **Treatment- expanded questions** | | |
| E-SA40 | Treatment performance | What percentage of the treated faecal sludge (solid component) complies with national performance standards?<br>(Please provide annual average) | % compliance<br>3. No tested<br>8. Don't know |

| | Overarching question | Sub-questions | Response |
|---|---|---|---|
| E-SA41 | | What percentage of the treated liquid effluent from this treatment complied with national performance (discharge) standards?<br>(Please provide the annual average) | % compliance<br>3. No tested<br>8. Don't know |
| E-SA42 | | Where is the final treated effluent (treated wastewater) discharged (or given/sold) to? | 1. Land or water for food production<br>2. Land or water bodies – NOT for food production<br>3. Long ocean outfall<br>4. Groundwater recharge<br>8. Don't know |
| E-SA43 | Reuse | Are the solids from the treatment process used in agriculture or other purposes? | 1. Yes<br>2. No<br>3. Maybe / Occasionally<br>8. Don't know |
| E-SA44 | | What types of activities is the liquid effluent used for? | A. Food production<br>B. Agriculture non-food production<br>C. Aquaculture/fishing<br>D. Energy production<br>E. Building/construction<br>X. Other |
| E-SA45 | | Does any further treatment or storage of solids occur prior to reuse? | 1. Yes<br>2. No<br>8. Don't know |
| E-SA46 | | Are the areas where treated wastewater or sludge are reused accessible to the public? | 1. Yes<br>2. No<br>3. Maybe / Occasionally<br>8. Don't know |

## D.3 Service provider survey - Emptying and transport

Service provider surveys are separated into a survey on emptying and transport, and one on treatment, as these activities are not necessarily conducted by the same provider. These questions could be integrated into regular reporting or data collection from service providers, such as may be required for licencing arrangements or by the regulator or could be implemented as a dedicated survey. The survey was designed to be captured from the service provider directly, however regulators or service authorities may regularly collect this data and be able to complete the information. Sampling should aim to be representative of the range of service providers (e.g. government, private, informal), different areas of coverage (e.g. across each administrative unit, urban and rural) and the types of services provided (e.g. vacuum emptying, manual emptying). Other considerations for sampling to be both representative within the administrative area and representative nationally are provided in section D7.2.

These emptying and treatment questions were drawn from a set of draft questions previously developed by WHO and UNICEF in 2016. These were developed as a person-person survey or interview and suggested that the interviewer should ensure they understand the local context before conducting the interview. This includes background knowledge about what service providers exist in the area, the location and the use and management of treatment plants or other disposal sites and would also be valuable background knowledge when adapting these surveys to suit the national context.

### D.3.1 Core questions - Service providers of faecal sludge emptying and transport

Table D4 summarises the core questions for a service providers for faecal sludge emptying and transport with a detailed questionnaire including these core questions provided in D5. The scope aims to cover all types of containments, emptying and transport methods. Recognising that there are different ways data can be collected, alternative questions are provided in the expanded question table D6 and the questions most relevant to available data should be used. For example, the number of containments emptied in a year is the proposed core question however similar results could be achieved through the expanded question on the volume emptied and the average containment volume. Since service providers don't necessarily cover the entire administrative area, additional questions are included to understand what geographical areas or social groups their services relate to.

**Table D 4. Core questions on emptying for service authorities and additional questions for analysis**

| Indicator | Core question | Additional questions for analysis |
|---|---|---|
| S9 - Percentage of **population with on-site sanitation emptied in the past year** | SPE13 - How many households did you provide emptying services last year? | a. How many pits or tanks did you empty on average each month or last month?<br>b. What geographical areas do you serve?<br>c. What is the average volume of sludge emptied from pits and tanks?<br>d. What frequency are pits and tanks emptied? |
| S12 - Percentage of emptied **excreta discharged to treatment** or disposal site | SPE14 - What proportion of emptied OSS were discharged to treatment or formal disposal sites? | a. Indicate the typical proportion of flows discharge to treatment, disposal sites, agriculture land, other surfaces, waterways, pits at the household, other?<br>b. Which specific treatment plants do you discharge to? |

**Table D 5. Draft questionnaire for core questions for emptying and transport service providers**

| ID | Question | Response |
|---|---|---|
| **SPE-10** | What is your employment status? | 1. Self-employed,<br>2. Company owner,<br>3. Work for a private company/NGO<br>4. Work for a public company/municipality/ government<br>5. Other (specify)<br>6. Don't know |
| **SPE-11** | Which location(s) do you work in (describe by district, zone, village etc. of the urban or rural location)? | List name(s) of service area(s)_____<br>2. Don't know |
| **SPE-12** | What type of containments do you empty? | Multiple answers<br>A. Flush to septic tank<br>B. Flush to pit latrine<br>C. Flush to open drain<br>D. Flush to elsewhere<br>E. Flush to don't know where<br>F. Pit latrine with slab<br>G. Pit latrine without slab / open pit<br>H. Composting toilet<br>I. Bucket<br>J. Hanging toilet/hanging latrine<br>K. No facility/bush/field<br>X. Other (specify)<br>*Optional*<br>*L. Ventilated improved pit latrine (with slab)*<br>*M. Twin pit latrine with slab*<br>*N. Container based sanitation* |
| **SPE-13** | On average, how many containments (septic tanks, pit latrines and other systems) do you empty per day/week/month/year? | Total number of containments:<br>Unit of data:<br>1. Day |

| | | |
|---|---|---|
| | | 2. Week<br>3. Month<br>4. Year |
| **SPE-14** | In the last month, what proportion of the faecal sludge you collect do you discharge at the following sites?<br>*(Note: If all delivered to one site mark 100%, otherwise distribute based on number of containments/trucks/volume depending on data available*). | Proportion of emptied containments discharged at:<br><u>Off-site discharge site</u><br>a) Faecal sludge treatment plant<br>b) Wastewater treatment plant<br>c) Sewer line<br>d) Composting plant<br>e) Landfill with treatment of FS<br>f) Landfill without treatment of FS<br>g) Covered pit/trench<br>h) Designated waste pond<br>i) Other designated disposal site (specify)<br><u>Disposed safely in-situ</u><br>j) Covered pit at household<br><u>Delivered elsewhere</u><br>k) Surface environment (includes agriculture, field, waterway, unprotected landfill)<br>l) Don't know |

