July 2016

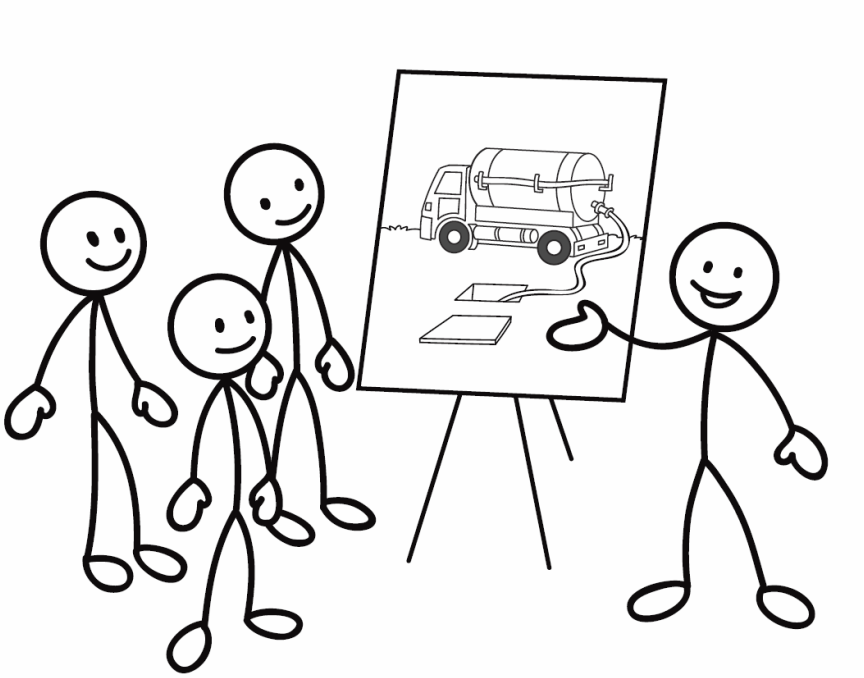
Trainer Manual

CAWST
Centre for Affordable Water and Sanitation Technology

eawag
aquatic research

Sandec
Sanitation, Water and Solid Waste for Development

Introduction to Faecal Sludge Management



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CAWST (the Centre for Affordable Water and Sanitation Technology) is a nonprofit organization that provides training and consulting to organizations working directly with populations in developing countries who lack access to clean water and basic sanitation. One of CAWST's core strategies is to make water knowledge common knowledge. This is achieved, in part, by developing and freely distributing education materials with the intent of increasing the availability of information to those who need it most.

Sandec is the Department of Sanitation, Water and Solid Waste for Development, at Eawag, the Swiss Federal Institute of Aquatic Science and Technology. Sandec's mandate is to develop and test methods and technologies that help the world's poorest access sustainable water and sanitation services. The Sandec team is composed of scientists who work together with partner organizations worldwide, make use of Eawag's multidisciplinary scientific and technological knowledge, and publish and disseminate our research and training materials for free.

CAWST and Eawag-Sandec will produce updated versions of this document periodically. For this reason, we do not recommend hosting this document to download from your website.

CAWST and Eawag-Sandec provide mentoring and coaching on the use of its education and training resources.

Stay up-to-date and get support:

- Latest updates to this document
- Other workshop and training related resources
- Support on using this document in your work

www.cawst.org/resources and www.sandec.ch

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Acronyms

CAWST	Centre for Affordable Water and Sanitation Technology
Eawag	Swiss Federal Institute for Environmental Sciences and Technology
LP	lesson plan
Sandec	Department Sanitation, Water and Solid Waste for Development

1 Introduction

This Trainer Manual is to support people who facilitate faecal sludge management workshops. This manual provides:

- Background on how and why the workshop was developed
- Tips that help you plan for a successful workshop
- Several tools to help deliver your training, such as checklists, lesson plans and PowerPoint presentations

We recommend that you adapt the tools to suit your style and the needs of your audience.

The workshop was developed in collaboration between CAWST (the Centre for Affordable Water and Sanitation Technology) and Eawag-Sandec. CAWST provides technical training and consulting services to organizations that implement water, sanitation and hygiene (WASH) projects in developing countries. CAWST focuses on the planning, design and implementation of on-site sanitation projects for low-income communities not connected to a sewer. This includes implementation of the entire sanitation system, including faecal sludge management.

Eawag-Sandec is the Department of Sanitation, Water and Solid Waste for Development (Sandec) at the Swiss Federal Institute of Aquatic Science and Technology (Eawag). The Sandec team is composed of scientists and engineers and works with partner organizations worldwide, while making use of Eawag's multidisciplinary scientific and technological knowledge. Sandec is committed to:

- Developing and facilitating the implementation of new concepts and technologies in water supply and environmental sanitation.
- Increasing research capacity and professional expertise in low and middle-income countries in the field of water supply and environmental sanitation.
- Raising awareness and advocating in high-income countries to increase the priority for water supply and environmental sanitation issues in low- and middle-income countries.

Eawag-Sandec is a leader in faecal sludge management research and implementation at a city-wide scale, and has published numerous scientific papers and books on this topic.

2 Workshop Overview

Sanitation aims to protect and promote public health by safely managing human excreta, providing a clean environment, and breaking the cycle of disease. On-site sanitation technologies (like pit latrines, septic tanks) are an essential component of sanitation, but sanitation is more than just building latrines. It is a system that addresses human excreta from the moment it is generated, through to its treatment and use. Faecal sludge management focuses on the last three components of a sanitation system: faecal sludge collection and transportation, treatment, and its ultimate use. This is often called the faecal sludge service chain.

In this workshop, participants will learn about faecal sludge management for low-income communities not connected to a sewer. The workshop provides participants with an overview of technologies for faecal sludge collection, transportation, treatment, and use. It also introduces

planning and management of faecal sludge management systems.

The overall goal for this workshop is for participants to be able to apply concepts of sustainable faecal sludge management at a community or city-wide scale. Upon completion of the workshop, participants will be able to:

- Discuss the importance of faecal sludge management to protect public health and the environment
- Describe faecal sludge management in relation to the entire sanitation service chain
- Describe the design approach for the sanitation service chain
- Identify different faecal sludge collection and transportation technologies
- Identify different faecal sludge treatment technologies
- Identify different options for the safe use or disposal of faecal sludge treatment products
- Identify common faecal sludge management implementation challenges and discuss solutions
- Discuss a planning approach for faecal sludge management
- Establish a network of contacts with other faecal sludge management practitioners

The target audience of this workshop are practitioners in developing countries who are or will be designing, planning, promoting or managing faecal sludge management systems. Participants are expected to have basic knowledge of sanitation. The workshop does not go into detail on the engineering design of different faecal sludge management technologies.

Participatory approaches are widely used to engage and actively involve everyone in the workshop. Effective learning often comes from shared experiences and participants learning from each other. Much of the workshop content is delivered through interactive presentations, group activities, discussions, scenarios and case studies.

3 Workshop Planning

The following activities should be undertaken to get started with workshop planning and arranging logistics.

3.1 Identify the Planning Team

Many decisions must be made and work done leading up to the workshop. You will find it helpful to have a team to handle many of the details. The workshop planning team should include people who are:

- Familiar with the workshop material
- Familiar with the participants that will be attending
- Knowledgeable about the training site

3.2 Fit Training into a Broader Plan

Training is just one element of a successful project. This workshop makes the most sense when it is part of an individual's or organization's plan to support faecal sludge management. There must be follow-up and ongoing support to the participants to help them successfully implement the knowledge they gain during this workshop.

3.3 Select Trainers

To be an effective trainer for this workshop, you should possess the following knowledge, skills and attitudes.

Knowledge. This manual is designed for trainers who have expertise in the subject matter and knowledge regarding the background of the participants, including:

- Technologies for faecal sludge collection, transportation, treatment, use and disposal
- faecal sludge management planning
- faecal sludge management implementation

Skills. This manual assumes that you have experience in planning and organizing workshops and are comfortable with group facilitation. An effective trainer uses various facilitation skills to:

- Help people feel comfortable with a participatory approach to learning
- Encourage people to share information, ideas, concerns and knowledge
- Communicate clearly
- Manage group dynamics and resolve conflicts
- Keep the training practical and relevant

Attitude. You should aim to create a positive learning environment for all participants. This is achieved in part by your approach and manner, such as being:

- Friendly, open and approachable
- Objective
- Respectful
- Aware of cultural differences
- Gender sensitive

Any multiday workshop is a big responsibility. You may want to have several co-trainers to share the work, especially if you have a many participants. We recommend having two trainers for every 20 participants. All trainers should be comfortable with the subject matter and have good facilitation skills.

It can also be helpful to have guest speakers or local experts on a topic to participate in the training. If the guest speakers have a strong technical background or experience, then it's more likely they can help respond to practical issues and provide clear responses to questions.

Always talk to your guest speakers beforehand about your expectations and be sure that they understand their role and time commitment.

3.4 Select Participants

For the most effective workshop, it is important to take care in inviting participants by considering:

- Number of participants. It is important to choose the correct number of people. You may want to have a small group to provide intensive training and support, or a larger group to have a wider range of participation. A common reason for training sessions to fail is that too many participants attend. A maximum of 20 participants is recommended so that everyone has the chance to fully participate in the training.
- Participants from diverse backgrounds and levels of experience add to the discussions that evolve through the workshop. If there is a group that is going to be working on the same project, it is advantageous to have people with different roles and responsibilities involved. Then they all will understand the whole process involved and are better able to coordinate using the same concepts and methods. The reason for training is to enable the participants to put their knowledge into practice. This is most likely to happen when a critical mass of an organization's staff is familiar with faecal sludge management.

The ideal participants are those who:

- Are practitioners in developing countries who are or will be designing, planning, promoting or managing faecal sludge management systems
- Have basic knowledge of sanitation
- Have good understanding of the language of instruction

You should be clear about who you will be training before the workshop begins. Understanding your audience is an essential first step to facilitating a successful workshop. The following questions will help you conduct a needs assessment of your participants. The information will help you adapt the content of the workshop if necessary and select relevant learning aids:

- Why are the participants attending? Is it their own choice or has a superior instructed them to be present?
- What prior knowledge might they have about faecal sludge management?
- What are their learning expectations?
- What range of experience is likely to be represented?
- Do they have any biases against you or your organization?

A preworkshop questionnaire can be used to help you better understand the background of your participants and their expectations. However, participants often do not complete the questionnaire in advance. The planning team may need to follow up with participants to encourage them to submit their responses. See the CAWST Workshop Materials for an example preworkshop questionnaire.

If you do not use a preworkshop questionnaire or do not get all of the responses back, the workshop opening session includes time for you to help determine the participant's prior

knowledge, experience and learning expectations. You may need to be flexible in adapting the workshop agenda to meet their needs based on what you learn in this session.

Keep in mind that in any workshop there may be participants who have different levels of ability in reading and writing. There may be participants who do not understand the language of instruction well, even if they said they do. You will need to modify the way you normally train to accommodate their learning needs. Use short sentences, pictures and illustrations, gestures, activities and small group discussions. These methods will help all participants understand and remember the information better, but are especially important for participants with lower reading, writing or language skills.

3.5 Identify the Workshop Host

The organization that hosts the workshop has a number of responsibilities, from helping to select the venue and organizing registration to planning events outside of the workshop hours (if applicable).

Finding the perfect host for your workshop is not always easy. An ideal workshop host will:

- Ask you to organize a training
- Communicate with you in a timely and honest way
- Have the authority to make decisions regarding the workshop (such as, no need for approval at a higher level)
- Be in charge of inviting and registering the participants
- Invite people from organizations that are motivated to use what they will be learning during the training
- Have a good reputation and is well-known in the country/town
- Have access to grass-root organizations
- Be well located (such as, accessible to lots of other organizations)
- Find a good venue for the training
- Translate materials (if needed)
- Print the training materials
- Provide an interpreter (if needed)
- Provide accommodation and local transport for trainers
- Be available and willing to help you with logistics during the workshop
- Be someone you can trust

3.6 Logistics Management

The workshop planning team (the trainers and the host) will need to determine the workshop logistics such as:

Preworkshop

- What is the workshop budget?
- Who will invite the participants and communicate with them?
- Who will organize and coordinate food and accommodation?
- Who will manage participant travel?
- Who will organize the training site and set up?
- Who will purchase and organize the training equipment and materials?
- Who is responsible for preworkshop registration?
- Who is responsible for on-site registration?
- Who is responsible for organizing construction materials?
- Who is responsible for printing the participant materials?
- Who is responsible for training what session in the agenda?

During the workshop

- Who will check that snacks and food are ready at the appropriate times?
- Who will prepare the room in the morning and reorganize in the evening?
- Who will prepare the flip charts for the day?
- Who is in charge of checking participant list details?
- Who is in charge of preparing evaluations, certificates and CDs?
- Who will make sure that all the construction materials are ready for the next day?

Post-workshop

- Who will type up the workshop evaluations?
- Who will clean up the workshop materials and space?
- Who is responsible for replacing materials if needed?
- Who is responsible for the reporting?
- Who is responsible to maintain communication with the participants?

3.7 Addressing Barriers to Participation

When setting up a workshop, it is important to consider barriers that may limit certain participants from attending. What can you do to make it easier for them to attend? Factors that you may want to consider are:

- **Time of the workshop:** Is the workshop being held at a time of day and week that all people can attend? Is there a time that will interfere less with other work obligations? Is it being held at a time of year when national holidays, celebrations or political events may prevent people from attending? Do organizations or staff have major project deadlines at that time?
- **Length:** Will participants need to be away from home to attend the workshop? If so, is the length of the workshop reasonable?
- **Location:** Is the location easy and convenient for participants to access? Can people with disabilities access the space? Is the location safe for both men and women to access independently at any time of day? If people need to stay over, are there affordable accommodations and places to eat nearby?
- **Language:** Will interpretation and/or translated documents be available for participants who are not fluent in the language in which the workshop will be delivered? Does everyone invited know that interpretation will be available, and into which languages? People often overestimate their language skills, and may feel embarrassment about their language level. Even if they do not understand during the workshop, they may not request interpretation.
- **Finances:** If you are charging a participant registration fee, can everyone afford the fee? Is it possible to offer scholarships or opportunities for reduced fees? Can those who cannot afford the fee arrange to volunteer or contribute in-kind instead of paying a fee?

When planning the workshops, anticipate the barriers that may prevent your target audience from attending. Reduce these challenges as much as possible when organizing the logistics.

4 Workshop Preparations

There are several things that you will need to do to get ready for the workshop.

4.1 Trainer Roles and Responsibilities

It is essential that the facilitation team work well together. You should meet with the other trainers before the workshop to discuss the workshop agenda and then assign the roles and responsibilities. It is also useful to clarify the role of the other trainers when they are not actually conducting a workshop session – should they be assisting in the group work, be available to answer questions, or be setting up for the next session? Where possible, ensure that all the trainers can be present for the entire workshop.

4.2 Trainer Preparation

This is a technical workshop that might have challenging content for new trainers. All trainers, whether new or experienced, should read *Faecal Sludge Management: Systems Approach for Implementation and Operation* and CAWST's faecal sludge management resources and be comfortable with the content.

Faecal Sludge Management: Systems Approach for Implementation and Operation. Strande, L., Ronteltap, M., Brdjanovic, D. (editors). 432 pg. ISBN: 9781780404721 (Hardback) 9781780404738 (eBook), IWA Publishing, London. 2014.

Available at: www.sandec.ch/fsm_book

- We recommend that training organizations order a hard copy or download a copy to use as a reference.
- This is the first book dedicated to faecal sludge management. It summarizes the most recent research in this rapidly evolving field, and focuses on technology, management and planning. It addresses sludge collection and transport, treatment, and the final end use or disposal. The book also goes into detail on operational, institutional and financial aspects, and gives guidance on project planning involving all stakeholders. It is freely available in English and Spanish. In 2017, the book will be available in French.

Compendium of Sanitation Systems and Technologies. Tilley, E., Ulrich, L., Lüthi, C., Reymond, P. and C. Zurbrügg (2014). 2nd Revised Edition. Eawag: Swiss Federal Institute of Aquatic Science and Technology, Dübendorf, Switzerland. Available at: www.eawag.ch/forschung/sandec/publikationen/compendium_e/index_EN

- We recommend that training organizations order a hard copy of the Compendium to use as a reference.
- The Compendium presents the concept of sanitation systems together with detailed information about sanitation technologies for each component of sanitation systems. The document targets engineers, planners and other professionals who are familiar with sanitation technologies and processes. However, it is also a useful document for non-experts to learn about the main advantages and limitations of different technologies and the appropriateness of different systems.
- The e-Compendium, is an online, interactive version of the Compendium, complete with a tool for combining technologies into a complete sanitation system. Available at: http://ecompendium.sswm.info/

CAWST Sanitation Resources. Available at: http://resources.cawst.org

- CAWST's technical briefs, fact sheets and training resources are available on a variety of sanitation topics including:
    - Environmental sanitation
    - Latrine design, siting and construction
    - Faecal sludge management
    - Sanitation implementation

There are also many high quality sanitation resources produced by organizations around the world. The following resources as a good place to start if you are looking for more information, would like to receive updates from the global sanitation community, or wish to become involved in sanitation forums and discussions:

Sustainable Sanitation Alliance (SuSanA). Available at www.susana.org

- This sanitation hub includes a library, discussion forum, and global working groups on several theme topics, including faecal sludge management. It links on the ground experiences with an engaged community of practitioners, policy makers, researchers and academics with the aim of promoting innovation and best practices in policy, programming and implementation.

4.3 Sanitation Terminology

It is essential that the facilitation team is familiar with different words used in the sanitation sector. There are many words – some of which are synonyms and some of which have subtle but important differences. Trainers should understand these differences. Participants will use a variety of sanitation words which can create confusion in the workshop. It is the trainers' role to clarify the use of words and correct participants if a word is not use appropriately. It is important for the trainers to be consistent with their own sanitation terminology.

CAWST and Eawag-Sandec have selected and employed sanitation words consistently throughout this trainer manual. These selected words are maybe not the most appropriate for the participants. The trainers should ask participants which words are commonly used in their context. Participants and trainers should agree on the use and meaning of these words. The following table are words that are sometimes used in the sanitation sector depending on the organization and location.

Table: Sanitation Terminology

Words Used in This Trainer Manual	Other Words Used
Sanitation service chain	Sanitation system, Sanitation chain
On-site sanitation technology	On-site sanitation, On-site sanitation system, Latrine, Toilet
User interface	User experience, Latrine, Toilet
Containment	Excreta Storage, Pit, Tank
Sewered system	Offsite sanitation, Wastewater Management, Sewerage, Networked system, Connected system, Sewer system
Nonsewered system	Non-networked system, Non-connected system
Collection and transport	Emptying and transport
Anaerobic digester	Biogas reactor, Biogas digester
Treatment product	Product, Endproduct

4.4 Translations and Interpreters

The materials may need to be translated and an interpreter may be required if the participants do not speak the language of instruction (for example, English, French, Spanish) as their first language. It is common for participants to overstate their language comprehension. This is often out of embarrassment and not wanting to look bad in front of their colleagues. If there is any doubt, you should translate the training materials and use an interpreter for the workshop to make sure that all participants have equal opportunity to fully understand the content and participate.

Using an interpreter takes more time than if you are delivering the workshop in one language. You will likely have to adjust the workshop agenda to account for the extra time required.

Some tips for working with an interpreter include:

- Try to find an experienced interpreter who is known and trusted by the organizer
- Give them a copy of the training materials to review in advance of the workshop, including the participant materials, trainer manual and PowerPoint presentations
- Meet at least one day before the workshop to discuss their role, review the agenda and learning activities, and ensure that they understand the content and key vocabulary
- Practice using microphones and headsets if simultaneous interpretation is going to be used
- Ask them to write out the flip chart headings in the local language in advance
- Include them in the end of day debrief meetings and ask for their feedback

4.5 Workshop Space

If possible, visit the training site before the participants are due to arrive, and set up your electrical equipment and materials. Try to identify potential sources of distraction in the room, both to yourself and participants, and make changes to mitigate them.
Seating arrangements have a big influence on the training. We recommend arranging the tables and chairs so that participants can make eye contact with one another and can break into small groups easily. Participants will also need to be able to view the speakers, PowerPoint presentations and flip charts.

4.6 Equipment and Materials

You will need to gather materials and equipment in advance the workshop. Appendix 1: Workshop Materials gives a full list of what you will need.

Some equipment and materials are optional depending on how you use the lesson plans. Check the lesson plans and determine what equipment and materials you will need. Be aware that certain things may need to be purchased and gathered well in advance of the workshop, possibly prior to your arrival.