## D.3.2 Expanded questions - Service providers of emptying and transport services

**Table D 6. Service providers emptying and transport survey – expanded questions**

| ID | Question | Response |
|---|---|---|
| E-SPE10 | Cluster no./service area no. | |
| E-SPE11 | Service provider number | |
| E-SPE12 | Interviewer's name | |
| E-SPE13 | Day / Month / Year of interview | |
| E-SPE14 | Location | |
| E-SPE15 | Area | 1. Urban<br>2. Rural |
| E-SPE16 | Name | |
| E-SPE17 | Organisation name (if any) | 1. Name___<br>2. Don't know |
| E-SPE18 | Title or position held in organisation (if any)? | |
| E-SPE19 | License number (if any)? | |
| E-SPE20 | Are you a member of, or affiliated to, an association of 'emptiers'? | 1. Yes<br>2. No<br>3. Other (specify)<br>4. Don't know |
| E-SPE21 | Are there other E&T service providers working in the same areas? | 1. Yes<br>2. No<br>3. Don't know |
| E-SPE22 | How many other E&T service providers working in the same areas? | Other responses to be added |
| E-SPE23 | What percentage of the overall district/city population do you serve?<br>(Note: They may either have specific population numbers or estimate, 100%, 90%, 50%, 10%) | % of city/district population |
| E-SPE24 | Do you serve particular groups of the population? | Multiple answers<br>A. Household/domestic<br>B. Institutions<br>C. Commercial<br>D. Residential – specifically low-income / informal/slum areas<br>E. Emergency camps<br>X. Other |
| E-SPE25 | What type of equipment do you use for emptying? | Multiple answers<br>A. Pump attached to vacuum truck<br>B. Submersible pump |

| ID | Question | Response |
|---|---|---|
| | | C. Manual pump<br>D. Bucket<br>E. Shovel<br>X. Other (specify) |
| E-SPE26 | Does emptying require you (or your colleagues or employees) to enter the containment to empty? | 1. Yes<br>2. No<br>3. Don't know |
| E-SPE27 | What type of equipment do you use for transport? | 1. Vacuum truck<br>2. Truck with tank<br>3. Truck with open storage<br>4. Cart<br>5. Other (specify)<br>6. No transport, direct disposal |
| E-SPE28 | When emptying and/or transporting the faecal sludge, do you (or your colleagues or employees) wear any special clothes or equipment? | 1. Yes<br>2. No<br>3. Don't know |
| E-SPE29 | What special clothes or equipment is worn? | Select all that apply<br>A. Gloves;<br>B. Boots;<br>C. Masks;<br>D. Overalls;<br>E. Others (specify);<br>F. Don't know. |
| E-SPE30 | If, available please report the average number of containments emptied per type (septic tank, pit latrine) per day/week/month/year? | a) Septic tanks emptied:<br>b) Pit latrines emptied:<br>Unit of data:<br>1. Day<br>2. Week<br>3. Month<br>4. Year |
| E-SPE31 | On average, what is the total volume of excreta did you empty from on-site sanitation facilities per day/week/month/year? | Quantity (m3):<br>Unit of data:<br>1. Day<br>2. Week<br>3. Month<br>4. Year |
| E-SPE32 | What is the average size/volume of household containments?<br>(Reported per sanitation facility type) | Average volume:<br>a) Septic tank xx m3<br>b) pit latrine xx m3<br>96. Don't know |
| E-SPE33 | Are you permitted to deliver to all treatment sites that exist in this area? If not, why? | |
| E-SPE34 | During the year are there periods when it is not possible to deliver to the treatment sites? If so, why? | |
| E-SPE36 | Do you keep a record of all household emptying and transport activities? | |
| E-SPE37 | Do you have records of your annual income from emptying? | |
| E-SPE38 | What is average the cost / rate charged for emptying one containment? | |

## D.4 Service provider survey – faecal sludge treatment

Service providers that operate faecal sludge treatment facilities, or wastewater treatment that receives faecal sludge, may differ from the stakeholder providing emptying and transport services therefore a separate questionnaire is proposed. Similar to the emptying and transport service provider survey, these questions can be implemented into an existing monitoring system, such as conducted by a technical ministry or conducted by regulators. These systems more commonly focus on compliance with environmental effluent standards or capacity of the systems but do not always include questions relevant to inform SMOSS estimates. In particular often the details of treatment steps are not provided and may need to be added or how solids are treated in a wastewater treatment plant.

A dedicated survey can also be conducted collect once-off data on the type and status of treatment facilities for faecal sludge, depending on the progress and function of systems this type of survey may not need annual updating. Identification of who will complete the survey will be important in the survey design, and the respondent should have some technical knowledge to be able to identify the type of treatment and whether it is designed and functioning as intended.

The core questions for treatment are presented in Table D7, with a detailed questionnaire in D8 and optional expanded questions in D9. The below Figure D1 provides examples of what treatment facilities can be considered as adequate treatment and highlights that both solid and liquid phases must be treated wastewater and faecal sludge waste streams.

**Table D 7. Core questions on treatment for service authorities and additional questions for analysis**

| Indicator | Core question | Additional questions for analysis |
|---|---|---|
| **S12 - Percentage of emptied excreta discharged to treatment** | What proportion of emptied OSS were discharged to this treatment site? | a. What is the average annual inflow to treatment of sludge emptied from septic tanks and pits (not sewer flows)?<br>b. Which emptying service providers discharge to this treatment plant?<br>c. What population is this treatment intended to serve? |
| **S13 - Percentage of excreta discharged receives both solid and liquid treatment** | Does this treatment provide both solid and liquid treatment?<br>(or for wastewater treatment, at least secondary treatment) | a. Which treatment proceses are used for the solid and liquid fractions of faecal sludge?<br>b. What proportion of inflows receive treatment as intended (i.e. not overflow, bypass, treatment not functioning)? |
| **SDG 6.3 - Percentage of excreta discharge to treatment that meets discharge standards.** | What proportion of treated sludge meets national discharge standards (solid and liquid)? | a. What proportion of liquid effluent tests met national discharge standards?<br>b. What proportion of sludge met sludge treatment standards? |

**Figure D1. Types of treatment for solid and liquid fractions**

| | Faecal sludge [a] | Wastewater and liquid fraction from faecal sludge |
|---|---|---|
| **Treated: Advanced treatment (possible for reuse)** | **Further drying/ pathogen reduction**<br>• Extended storage<br>• Thermophilic anaerobic digestion<br>• Sludge incineration<br>• Mechanical/thermal drying (e.g. Pelletiser)<br>• Lime or ammonia stabilization<br>• Co-composting, black soldier fly, vermi-composting<br>**Liquid fraction >**<br>As per wastewater treatment | **Advanced and Tertiary treatment [a]**<br>• Advanced oxidation<br>• Membrane filtration<br>• Carbon absorption<br>• Ion exchange<br>• Chemical oxidation<br>• Advanced N, P removal<br>• Disinfection<br>**< Sludge/solid fraction**<br>As per faecal sludge treatment |
| **Treated: Adequate treatment** | **Dewatering and/or stabilization of solid fraction**<br>Combined solid/liquid phase or septage<br>• Anaerobic pond, reactors or digestion<br>• Mechanical dewatering (screw press, belt press)<br>• Safe burial/storage (deep row entrenchment)<br>Solid fraction only<br>• Drying beds (planted or unplanted)<br>**Liquid fraction >**<br>• As per wastewater treatment | **Secondary treatment [b]**<br>• Aerobic suspended or attached growth (e.g. AS or trickling filters)<br>• Anaerobic suspended or attached growth (e.g. UASB)<br>• Waste stabilisation ponds<br>• Wetlands<br>**< Sludge/solid fraction**<br>• As per faecal sludge treatment |
| | **The levels above are the threshold for 6.2 and 6.3** | |
| **Not adequately treated** | **Solid liquid separation only**<br>• Sedimentation (settling-thickening tanks or pond)<br>• Storage / partial treatment (septic tanks) | **Primary treatment [c]**<br>Screening and grit removal with<br>• Sedimentation<br>• Chemical precipitation<br>• Filtration<br>• High rate clarification<br>Flotation |
| **Not treated** | | |

Notes:

a. Table adapted from the WHO and UN-Habitat 2018 description of treatment types to also include the faecal sludge treatment technologies referenced in Tayler 2018 and Strande et al 2014.[3]

b. **Tertiary treatment** is a process that follows secondary treatment and removes nitrogen, phosphorous or any other pollutant, such as microbiological pollution or colour, that affects the quality or a specific use of water.

c. **Secondary treatment** is a process that follows primary treatment of water and generally involves biological or other treatment with a secondary settlement or other process that results in a BOD removal of at least 70 per cent and a chemical oxygen demand (COD) removal of at least 75 per cent.

d. **Primary treatment** can be described as a mechanical, physical or chemical process involving settlement of suspended solids or any other process in which the biochemical oxygen demand (BOD) of the incoming water is reduced by at least 20 per cent before discharge, and the total suspended solids of the incoming water are reduced by at least 50 per cent. Where effluent from primary treatment plants is discharged to water bodies at very low risk of exposure to humans (for example, long ocean outfalls) these wastes are also classified as safely managed.[4]

[3] WHO and UN-Habitat, 2018. Piloting the monitoring methodology and initial findings for SDG indicator 6.3.1. Geneva: World Health Organization and UNHABITAT.
Tayler, K., 2018. Faecal Sludge and Septage Treatment: A guide for low-and middle-income countries. Warwickshire: Practical Action publishing.
Strande,L. & Brdjanovic, D. (Eds.), 2014. Faecal sludge management: Systems approach for implementation and operation. IWA publishing.

[4] WHO and UNICEF, 2017. Progress on Drinking Water, Sanitation and Hygiene Update and SDG Baselines 2017. Geneva: World Health Organization and UNICEF

## D.4.1 Questionnaire for service providers of faecal sludge treatment

**Table D 8. Core questions for treatment service providers**

| ID | Question | Response |
|---|---|---|
| **SPT-10** | What types of materials are received for treatment at this facility? | 1. Wastewater only<br>2. Faecal sludge only<br>3. Wastewater and faecal sludge<br>4. Solid/organic waste and faecal sludge<br>6. Other<br>7. None<br>8. Don't know |
| **SPT-11** | What is the volume of faecal sludge currently delivered to this treatment?<br><br>(Do you have records that could verify these flows? How do you calculate/monitor it?) | Xxx inflow<br>Units (m3 per year, m3/month, trucks per week) |
| **SPT-12** | How is wastewater (sewage) treated at this WWTP facility?<br>(Respond if SPT-1 is 1 or 3) | 1. Tertiary or higher treatment<br>2. Secondary treatment<br>3. Primary treatment<br>4. Other (specify)<br>5. No treatment<br>6. Don't know |
| **SPT-13** | How is faecal sludge treated at this facility?<br>(Respond if SPT-1 is 2) | 1. Advanced treatment of solid and liquid fraction (including further drying / pathogen reduction)<br>2. Adequate treatment - Dewatering and/or stabilisation of solid fraction and treatment of liquid fraction<br>3. Solid liquid fraction separation only<br>4. Other<br>5. No treatment<br>6. Don't know |
| **SPT-14** | Which treatment processes are used for the solid fraction of faecal sludge?<br>(Respond if SPT-1 is 2) | (Select multiple)<br><u>Typically combined fractions</u><br>A. Disposal uncovered on land or uncovered burial<br>B. Safe burial/storage (deep row entrenchment)<br>C. Sedimentation (settling-thickening tanks or pond)<br>D. Mechanical dewatering (screw press, belt press)<br>E. Drying beds (planted or unplanted)<br>F. Anaerobic pond, reactors or digestion<br><u>Solids fraction only</u><br>G. Thermophilic anaerobic digestion<br>H. Sludge incineration<br>I. Mechanical/thermal drying (e.g. Pelletiser)<br>J. Extended storage (unplanted drying bed)<br>K. Lime or ammonia stabilization<br>L. Co-composting, black soldier fly, vermi-composting<br>M. Other<br>X. Don't know |
| **SPT-15** | Which treatment processes are used for the liquid fraction resulting from faecal sludge treatment? | <u>Tertiary</u><br>A. Advanced oxidation<br>B. Membrane Filtration<br>C. Carbon absorption<br>D. Ion exchange<br>E. Chemical oxidation Advanced N,P removal<br>F. Disinfection (chlorination, UV, etc.)<br><u>Secondary</u><br>G. Aerobic suspended or attached growth (e.g. trickling filter, activated sludge)<br>H. Anaerobic suspended or attached growth (e.g. UASB)<br>I. Waste stabilization ponds<br>J. Constructed wetlands<br><u>Primary treatment</u> |