4.7 Participant Materials

You will need to decide where and when the participant materials will be printed; and who will manage the printing.

Appendix 1: Workshop Materials contains a list of the participant materials that need to be printed and compiled into one document (for example, bound together, use a folder or binder).

All of the PowerPoint presentations can be optionally printed as handouts and included in the participant materials.

We recommend providing each participant with an electronic version of all the materials on a CD or USB flash drive, to take with them.

There may be other resources that participants will need during the workshop that are included with the corresponding lesson plans. Read the lesson plans carefully in advance of the workshop and look at the end of them for any materials that may need to be printed (and possibly translated) for the participants. A list of additional printed materials is also given in Appendix 1: Workshop Materials.

You will also need to determine if any adjustments to language, concepts or materials are required based on the participants' needs assessment.

4.8 PowerPoint Presentations

This workshop includes PowerPoint presentations that can be used as a learning aid. Many of the presentations include photos to show the sanitation service chain from different locations. Since the workshop is quite theoretical, it can be helpful for participants to see what the different technologies and services look like in reality.

For optimal learning, PowerPoint presentations should only be used as a supplemental tool to discussions and learning activities, and not be the only way to transfer information to the participants. The lesson plans have been organized so that PowerPoint presentations are usually an optional tool. If power point presentations are not used, alternate visual aids should be used while speaking to enhance learning. It has been shown that it is easiest to understand and remember information when learners see text with simple pictures. This is especially true for learners with lower reading and writing skills.

For optimal learning, PowerPoint presentations should only be used as a supplemental tool to discussions and learning activities, and not be the only way to transfer information to the participants.

If you decide to use the PowerPoint presentations, much of the content of the workshop is described in detail in the speaker's notes within the file. To use them fully, you should print and study the speaker notes pages along with the lesson plans to help prepare in advance. The notes provide more background and detail that you need to understand the content and the order for the presentation. The notes should *not* be read aloud during the presentation. Rather, you will want to become familiar with the material, prepare your own brief notes and practice speaking with the slides.

Several of the presentations include slides for introducing or explaining the participatory activities. The speaker notes explain when to display these so that participants can refer to them during their individual or small group work.

There are also optional PowerPoint slides that are country specific. You will need to select the appropriate slides depending on the audience.

You may want to alter or reorganize some of the slides. This is best done prior to printing the handouts for the participant binders. Keep in mind that if you add or delete slides, the slide

numbers will change, shifting the content in the lesson plans. If changing the slide format or design, please take care to retain the embedded logos that indicate the workshop authors.

4.9 Videos

Videos are used as optional learning aids in some lessons. Use the following criteria to decide whether or not to show a video in the workshop:

- The content of the video (is it relevant to the workshop?)
- The experience of the participants (do they need to learn this?)
- Whether a similar video has already been shown, or the material has already been covered in the workshop (is it repetitive?)
- The language spoken and how fast people talk in the video (will participants be able to understand the speakers?)
- The language of the subtitles (if any), and the participants' reading ability (will participants be able to understand the text?)
- The cultural relevance and context (is it appropriate?)

Note that while many videos can be useful teaching tools, the information presented in a video may not be correct or may not be exactly what you want to teach the participants. Watch every video you plan to show in the workshop before the workshop, so that you understand exactly what it teaches. Make a list of points in the video that you will discuss with participants after watching the video. The list of discussion points may include:

- Things that were done well in the video
- Things that you recommend doing differently
- Things that are done differently in your local area

It is helpful when using videos as teaching tools to provide participants with a short list of questions to consider while watching the video. You can write the questions on the flip chart, or hand out printed questions to each participant. The questions should focus on what you want the participants to learn from the video, and what you want them to think about. Discuss participants' answers to the questions after watching the video.

In each lesson plan, the internet link to each video is given in the materials section. Because the internet may not be available during the workshop, or the connection may not be strong, we recommend downloading the videos to your computer before the workshop. You may be able to get a copy of some downloaded videos from CAWST. Alternatively, the following website is an example of one way you can download videos that are publicly available online.

Application: aTube Catcher

Instructions:

- Download and install aTube Catcher (freeware application to save videos) from http://atube-catcher.dsnetwb.com/video/index.html
- Go to the website of the video you want to download, such as YouTube.
- Copy the web address of the video you want to download.
- Open aTube Catcher on your computer.
- Paste the web address into aTube Catcher where indicated.
- Select the format you want to save the video in. The mp4 version is recommended – it has high quality with a reasonable file size. Save the video to your computer or an external/USB flash drive.

Appendix 1: Workshop Materials contains a list of the optional videos that can be downloaded for the workshop.

5 How to Use This Manual

This section explains the workshop agenda and individual sessions that have been developed to meet the participant learning outcomes.

5.1 Learning Outcomes

The following learning outcomes describe what the participants will be able to do by the end of the workshop to demonstrate increased knowledge, improved skills, or changes in attitude. Each lesson plan refers to the specific learning outcomes covered in that lesson.

Table: Participant Learning Outcomes

Lesson Plan #	Lesson Plan	Learning Outcomes
1	Workshop Introduction	1. Meet the trainers, host organization and workshop participants. 2. Determine participants' existing level of knowledge and skills on workshop topics. 3. Establish how the group is expected to work together during the workshop. 4. Describe the roles of EAWAG, CAWST and/or the host organization.
2	Introduction to Faecal Sludge Management	1. List the five components of a sanitation service chain. 2. Identify the three components that are called "faecal sludge management". 3. Explain the difference between non-sewered and sewered sanitation systems. 4. Identify how faecal sludge management can effectively manage sanitation and protect public health.
3	Local and Global Issues	1. Discuss the local and global issues around faecal sludge management. 2. Identify key challenges that contribute to poor faecal sludge management.
4	Risk Management	1. Discuss the risks of faecal sludge management in relation to public health. 2. Identify ways to reduce the risks of faecal sludge management. 3. Explain the importance of using multiple barriers for risk reduction.
5	Design Approach	1. Explain the importance of having a rational design approach. 2. Identify design factors that need to be considered to arrive at a sustainable faecal sludge management solution. 3. Explain why designing for use results in more sustainable solutions.
6	Introduction to Case Studies	1. Explain the purpose of the case study and exercise book. 2. Discuss their case study.

Lesson Plan #	Lesson Plan	Learning Outcomes
7	Faecal Sludge Use (Resource Recovery)	1. Discuss the value of using faecal sludge. 2. List at least five different faecal sludge treatment products. 3. Identify different ways to use faecal sludge treatment products. 4. Discuss health, environmental and social considerations related to using faecal sludge.
8	Quantification and Characterization	1. Identify the characteristics of excreta and faecal sludge. 2. Explain the difference between faecal sludge and wastewater characteristics. 3. Explain the variability of faecal sludge characteristics. 4. Discuss the difficulties in reliable faecal sludge quantification and characterization.
9	Treatment Objectives	1. Identify four treatment objectives. 2. Relate the environmental, health, and logistical impacts to each treatment objective. 3. List seven ways pathogens can be inactivated. 4. Discuss the challenges in monitoring pathogen inactivation from faecal sludge.
10	Treatment Technologies	1. List established, transferring, and innovative faecal sludge treatment technologies. 2. Identify the objectives, pathogen inactivation mechanisms, and treatment products of different faecal sludge treatment technologies.
11	Operation and Maintenance	1. Identify common operational challenges of faecal sludge treatment facilities. 2. Discuss the importance of a monitoring plan to ensure a faecal sludge treatment facility is operating as designed. 3. Discuss methods of ensuring that industrial sludge is not discharged at faecal sludge treatment facilities.
12	Collection and Transport	1. Describe faecal sludge collection and transport process from a household to a treatment facility. 2. Identify suitable faecal sludge collection and transport methods for the local context. 3. Identify challenges and solutions for improving faecal sludge collection and transport.
13	Stakeholders	1. Discuss why stakeholder analysis and engagement is critical for faecal sludge management. 2. Identify potential stakeholders in faecal sludge management. 3. Characterize stakeholders based on their levels of interest and influence. 4. Discuss participation levels to engage stakeholders based on their interest and influence.
14	Financial Transfers	1. Identify stakeholders involved in financial transfers in faecal sludge management. 2. List different types of financial transfers that play a role in faecal sludge management. 3. Identify different financial flow models for faecal sludge management. 4. Discuss the complexity of stakeholders and financial interactions in faecal sludge management.

Lesson Plan #	Lesson Plan	Learning Outcomes
15	Legal Framework	1. Discuss the importance of having a legal framework for faecal sludge management. 2. Discuss the challenges with legal frameworks for faecal sludge management. 3. Discuss solutions to overcome legal challenges in faecal sludge management.
16	Integrated Planning	1. Discuss the importance of integrated planning for faecal sludge management. 2. Discuss what is included in the planning process for faecal sludge management. 3. Identify three key characteristics of a planning framework for faecal sludge management.
17	Improvement Plan	1. Analyze risks and barriers to improve faecal sludge management within a community. 2. Develop an incremental improvement plan, including first and later steps.
18	Case Study Review	1. Discuss their recommendations for the case study. 2. Discuss the opportunities and risks of each group's faecal sludge management service chain.
19	Action Planning	1. Discuss immediate, easy steps that you can take to improve faecal sludge management. 2. Develop an action plan for next steps after the workshop.
20	Workshop Closing	1. End of workshop self-assessment and reflection. 2. Review learning outcomes to see if they were met. 3. Complete a final evaluation of the workshop. 4. Distribute certificates and make closing remarks.
21 (Optional)	Field Trip	1. Identify local faecal sludge management technologies and describe their operation. 2. Identify local faecal sludge management stakeholders. 3. Identify different ways faecal sludge management is implemented locally. 4. Discuss faecal sludge management practices.

5.2 Workshop Agendas

The general outline of the workshop is as follows:

- **Workshop opening.** To welcome people and allow participants and trainers to get to know one another.
- **Individual sessions.** To focus on a selected topic. Each individual session includes an introduction, a main lesson, and a closing activity to review the content.
- **Breaks and lunch.** To keep people working and feeling positive, breaks are needed. Plan for a mid-morning and mid-afternoon break that allows people to use the washroom, take a drink or eat a snack. While planning your workshop it is also important to clarify with participants in advance as to whether or not food and snacks will be provided.
- **Review of previous day.** Start the day with a review of the material learned during the previous day. This also helps focus the participants and trainers' brains on the workshop. See the list of review tools in the Trainer Manual Appendix 2 for activities you can use.
- **End of day review.** To gain feedback from the participants and to clarify any areas of uncertainty. Example review activities are provided in the Trainer Manual Appendix 2.
- **End of day evaluation.** To gain feedback from the participants and to clarify any areas of uncertainty. See the list of evaluation tools in the Trainer Manual Appendix 2 for activities you can use.
- **End of workshop closing.** The end of the workshops can be official or unofficial depending on what is appropriate. Certificates are typically handed out.
- **End of workshop evaluation.** To allow participants to assess the strengths and weaknesses of the workshop for further improvement.
- **Organizer and trainers' debrief.** A daily exercise to discuss what went well, what areas of the day can be improved and what needs to be done for the next day and in the future. Debriefs are held at the end of the workshop.

The following agendas have been developed based on CAWST and Eawag-Sandec's experience. However, the trainers should customize the agenda for each workshop, based on the audience. For example, the trainer may go in depth with certain topics. There is also an option to extend the workshop by a day to add a field trip. Look at the following agendas to see options for how sessions may be arranged, added or removed.

2-Day - Introduction to Faecal Sludge Management – Trainer Agenda

Suitable for a general audience, focus on overall introduction, 8.5 hour day

Time	DAY 1	LP	DAY 2	LP
2 hours	Workshop Opening (40 min) Introduction to Faecal Sludge Management (30 min) Global and Local Issues (40 min) Design Approach (20 min)	**1** **2** **3** **5**	Opening Activity and Review (15 min) Treatment Technologies (continued) [35 min] Operation and Maintenance (45 min)	 **10** **11**
15 min	**BREAK**		**BREAK**	
1 hour 30 min	Introduce Case Studies (30 min) Fecal Sludge Use (60 min)	**6** **7**	Collection and Transport (70 min) Stakeholders (60 min)	**12** **13**
1 hour	**LUNCH**		**LUNCH**	
2 hours	Quantification and Characterization (75 min) Treatment Objectives (50 min)	**8** **9**	Financial Transfers (60 min) Legal Framework (40 min) Integrated Planning (30 min)	**14** **15** **16**
15 min	**BREAK**		**BREAK**	
1 hour 30 min	Treatment Technologies (60 min) Closing and Evaluation (15 min)	**10**	Case Study Review (40 min) Workshop Closing and Evaluation (30 min)	**18** **20**

LP – Lesson Plan

Other optional lessons to consider:

- Risk Management (Lesson Plan 4)
- Improvement Plan (Lesson Plan 17)
- Action Planning (Lesson Plan 19)

Suggested Daily Opening and Closing Activities:

Day	Opening Activity	Closing and Evaluation Activity
Day 1	Workshop opening	Participatory: Apples and Onions Written: End of Day Evaluation 1
Day 2	Graffiti Wall	Participatory: Word in a Hat Written: Final workshop evaluation

3-Day - Introduction to Faecal Sludge Management – Trainer Agenda

Suitable for a general audience, allows more time and a few additional lesson plans, 8 hour day

Time	DAY 1	LP	DAY 2	LP		LP
1 hour 45 min	Workshop Opening (40 min) Introduction to Faecal Sludge Management (30 min) Global and Local Issues (40 min)	**1** **2** **3**	Opening Activity and Review (15 min) Treatment Technologies (95 min)	**10**	Opening Activity and Review (15 min) Integrated Planning (30 min) Improvement Plan (50 min) Case Study Review (15 min)	**16** **17** **18**
15 min	**BREAK**		**BREAK**		**BREAK**	
1 hour 30 min	Risk Management (40 min) Design Approach (20 min) Introduce Case Studies (30 min)	**4** **5** **6**	Operation and Maintenance (45 min) Collection and Transport (45 min)	**11** **12**	Case Study Review continued (30 min) Action Planning (60 min) Workshop Closing and Evaluation (30 min)	**18** **19** **20**
1 hour	**LUNCH**		**LUNCH**		**LUNCH**	
1 hour 45 min	Fecal Sludge Use (60 min) Quantification and Characterization (75 min)	**7** **8**	Collection and Transport continued (25 min) Stakeholders (60 min)	**13** **14**		
15 min	**BREAK**		**BREAK**			
1 hour 30 min	Treatment Objectives (50 min) Closing and Evaluation (5 min)	**9**	Financial Transfers (60 min) Legal Framework (40 min) Closing and Evaluation (5 min)	**15** **16**		

LP – Lesson Plan

Trainer Notes:

- Day 3 – the total time is over by 30 minutes

Suggested Daily Opening and Closing Activities:

Day	Opening Activity	Closing and Evaluation Activity
Day 1	Workshop opening	Participatory: Apples and Onions Written: End of Day Evaluation 1
Day 2	Graffiti Wall	Participatory: Scales Written: End of Day Evaluation 2
Day 3	Charades	Participatory: Word in a Hat Written: Final workshop evaluation

3-Day - Introduction to Faecal Sludge Management – Trainer Agenda

Suitable for a general audience, allows more time for a few additional lesson plans and field trip, 8 hour day

Time	DAY 1	LP	DAY 2	LP		LP
1 hour 45 min	Workshop Opening (40 min) Introduction to Faecal Sludge Management (30 min) Global and Local Issues (40 min)	**1** **2** **3**	Opening Activity and Review (15 min) Treatment Technologies (95 min)	**10**	Opening Activity and Review (15 min) Integrated Planning (30 min) Improvement Plan (50 min) Case Study Review (15 min)	**16** **17** **18**
15 min	**BREAK**		**BREAK**		**BREAK**	
1 hour 30 min	Risk Management (40 min) Design Approach (20 min) Introduce Case Studies (30 min)	**4** **5** **6**	Operation and Maintenance (45 min) Collection and Transport (45 min)	**11** **12**	Field Trip	**21**
1 hour	**LUNCH**		**LUNCH**		**LUNCH**	
1 hour 45 min	Fecal Sludge Use (60 min) Quantification and Characterization (75 min)	**7** **8**	Collection and Transport continued (25 min) Stakeholders (60 min)	**13** **14**	Field Trip	**21**
15 min	**BREAK**		**BREAK**			
1 hour 30 min	Treatment Objectives (50 min) Closing and Evaluation (5 min)	**9**	Financial Transfers (60 min) Legal Framework (40 min) Closing and Evaluation (5 min)	**15** **16**	Case Study Review continued (30 min) Action Planning (60 min) Workshop Closing and Evaluation (30 min)	**18** **19** **20**

LP – Lesson Plan

Trainer Notes:

- Consider doing the field trip in the afternoon and closing the workshop before the trip

Suggested Daily Opening and Closing Activities:

Day	Opening Activity	Closing and Evaluation Activity
Day 1	Workshop opening	Participatory: Apples and Onions Written: End of Day Evaluation 1
Day 2	Graffiti Wall	Participatory: Scales Written: End of Day Evaluation 2
Day 3	Charades	Participatory: Word in a Hat Written: Final workshop evaluation

5.3 Lesson Plan Structure

Here is a list of the icons used in this Trainer Manual and their explanations.

	**Lesson Description.** Describes broadly what the lesson will be about.
	**Learning Outcomes.** Describes what the participants will be able to do by the end of the lesson to demonstrate increased knowledge, improved skills or changes in attitude.
	**Time.** The clock symbol appears next to the amount of time the lesson may take. This is an estimate and the lesson may be longer or shorter depending on how you facilitate it.
	**Materials.** Lists all the materials that will be required for the lesson.
	**Preparation.** The clipboard appears when there is preparation that needs to be done prior to the lesson, including materials needed and things to do in advance.
	**Introduction.** This hook appears where there is an introduction to a topic. This will help participants connect personal experience to the knowledge they are about to learn.
	**Key Points.** The key appears where there are important points and topics to discuss. These are reminders of what key points the participants should understand by the end of the lesson.
	**Main Activity.** The puzzle appears at the beginning of a main learning activity.
	**Trainer Notes.** The exclamation point appears to remind you of things to do or consider while facilitating the lesson.
	**Review.** The question mark appears when you are reviewing a topic or checking for learning. What have participants learned? Can they recall the information?
	**Handouts**. This appears when there are handouts for the participants.

6 Lesson Plans

Lesson Plan: Workshop Opening

40-60 minutes

Lesson Description

This lesson opens the workshop and sets the tone for the training and learning environment by using a variety of participatory activities. Participants have an opportunity to meet the trainer, host organization and other participants, as well as create their ground rules for how they are expected to work together during the workshop. The trainer has the opportunity to better understand the participant's background, assess their knowledge and skills, and determine their learning expectations.

Learning Outcomes

1. Meet the trainers, host organization and workshop participants.
2. Determine participants' existing level of knowledge and skills on workshop topics.
3. Establish how the group is expected to work together during the workshop.
4. Describe the roles of CAWST, Eawag-Sandec, or the host organization.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape
- □ Name tags
- □ Printed package of Faecal Sludge Management participant materials (1 per participant)
- □ Pens or pencils (1 per participant)
- □ Notebooks (1 per participant)

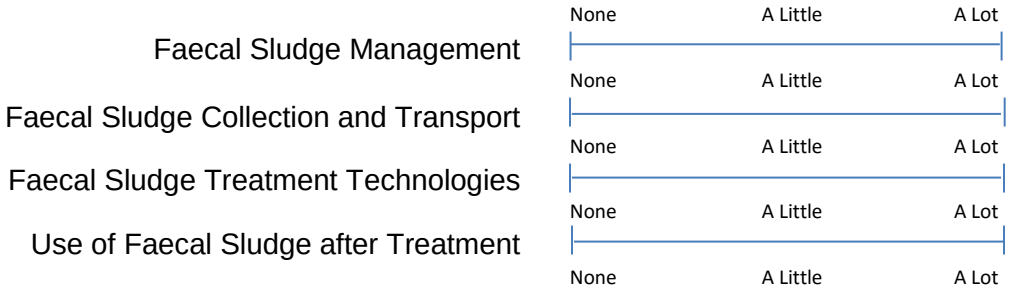
Optional:

- □ Sticker dots (2 different colours)
- □ PowerPoint: Introduction to CAWST and Eawag-Sandec
- □ Computer and projector

Preparation

- □ Write the agenda for the day on flip chart paper
- □ Write the heading "*Group Learning Expectations"* on flip chart paper
- □ Write the heading "*Group Agreement"* on flip chart paper
- □ Write the heading "*Word Wall*" on flip chart paper. See Tool: Word Wall in Appendix 2: Tools & Evaluations

- □ Write on a piece of flip chart paper 3-6 key topics of the workshop that you plan to cover with a scale written beside each topic. For example:



- □ Print Faecal Sludge Management participant materials and organize them into one package for each participant (see list in Appendix 1)
- □ Organize the participant materials, name tag, notebook and pen at each seat (1 per participant)
- □ If you are planning to use PowerPoint: Introduction to CAWST and Eawag-Sandec
  - Review the PowerPoint presentation
  - Print the speaker's notes
  - Check that the projector is working
  - Cue the PowerPoint on the computer
- □ Optional: Write the learning outcomes on flip chart paper

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Introduction **15-20 minutes**

1. Introduce trainers, workshop hosts and other guests as appropriate.

In some countries, a formal welcoming ceremony will start the workshop. Consult with your host beforehand to determine the protocol and the amount of time required. You may need to adjust your agenda accordingly.