| | | |
|---|---|---|
| | | K. Screening and grit removal with<br>L. Sedimentation<br>M. Chemical precipitation<br>N. Filtration<br>O. High rate clarification<br>P. Floatation.<br>Q. Other<br>X. Don't know |

## D.4.2 Expanded questions - Service providers of faecal sludge treatment

**Table D 9. Example expanded questions for treatment service provider survey**

| | **Background** | |
|---|---|---|
| E-SPT10 | Cluster no./service area no. | |
| E-SPT11 | Service provider number | |
| E-SPT12 | Interviewer's name | |
| E-SPT13 | Day / Month / Year of interview | |
| E-SPT14 | Location | |
| E-SPT15 | Area | 1. Urban<br>2. Rural |
| E-SPT16 | Name | |
| E-SPT17 | Organisation name (if any) | |
| E-SPT18 | Title or position held in organisation (if any)? | |
| | **Inflows to treatment plant** | |
| E-SPT19 | What size population does the treatment plant serves? (do you have records to verify this figure?) | 1. Population<br>8. Don't know |
| E-SPT20 | What percentage of the overall district/city population do you serve?<br>(Note: They may either have specific population numbers or estimate, 100%, 90%, 50%, 10%) | % of city/district population<br>8. Don't know |
| E-SPT21 | Which location(s) does this treatment plant serve (describe by district, zone, village etc. of the urban or rural location)? | List name(s) of service area(s)_____<br>2. All city/district<br>3. Don't know |
| E-SPT22 | What is the treatment plant design capacity for wastewater and faecal sludge? | a. Xxxx Capacity m3/d for faecal sludge<br>b. Xxxx Capacity m3/d for wastewater |
| E-SPT23 | Where does the faecal sludge come from and in what proportions?<br>(Do you have records to verify these figures?) | 1. Household/domestic<br>2. Institutions<br>3. Commercial<br>4. Residential – specifically low-income / informal/slum areas<br>6. Other<br>8. Don't know |
| E-SPT24 | What proportion of containments/ volume of faecal sludge discharged to this treatment plant comes from each of the following emptying service providers?<br>(Do you keep a record of all deliveries to the treatment plant? If so, please can i see it?) | Either mark which group and/or provider details (names)<br>a) Public/municipality/government<br>b) Private enterprise/company/NGO<br>c) Informal emptier (e.g. unlicensed)<br>d) Other (specify)<br>e) Don't know |
| E-SPT25 | Are all service providers permitted to discharge faecal sludge to this treatment plant? | 1. Yes<br>2. No<br>8. Don't know |
| E-SPT26 | What type of equipment is used to deliver excreta to this treatment plant? | (Select all that apply)<br>A. Vacuum truck<br>B. Truck with tank (pump not integrated)<br>C. Truck with open storage |

| | | |
|---|---|---|
| | | D. Cart<br>E. Other (specify)<br>F. None – sewer only<br>X. Don't know |
| | **Level of treatment** | |
| E-SPT28 | Which treatment processes are used at the wastewater treatment plant (for the liquid fraction)?<br>(Respond if SPT-10 is 1,3) | <u>Tertiary</u><br>A. Advanced oxidation<br>B. Membrane Filtration<br>C. Carbon absorption<br>D. Ion exchange<br>E. Chemical oxidation Advanced N,P removal<br>F. Disinfection (chlorination, UV, etc.)<br><u>Secondary</u><br>G. Aerobic suspended or attached growth (e.g. trickling filter, activated sludge)<br>H. Anaerobic suspended or attached growth (e.g. UASB)<br>I. Waste stabilization ponds<br>J. Constructed wetlands<br><u>Primary treatment</u><br>K. Screening and grit removal with<br>L. Sedimentation<br>M. Chemical precipitation<br>N. Filtration<br>O. High rate clarification<br>P. Floatation.<br>Q. Other<br>X. Don't know |
| E-SPT29 | Which treatment processes are used for the solid fraction or sludge produced at the wastewater treatment plant?<br>(Respond if SPT-10 is 1,3) | (Select multiple)<br><u>Typically combined fractions</u><br>A. Disposal uncovered on land or uncovered burial<br>B. Safe burial/storage (deep row entrenchment)<br>C. Sedimentation (settling-thickening tanks or pond)<br>D. Mechanical dewatering (screw press, belt press)<br>E. Drying beds (planted or unplanted)<br>F. Anaerobic pond, reactors or digestion<br><u>Solids fraction only</u><br>G. Thermophilic anaerobic digestion<br>H. Sludge incineration<br>I. Mechanical/thermal drying (e.g. Pelletiser)<br>J. Extended storage (unplanted drying bed)<br>K. Lime or ammonia stabilization<br>L. Co-composting, black soldier fly, vermi-composting<br>M. Other<br>X. Don't know |
| E-SPT30 | What is done with the solids remaining after treatment? | 1. Land for food production<br>2. Land not for food production<br>3. Protected landfill or safe burial<br>4. Open land, unsafe burial<br>6. Other<br>8. Don't know |
| E-SPT31 | Where is the treated liquid fraction remaining after treatment? | 1. Land or water for food production<br>2. Land or water bodies – NOT for food production<br>3. Long ocean outfall<br>4. Groundwater recharge<br>6. Other<br>8. Don't know |
| E-SPT32 | What percentage of the treated faecal sludge complies with national performance (discharge) standards?<br>(Please provide annual average) | % compliance<br>3. No tested<br>8. Don't know |

| | | |
|---|---|---|
| E-SPT33 | What percentage of the treated liquid effluent from this treatment complied with national performance (discharge) standards? (Please provide the annual average) | % compliance<br>3. No tested<br>8. Don't know |

## D.5 Spot check / inspection - treatment plant

### D.5.1 Proposed spot check core questions

The below questions have not been widely tested however are the suggested minimum questions to be included in inspections or spot checks of treatment plants to inform global indicators. While spot checks or inspections can also occur for emptying and transport services, data on emptying and transport to inform the core indicators are more likely to come from other sources to achieve an adequate sample size (household questionnaire, local government or service provider sources). Inspections of emptying and transport are likely more useful for triangulation and verification of data collected through other sources.

**Table D 10. Draft core questions for treatment inspection / spot checks**

| ID | Core inspection question | Responses |
|---|---|---|
| SI-10 | What types of materials are received for treatment at this facility? | 1. Wastewater only<br>2. Faecal sludge only<br>3. Wastewater and faecal sludge<br>4. Solid/organic waste and faecal sludge<br>6. Other<br>7. None<br>8. Don't know |
| SI-11 | How is faecal sludge treated at this facility?<br>(Respond if SI-10 is 2, 3 or 4) | 1. Advanced treatment of solid and liquid fraction (including further drying / pathogen reduction)<br>2. Adequate treatment - Dewatering and/or stabilisation of solid fraction and treatment of liquid fraction<br>3. Solid liquid fraction separation only<br>4. Other<br>5. No treatment<br>6. Don't know |
| SI-12 | Which treatment processes are used for the solid fraction of faecal sludge? | (Select multiple)<br>Typically combined fractions<br>A. Disposal uncovered on land or uncovered burial<br>B. Safe burial/storage (deep row entrenchment)<br>C. Sedimentation (settling-thickening tanks or pond)<br>D. Mechanical dewatering (screw press, belt press)<br>E. Drying beds (planted or unplanted)<br>F. Anaerobic pond, reactors or digestion<br>Solids fraction only<br>G. Thermophilic anaerobic digestion<br>H. Sludge incineration<br>I. Mechanical/thermal drying (e.g. Pelletiser)<br>J. Extended storage (unplanted drying bed)<br>K. Lime or ammonia stabilization<br>L. Co-composting, black soldier fly, vermi-composting<br>M. Other<br>X. Don't know |
| SI-13 | How is wastewater (sewage) treated at this WWTP facility?<br>(Respond if SI-10 is 1 or 3) | 1. Tertiary or higher treatment<br>2. Secondary treatment<br>3. Primary treatment<br>4. Other (specify)<br>5. No treatment<br>6. Don't know |

| ID | Core inspection question | Responses |
|---|---|---|
| SI-14 | Which treatment processes are used for the liquid fraction resulting from faecal sludge treatment? | Tertiary<br>A. Advanced oxidation<br>B. Membrane Filtration<br>C. Carbon absorption<br>D. Ion exchange<br>E. Chemical oxidation Advanced N,P removal<br>F. Disinfection (chlorination, UV, etc.)<br>Secondary<br>G. Aerobic suspended or attached growth (e.g. trickling filter, activated sludge)<br>H. Anaerobic suspended or attached growth (e.g. UASB)<br>I. Waste stabilization ponds<br>J. Constructed wetlands<br>Primary treatment<br>K. Screening and grit removal with<br>L. Sedimentation<br>M. Chemical precipitation<br>N. Filtration<br>O. High rate clarification<br>P. Floatation.<br>Q. Other<br>1. Don't know |
| SI-15 | What is the volume of faecal sludge currently delivered to this treatment?<br><br>(Do you have records that could verify these flows? How do you calculate/monitor it?) | Xxx inflow<br>2. Units (m3 per year, m3/month, trucks per week) |

## D.5.2 Proposed spot check expanded questions

**Table D 11. Example expanded questions for treatment inspections/sport**

| ID | Core inspection question | Responses |
|---|---|---|
| E-SI1 | Cluster no./service area no. | |
| E-SI2 | Service provider number | |
| E-SI3 | Interviewer's name | |
| E-SI4 | Day / Month / Year of interview | |
| E-SI5 | Location | |
| E-SI6 | Area | 1. Urban<br>2. Rural |
| E-SI7 | Name | |
| E-SI8 | Organisation name (if any) | |
| E-SI9 | Title or position held in organisation (if any)? | |
| | **Treatment questions** | |
| E-SI0 | What types of materials are received for treatment at this facility? | 1. Wastewater only<br>2. Faecal sludge only<br>3. Wastewater and faecal sludge<br>4. Solid/organic waste and faecal sludge<br>6. Other<br>7. None<br>8. Don't know |
| E-SI1 | If the treatment is not a FSTP, is it designed (or designated/intended) to receive excreta from on-site sanitation? | 1. Yes records of design and intended for FS<br>2. Yes designated by authority to receive FS<br>3. Yes think it is designed or designated for FS but no evidence<br>4. Other |