2. Explain the building or workshop layout, bathroom location, emergency exits, first aid, and daily schedule. Ask host if there is anything that needs to be communicated.
3. Lead the following icebreaker activity to help participants meet each other and introduce themselves to the group. You can estimate that it will take about 1 minute per participant for the introduction activity (for example, it will take about 20 minutes for 20 participants to introduce themselves).
   - Use tent card or paper, ask the participants to briefly write down their experience with faecal sludge management (FSM) and current role, but not to put their names on the cards. Ask participants to be specific about their type and level of experience (for example, emptying association, design treatment plant, design policy, project implementation) and current role (for example, policy maker,

engineer, treatment plant operator, project manager). For participants that have no experience in faecal sludge management, ask them to share their experience in the sanitation sector. To save time, you can ask the participants to write their cards as they enter the room and are waiting for the workshop to start.

- Collect and redistribute the cards. Ask the participants to stand up, mingle and find out which person their card belongs to. Participants should learn their name, where they are from, their experience in the sanitation sector, their current role, and the reason why they are attending the workshop.
- Ask the participants to briefly introduce the person they found to the large group. Afterwards, ask the participants to place their tent cards on the table so that you and others can clearly see them.

- During the introductions, write the participant's roles (for example, policy maker, engineer, treatment plant operator, project manager) besides their name on the participant list. This will help you when creating groups later in the workshop to ensure a mix of expertise.

4. Present the lesson description or learning outcomes.

Group Agreement – Making Ground Rules **5-10 minutes**

1. Explain that ground rules are agreements created by the group that will allow everyone to learn together.
2. Ask the participants to reflect on their past training or learning experiences. What made those experiences positive or negative?

3. Ask the participants to suggest ways to create a positive learning environment for everyone. Write the expectations on the *"Group Agreement*" flip chart.
   - *Respect, ask questions, silence phones, punctuality, no side talk*
4. Determine daily timetable including start and end times and breaks (length and time).
5. If not already suggested, ask for a timekeeper.
6. Optional: Ask if there will be consequences for breaking group agreements and have the group suggest humourous consequences (for example, lead the group in song or dance when late).
7. Explain that any other ground rules can be added through the workshop.
8. Place the flip chart in a prominent place to be seen throughout the workshop.

Self-Assessment **5-10 minutes**

1. Optional: To save time, place the self-assessment flip chart by the room entrance and ask participants to do their assessment as they enter the workshop.
2. Explain this is a tool to assess what knowledge and skills participants have before starting the workshop. Discuss how it is OK for people to have little or no knowledge of a topic at the start of the workshop. Explain that we will do this exercise again at

the end of the workshop to see how much we have learned. The goal of the workshop is to help each person move up on the scale.

3. Ask the participants to place a sticker dot along the line based on where they think they are at the moment. Use one color dot for the beginning of the workshop and a different color dot at the end of the workshop. If you don't have coloured sticker dots use marker pens.

Group Learning Expectations **5-10 minutes**

1. Discuss how there is a range of understanding among the participants and the importance of a common base of knowledge. Some of the material that will be presented may be new for some and repetition for others. It is helpful for participants who have more knowledge or experience to share with the group.
2. Ask the participants to list what they hope to learn or expect during the training. Record participants' expectations on the "*Group Learning Expectations"* flip chart.

   Note: Expectations may already be discussed during the icebreaker activity. In this situation, write down the expectations during the icebreaker. Ask participants to list any other expectations.
3. Review the list and identify the expectations that you will be covering during the workshop.
4. If there are things that are outside the scope of the workshop, explain that they will not be discussed. Offer any alternatives for discussing those topics if they are relevant, such as websites, research papers, other workshops, consulting visits and names of other organizations.

Workshop Format and Agenda **5 minutes**

1. Discuss the philosophy for training and learning:
   - *Experiential and learn by doing*
   - *Individual and group activities*
   - *Case studies and exercises integrated throughout the workshop*
   - *Learning from others' experience*
   - *Open discussion, questions and answers*
   - *Develop a sense of community and network within group*
2. Review the daily agenda.
3. Explain the participant materials (for example, Faecal Sludge Management: Systems Approach for Implementation and Operation).
4. Explain that there will be many new sanitation words used in this workshop, especially technical terms. You will create a *Word Wall* to post new key words that come up during the training. Show the participants where the *Word Wall* will be in the room for the duration of the workshop. Add new words to the *Word Wall* as they are introduced.

Introduction to CAWST, Eawag-Sandec, and Host Organization **5 minutes**

1. Introduce CAWST. Optional: Use PowerPoint: Introduction to CAWST and Eawag-Sandec.
   - *CAWST is a nonprofit organization based in Canada. We provide training and consulting to organizations that work directly with populations in developing countries who lack access to clean water and basic sanitation.*
   - *CAWST "walks beside" over 970 organizations — government agencies, community groups, and local and international nongovernmental organizations of all sizes — in 78 countries. We work with them as they develop their capacities to deliver water and sanitation programs locally.*
   - *CAWST provides training in developing countries for organizations and agencies who implement water and sanitation projects. We may also do consulting visits to projects to assist with troubleshooting, problem solving, improve monitoring or do on-site training with local staff.*
2. Introduce Eawag-Sandec. Optional: Use PowerPoint: Introduction to CAWST and Eawag-Sandec.
   - *Eawag is a Swiss federal research institute focused on aquatic science and technology, and Sandec – Sanitation, Water, and Solid Waste for Development is one of the departments at Eawag.*
   - *Our mandate is to develop and test methods and technologies that help the worlds' poorest access sustainable water and sanitation services. We do this by:*
     - *Working in close collaboration with international and local universities, nongovernmental organizations, governmental bodies and development organizations, to ensure buy-in and future scale-up.*
     - *Testing and piloting in partner countries, at the household, community, and city-wide scale.*
     - *Pursuing five strategic research themes: Strategic Environmental Sanitation Planning, Water Supply and Treatment, Safe Water Promotion, Excreta and Wastewater Management, and Solid Waste Management.*
     - *Publishing and disseminating our research and training tools for free.*
     - *Offering basic and advanced training opportunities with curricula development, courses and seminars.*
3. Introduce host organization.

Review **5 minutes**

1. Ask the participants "Do you have any thoughts or questions about the workshop?"

Reflections on Lesson

Lesson Plan: Introduction to Faecal Sludge Management

30 minutes

Lesson Description

This lesson introduces the sanitation service chain. It focuses on the last three components which encompass faecal sludge management (FSM): (1) collection and transportation of faecal sludge from on-site sanitation technologies, (2) faecal sludge treatment, (3) and use or disposal of faecal sludge. Participants will explore the importance of each component in protecting public health. They will also learn the difference between sewered and non-sewered sanitation systems.

Learning Outcomes

At the end of this session participants will be able to:

1. List the five components of a sanitation service chain.
2. Identify the three components that are called “faecal sludge management”.
3. Explain the difference between non-sewered and sewered sanitation systems.
4. Identify how faecal sludge management can effectively manage sanitation and protect public health.

Materials

- □ Flip chart paper
- □ Tape
- □ Markers
- □ Sanitation Service Chain Posters (1 set)

Optional:

- □ Sanitation Service Chain diagram (1 for every 2 participants)
- □ PowerPoint: Introduction to Faecal Sludge Management
- □ Computer and projector

Preparation

- □ Review Chapter 1: The Global Situation of *Faecal Sludge Management: Systems Approach for Implementation and Operation*
- □ Print the Sanitation Service Chain Posters or draw each component of the sanitation service chain on flip chart paper. Tape the posters together to create a sanitation service chain. The posters should be visible to all participants. It will be a useful visual tool to refer to throughout the workshop. Tape flip chart paper under each component. Write the heading “*Sanitation Service Chain*” above.
- □ Optional: If not using PowerPoint, print and cut out the Sanitation Service Chain diagram (1 for every 2 participants)
- □ Optional: Write the learning outcomes on flip chart paper

- □ If using PowerPoint: Introduction to Faecal Sludge Management
  - Review the PowerPoint presentation
  - Print the speaker's notes
  - Check that the projector is working
  - Cue the PowerPoint on the computer

Introduction **5 minutes**

1. Ask the participants "What is needed to make a phone call to someone? What does that entire service chain look like?"
   - *The caller and receiver both need to purchase phones.*
   - *The caller needs to have credit or an agreement to pay the bill for the phone call.*
   - *The caller needs to know how to use the phone to dial the number.*
   - *The cell phone towers need to connect the calls.*
   - *The receiver needs to pick up the phone.*
2. Ask the participants "What would happen if one part of this service chain didn't work?"
   - *You still might have the phone and be able to use it to play games or music.*
   - *You could get the call display and know that the person called you.*
   - *In most of the cases, the call would not be made and the message would not be communicated.*

3. Ask participants to now think of sanitation as a service chain. Ask, "What would happen if one part of the sanitation service chain didn't work?" Share some answers as a large group.
   - *Contaminated environment*
   - *Contaminated drinking water*
   - *Sick people*
4. Present the lesson description or learning outcomes.

What is a Sanitation Service Chain? **20 minutes**

1. Explain that sanitation (or managing human excreta) is much more than building on-site sanitation technologies (like a latrine) and stopping people from open defecation. Sanitation requires an entire service chain, and people interacting at each step in the chain, rather than a single technology.
2. Explain to participants that they will be looking at a sanitation service chain diagram. The sanitation service chain is also called other names, like sanitation system or

sanitation chain. Ask participants what other words they use to describe the sanitation service chain. Add these words to the *Word Wall*.

3. In pairs, they should identify and discuss the purpose of the different components.

4. Divide participants into pairs. Options: Hand out a Sanitation Service Chain diagram to each pair or use the PowerPoint: Introduction to Faecal Sludge Management to show the diagram.

5. After 1 or 2 minutes, share responses as a large group. Write the sanitation service chain components on the flip chart paper under each poster. Participants may use different terms for the components. Write these terms on the flip chart paper. Agree on one term for each component. This term should be used consistently throughout the workshop. Explain that we should all be accepting of the different terminology.

   - *User interface: Toilet, slab, superstructure, latrine accessories (e.g., anal cleansing materials, a place to dispose of menstrual hygiene products, handwashing station). May also be called: User experience, toilet, or latrine.*
   - *Containment: On-site sanitation technologies need to include some type of pit, tank or chamber to safely collect and store excreta until it is removed. Treatment may or may not occur in the containment. May also be called: excreta storage.*

     Note: User Interface and Containment together are referred to as an on-site sanitation technology.
   - *Collection and transport: Manual or mechanical methods to remove faecal sludge and transport it (for example, vacuum trucks). May also be called: emptying and transport.*
   - *Treatment: This refers to treatment after the fecal sludge is collected. It does not include the treatment that happens in the containment.*
   - *Use or disposal: May also be called end-use or resource recovery. Disposal is the return of fecal sludge to the environment, ideally in a way that poses less risk to the environment and public health. Disposal is sometimes described as the containment of fecal sludge on-site. This is not disposal – it is containment.*

6. Explain that faecal sludge management consists of the last three components of the sanitation service chain. This workshop will focus on collection and transport, treatment, and use or disposal of faecal sludge. Explain that although we will not cover user interface and containment in detail, these components influence the rest of the sanitation service chain. They will be discussed as needed in the workshop, and for further information refer to the CAWST and Eawag-Sandec websites where relevant resources can be downloaded for free.

7. Explain that the sanitation service chain is a general term for both non-sewered and sewered sanitation. Ask “What is a sewered sanitation system? What is a non-sewered sanitation system?” Use PowerPoint: Introduction to Faecal Sludge Management to show the definitions of non-sewered and sewered. Explain that the terms “on-site” and “off-site sanitation” are also used. Add “*Non-sewered sanitation”* and “*Sewered sanitation*” to the *Word Wall*.

   - *Non-sewered sanitation (also known as on-site sanitation): A sanitation system in which faecal sludge is stored on the location where it is produced. The faecal sludge is emptied, treated, and used or disposed of on-site or off-site.*

- *Sewered sanitation (also known as off-site sanitation): A sanitation system that transports wastewater through a pipe network (like a simplified sewer, solids free sewer or conventional sewer) to another location for treatment, use or disposal. This includes centralized and decentralized wastewater treatment systems (DEWATS).*

Note: The difference between wastewater and faecal sludge can be confusing for participants. Explain that these will be discussed in more detail in the characterization and quantification lesson. Make it clear that for this workshop: sewered sanitation (transported through a sewer) = wastewater, and non-sewered sanitation (on-site sanitation) = faecal sludge.

8. Emphasize that this workshop focuses on the management of faecal sludge (non-sewered sanitation). It is not on wastewater (sewered sanitation). It therefore does not cover decentralized wastewater treatment systems (DEWATS). However, there is some overlap between faecal sludge treatment and DEWATS.
9. Ask: "What types of on-site sanitation technologies are used in your community?" Confirm whether these are on-site sanitation technologies. They should not mention flushing toilets connected to a sewer system. This will help participants distinguish the difference between non-sewered and sewered sanitation.
    - *Examples of on-site sanitation technologies: pit latrines, septic tanks, aqua privies, dry toilets, non-sewered public toilets*
10. Ask the participants to cover the collection and transportation component of the sanitation service chain with their finger. Ask: "What happens if there are no sludge collection and transportation services?" Discuss as a large group.
    - *On-site sanitation technologies will fill up.*
    - *On-site sanitation technologies will overflow or be abandoned.*
    - *Users will have to manually empty the on-site sanitation technology themselves. They will dig holes in their yard to dispose of the faecal sludge or they will dump it in the environment.*
    - *This will contaminate the environment and have impacts on public health. Faecal pathogens will be pervasive in the environment and make people sick. For example, sometimes diarrhea rates increase during the rainy season. Pits and tanks fill up with rainwater or groundwater. This can lead to faecal sludge being flushed into the environment, rivers or infiltrating groundwater.*
    - *In addition to human and environmental impacts, no one wants or deserves to live in dirty, smelly, and unsanitary conditions.*
11. Ask the participants to cover the treatment component of the sanitation service chain with their finger. Ask: "What happens if there are no treatment options?" Discuss as a large group.
    - *Faecal sludge will be used or disposed of without treatment.*
    - *This will contaminate the environment and result in human and environmental health issues. Faecal pathogens will be transmitted and make people sick.*
12. Ask the participants to cover the use and disposal component of the sanitation service chain with their finger. Ask: "What happens if there is nowhere to safely use or dispose of faecal sludge?" Discuss as a large group.

- *Treated faecal sludge would be dumped into the environment (for example, discharged into surface water). Often contaminates drinking water sources and cause public health issues. Faecal pathogens will be transmitted and make people sick.*
    - *For example, the cholera outbreak in Haiti 2010 following the earthquake was caused by "contamination of the Artibonite River as a result of human activity". There was poor disposal of faecal sludge at a camp. The faecal sludge was contained in holding tanks. It was collected twice a week in vacuum trucks and dumped into a large open pit on higher ground. Local residents commented that the disposal site was susceptible to flooding and overflow into a tributary of the Artibonite River, during rainfall. (Source: Cravioto, A., et al. Final Report of the Independent Panel of Experts on the Cholera Outbreak in Haiti: http://www.un.org/News/dh/infocus/haiti/UN-cholera-report-final.pdf)*

- *Dumped faecal sludge can attract animals, insect vectors, and smell bad.*
- *No one wants to live in dirty, smelly, and unsanitary conditions*

Use PowerPoint: Introduction to Faecal Sludge Management to briefly show pictures of on-site sanitation technologies and faecal sludge management.

Review **5 minutes**

Option A: Sanitation Service Chain Action

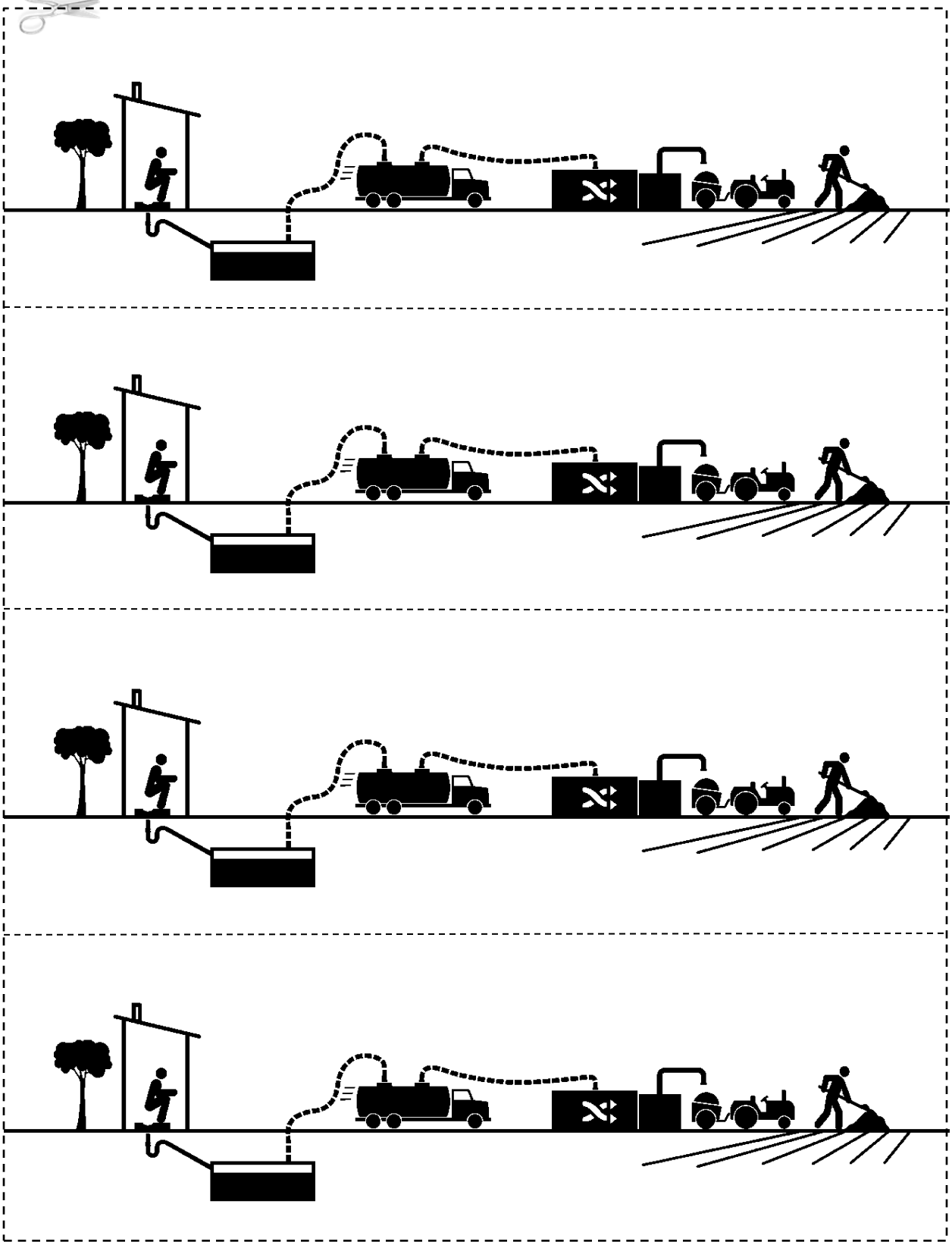
1. Explain that participants will work in groups to create actions to help remember the 5 components of a sanitation service chain. They will have 2 minutes to complete the activity.
2. Optional depending on time: After 2 minutes, ask each group to share their actions.
3. Optional depending on time: Call out each component and get the whole group to do their action. Do this more than once and when participants are comfortable, you can start calling them out of order.

Option B: Draw Your Sanitation Service Chain

1. Ask participants to draw the different components of the sanitation service chain. Participants will have 2 minutes to prepare. They will then share their sanitation service chain with a partner.

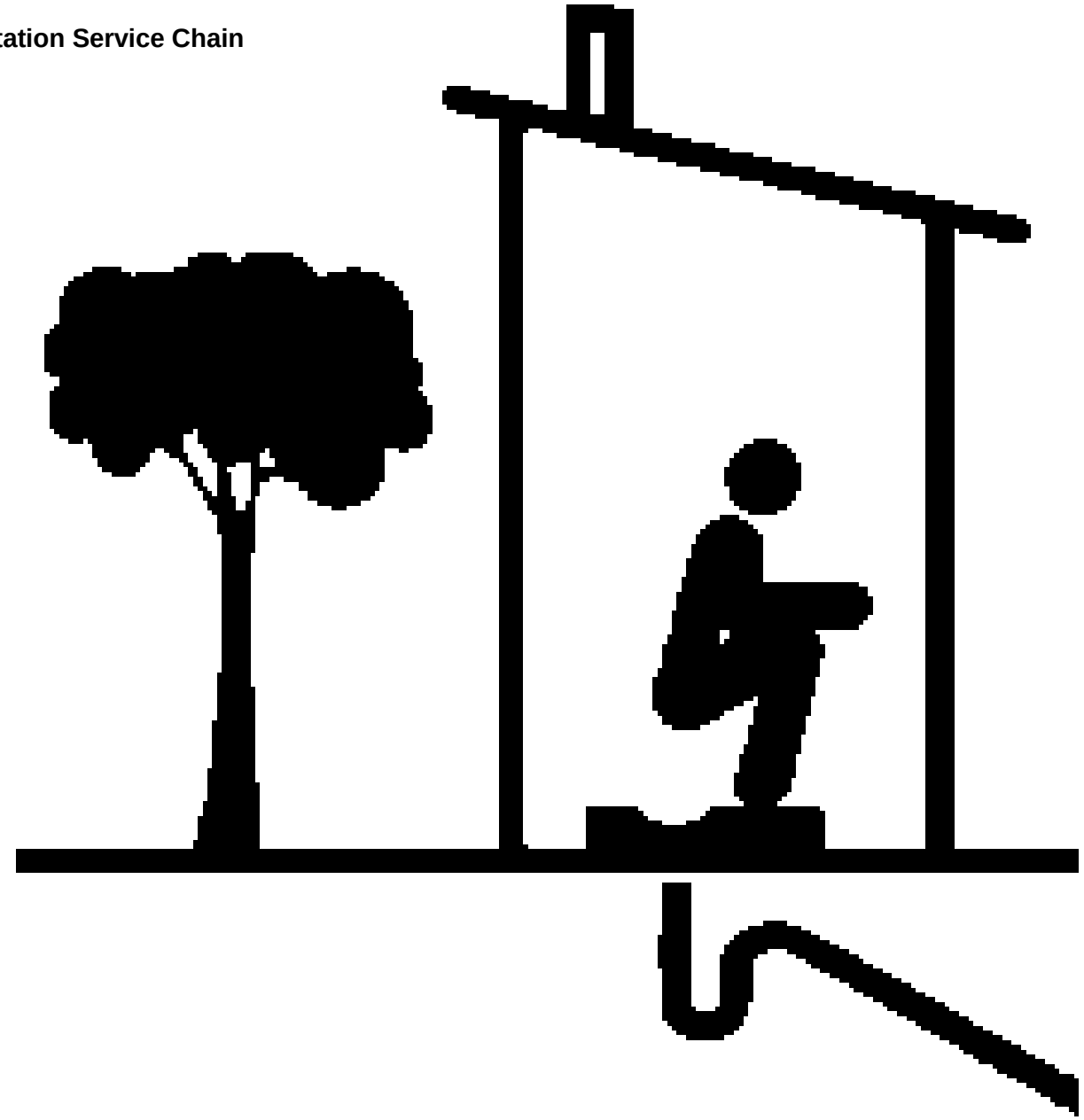
Reflections on Lesson

Activity: Sanitation Service Chain (Image Credit: Bill & Melinda Gates Foundation)

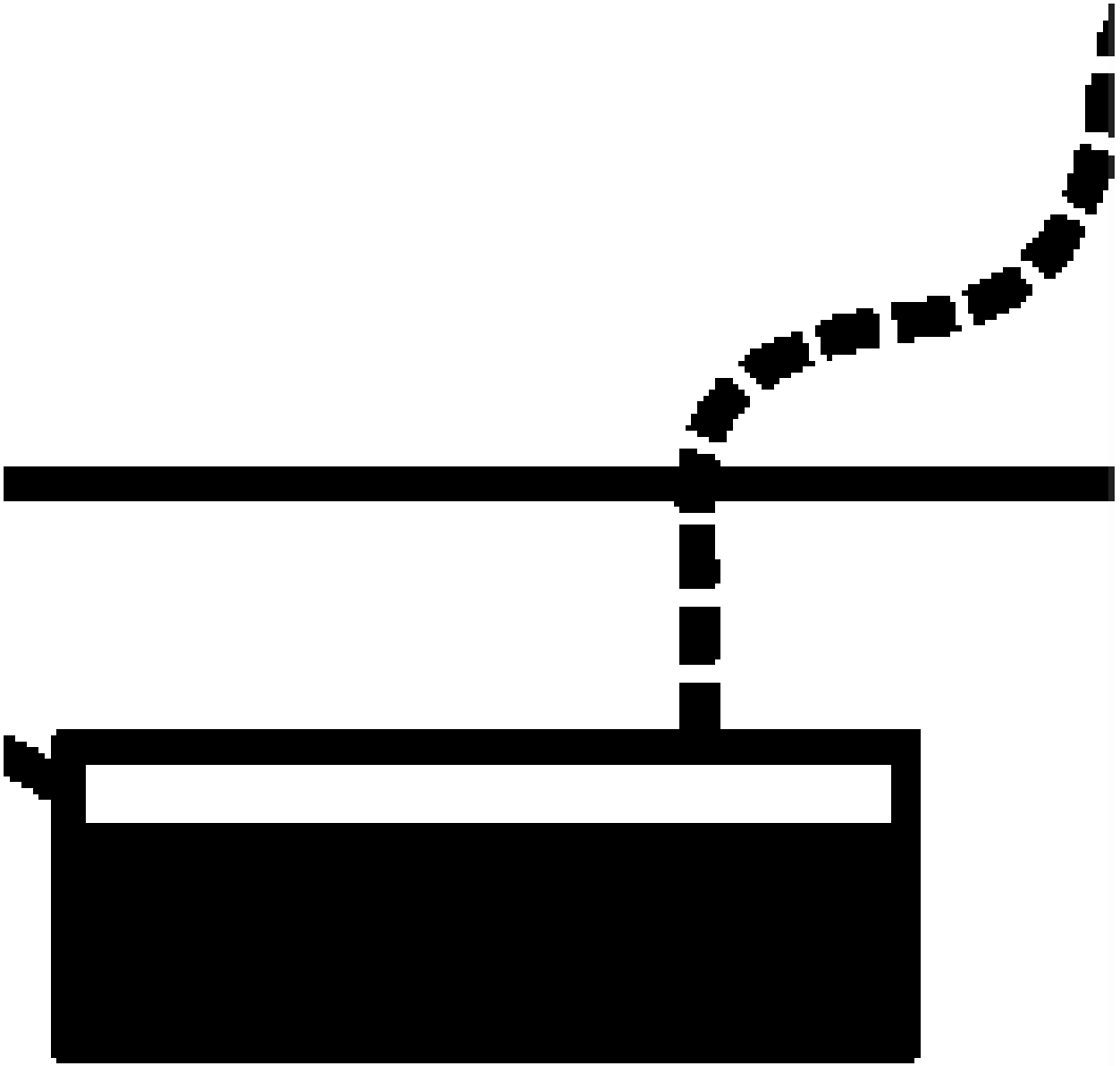


Introduction to Faecal Sludge Management

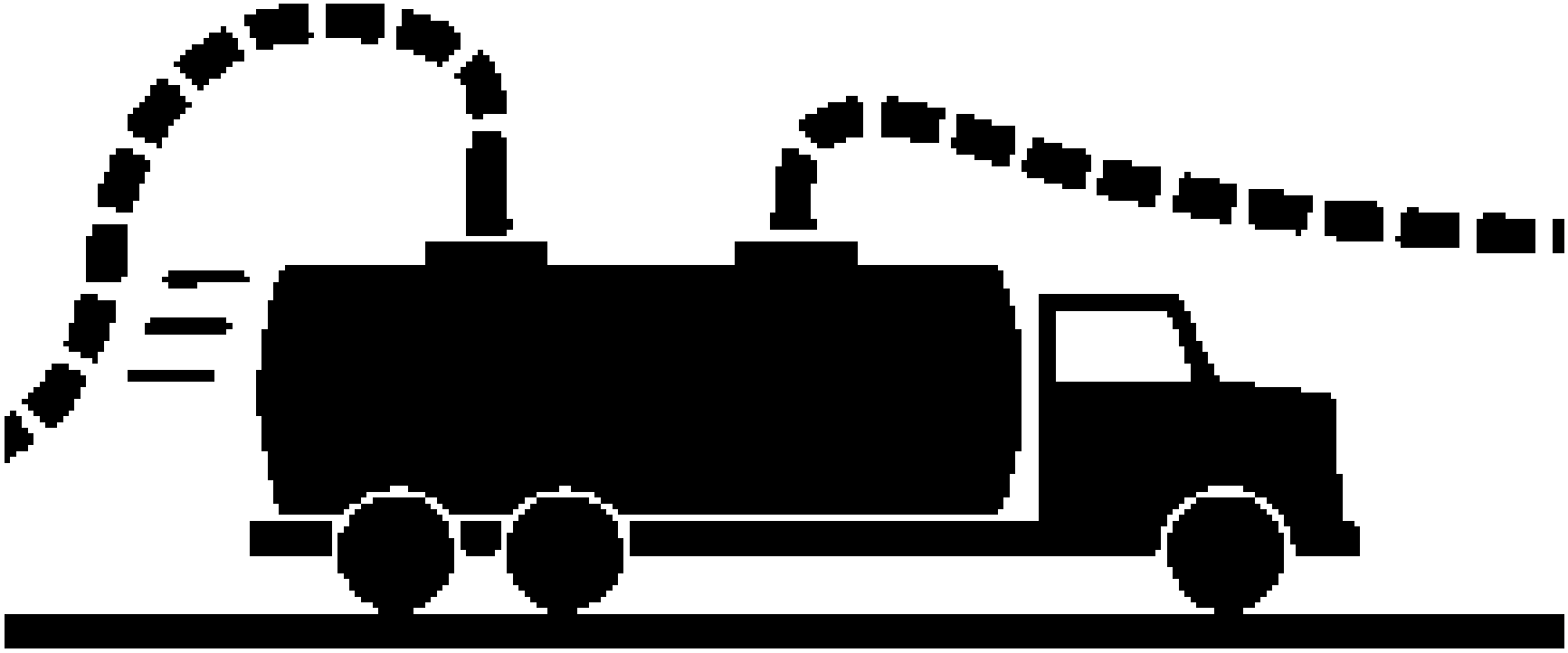
Posters: Sanitation Service Chain



Introduction to Faecal Sludge Management

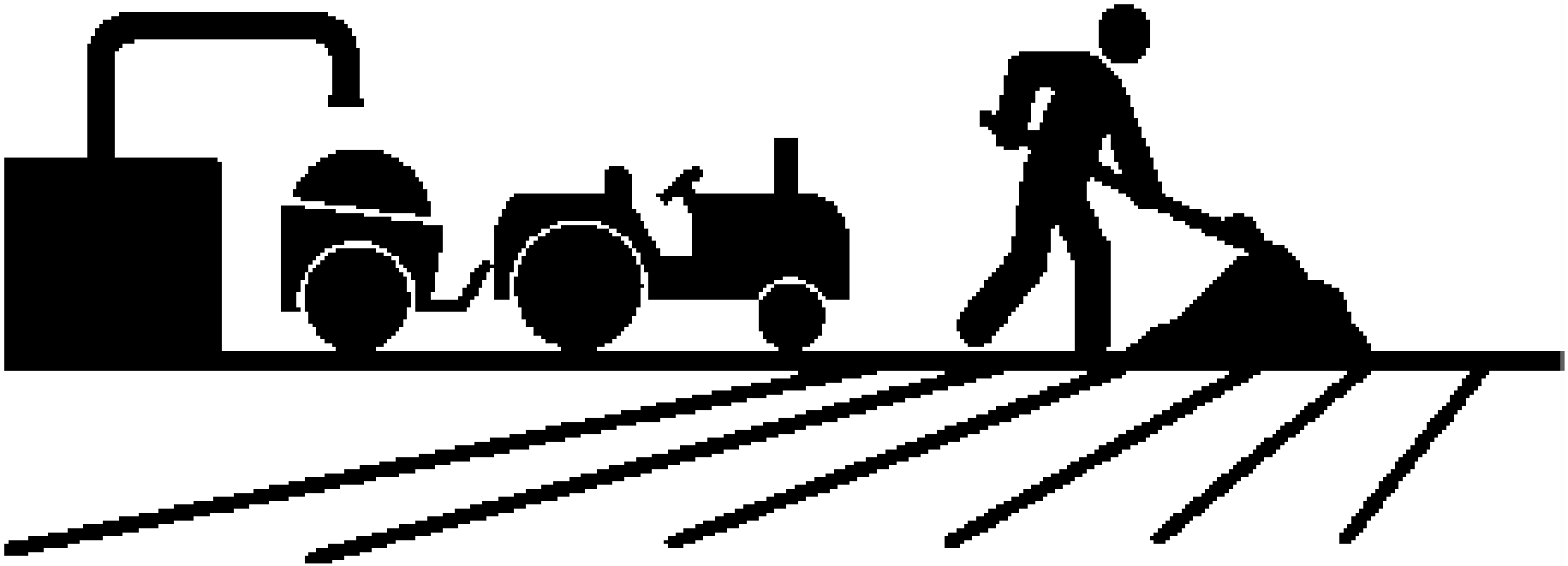


Introduction to Faecal Sludge Management



Introduction to Faecal Sludge Management

Introduction to Faecal Sludge Management



Lesson Plan: Local and Global Issues

40 minutes

Lesson Description

This lesson provides an overview of global faecal sludge management (FSM) issues. Participants also identify and discuss local faecal sludge management issues. Participants explore the challenges that contribute to these faecal sludge management issues. An understanding of these issues and challenges prepares the participants to better understand the technologies and solutions they learn in the rest of the workshop.

Learning Outcomes

At the end of this session participants will be able to:

1. Discuss the local and global issues around faecal sludge management.
2. Identify key challenges that contribute to poor faecal sludge management.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape

Optional:

- □ Faecal Sludge Management Challenges Activity (1 per pair)
- □ Video: Innovation in Urban Sanitation: FaME and U-ACT Research in Sub-Saharan Africa https://www.youtube.com/watch?v=9avo-Y4DLy0
- □ PowerPoint: Local and Global FSM Issues
- □ Computer, projector, and speaker

Preparation

- □ Review Chapter 1: The Global Situation and Chapter 18: The Way Forward in the book Faecal Sludge Management: Systems Approach for Implementation and Operation
- □ Research any relevant local faecal sludge management information and photos, and add to the PowerPoint under the local issues slides. Delete extra slide in the PowerPoint if there are no local issues to add.
- □ Optional: Print and cut out the Faecal Sludge Management Challenges activity cards (1 set per pair)
- □ Optional: Write the headings "*Stakeholders and Planning*", "*Accessibility*", "*Affordability*", "*Investment*", "*Policy, Legislation, and Regulation*", and "*Knowledge and Skills*" on individual flip chart papers
- □ Optional: Write the learning outcomes on flip chart paper
- □ If using PowerPoint: Local and Global FSM Issues

- Review the PowerPoint presentation
- Print the speaker's notes
- Check that the projector is working
- Cue the PowerPoint on the computer

Introduction 3 minutes

1. Ask the participants to imagine a town. The people of this town all have pit latrines. When the pits are full, they empty them manually. The sludge is dumped into the nearby river.
2. Ask: "How is this different to open defecation?" Share responses with the large group.
3. Explain to participants that one sludge truck illegally dumping is potentially the equivalent of 5,000 people open defecating.
4. Present the lesson description or learning outcomes.

Local and Global Issues 10-20 minutes

Option A:

1. Explain that it is important to understand the global context of faecal sludge management. This is a global issue across low-, middle-, and high-income countries.
   - *2.7 billion people around the world are in need of faecal sludge management services, this is nearly 40% of the population.*
   - *By 2030, this will rise to 4.9 billion people in need of* faecal sludge management*. This is due to population growth. It is also due to the push to end open-defecation - meaning more on-site sanitation technologies are built.*
   - *30% of the population in Japan has on-site sanitation technologies. They are called "Johkasou".*
   - *25% of the population in USA has on-site sanitation technologies.*
2. Explain that faecal sludge management is not only an issue in low- and middle-income countries. Some cities in high-income countries also have issues with managing their excreta. For example, as of 2016 Victoria (Canada), still discharges wastewater directly to the ocean without proper treatment. The city is in the process of approving a new CAN$1 billion wastewater treatment plant. In recent history, many cities in Europe only had primary treatment of wastewater and discharged the effluent into rivers. Wastewater management is also an issue in low- and middle-income countries where there is a lack of treatment or the treatment facilities do not work properly.
3. Explain that the most important reason we need faecal sludge management services is to protect human health. 88% of diarrheal deaths are attributed to lack of access to safe sanitation, unsafe drinking water, and inadequate availability of water for

hygiene (Prüss-Üstün A., et al., 2008). Ask participants, “What are some other reasons why it is important to have proper faecal sludge management services?”

- Environmental contamination
- Reduce smells
- Aesthetics
- Economy
- Tourism

Option B:

1. Use PowerPoint: Local and Global FSM Issues to present the global and local context. Tell participants to ask questions and share their local knowledge throughout the presentation. If a Shit Flow Diagram (SFD) exists for the local context, present it here (www.sfd.susana.org).

Option C: **(20 minutes)**

1. Show Video: Innovation in Urban Sanitation: FaME and U-ACT Research in Sub-Saharan Africa.
2. Ask participants to discuss:
   - *What challenges were identified in the video?*

Local and Global Challenges **20 minutes**

1. Explain we are now going to discuss the main challenges of faecal sludge management. We have picked six challenges that are seen globally, but we are going to consider them for the local context.

This activity should be focused on local faecal sludge management challenges, particularly with participants that are working or plan to work on local faecal sludge management projects.

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2. Encourage participants to think about their local context and what that challenge means to them.

Option A: Divide the participants into pairs. Provide the Faecal Sludge Management Challenges Activity to each pair. They will have 6 minutes to discuss the challenges in pairs (1 minute per challenge).

Option B: Graffiti Wall – Explain that the groups will have 1 minute to write their description of the challenge on the flip chart. After 1 minute, groups will move to the next challenge flip chart. Repeat until all the challenges are covered. Ask the groups to return to their first challenge. Each group should summarize what has been written on their flip chart. After the explanation, divide participants into 6 groups. Ask each group to choose one challenge flip chart.

Note: Place a timer that everyone can see. Participants will want to stay longer than one minute. To overcome this challenge, make a loud noise when the one minute is over (for example, clap, use a squeaky ball, whistle).

3. After 6 minutes, discuss each challenge as a large group. Ask participants to be brief. Explain that we will explore these challenges in more depth throughout the workshop.