| ID | Core inspection question | Responses |
|---|---|---|
| | | 5. No not designed or intended to receive FS<br>8. Don't know |
| | **Capacity and inflow** | |
| E-SI4 | What is the design capacity of the wastewater treatment plant?<br>And if available, what is the allowable inflow of faecal sludge per day? *(this is usually a fraction of the total capacity as faecal sludge is more concentrated)*<br>(if E-SI0=1) | Xxxx Capacity m3/d for wastewater<br>Xxx capacity m3/d for faecal sludge input |
| E-SI5 | What is the faecal sludge treatment plant design capacity?<br>(if E-SI0=2) | Xxxx Capacity m3/d for faecal sludge |
| E-SI6 | What is population that the treatment plant serves? | xxx Population<br>8. Don't know |
| E-SI7 | If population numbers not available, what proportion of the district/city does this treatment serve? | 1. <10%<br>2. 10-50%<br>3. 50-75%<br>4. >75%<br>Specific %<br>8. Don't know |
| E-SI8 | Which location(s) does this treatment plant serve (describe by district, zone, village etc. of the urban or rural location)? | List name(s) of service area(s)_____<br>B. All city/district<br>X. Don't know |
| E-SI9 | Where does the faecal sludge come from and in what proportions?<br>(Do you have records to verify these figures?) | A. Xx% from Household/domestic<br>B. Xx% from Institutions<br>C. xx% from commercial<br>D. Other (specify)<br>X. Don't know |
| E-SI10 | Is the average annual inflow above or below the design capacity of the plant? | 1. Above capacity / too much<br>2. At capacity<br>3. Below capacity / less flow<br>Xxx Actual % inflow / capacity<br>8. Don't know |
| E-SI11 | Has the plant overflowed or spilled past 2 years? | 1. Yes<br>2. No<br>8. Don't know |
| | **To assess function and performance** | |
| E-SI12 | Are all systems in place and functioning at the time of the visit? | 1. Yes<br>2. No<br>6. Other (specify) |
| E-SI13 | In the past year, how many days did the treatment plant not function as intended? | Xx days<br>8. Don't know |
| E-SI14 | Is there any visible damage to the tanks/basins causing excreta/wastewater to discharge or overflow to the surface environment or waterways? | 1. Yes<br>2. No<br>6. Other (specify) |
| E-SI15 | Are any parts of the system not being used or being bypassed?<br>(Does this significantly affect performance?) | 1. Yes significantly affects performance<br>2. Yes but not significant impact on performance<br>3. No not bypassed<br>6. Other (specify)<br>8. Don't know |
| E-SI16 | Are contaminated by-products safely disposed and not left in open (e.g. grit/sludge/solid waste removed from treatment processes)? | 1. Yes<br>2. No<br>6. Other (specify) |
| E-SI17 | Is the sludge drying area protected from flooding or wash out? | 1. Yes<br>2. No<br>6. Other (specify) |
| | **Disposal of treated waste** | |

| ID | Core inspection question | Responses |
|---|---|---|
| E-SI18 | What is done with the solids remaining after treatment? | 1. Land for food production<br>2. Land not for food production<br>3. Protected landfill or safe burial<br>4. Open land, unsafe burial<br>6. Other<br>8. Don't know |
| E-SI19 | Where is the treated liquid fraction remaining after treatment? | 1. Land or water for food production<br>2. Land or water bodies – NOT for food production<br>3. Long ocean outfall<br>4. Groundwater recharge<br>6. Other<br>8. Don't know |
| E-SI20 | Does the community access the waterways where liquid fraction is discharged? (e.g. for washing, recreation, other) | 1. Yes<br>2. No<br>3. Maybe<br>8. Don't know |
| E-SI21 | What percentage of the treated faecal sludge complies with national performance (discharge) standards?<br>(Please provide annual average) | % compliance<br>3. No tested<br>8. Don't know |
| E-SI22 | What percentage of the treated liquid effluent from this treatment complied with national performance (discharge) standards?<br>(Please provide the annual average) | % compliance<br>3. No tested<br>8. Don't know |

## D.6 Example service provider questionnaires

### D.6.1 Example service authority questionnaire from Ecuador pilot

During the M-SMOSS pilots, Ecuador included additional parameters related to on-site sanitation, which were included in the 2020 National System for Municipal Information (SNIM) reporting. The National System for Municipal Information (SNIM) is a digital platform collecting annual information on the management of municipalities at the national level. It is administered by the Association of Municipalities of Ecuador (AME), in coordination with Agency for Water Regulation and Control (ARCA) and the National Institute of Statistics and Censuses (INEC). The survey was distributed to all municipalities (221) by the AME. While submission was mandatory, there were a high percentage of non-responses for different SMOSS questions.

**Table D 12. Ecuador onsite sanitation survey questions in National System for Municipal Information (SNIM) survey 2019 (translated)**

| National System for Municipal Information – New questions | Responses |
|---|---|
| Does the municipality offer services of emptying waste (solid or liquid) generated in homes that have individual sanitation facilities such as septic tanks, cesspits, latrines, Basic Sanitary Units (UBS), among others? | Yes / No |
| What way is management carried out? (Selection) | Direct<br>Outsourced<br>other (specify) |
| Select the type of emptying: | Mechanic<br>Manual<br>Manual and Mechanical |
| Does the municipality have a suction vehicle for waste (solid or liquid) generated in the homes that have individual sanitation facilities? | Yes / No |
| Do you have records of their waste emptying service (solid or liquid)? | Yes / No |
| How many disposal sites do you have? | |