Stakeholders and Planning	• *There are a large number of stakeholders involved in faecal sludge management at different levels.* • *There is poor communication amongst the stakeholders.* • *Faecal sludge management is rarely planned with the involvement of all the stakeholders, which leads to more challenges during implementation.*
Accessibility	• *The roads can be too narrow and poorly constructed for collection vehicles (like vacuum trucks) to reach on-site sanitation technologies.* • *People constructing on-site sanitation technologies do not take into account the collection and transport component of the sanitation system. It can be difficult to have direct access to the pit or chamber. It can also be dangerous to empty (for example, unlined pits can collapse).* • *On-site sanitation technologies and treatment plants can be located too far for a service provider to make a profit. Trucks will drive surprisingly long distances to collect faecal sludge (empty truck = not heavy), however, if the treatment plant is then too far away (full truck = heavy), they will illegally dump the sludge nearby.*
Affordability	• *Households cannot afford emptying fees.* • *Collection and transport services cannot afford capital costs, transport costs, operation and maintenance costs, and discharge costs.*
Investment	• *Faecal sludge treatment plants are expensive. There is a need for investment in construction, and also very importantly, ongoing operation and maintenance.* • *Collection and transport capital costs are expensive. There is a need for investment in vehicles and pumps.*
Policy, Legislation, and Regulation	• *Many policy makers are not aware of the need for faecal sludge management. Many focus on sewered systems because that is the only example they know. On-site sanitation technologies can be sustainable solutions, if the entire sanitation service chain is managed properly, and it can also be much more affordable.* • *Many countries are lacking policy on faecal sludge management. As a result, faecal sludge management is often unplanned, unreliable, and operated by informal private services. This leads to illegal dumping of untreated faecal sludge into the environment.* • *Regulations need to protect public health, but if faecal sludge management regulations are too strict, it does not allow for innovation.* • *There is frequently a lack of enforcement of faecal sludge management regulations.*

Knowledge and Skills	• *Compared to 100+ years of wastewater management, faecal sludge management is only recently gaining acknowledgement.* • *Stakeholders in the sanitation sector and general population lack knowledge on the importance of faecal sludge management.* • *There is an important gap in knowledge on how to ensure faecal sludge is safe to dispose or use. There is less research and lessons learned in this field.* • *There is a need to incorporate faecal sludge management in university programs.*

4. Explain that one of the most important things to realize is that faecal sludge management is about technology and people. This is why we are discussing planning and management together with technology. We need both to work together to address the faecal sludge management crisis.

5. Explain that despite all these challenges, things are moving very fast in faecal sludge management.
   - *The Sustainable Development Goals (SDGs), Goal 6: Ensure availability and sustainable management of water and sanitation for all. The Sustainable Development Goals include the whole sanitation system. This is a move from the Millennium Development Goals (MDGs) that focused on access to improved sanitation. The term faecal sludge management is not directly used in Goal 6, but it is covered by "safely managed sanitation services". This is defined as excreta that is safely disposed in situ or transported and treated off-site (definition of faecal sludge management).*
   - *Governments and nongovernmental organizations (NGOs) are getting more involved.*
   - *There are leading research institutions involved in research such as the Swiss Federal Institute of Aquatic Science and Technology (Eawag-Sandec) and the University of Kwazulu-Natal in South Africa.*
   - *There is an important online discussion platform called SuSanA (Sustainable Sanitation Alliance).*
   - *There is a global faecal sludge management conference that takes places once every two years. The first took place in 2011. There have been three conferences so far.*
   - *There is a Massive Open Online Course (MOOC) planned for Spring 2017, called "Introduction to Faecal Sludge Management" by Eawag-Sandec. It will be a five-week course with a focus on what can actually be done to work toward solutions to faecal sludge management in developing countries.*

Review **2 minutes**

1. In pairs, ask the participants to discuss the most important faecal sludge management challenge for their context.
2. Optional depending on time: Ask some pairs to share their discussion with the larger group.

Reflections on Lesson

Activity: Faecal Sludge Management Challenges

Challenge	Description
Stakeholders and Planning	
Accessibility	
Affordability	
Investments	
Policy, Legislation, and Regulation	
Knowledge and Skills	

Lesson Plan: Risk Management

40 minutes

Lesson Description

This lesson introduces the importance of using multiple barriers to reduce the risk of pathogen transmission when managing faecal sludge.

Prerequisite: Participants should already be familiar with faecal pathogens and understand disease transmission routes.

Learning Outcomes

At the end of this session participants will be able to:

1. Discuss the risks of faecal sludge management in relation to public health.
2. Identify ways to reduce the risks of faecal sludge management.
3. Explain the importance of using multiple barriers for risk reduction.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape
- □ Risk Management Scenarios (1 per group)
- □ Risk Management Table (1 per group)
- □ Multi-Barrier Activity (1 card per participant)

Optional:

- □ PowerPoint: Risk Management
- □ Computer and projector

Preparation

- □ Review Module 2 (Describe the sanitation system) and 3 (Identify hazardous events, assess existing control measures and exposure risk) of *WHO Sanitation Safety Planning: Manual for safe use and disposal of wastewater, greywater and excreta (2015).*
- □ Print and cut out the Risk Management Scenarios and Table (1 per group of 3 to 5 people)
- □ Print and cut out the Multi-Barrier Activity (1 card per participant)
- □ If using PowerPoint: Risk Management
  - Review the PowerPoint presentation
  - Print the speaker's notes
  - Check that the projector is working
  - Cue the PowerPoint on the computer

Introduction **5 minutes**

1. Explain that it can be dangerous to drive a car. There are many car collisions on the roads.
2. Ask: "What are some precautions you would take before driving a car?"
   - *Put on a seatbelt*
   - *Make sure the tires are not flat*
   - *Adjust the mirrors*
   - *Ensure you are not tired*
   - *Avoid traffic*
3. Ask: "What could the government do to reduce car accidents?"
   - *Maintain roads when there's a hole or crack*
   - *Put signs when there is a sharp turn*
   - *Create awareness on the dangers of driving tired or under the influence of alcohol*
   - *Put barriers and traffic lights where necessary*
   - *Inform drivers about the traffic situation (for example, radio)*
   - *Require drivers to be trained before issuing a driver's license*
4. Explain that they have listed barriers that will reduce the risk of car accidents. These barriers can be implemented by the driver and government. Managing faecal sludge is also dangerous. Putting in place barriers will make it safer.

Risk Management Scenarios **30 minutes**

1. Explain that faecal sludge management aims to reduce the risk of pathogen transmission through protective measures. These are actions, often called barriers, to prevent or eliminate a sanitation-related risk, or reduce it to an acceptable level. Explain that treating faecal sludge is a barrier, but not the only one. There are many other barriers that should be put in place to reduce disease transmission risks when handling faecal sludge. These are non-treatment barriers.
2. Explain that you first need to identify the disease transmission risks in order to decide what barriers to put in place. Tell participants that they will be working in groups on one scenario. They will have to identify disease transmission risks, who is at risk and appropriate barriers. They will then have to present their scenario and share their ideas with the rest of the group. To present their scenario they can either draw it on flip chart paper or act it out.

3. Divide the participants into groups of 3 to 5 people. Provide one scenario and Risk Management Table to each group. They will have 4 minutes to list the different ways (risks) faecal sludge can spread into the environment and come into contact with

people.

4. After 4 minutes, tell the groups to identify barriers that could reduce the disease transmission risks they have identified. Tell the groups they will have another 4 minutes to identify the barriers.
5. After 4 minutes, ask the groups to present their scenario to the large group. Optional depending on time: One participant should read out the scenario while the other group members describe the drawing or act it out the scenario. For each identified risk, the group should present one or more barriers. At the end of each group presentation, ask the other participants if they have identified other risks and barriers.
6. Explain that the more barriers that are used, the lower the risk of pathogen transmission and environmental contamination. This is often called the multi-barrier approach.
7. Discuss how barriers can be difficult to put in place. They will be more or less efficient depending on various factors, such as local habits and available resources.

   Note: Prioritizing barriers will be discussed in the "improvement plan" lesson later in the workshop.
8. Ask participants, "Who is at risk of getting sick if faecal sludge is poorly managed?"
   - *Workers: People who empty and transport sludge, work at a treatment site or dispose of the sludge.*
   - *Farmers: People who use faecal sludge to fertilize their fields.*
   - *Consumers: People who eat food that has been grown using faecal sludge as a fertilizer.*
   - *Local community: People that live in a community near illegal dumping of faecal sludge.*
9. Collect the Risk Management Tables from each group. Explain that they will continue to work on these scenarios later in the workshop.
10. Optional: Use PowerPoint: Risk Management to show pictures of barriers such as personal protective equipment.

Review **5 minutes**

1. Explain that for the rest of the workshop, each participant will represent a barrier. They will have to decide on an action or pose that represents this barrier. At the end of some lessons, we will discuss barriers. Participants with appropriate barriers will be asked to stand up and do the corresponding action or pose. They will provide a brief explanation as to why they believe this barrier will reduce an identified risk.

2. Hand out one barrier to each participant. Ask the participants to read the description of their barrier and think of an appropriate action or pose to use later.
3. Optional depending on time: Ask participants to form a circle. Explain that you will call out different barriers and they have to do the corresponding action.

Reflections on Lesson

Activity: Risk Management Scenarios

Scenario A: Collecting and Transporting Fecal Sludge

An informal emptying service has been contacted by a client to empty their pit latrine. The two emptiers put on their work boots, shorts and t-shirt. They start emptying the pit using shovels and buckets. Once a bucket is full, they empty it in a large bin located on a cart. They use this cart to transport the sludge. The buckets have no lids and faecal sludge spills out as they carry them. They bring back all their tools to the cart and push the cart through the town.

Scenario B: Using Faecal Sludge as a Fertilizer

A farmer applies faecal sludge onto their field to increase the yield of the crops. They get the sludge from their latrine pit. The farmer works barefoot. He carries the faecal sludge in a bucket and pours it around their plants. It is difficult to aim the sludge with the bucket. The faecal sludge splashes and goes onto the plants. Children are often playing in the fields. They help the farmer to harvest the crops. The farmer then sells the food at the local market.

Scenario C: Disposing of Fecal Sludge

A family has paid for a collection and transport service to empty their pit latrine. The service only empties the pit. It is up to the family to dispose of the sludge. There is some space in the backyard to dig a hole and bury the sludge. Two family members start digging a pit using a shovel. They put on boots, shorts and a t-shirt as well as a mask to avoid the bad smells. They pour the faecal sludge into the hole and cover the hole with a thin layer of soil. They place a stick in the hole to let the children know not to walk on top of the hole. They bring the tools into the house.

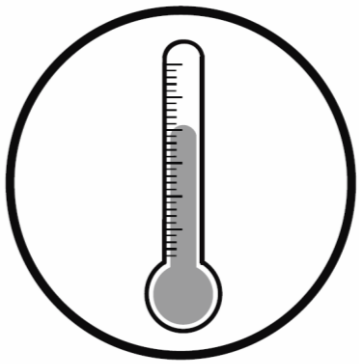
Activity: Risk Management Table

Disease Transmission Risks	Who is at Risk?	Barriers

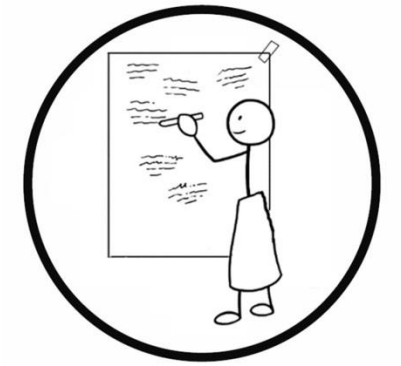
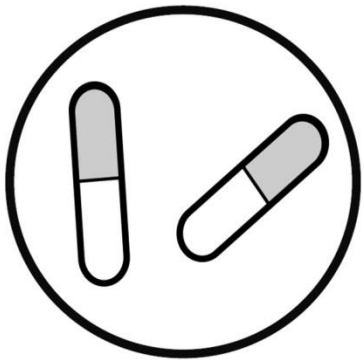
Activity: Multi-Barrier

Clean Tools	Restrict Access
	
Disinfect the tools used for collection and transport, and only use them for this activity. Safely store the tools so people do not touch them or use them for another purpose.	Construct a barrier (like a fence) to stop people from approaching and touching the treatment technology or disposal site. Put up warning messages (for example, Danger: Stay Away).

Use Protective Equipment	Prepare Food Properly
	
Wear protective equipment, such as clothing, gloves, boots and mask.	Wash fruits and vegetables with safe water before eating. Wash hands with soap before cleaning and preparing food. Cook all food thoroughly and do not eat raw food.

Monitor	Manage Effluent
	
Monitor faecal sludge throughout the treatment process to ensure it is safe to use.	Collect and treat effluent, don't let it run off

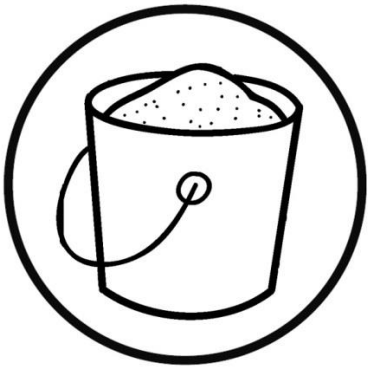
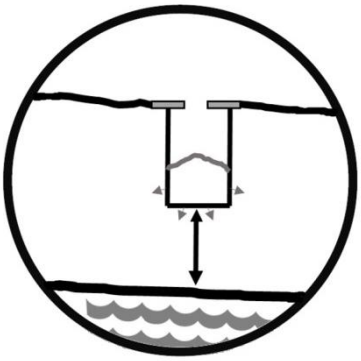
Wash Hands	Treatment
	
Wash hands with soap after handling faecal sludge, tools, and equipment.	Treat faecal sludge before use or disposal.

Train	Deworm
	
Train workers, families, and the community on best faecal sludge management and hygiene practices.	Provide treatment for helminth infections to workers and families to stop the cycle of transmission and reduce helminths in excreta.

Crop Restriction	Application Techniques
	
Only use treated faecal sludge for crops that: • Are not eaten (like cotton) • Are processed (like wheat) • Are cooked (like potatoes) • Do not directly touch the ground (like bananas)	Mix treated faecal sludge into the soil and then cover with soil.

Waiting Period	Use Containers with Good Lids
	
Wait one month after applying the faecal sludge before harvesting crops. Pathogens continue to be inactivated once they are in the soil. Inactivation is much faster in hot and sunny climates than cold and rainy climates.	Use an undamaged container with a good lid to prevent faecal sludge from spilling.

Keep Site Clean	Siting
	
Clean the area where sludge may have spilled.	Site treatment and disposal facilities in an appropriate and safe location. Consider groundwater level, flooding risks, and proximity to households.

Cover	Depth
	
Cover the disposal site with at least 50 cm of soil. This creates a physical barrier between the faeces, people, and animals. It also limits the risk of faeces resurfacing if there is heavy rainfall.	The bottom of the disposal site should be at least 2 metres above the highest annual groundwater level.

Lesson Plan: Design Approach

20 minutes

Lesson Description

This lesson introduces a rational design approach for faecal sludge management (FSM). It covers all the factors that need to be considered when designing a faecal sludge treatment facility. Participants will focus on two important factors: faecal sludge quantities and characteristics, and the use of treatment products.

Learning Outcomes

At the end of this session participants will be able to:

1. Explain the importance of having a rational design approach.
2. Identify design factors that need to be considered to arrive at a sustainable faecal sludge management solution.
3. Explain why designing for use results in more sustainable solutions.

Materials

- □ Flip chart paper
- □ Tape
- □ Markers

Optional:

- □ Design Approach Posters (1 set)

Preparation

- □ Write the heading "*Design Factors*" on flip chart paper
- □ Print the Design Approach Posters or draw the design approach on a flip chart paper.
- □ Write the following questions on flip chart paper:

  "What is the risk of over-designing or under-designing a treatment facility?"

  "What design factors need to be considered for a sustainable faecal sludge management solution?"

- □ Optional: Write the learning outcomes on flip chart paper

Introduction

5 minutes

1. We think a lot before making a big purchase such as a car or a house because we want to make the right decision. There are a lot of risks involved in purchasing a car or house.

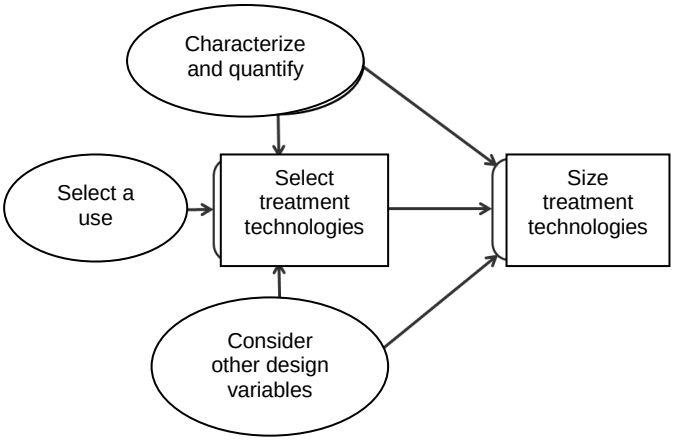
Note: Use an analogy that is applicable to the audience, for example, hosting a party.

2. Ask, "What is the risk of buying a house that is too big?"
   - *Expensive to buy*
   - *Expensive and time-consuming to maintain*
   - *Feel lonely*
3. Ask, "What is the risk of buying a house that is too small?"
   - *Not a lot of space for family members*
   - *More family arguments*
   - *No privacy*
4. Explain that it is important to choose the right size house. A big house will be expensive, but a small house will be uncomfortable. It is also important to not **over-design** treatment facilities because it wastes money and resources. You don't want to **under-design** either because it does not provide adequate protection of human and environmental health. In the faecal sludge management sector, we have often under-designed treatment facilities. For example, facilities that don't include effluent treatment as part of the full treatment process, or dewatered sludge that is used for food production without adequate pathogen inactivation. In some cases, facilities have also been over-designed. Treatment technologies have been designed, for example, based on literature values rather than the specific context.
5. Explain that the word design means both the size of the treatment facility, as well as the level of treatment.
6. Present the lesson description or learning outcomes.

Design Approach **10 minutes**

1. Ask participants to imagine they were responsible for designing a faecal sludge treatment facility. Ask, "What information would you need to design this faecal sludge treatment facility?" Record responses on the "*Design Factors*" flip chart.
2. Explain that there are many factors to consider when designing a faecal sludge treatment facility. Circle the factors that will be discussed in this workshop: select a use, characterize and quantify, and select treatment technologies.
3. Present the design approach diagram. Tape "*Select Treatment Technologies*" and "*Size Treatment Technologies*" posters on a wall. Tape the arrow between the two. Explain that to design a faecal sludge treatment facility you need to select treatment technologies based on the desired treatment objectives, and then size the treatment technologies. These are important factors to consider, but first you need to start with the end in mind: "*Select a Use*".

4. Tape the factor posters like the following diagram.



Note: You will refer to this diagram throughout the first day of the workshop. Make sure that it is in a location where all participants can see it.

5. Ask participants, “Why is it important to select a use before selecting treatment technologies?”
   - *You first need to know how the faecal sludge will be used so you know what level of treatment is required. You may need more treatment if you are using faecal sludge for agriculture than if you plan on using it for fuel.*
6. Ask participants, “Why is important to characterize and quantify faecal sludge before selecting treatment technologies?”
   - *You need to know what is coming into the treatment facility (faecal sludge quantities and characteristics) to know what treatment technologies to select. For example, if you are primarily receiving wet faecal sludge from septic tanks, you may need to dewater before using another treatment technology.*
   - *You need to know the quantity of faecal sludge to design the size of the treatment technology. You also need to know the faecal sludge characteristics (for example, solids concentration).*
7. Explain that there are a lot of other design factors that will influence the design of a treatment facility. Point to the flip chart with all the factors.
8. Explain this is the same approach engineers use to design wastewater treatment plants. It has been challenging in low-income settings to use a similar approach for faecal sludge management. This may be because of a combination of strict regulatory requirements (which cannot be met or are not enforced) and a lack of faecal sludge treatment requirements.
9. Explain that the first part of the workshop is focused on designing treatment technologies. We will cover faecal sludge use, characterization and quantification, treatment objectives and then treatment technologies. The second part of the workshop will focus on the other factors which affect the design of treatment technologies as well as the whole sanitation service chain. An integrated planning approach includes: operation and maintenance, collection and transport, stakeholders, financial transfers and the legal framework.

Review **5 minutes**

1. In pairs, ask the participants to discuss the questions written on the flip chart. After 2 minutes, discuss their responses as a large group.

   "What is the risk of over-designing or under-designing a treatment facility?"

   - *Under-designing does not adequately protect human or environmental health, over-designing wastes resources.*

   "What design factors need to be considered for a sustainable faecal sludge management solution?"

   - *What is coming into a treatment plant – characterization and quantification*
   - *How is faecal sludge going to be used – use*
   - *Other factors can include anything, such as (will be discussed more in the upcoming lessons):*
     - *Existing faecal sludge infrastructure and services*
     - *Skills, knowledge, and abilities*
     - *Legal requirements, regulations, and norms*
     - *Social acceptance*
     - *Operation and maintenance*
     - *Financial viability*

Reflections on Lesson

Design Approach Posters

Select Treatment Technologies

Size the Treatment Technologies

Characterize and Quantify

Select a Use

Other Design Factors

Lesson Plan: Introduction to Case Studies

30 minutes

Lesson Description

This lesson introduces the case studies and the exercise book. Participants will understand the purpose and structure of these two documents that they will use throughout the workshop. They will also be given time to read the case study.

Learning Outcomes

At the end of this session participants will be able to:

1. Explain the purpose of the case study and exercise book.
2. Discuss their case study.

Materials

- □ Case Studies (1 per participant)
- □ Faecal Sludge Management Exercise Book (1 per participant)

Preparation

- □ Print Case Studies and Exercise Book for each participant.
- □ Optional: Develop local case studies.

Introduction 2 minutes

1. Ask participants what they do to retain information (for example, school, workshops, interviews)?
   - *Write down the information*
   - *Memorize information*
   - *Draw (images, diagrams)*
   - *Record and listen again*
   - *Practice with exercises*
   - *Share the information with another person*

2. Explain that there are many ways to learn information and gain knowledge. Everyone has their own methods. A key way of retaining information is through practice and applying what we learn. Participants will be practicing and applying their knowledge throughout this workshop using case studies and an exercise book.
3. Present the lesson description or learning outcomes.

Case Study and Exercise Book **20 minutes**

1. Explain that each group will have a case study that they will work on throughout the workshop. Each participant will also have an exercise book. In many lessons, the trainer will provide some time for the group to work on their case study and fill out the appropriate section of the exercise book.
2. Explain that each group will represent a consulting organization. Their task is to design an appropriate sanitation service chain for their case study. Throughout the workshop, they will also consider implementation strategies.
3. Explain that the case studies are based on existing data. The case studies, however, will not provide all the information needed to make an informed decision. This is often the reality of the faecal sludge management sector. Ask participants to discuss what information is missing and how they would collect it. They will, however, have to make some final decisions despite not having all the data they require. At the end of the workshop, each group will present their sanitation service chain.

4. Divide participants into their groups. Create groups that have a mix of expertise (for example, policy maker, engineer, treatment plant operator, project manager). Hand out a case study and an exercise book to each participant. All the participants of a group should have the same case study.
5. Provide 15 minutes for the participants to read the case study.

Review **5 minutes**

1. Ask participants to open their exercise book to Section 2: Case Study Profile. They have 5 minutes to fill out this section. They should first create a name and slogan for their consulting organization. Then they should fill out the different sections. There is a blank page that can be used to draw the project area.
2. Ask groups to briefly introduce their consulting organization (name and slogan) and the location of their project.

Reflections on Lesson

Lesson Plan: Faecal Sludge Use (Resource Recovery)

60 minutes

Lesson Description

This lesson introduces the value of using faecal sludge (faecal sludge) treatment products. Participants will identify different treatment products and their uses. Participants will also discuss other factors that should be considered when deciding on a use, like health and environmental protection, social acceptance, and market demand.

Learning Outcomes

At the end of this session participants will be able to:

1. Discuss the value of using faecal sludge.
2. List at least five different faecal sludge treatment products.
3. Identify different ways to use faecal sludge treatment products.
4. Discuss health, environmental and social considerations related to using faecal sludge.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape
- □ Introduction items: four items made from plastic (bucket, ball, stapler, pen)
- □ Activity: Treatment Products and Uses (1 set for every 2 or 3 people)
- □ Case Studies (1 per participant)
- □ Faecal Sludge Management Exercise Book (1 per participant)

Preparation

- □ Review Chapter 10: Enduse of Treatment Products in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*
- □ Print and cut out the Activity: Treatment Products and Uses (1 set for every 2 or 3 people)
- □ Place the introduction activity items on display on a table, in front of participants.
- □ Optional: Write the learning outcomes on flip chart paper

Introduction 5 minutes

1. Ask participants to look at the items on the table and share (1) what is each item made from and (2) what is each item's use.

2. Explain that these are all products that are made from plastic, come from different factories and have very different uses. Similarly, in this lesson we will learn about the variety of products that come from faecal sludge treatment technologies and their different uses.
3. Present the lesson description or learning outcomes.

Faecal Sludge Use **15 minutes**

1. Divide participants into groups of 2 or 3 people (or use the case study groups).
2. Explain that faecal sludge is transformed by treatment technologies into different products. These products can be sold and used in different ways. Using a product rather than creating waste is called “resource recovery”.

3. Hand out the Activity: Treatment Products and Uses. Explain that there are duplicates of some treatment products because some ‘uses’ have multiple ‘products’. Also, each treatment product has an example of treatment technology that produces that product.
4. Explain that participants may not know all the treatment products. These will be further discussed in the treatment technologies lesson plan.

   Ask participants, “Do you have any questions about the products?” For now, all participants need to know is that:

   - *Dewatered faecal sludge is still quite wet (mainly water).*
   - *Dry faecal sludge has less moisture.*
   - *Use the analogy of a wet towel. Wringing the towel is like dewatering. Then putting the towel out in the sun is like drying.*

5. Hand out the faecal sludge use options. Tell the participants to match treatment products to possible uses. They have 10 minutes to complete the activity.
6. Review solutions as a large group.

Faecal Sludge Use	**Treatment Product**
Irrigation	Effluent
Energy	Biogas, dry faecal sludge (solid fuel)
Agriculture	Dewatered or dry faecal sludge (low pathogens)
Livestock	Insect larvae, plants
Construction	Dry faecal sludge (building materials)
Forestry	Dewatered or dry faecal sludge
Aquaculture	Fish, aquatic plants, insect larvae

7. Review key points and clarify questions with the group:

   - *Energy (solid fuel), Construction: Can use dry faecal sludge with pathogens.*

- *Forestry: Can use dewatered or dry faecal sludge with higher pathogens than used in agriculture.*
- *Aquaculture:*
    - *WHO has developed guidelines to "maximize public health protection and the beneficial use of important resources. (The) purpose of the (guidelines are) to ensure that waste-fed aquacultural activities are made as safe as possible so that the nutritional and household food security benefits can be shared widely in affected communities. Thus, the adverse health impacts of waste-fed aquaculture should be carefully weighed against the benefits to health and the environment associated with these practices." Nutrition from aquaculture has the ability to improve nutrition, especially for children.*
    - *This practice is primarily done in South East Asia, where both fish and aquatic plants from fish ponds or floating plant ponds are consumed directly by humans or used as animal feed.*
    - *Aquatic plants include watercress, water chestnut, water spinach, water mimosa and duckweed.*
    - *Black soldier fly larvae are being tested as fish food, for example, with catfish and tilapia.*
    - *Using aquatic plants as animal feed is likely a safer use than direct consumption by humans.*
    - *This is more accurately a "disposal product" rather than a "treatment product"*

Value of Faecal Sludge in Resource Recovery **15 minutes**

1. Explain that during treatment, faecal sludge is turned into products that can be a valuable asset with economic and environmental benefits. Historically, the most common use for faecal sludge has been agriculture. But as the introduction activity showed, there are several other use options for faecal sludge. Research is being done on new ways to beneficially use faecal sludge, such as a biofuel or using black soldier flies to make animal protein.
2. Explain that the case study groups will work together to identify faecal sludge treatment products and uses for their case study. They will brainstorm what is being used now that can be replaced with faecal sludge products. For example, farmers are currently buying plants to feed their animals. They could instead use plants grown from a faecal sludge drying bed. They have 5 minutes to brainstorm their ideas and record them in the first question of Section 3: Faecal Sludge Use (Resource Recovery) in their Exercise Book. Encourage the groups to be creative in recording their ideas. They can use illustrations, diagrams, or words.

   Note: Participants should list the different possible uses, not rate them. Groups should hopefully eliminate a few options.

3. After 5 minutes, ask each group to share 1 idea for faecal sludge use from faecal sludge products to the large group. Briefly discuss each idea after it is presented. Continue going through the groups until there are no more ideas.
4. Discuss how selling faecal sludge is unlikely to fully cover all of the treatment costs, but it could be a significant portion of the budget and help offset the costs. For example, they could generate maybe 5–15% of the total annual faecal sludge treatment plant operating costs.

Other Considerations **5 minutes**

1. Explain that the previous activity looked at using faecal sludge only from a technical perspective. There are other things that need to be considered for when deciding on a use, such as health risks and environmental contamination. Ask participants, "What is the biggest health risk when using faecal sludge?"
    - *Transmission of faecal pathogens*
    - *Need to consider health risks for any use; they are all just different levels and types of risks. For example, faecal sludge needs to be treated to reduce pathogens to a safe level if used in agriculture, especially if people are going to eat uncooked crops. For pellets used as fuel, pathogen transmission is also important, but maybe in that case it only means protective clothing for workers while they handle the pellets.*
    - *Other barriers can also be put in place to reduce the risk of pathogen transmission, like crop restrictions (for example, above ground crops like fruit trees), application techniques, protective equipment, waiting period and food preparation. For more information, refer participants to the World Health Organization (WHO) Guidelines for the Safe Use of Wastewater, Excreta and Greywater (2006) and the WHO Sanitation safety planning: manual for safe use and disposal of wastewater, greywater and excreta (2015).*
2. Ask participants, "Apart from health risks, what else do you need to consider when deciding on a use?"
    - *Environmental impact*
    - *Social factors:*
        - *Acceptance of the product (for example, some cultures reject the use of excreta, whereas others have a long history of excreta use in agriculture)*
        - *Market demand (for example, people actually want and will use the product)*
    - *Regulations, if they exist*
    - *Competition from other products on the market*
    - *Treatment technologies required to treat faecal sludge*
3. Emphasize that every solution is context specific. It important to evaluate the local health, environmental and social factors before deciding on a treatment and use plan.

Optional: Risk Management **5 minutes**

1. Explain that there are several barriers that can be put in place to avoid the spread of faecal pathogens when using faecal sludge. These barriers will depend on the type of use.
2. Ask participants to stand up if their barrier reduces the spread of faecal pathogens for agricultural use (see Lesson Plan: Risk Management). Explain that faecal sludge should be treated to remove pathogens before it is applied to crops. However, it is difficult to treat and monitor faecal sludge to ensure that it is completely free of pathogens. As such, there are several barriers that can be put in place after treatment to avoid the spread of pathogens in agriculture.
3. Ask participants, "Are there any other barriers that could be put in place when using faecal sludge in agriculture?"

- Crop restriction
- Application techniques
- Protective equipment
- Waiting period
- Food preparation
- Handwashing
- Cleaning tools
- Training
- Deworming

Exercise Book **10 minutes**

1. Ask the case study groups to use their Exercise Book and complete the analysis of the other factors (health risks, environmental impact, social factors, regulation, competition, and treatment technologies required). Ask the groups to recommend a treatment product and faecal sludge use for their case study. Emphasize that there is no right answer. Groups may change their decision after learning about the treatment technologies, in another lesson. Each group has 10 minutes to complete Section 3 of the Exercise Book.

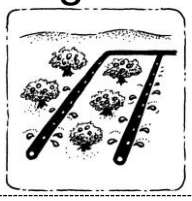
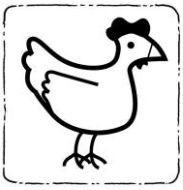
Review **5 minutes**

1. Ask participants to find a partner from another case study group. Ask them to share one another possible treatment product and faecal sludge use their group could have selected.

Reflections on Lesson

Activity: Treatment Products and Uses

Treatment Products	
Biogas Treatment technology example: Anaerobic digester	Dewatered or Dry faecal sludge Treatment technology example: Unplanted drying bed
Dewatered or dry faecal sludge (with low pathogens) Treatment technology example: Co-composting	Dry faecal sludge Treatment technology example: Unplanted drying bed
Insect larvae Treatment technology example: Black soldier fly larvae	Dry faecal sludge Treatment technology example: Unplanted drying bed
Insect larvae Treatment technology example: Black soldier fly larvae	Plants Treatment technology example: Planted drying bed
Effluent Treatment technology example: Co-treatment with wastewater	Aquatic plants Disposal example: Fish and floating plant ponds
Fish Disposal example: Fish and floating plant ponds	

Faecal Sludge Use	
Energy (solid fuel) 	Construction (building materials) 
Aquaculture 	Irrigation 
Agriculture, horticulture 	Livestock 
Forestry 	Energy (biogas) 

Lesson Plan: Quantification and Characterization

75 minutes

Lesson Description

This lesson explains the importance and the challenges of quantifying and characterizing faecal sludge. Participants learn what excreta and faecal sludge are made of. They discuss the key differences between faecal sludge and wastewater characteristics, focusing on faecal sludge variability. The difficulties of quantifying and characterizing faecal sludge are also introduced.

Prerequisite: Participants should already be familiar with faecal pathogens and disease transmission routes.

Learning Outcomes

At the end of this session participants will be able to:

1. Identify the characteristics of excreta and faecal sludge.
2. Explain the difference between faecal sludge and wastewater characteristics.
3. Explain the variability of faecal sludge characteristics.
4. Discuss the difficulties in reliable faecal sludge quantification and characterization.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape
- □ Activity: What is Faecal Sludge? (1 for every 4 or 5 participants)
- □ Activity: Excreta Icons (2 of each icon)
- □ Case Study (1 per participant)
- □ Faecal Sludge Management Exercise Book (1 per participant)

Optional:

- □ PowerPoint: Quantification and Characterization
- □ Computer and projector

Preparation

- □ Review Chapter 2: Quantification, Characterization and Treatment Objectives in the book Faecal Sludge Management: Systems Approach for Implementation and Operation and Design Approach presentation from Lesson Plan: Design Approach
- □ Write the heading "*Quantification*" on flip chart paper
- □ Write the heading "*What is in Faecal Sludge*?" on flip chart paper. Draw the outline of a poop underneath the heading.
- □ Write the heading "*Excreta*" on flip chart paper.

- □ Write the heading "V*ariability Factors*" on flip chart paper.
- □ Print the Activity: What is Faecal Sludge? (1 for every 4 or 5 participants)
- □ Print the Activity: Excreta Icons (2 of each icon)
- □ If using PowerPoint: Quantification and Characterization
  - Review the PowerPoint presentation
  - Print the speaker's notes
  - Check that the projector is working
  - Cue the PowerPoint on the computer

Introduction 5 minutes

1. Explain that you are the leader of the local fishing agency. You have been asked to quantify or count all the fish in your local lake. Ask participants, "How would you quantify all the fish in a lake?" Share some responses as a large group.
2. Explain that now you need to categorize the fish by species (type), size, weight, and colour. Ask participants, "How would you do that?" Share some responses as a large group.
3. Explain that quantifying and characterizing faecal sludge is similar to quantifying and characterizing fish in a lake – it is difficult and will never be 100% accurate. But we can come up with reasonable estimates.

Faecal Sludge Quantification 5 minutes

1. Explain that we will first look at faecal sludge quantification, and then we will discuss characterization in more detail. Remind participants that you need to quantify and characterize faecal sludge to design a treatment facility.
2. Ask participants, "What data would you need to estimate faecal sludge quantities for a town?" Record responses on the "*Quantification*" flip chart.
   - *Number of users*
   - *Location*

   - *Types and number of on-site sanitation technologies*
   - *Faecal sludge accumulation rates*
   - *Socioeconomic levels (this could be an indicator of faecal sludge characteristic. For example, maybe in high-income areas on-site containment is better constructed, and there is more use of flush toilets and greywater.)*
3. Explain that there is no proven method to quantify faecal sludge. There is a need to develop a methodology to estimate faecal sludge sludge quantities. This is something that Eawag-Sandec is working on. Sandec has hypothesized that demographic data could be used to develop citywide characterization and quantification plans, to collect data for the design of faecal sludge treatment facilities.

   More information can be found on the Eawag-Sandec website (www.sandec.ch).

4. Explain that a vacuum truck counting study is a method to estimate the amount of faecal sludge currently delivered to a discharge location. In a vacuum truck counting study, record the number of vacuum trucks and their discharge volume. The study should be implemented over at least one week and repeated a few times at different times of the year. This should ensure that the weekly and annual variability of faecal sludge collection is considered. For example, less faecal sludge is commonly discharged on Sundays or during the year when major investments (such as school fees) are due.

   A vacuum truck counting study does not quantify all of the faecal sludge generated in a community, nor can it predict future developments. As well, it can only be done in cities where faecal sludge discharge locations exist.

What is Faecal Sludge? **30 minutes**

1. Explain we will now discuss faecal sludge characterization. To understand faecal sludge characterization, you first need to understand what faecal sludge is. Faecal sludge is what you find in an on-site sanitation technology, like a pit latrine or septic tank. It includes faeces and urine (which is known as excreta), as well as other components. We will first focus on faeces and urine. We will then discuss the other components of faecal sludge.
2. Explain that we need to know what excreta is, to understand faecal sludge characterization. Ask participants, "What is excreta (faeces and urine) made of?" Tape icons on the "*Excreta*" flip chart as they are mentioned.

- *Water: Both urine and faeces are largely made of water. On average, 91-96 % of urine is water and 75% of faeces are water.*
- *Organic material: Organic material in excreta comes from the remains of living organisms such as plants and animals that our body is not able to digest. When we eat a meal that has vegetables and meat, we are eating organic material. 25% of faeces are solids, of which 84-93% is organic material. 4-9% of urine is dissolved and suspended solids, of which 65-85% is organic material.*
- *Nutrients: Nutrients are found in the food we eat. They go through our digestive system where some are used by our bodies and others are excreted. Humans need nutrients to grow and stay healthy. Examples of nutrients are nitrogen (N), phosphorous (P) and potassium (K). They are excreted through our urine and faeces, with more of the nutrients in urine. For example, 88% of nitrogen is excreted in urine and 12% in faeces, however, 67% of phosphorus is in urine and 33% in faeces.*
- *Pathogens: Bacteria, viruses, helminths and protozoa can all be found in excreta.*
- *Trace organics: Natural hormones, synthetic hormones and pharmaceuticals that can be passed through excreta* and *could still be biologically active.*
- *Salt: There is not a significant amount of salt in faeces. Urine has high concentrations of salt. The salt concentration in urine depends on what a person eats and how much they drink. For example, one study reported we excrete on average 8.8 g of salt per litre of urine (Ganrot, Dave, & Nilsson, 2007). Salt in urine is not a health issue.*

3. Participants will brainstorm in groups what they think faecal sludge is. To help them brainstorm, ask participants, "What else goes into an on-site sanitation technology other than excreta?" They have 2 minutes to write or draw the components of faecal sludge on the handout.

4. Divide the participants into groups of 4 or 5 people. Hand out the Activity: What is Faecal Sludge? to each group.
5. After 2 minutes, ask the groups to share some of their responses. Record responses on the "*What is in Faecal Sludge?*" flip chart. Add "*Excreta*" and "*Faecal Sludge*" to the Word Wall.
    - *Faeces and urine*
    - *Cover material*
    - *Anal cleansing material*
    - *Solid waste*
    - *Flush water*
    - *Greywater*
6. Summarize the two activities.
7. Explain that people often confuse faecal sludge and wastewater. Faecal sludge is from on-site sanitation technologies, like a pit latrine or septic tank. Wastewater is used water from any combination of domestic, industrial, commercial or agricultural activities, surface runoff (stormwater), and any sewer inflow (infiltration). Wastewater can be managed on-site or off-site. Wastewater managed off-site is often called sewage. Add "Wastewater" to the Word Wall.
8. Ask participants, "What is the difference between faecal sludge and wastewater characteristics?" Explain that there are two key differences.
    - *Faecal sludge is **highly variable** in consistency, quantity, and concentration. Wastewater is not as variable because it is mixed as it is transported in the sewer.*
    - *Wastewater is transported through the sewer system to the wastewater treatment facility. Whereas faecal sludge is stored for a certain period of time in a containment technology (like a latrine pit or septic tank). Depending on the length of storage, faecal sludge **can be more degraded** and stabilized than wastewater.*
9. Ask participants, "Why is faecal sludge highly variable?" Record the responses on the "*Variability Factors*" flip chart.
    - *Variety of on-site sanitation technologies: Septic tank, pit latrine, dry latrine*
    - *Storage duration: faecal sludge will be more or less stabilized depending on how long it is stored.*
    - *Infiltration: faecal sludge will be more or less viscous (thick) if there is a high infiltration rate into or out of the containment.*

- *Amount of greywater: faecal sludge will be more or less dilute depending on the different used water streams going into the on-site sanitation technology (for example, water from bathing, dishwashing, laundry, and cleaning)*
- *Emptying method: Water could be added to help liquefy faecal sludge for pumping. Some emptying methods can only remove part of the contents, for example, faecal sludge at the bottom of a containment technology that is very thick. Other methods can remove the entire contents, for example manual emptying. Sometimes the household can only afford to get part of the contents removed.*
- *Climate: During rainy seasons, on-site sanitation technologies can fill up with runoff and overflow. Warmer temperatures increase degradation rates.*
- *Solid waste: Quantities of solid waste disposed in the on-site sanitation technology, depending on access to solid waste management and awareness.*

10. Optional: Use PowerPoint: Quantification and Characterization to show pictures of faecal sludge from different containment technologies (for example, public latrines, pit latrine, septic tank).