| National System for Municipal Information – New questions | Responses |
|---|---|
| Type of waste discharge site (solid or liquid) Select: | -Residual water treatment plant<br>-Dump / landfill<br>-River<br>-Broken<br>-Floor<br>-Other (specify) |
| Disposal site name | Name: |
| Do the staff of the municipality that offers the service of emptying waste (solid or liquid) have personal protective equipment such as respiratory protection equipment, hooded coveralls, gloves, boots, helmet, goggles, among others? | Yes / No |
| In the canton, are there private companies that empty the waste (solid or liquid) generated in the homes that have individual sanitation facilities such as septic tanks, blind wells, latrines, Basic Health Units (UBS), among others . | Yes / No |
| Are they authorized by the municipality? | Yes / No |
| Do you know where their final disposal of waste (solid or liquid) is made? | Yes / No |
| What type of waste discharge site (solid or liquid) do the private companies dispose waste? Select: | -Residual water treatment plant<br>-Dump / landfill<br>-River<br>-Broken<br>-Floor<br>-Other (specify) |
| Do you have records of private companies that empty individual sanitation facilities and / or final disposal of sludge? | Yes / No |
| Does the municipality have regulations / ordinance that regulates the private sector that empties individual sanitation facilities and / or final disposal of sludge? | Yes / No |
| Does the Wastewater Treatment Plant (WWTP) has the capacity to receive the waste (solid or liquid) generated in the individual sanitation facilities? | Yes / No |
| Does the wastewater treatment plant has a full-time operator who is responsible for its operation? | Yes / No |
| Number of dwellings with the following individual services in **urban areas**:<br>- septic tanks,<br>- cesspits<br>- latrines,<br>- Basic Sanitary Units (UBS) | Number for each: |
| Number of dwellings with the following individual services in **rural areas**:<br>- septic tanks,<br>- cesspits<br>- latrines,<br>- Basic Sanitary Units (UBS) | Number for each: |
| Number of inspection boxes connected to homes (with effective connection) | |

## D.6.2 Example service authority questionnaire from Serbia pilot

The Serbia M-SMOSS pilot implemented a structured checklist of indicators to assess toilets, containment, emptying, transport, treatment and disposal from households' and institutional on-site systems in line with JMP indicators. It was distributed to all 150 public utility companies responsible for emptying of septic tanks and transport of faecal sludge to further treatment. The survey was implemented through an online survey (using Google forms) shared by the Standing Conference of Towns and Municipalities, which has got organised network for supporting the work of local self-government and units (LGUs). The response rate was 50% of LGUs which represented 80% of the population. This

assessment was complemented with the key-informant interviews in 4 districts, selected one per each statistical region (Vojvodina region, City Belgrade region, Western Serbia and South-East Serbia).

The survey of local self-governments consisted of the following sections:

1. Basic data on the local self-government unit
2. Management of emptying, transport and treatment of faecal sludge from pit latrines, septic and holding tanks and small-scale sewage systems (up to 2000 PE) at the local self-government unit
    - Assembly Decisions governing the performance of utility services
    - Scope and management of utility services
3. Inspection surveillance over management of containment, emptying, transport and treatment of faecal sludge on-site
4. Planning in the field of sanitation at the level of the local self-government unit
5. Human resources for performing tasks involving emptying, transport and treatment of faecal sludge from septic and holding tanks and small-scale sewage systems
6. Financing services and investments in the local self-government unit
7. Coordination

Link to the full survey of local authorities

**Table D 13. Summary of topics included in Serbia national survey**

| SERBIA LOCAL GOVERNMENT SURVEY CATEGORIES | SERBIA SERVICE PROVIDER SURVEY CATEGORIES |
|---|---|
| • Basic data on the local self-government unit<br>• Management of emptying, transport and treatment of faecal sludge from pit latrines, septic and holding tanks and small-scale sewage systems (up to 2000 PE) at the local self-government unit<br>• Assembly Decisions governing the performance of utility services<br>• Scope and management of utility services<br>• Inspection surveillance over management of containment, emptying, transport and treatment of faecal sludge on-site<br>• Planning in the field of sanitation at the level of the local self-government unit<br>• Human resources for performing tasks involving emptying, transport and treatment of faecal sludge from septic and holding tanks and small-scale sewage systems<br>• Financing services and investments in the local self-government unit<br>• Coordination | • General data about service provider<br>• Regulations, standards and guiding documents for emptying, transport and treatment provided by public utility companies<br>• Monitoring/ records of emptying, transport and treatment of faecal sludge from pit latrines, septic and holding tanks and small-scale sewage systems (up to 2000 PE)<br>• Emptying, transport, treatment and disposal<br>• Human resources<br>• Financing |

## D.7 Sampling for service authority and service provider surveys

### D.7.1 Service authority surveys

Sampling depends on the method of implementation and sample unit. Typically, administrative data applies to all administrative units nationally, however there may be cases where a smaller representative sample is acceptable. A representative sample could follow the approaches proposed in the service provider surveys, such as UN-Habitat's guidance on nationally representative sampling from cities[5] or focusing on larger towns as proposed in the Eurostat data collection on water and wastewater[6], as these populations will have more impact on the national estimate. In some cases, samples may need to include different sample populations depending on the institutional arrangements, for example when the responsibility for sanitation differs between rural and urban areas two different sample populations are needed (for example the health department may be responsible for sanitation in rural areas and the infrastructure department in urban areas).

The response rate is an important consideration for service authority surveys and national requirements or practices for acceptable response rates should guide this, given they are considered reasonable for a representative estimate. Response rate could be based on the number of responses, or the population represented, which was the approach used in Serbia where 50% of local governments responded yet as this represented 80% of the population it was deemed nationally representative. As noted by FAO 2019[7], it cannot be assumed that the characteristics of nonrespondents are equivalent to the respondents, and further investigation of the sanitation status of these non-respondents or adjustment of estimates may be necessary to ensure there is not bias in data from respondents only.

**Box 2. Example of service authority sampling from France (Eurostat, 2021).**

France undertook an extensive survey of water and wastewater in local authority areas in 1998, 2001, 2004 and 2008 (approximately every three years). In 2008, a sample of 5 215 local authority areas (out of a total of 36 686) was taken from across the whole country, including overseas territories. The samples were stratified according to the size of the regional and local authority areas. The survey rate ranged from full coverage, for local authority areas with more than 10 000 inhabitants, to 5%, for areas with under 400 inhabitants. This selection is statistically valid sample, and the data can therefore be grossed up to reflect the country as a whole, and the results used for reporting.