Faecal Sludge Characterization **15 minutes**

1. Ask participants, “Has anyone tried to characterize faecal sludge before? If so, how did you do it?” Discuss responses as a large group.
2. Ask participants, “Why is characterizing faecal sludge not common?”
   - *Lack of knowledge of how to do so*
   - *Lack of simple methods to characterize faecal sludge*
   - *No guidelines or standards exist*
   - *Time consuming and expensive*
3. Explain that every on-site sanitation technology is like a person – it has its own characteristics. We will never be able to characterize every type of faecal sludge. There are, however, easier qualitative methods that allow a good understanding of sludge characteristics:
   - *The actual latrine itself can provide a lot of information about faecal sludge characteristics. Key information includes the excreta containment technology, type of user interface, and how long the faecal sludge has been stored. The sludge from a privately owned pay-per-use toilet facility or public toilet, for example, will tend to be relatively fresh because it requires frequent emptying and was stored for a short period of time.*
   - *Septic tanks are commonly operated with a greater amount of water and therefore tend to have more water than pit latrines. Therefore, the excreta containment technology can be used as an indicator for the moisture content.*
   - *Information can be obtained through observation and conversations with the users, latrine emptiers and maintenance staff.*
4. Emphasize that even though it is difficult to characterize sludge, it shouldn’t prevent us from doing the best that we can with the information that we have available. As

explained, information on the on-site sanitation technology and its mode of operation can give us an indication of faecal sludge characteristics such as moisture content and chemical oxygen demand. Characterization and quantification of faecal sludge is particularly important for designing treatment technologies.

Exercise Book **15 minutes**

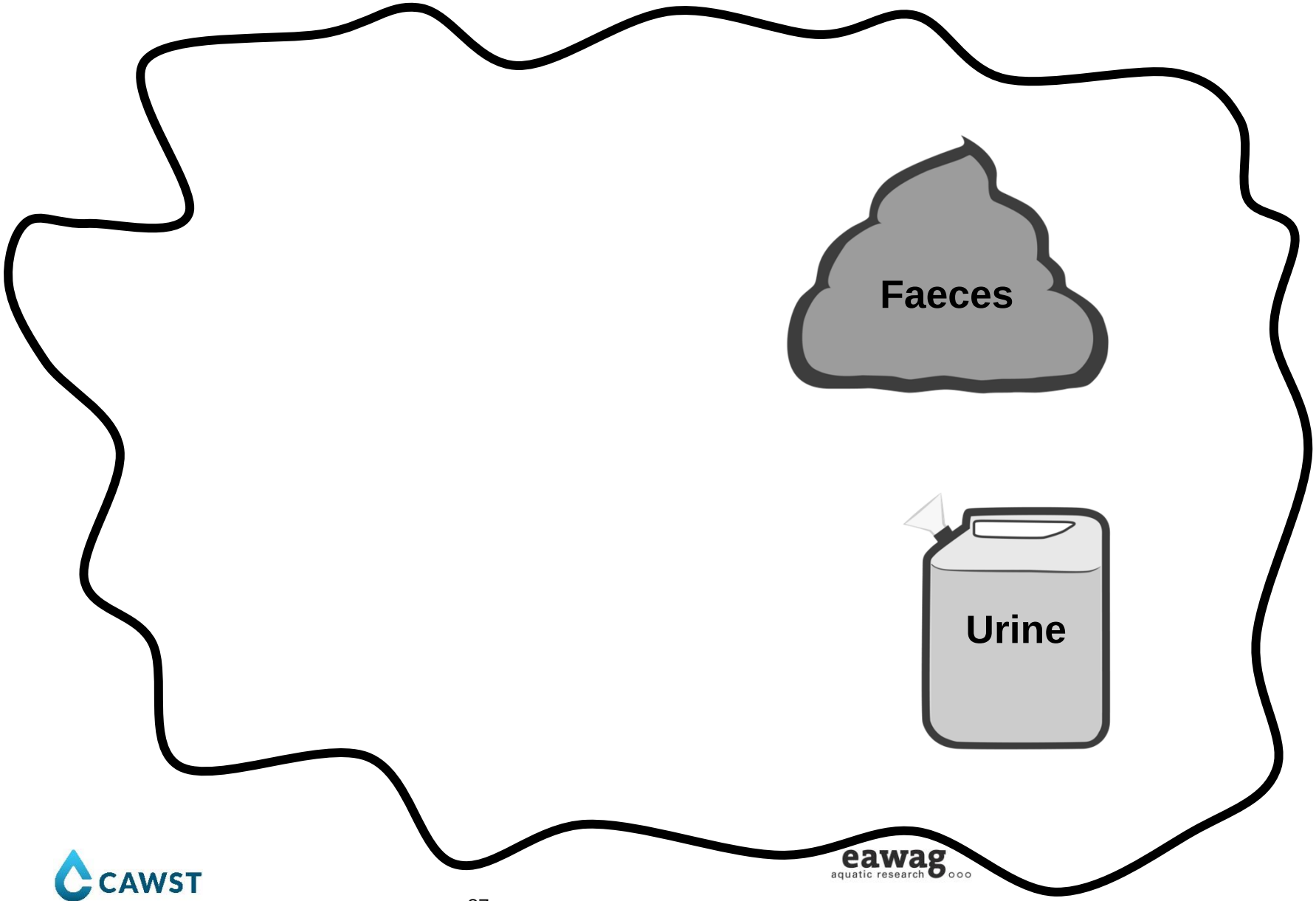
1. Ask the case study groups to use their Exercise Book and complete Section 4: Faecal Sludge Characterization. Groups will list the different on-site sanitation technologies in their case study and describe the characteristics of the faecal sludge. They have 15 minutes to complete the exercise.

Review **5 minutes**

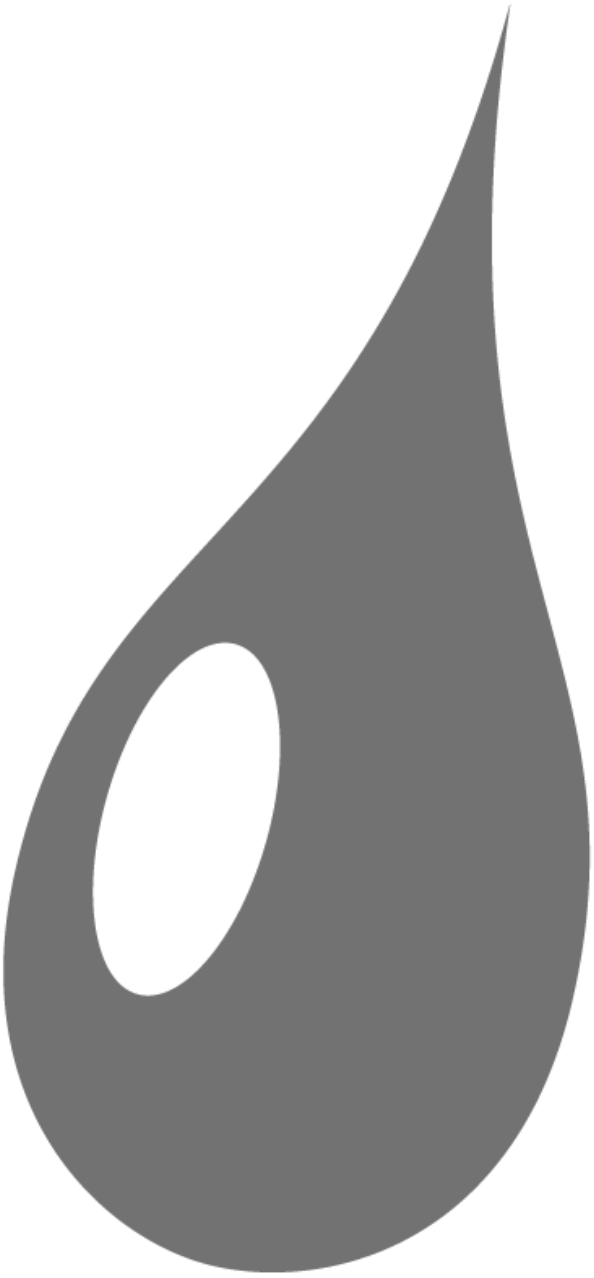
1. Ask participants to find a partner from another case study group. Ask participants to share the on-site sanitation technologies and characteristics of the faecal sludge in their case study.

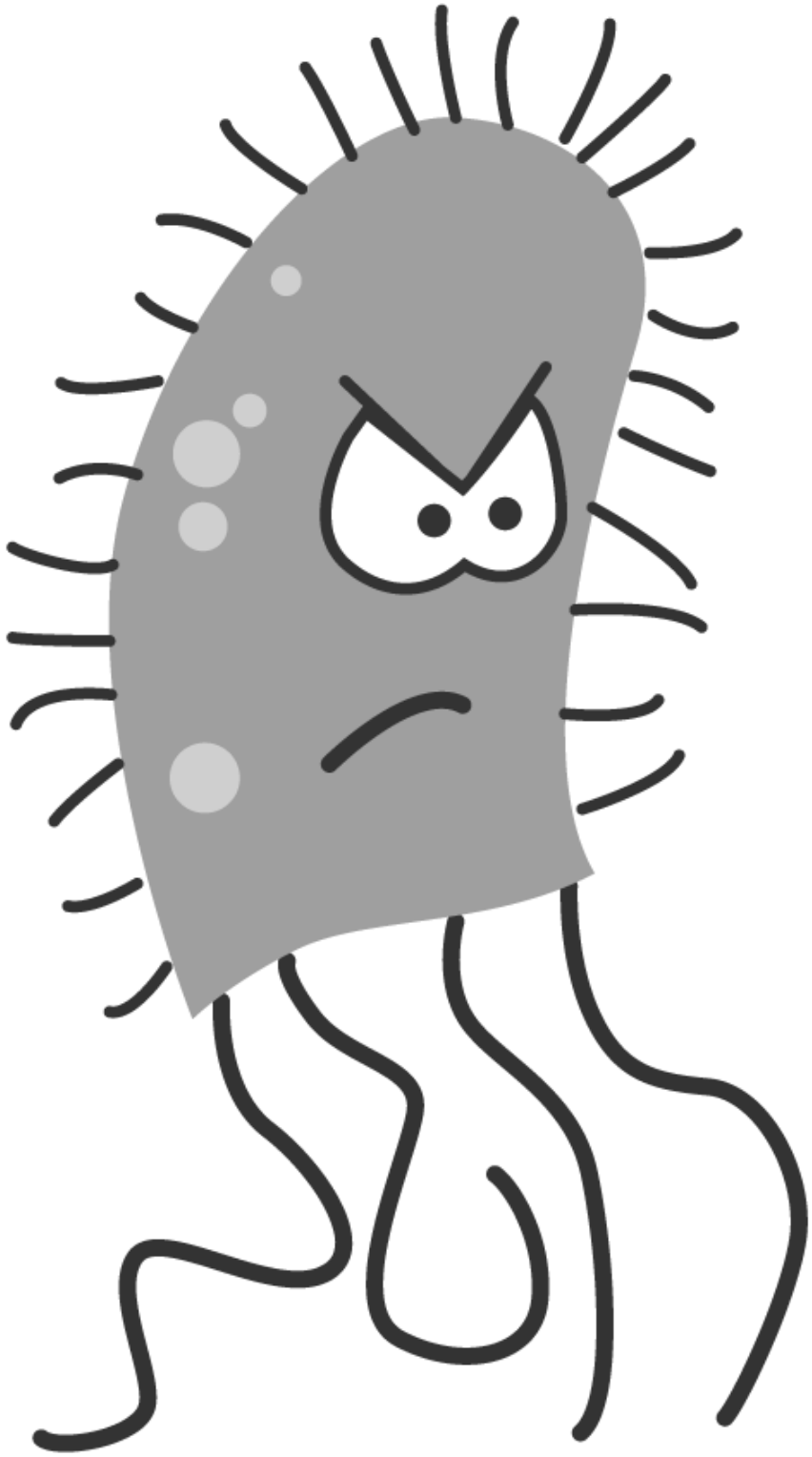
Reflections on Lesson

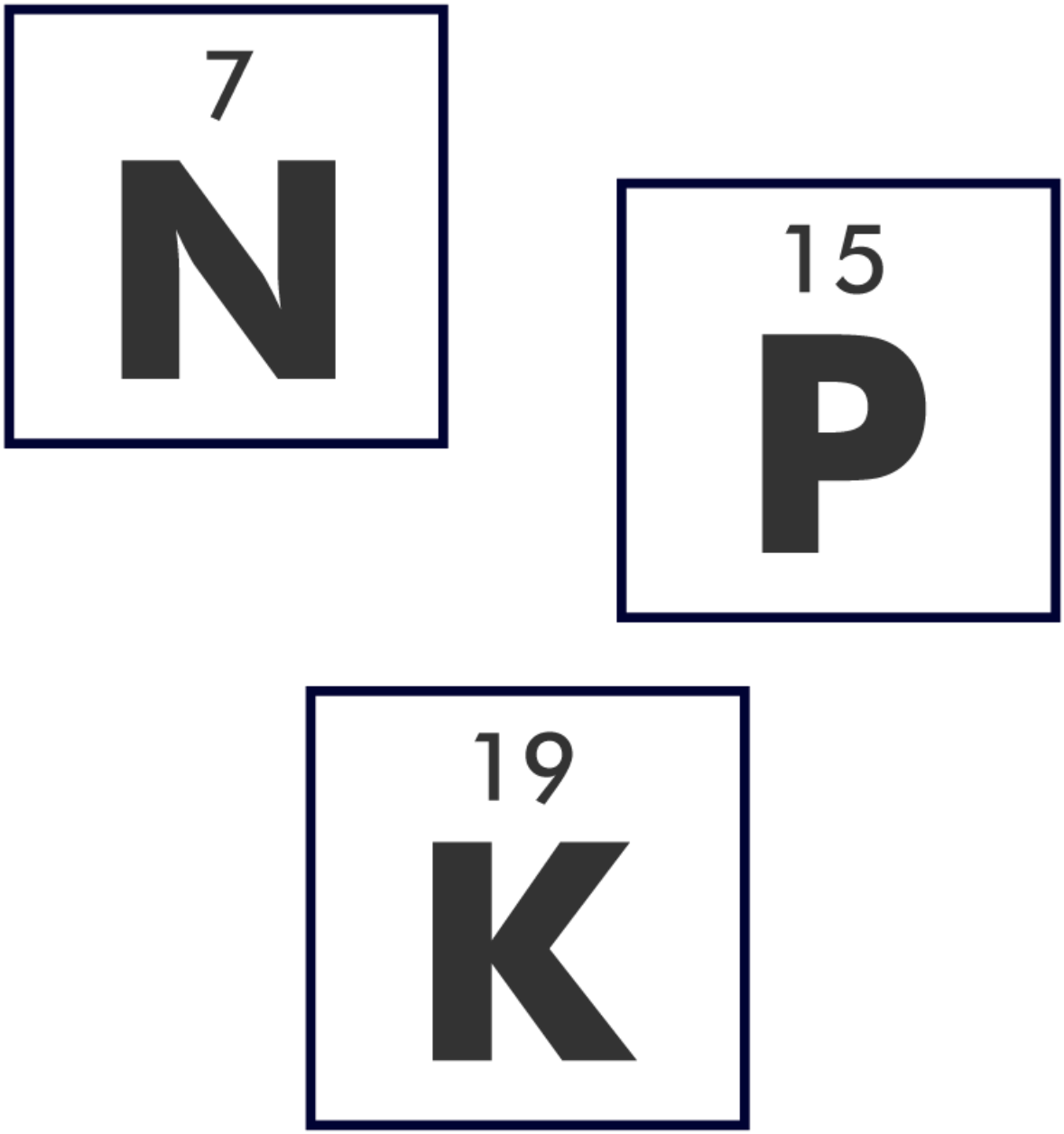
Activity: What is Faecal Sludge?



Activity: Excreta Icons



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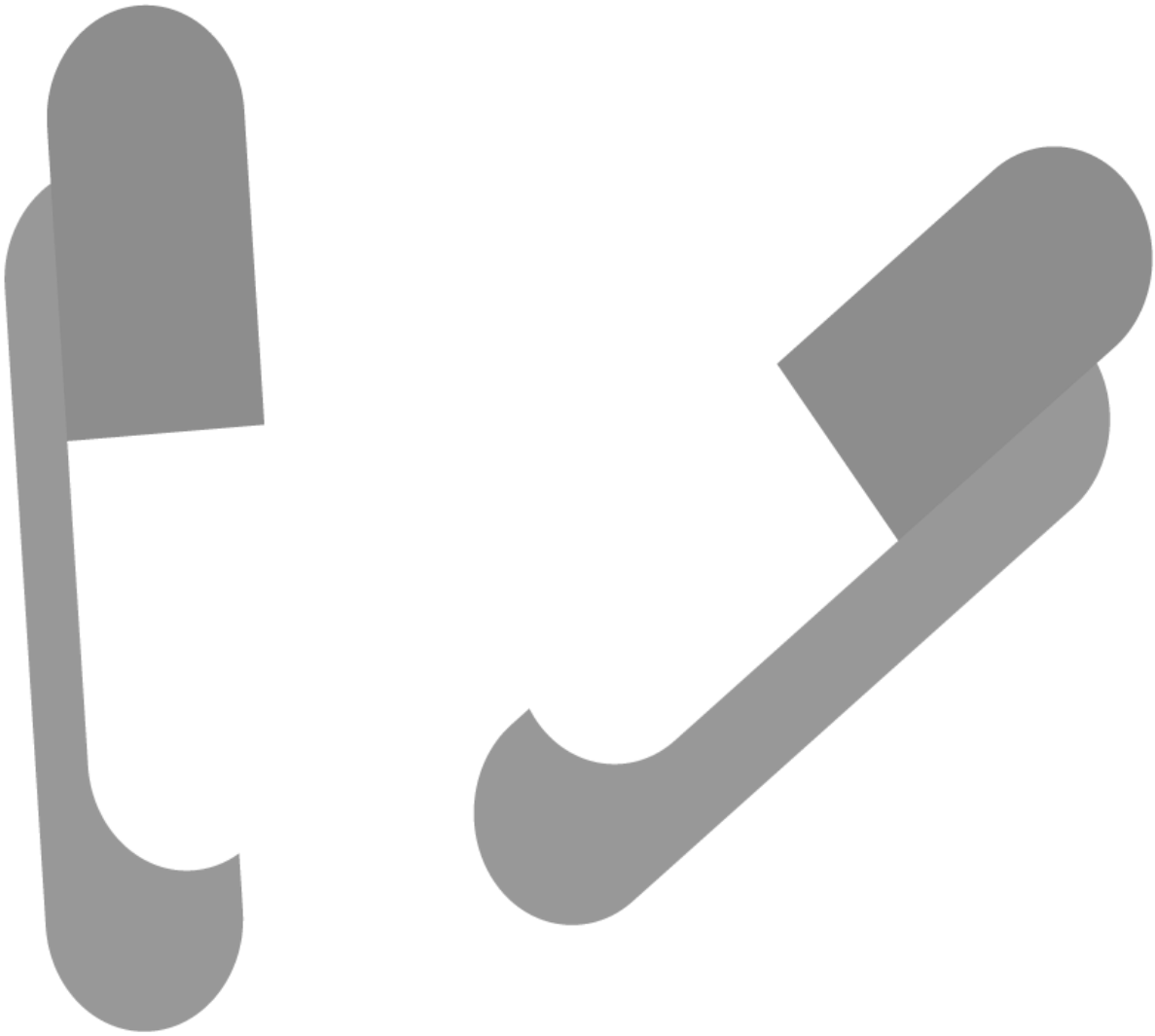


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Lesson Plan: Treatment Objectives

50 minutes

Lesson Description

This lesson looks at what the term faecal sludge treatment means in the sanitation sector. It introduces four treatment objectives: (1) pathogen inactivation, (2) stabilization, (3) dewatering, and (4) nutrient management. The participants also discuss environmental, health, and logistical impacts of the treatment objectives.

Learning Outcomes

At the end of this session participants will be able to:

1. Identify four treatment objectives.
2. Relate the environmental, health, and logistical impacts to each treatment objective.
3. List seven ways pathogens can be inactivated.
4. Discuss the challenges in monitoring pathogen inactivation from faecal sludge.