### D.7.2 Service provider surveys

The sampling approach for service provider surveys is also more complex as the population they serve is not fixed, may overlap with other providers or may cross administrative boundaries. Compared with an off-site network where it is clear which households are served by a sewer network and which treatment plant this connects to, the populations served by on-site sanitation emptying, transport and treatment providers may not be fixed and needs to be identified in the surveys.

The sample size and approach may require some understanding of the possible data variability between service providers (e.g. government, enterprises or informal emptying services), which could be informed by previous studies or secondary data. Understanding of the regulations may also be important as these may influence the chosen sample. For example, in Serbia private emptying providers are not permitted to

[5] UN-Habitat, 2016. National Sample of Cities: A model approach to monitoring and reporting performance of cities at national level. Nairobi: UN-Habitat. Available at: https://unhabitat.org/sites/default/files/2020/06/national_sample_of_cities_english.pdf

[6] EUROSTAT, 2021. Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters and Eurostat Regional Water Questionnaire. Luxembourg: Eurostat. Available at: https://ec.europa.eu/eurostat/documents/1798247/6664269/Data+Collection+Manual+for+the+OECD_Eurostat+Joint+Questionnaire+on+Inland+Waters+%28version+3.0%2C+2014%29.pdf/f5f60d49-e88c-4e3c-bc23-c1ec26a01b2a

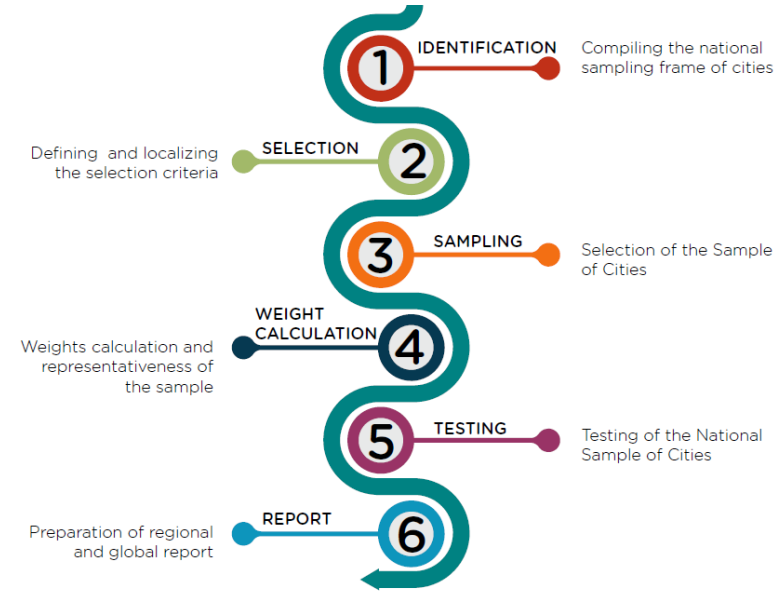
[7] FAO, 2019. Guidelines on improving and using administrative data in agricultural statistics. Rome: Food and Agriculture Organization of the United Nations. Available at: http://www.fao.org/3/ca6413en/ca6413en.pdf

deliver sludge to the treatment plant, therefore only government providers were sampled as private providers will always be considered unsafe. However for local indicators or planning, it may be useful to collect data from these operators to understand where they dispose of excreta, even if illegal. Effort should be given to ensure a representative sample is achieved, which may require different approaches to engage with and sample formal and informal providers. Similarly assumptions about the existence of services in certain areas (e.g. emptying providers in informal settlements or rural areas) should be validated by data, such as cross checking with the household responses.

Sampling will need to be representative for within the district (e.g. between formal and informal providers) and also representative for national estimates. This may depend on the scale and homogeneity of the management of on-site sanitation across the country. While some countries may have a treatment plant and emptying service in every administrative unit and therefore a representative sample may be suitable, other countries may only have a handful of treatment plants in the entire country, therefore requiring a different approach to sampling and analysis. An understanding of how the data will be analysed will inform the sampling approach and is discussed in the following chapter. The UN-Habitat guidance on nationally representative sampling from cities summarised below could be relevant to service provider surveys.[8]

**Box 3. Guidance on nationally representative sampling from cities**

The national sample of cities (NSC) is a carefully constructed representative sample of cities that takes into account sub-regional and city specific characteristics and variances to monitor the dominant pattern in the country's cities in an aggregated manner in any given country.




A brief summary of some of the steps proposed for the national sampling of cities approach that are relevant to service provider survey sampling include:

1. Compiling the national sampling frame of cities: Identify and compile a complete listing of all the cities (or relevant sampling unit) in a given country. This identification of all cities requires a definition of what constitutes a city.
2. Defining and localizing the selection criteria: representative of a given country's territory, geography, size, history, and systems of cities. In general, the national sample of cities will be drawn using sound scientific methods based, but not limited to the following recommended criteria: city population size, city area sizes, geographical location, city functionality, economic and political importance, etc.
3. Selection of the Sample of Cities including a) Defining city clusters/combinations or b) Random sampling within clusters
4. Weights calculation and representativeness of the sample. It is important to ensure that measures obtained using the final sample are accurate and can be extrapolated to the universe of cities.

[8] UN-Habitat, 2016. Ibid

### D.7.3 Spot check

Depends on the objective of the spot check and the results of supplementary data that is to be validated. Also influenced by budget as labour intensive to physically visit plants, unless a remote approach to monitoring is applied through local actors conducting it, provided they have sufficient technical knowledge or training.

As per service provider surveys, consideration should be given to identify the range of service services that exist and how sampling and implementation of inspections includes a representative sample, not avoiding the harder to reach respondents, such as manual emptiers or private service providers. The frequency of such inspections depends on whether it serves as a primary data source, in which a representative sample is needed, or for validating other data, in which a smaller sample may be adequate. It also depends on the level of trust by environmental health staff in the service providers and the potential hazards arising from non-compliance.[9]

[9] WHO and UNICEF, 2018. Core questions on drinking water, sanitation and hygiene for household surveys: 2018 update. New York: United Nations Children's Fund and World Health Organization