Materials

- □ Paper
- □ Markers
- □ Activity: Pathogen Inactivation (1 for every 2 people)

Option A:

- □ Activity: Faecal Sludge Components (1 set)

Option B:

- □ Activity: Small Group Activity (1 per group of 3 or 4 people)

Optional:

- □ PowerPoint: Treatment Objectives
- □ Computer and projector

Preparation

- □ Review Chapter 2: Quantification, Characterization and Treatment Objectives in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*
- □ Write the heading "*Treatment Objectives*" on flip chart paper. Underneath write the following:
  1. Pathogen inactivation
  2. Stabilization
  3. Dewatering
  4. Nutrient management

- □ Print and cut out the Pathogen Inactivation Activity (1 for every 2 people)
- □ Option A: Print and cut out the Faecal Sludge Components Activity (1 set)
- □ Option B: Print and cut out the Small Group Discussions Activity (1 per group of 3 or 4 people)
- □ Optional: Use PowerPoint: Treatment Objectives
  - Review the PowerPoint presentation
  - Print the speaker's notes
  - Check that the projector is working
  - Cue the PowerPoint on the computer

Introduction 5 minutes

1. In pairs, ask participants to write down their definition of faecal sludge treatment.
2. Ask some pairs to share their definition with the large group.
3. Explain that faecal sludge treatment is the fourth component of the sanitation service chain. It can be a confusing term because it has several meanings (especially if faecal sludge management is not your profession). Treatment can mean the inactivation of pathogens in faecal sludge. It can also mean transformations of faecal sludge (for example, dewatering and drying).
4. Present the lesson description or learning outcomes.

Treatment Objectives 20 minutes

Option A: Large Group Activity

1. Divide the participants into 4 groups (or use the case study groups). Hand out one faecal sludge component to each group: pathogens, organic material, nutrients, and water. Ask groups to briefly introduce their group and their component.

2. Explain that when faecal sludge is poorly managed, these components have negative impacts on the environment, public health and logistics of faecal sludge management. Tell participants that you will show them images of these impacts. Each group should stand up and give a brief explanation if they believe their faecal sludge component is responsible for this impact. Groups should also point at the other groups they believe are responsible for this negative impact.
3. Optional: Use PowerPoint: Treatment Objectives to show images of the potential impacts of poor faecal sludge management.

- *Sick person: Pathogens*

  Through the faecal-oral route, pathogens cause the spread of diseases. Pathogens can be spread via fingers, flies, fields, fluids, and food.

- *Eutrophication: Nutrients and organic material*

  High concentrations of nutrients and organic material in surface water can disrupt the aquatic ecosystem. Algae in the water feed on the nutrients and reproduce rapidly, called an algal bloom. The algae blocks the sunlight from penetrating the water, and other aquatic plants are unable to grow. When the algae dies and is eaten by other organisms, the oxygen in the water is used up and aquatic organisms (like fish) suffocate. (When oxygen is depleted to low levels, this is called anoxic water.) In fresh water systems, phosphorous is the limiting nutrient whereas in salt water it is nitrogen.

- *Smell: Organic material*

  Fresh excreta is smelly, in addition to putrefaction (decay of organic material).

- *Heavy and voluminous: Water*

  Faecal sludge is difficult and expensive to transport because it contains so much water (water is heavy).

- *Drinking water source contamination (groundwater and surface water): water, pathogens, nutrients*

  The more water in faecal sludge, the higher the risk of surface and groundwater contamination. Pathogens in wet faecal sludge will infiltrate into the ground faster and travel farther than pathogens in dry faecal sludge. Nutrients in faecal sludge can also contaminate drinking water sources, particularly nitrogen (nitrates can cause blue baby syndrome).

- *Attracts vectors: Organic material*

  Vectors (for example, flies and rats) are a nuisance, and can also spread disease.

4. Explain that other contaminants can be in faecal sludge, such as heavy metals from industrial pollution. This is not included as a treatment objective, because treatment does not remove them. The strategy should be to prevent them from entering the faecal sludge through the proper management of industrial waste. Other compounds, such as hormones and pharmaceuticals (trace organics) can also be in faecal sludge. This is something we are continuing to learn about, and the effectiveness of various treatment technologies for removing them.
5. Ask participants, “Are your faecal sludge components responsible for any positive impacts?”

- *Nutrients:*

  Plant growth: Plants need nutrients to grow. The three important nutrients, also known as macronutrients, are nitrogen, phosphorous and potassium.

- *Organic material:*

  Soil conditioner: Farmers often focus on using fertilizers to increase crop growth. However, adding soil conditioners, particularly organic material, can be just as important. Soil conditioners improve the physical soil structure through microbial activity and by increasing the amount of pore space (making the soil less compact). This extra space increases air and water movement in the soil and allows better root growth, and reduces compaction. The organic material needs to be stabilized prior to application (broken down). This prevents negative impacts such as eutrophication, nitrate leaching, and harm to plants. The nutrients incorporated in the organic material will become gradually available to plants.

- *Energy:*

  The breakdown of organic material produces energy. In an anaerobic setting it will produce biogas. In an aerobic setting the breakdown of organic material will generate heat. You therefore want less stabilized organic material if your goal is to produce energy. The less stabilized organic material has the potential to produce greater amounts of energy.

  Note: Check if participants understood stabilization. Ask participants, "Would you want stabilized or fresh sludge for energy use? Ask participants, "Would you want stabilized or fresh sludge for agricultural use?"

- *Water:*

  Irrigation: Plants require water to grow.

6. Explain that this is why we have faecal sludge treatment objectives – to manage and reduce negative impacts, as well as increase the potential positive impacts. Show the "Treatment Objectives" flip chart to summarize the 4 different treatment objectives.

- *Pathogens: Pathogen inactivation*

  Depending on the use of the faecal sludge, pathogens need to be inactivated to the appropriate level. The degree of pathogen inactivation for different uses is still a new science and therefore existing recommendations are very strict. We look a bit more into how pathogens are inactivated after this section.

- *Nutrients: Nutrient management*

  This generally means changing the form of the nutrients (for example, liquid or solid, inorganic or organic). Nutrients are not necessarily removed during treatment, but transformed. The form of the nutrient is important to manage, to protect the environment and for use. For example, nitrogen in an organic form (for example, composting) can be directly applied to crops. Whereas nitrogen in an inorganic (ionic) form (for example, leachate) could "burn" plants or leach into the groundwater.

- *Organic material: Stabilization*

  Stabilized sludge means that easily degradable organic material is degraded by microorganisms. Stabilized sludge is important for agriculture. For energy purposes you do not want organic material to be as stabilized.

- *Water: Dewatering*

  Dewatering means removing water from the faecal sludge, mainly through filtration or settling. The term drying is also sometimes used, and implies an increased level of dryness through evaporation or thermal energy (heat). To understand the two words, think of a wet towel. You first have to wring the towel (dewatering), then you have to hang your towel to dry (drying).

7. Explain that stabilization and nutrient management are interconnected. When organic material is stabilized, nutrients are also stabilized. This means that nutrients are slowly released into the environment, allowing them to be better managed. In the treatment technologies lesson plan these two objectives will be merged together.
8. Explain that generally, faecal sludge is first dewatered and then stabilized or pathogens are inactivated. Before dewatering, there is also solid waste removal. This is considered pre-treatment. Although it is an important treatment objective, it is not covered further in this workshop.

Option B: Small Group Activity

1. Divide participants into groups of 3 or 4 people (or use the case study groups).

2. Explain that when faecal sludge is poorly managed, these components have negative impacts on the environment, public health and logistics of faecal sludge management. Each group will receive a paper with a table. In the left column are the potential negative impacts. In the right column is the component(s) responsible for these negative impacts. Participants need to go through the impacts and decide which faecal sludge components are responsible. They should place the faecal sludge component icons in this column. Several components could be responsible for an impact.

3. Hand out the faecal sludge component icons and the table of impacts. The groups have 5 minutes to complete the activity.
4. Ask the groups to share which impacts they associated to each component.

- *Sick person: Pathogens*

  Through the faecal-oral route, pathogens cause the spread of diseases. Pathogens can be spread via fingers, flies, fields, fluids, and food.

- *Eutrophication: Nutrients and organic material*

  High concentrations of nutrients and organic material in surface water can disrupt the aquatic ecosystem. Algae in the water feed on the nutrients and reproduce rapidly, called an algal bloom. The algae blocks the sunlight from penetrating the water, and other aquatic plants are unable to grow. When the algae dies and is eaten by other organisms, the oxygen in the water is used up and aquatic organisms (like fish) suffocate. (When oxygen is depleted to low levels, this is

called anoxic water.) In fresh water systems, phosphorous is the limiting nutrient whereas in salt water it is nitrogen.

- *Smell: Organic material*

  Fresh excreta is smelly, in addition to putrefaction (decay of organic material).

- *Heavy and voluminous: Water*

  Faecal sludge is difficult and expensive to transport because it contains so much water (water is heavy).

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Note: Check if participants understood stabilization. Ask participants, "Would you want stabilized or fresh sludge for energy use? Ask participants, "Would you want stabilized or fresh sludge for agricultural use?"

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is considered pre-treatment. Although it is an important treatment objective, it is not covered further in this workshop.

Pathogen Inactivation **20 minutes**

1. Explain that we have covered the four faecal sludge treatment objectives. They are all equally important; however, pathogen inactivation is extremely important to protect human health. This is why we will focus on this objective in this section.
2. Explain to participants that they will be given images of a pathogen dying in various ways. In pairs, they should guess what the pathogen is dying of. They will have 5 minutes to complete the activity.

3. Hand out the Pathogen Inactivation Activity.
4. After 5 minutes, discuss each image as a large group.
   - *Age: Just like any living organism, pathogens naturally die. Some live longer than others.*

   - *Predation: There are other microorganisms that feed on pathogens.*
   - *Starvation: Pathogens need to eat to survive. If there is no food, they will starve and eventually die.*
   - *Temperature: Pathogens have optimal growth temperatures. If it is too hot or too cold, they slow down their activity to survive for a longer time. However, over certain temperatures, molecules that are essential for life are denatured. Similar to the change in proteins you see when you fry an egg. References are available for the amount of time at different temperatures that are required for pathogen inactivation. Some pathogens, like Ascaris eggs, will survive for years even at 40°C.*
   - *Moisture: Just like humans, microorganisms need water. As moisture drops to a certain level, pathogens will start to die.*
   - *pH: The pH is a measure of how acidic or basic (alkaline or caustic) something is. It ranges from 0 to 14, with 7 being neutral. A pH less than 7 is acidic and a pH greater than 7 is basic. Most pathogens can only survive within a range of 2-3 pH units. Furthermore, most pathogens cannot survive below pH 3 or above pH 10. By changing the pH of faecal sludge, pathogens can be inactivated.*
   - *Solar radiation or ultraviolet light: Sunlight can destroy pathogens with ultraviolet (UV) and infrared radiation. UV radiation damages DNA and kills living cells. The light rays must reach the pathogens to inactivate them, so this is only effective for pathogens on the surface of the sludge. Infrared radiation heats the sludge to reach temperatures that inactivate pathogens.*
5. Ask participants, “How does storage kill pathogens?” Tell participants to circle the mechanisms.
   - *Starvation, predation, and old age are natural deaths. When faecal sludge is stored, pathogens will naturally die these ways. It is difficult to know which mechanism is responsible for pathogen inactivation. They are therefore often regrouped as one mechanism called “time” or “storage”. Generally, storage takes the longest time to kill pathogens.*

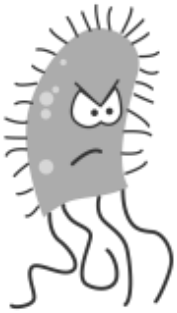
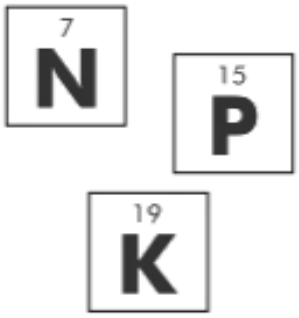
6. Explain that there are a lot of different types of pathogens that have different tolerances to these mechanisms. There is still a lot of research that needs to be done to fully understand these mechanisms and how they impact pathogen inactivation. For example, the relationship between moisture level and pathogen inactivation is still unclear. The relationship between pH and other chemical reactions is also unclear (for example, ammonia)
7. Ask participants, "How do you know if a faecal sludge treatment technology has effectively inactivated pathogens?"
    - *Ascaris eggs are very difficult to kill, so they are often used as an indicator for whether or not faecal sludge is safe after treatment. Ascaris is a type of roundworm (helminth). It is especially common in areas with warm climates and poor sanitation. Ask participants, "Why is it difficult to monitor pathogen inactivation in faecal sludge?" For now, Ascaris eggs can only be counted using a microscope or sending samples to a laboratory. It is time consuming, expensive, and requires technical skills.* [Optional: Use PowerPoint: Treatment Objectives to show images of Ascaris eggs.]
    - *If testing is not possible, then you can monitor other operational parameters depending on the treatment, such as temperature, pH, and moisture. It is assumed that if the technology is operating properly, then the pathogens should be reduced as expected. All three parameters can be measured using long probes which are not too expensive.*
    - *Put in place protective measures!*

Review **5 minutes**

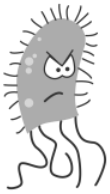
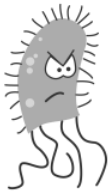
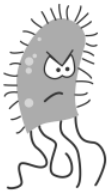
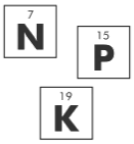
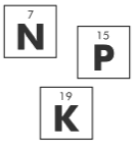
1. Divide participants into the same groups that were previously created.
2. Explain that it can be difficult to remember the four treatment objectives. Ask the groups to think of a fun and easy way to help people remember these objectives (for example, song, rhyme, acronym).
3. Optional depending on time: Share as a large group.

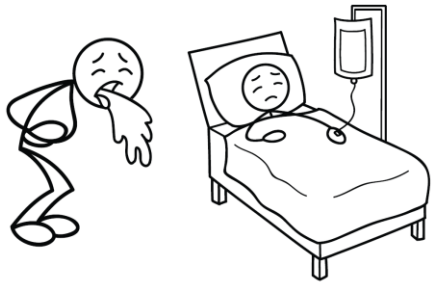
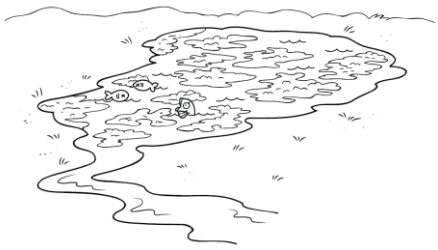
Reflections on Lesson

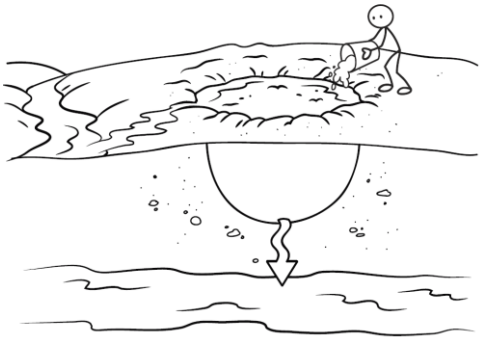
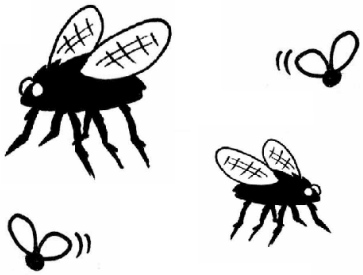
Option A: Faecal Sludge Components

PATHOGENS 	**ORGANIC MATERIAL** 
NUTRIENTS 	**WATER** 

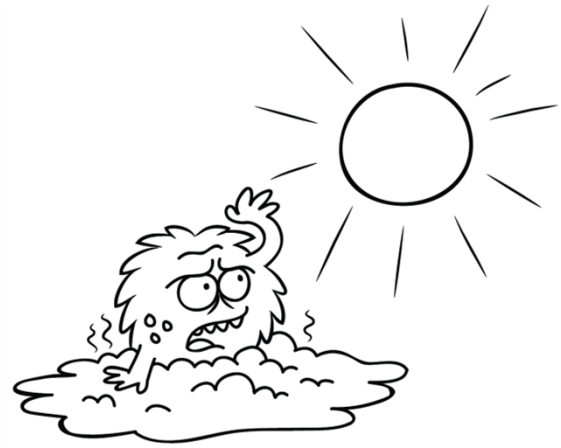
Option B: Small Group Activity

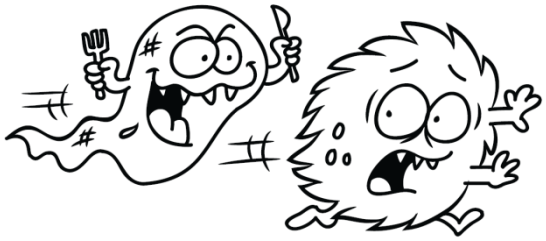
PATHOGENS 	**PATHOGENS** 	**PATHOGENS** 
WATER 	**WATER** 	**WATER** 
NUTRIENTS 	**NUTRIENTS** 	**NUTRIENTS** 
ORGANIC MATERIAL 	**ORGANIC MATERIAL** 	**ORGANIC MATERIAL** 

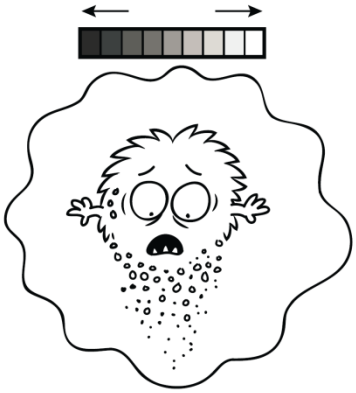
Impact	Responsible Faecal Sludge Components
Sick person: What component will make people sick? 	
Eutrophication: What component would increase algae in surface water and lead to the death of aquatic organisms (like fish)? 	
Smell: What component would make faecal sludge smell badly? 	

Impact	Responsible Faecal Sludge Components
Heavy and voluminous: What component makes faecal sludge heavy and voluminous to manage? 	
Drinking water contamination (surface water or groundwater): What component will increase the risk of water contamination? 	
Vectors: What component would attract vectors, such as flies and rats?  	

Activity: Pathogen Inactivation







Lesson Plan: Treatment Technologies

95-110 minutes

Lesson Description

This lesson introduces established, transferring, and innovative faecal sludge treatment technologies. These technologies are currently in use for faecal sludge management or could be in the future. Participants learn about the treatment objectives, pathogen inactivation mechanisms, stage of development and treatment products of each technology.

Learning Outcomes

At the end of this session participants will be able to:

1. List established, transferring, and innovative faecal sludge treatment technologies.
2. Identify the objectives, pathogen inactivation mechanisms, and treatment products of different faecal sludge treatment technologies.

Materials

- □ Flip chart paper
- □ Tape
- □ Markers
- □ Scissors
- □ Glass of dirty water
- □ Treatment Technologies Table (1 per participant)
- □ Icon Key (1 per participant)
- □ Treatment Technologies Table – Solutions (1 per participant)
- □ Treatment Technology Fact Sheets (1 set)
- □ Case Studies and Faecal Sludge Management Exercise Book

Optional:

- □ Activity: What Technology Am I? (1 card per participant)

Preparation

- □ Review Chapter 5: Overview of Treatment Technologies in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*
- □ Set up four stations for the treatment fact sheets. Tape the fact sheets on the wall or use tables for stations.
  - Dewatering: Settling-thickening, mechanical dewatering, unplanted drying bed, planted drying bed, thermal drying
  - Pathogen inactivation: Co-composting, alkaline treatment, ammonia treatment, storage

  - Stabilization/Nutrient management: Deep row entrenchment, incineration, anaerobic digestion, black soldier fly larvae, vermicomposting, fish pond, plant pond
  - Other: Pelletizing, Co-treatment with wastewater

- □ Write the heading "*Treatment Technologies*" on flip chart paper
- □ Write the heading "*Other Factors for Technology Selection*" on flip chart paper
- □ Print Treatment Technologies Table, Icon Key, and Treatment Technologies Table - Solutions (1 per participant)
- □ Optional: Print and cut out the cards for the Review Activity: What Technology Am I? (1 card per participant)

Introduction **5 minutes**

1. Place a cup of dirty water with a lot of solids in front of the participants. Explain that it represents a cup of faecal sludge.
2. Ask participants, "What technologies could be used to treat this?" Record responses on the *"Treatment Technologies"* flip chart. Do not add any missing technologies – these will be introduced later.

   - *Settling-thickening (for example, settling-thickening tanks, settlers, Imhoff tanks, septic tanks)*
   - *Mechanical dewatering (for example, filter press, centrifuge press, belt press)*
   - *Unplanted drying bed (also called sand drying beds)*
   - *Planted drying bed (also called planted dewatering beds, vertical flow constructed wetlands, and sludge drying reed beds)*
   - *Co-composting*
   - *Deep row entrenchment*
   - *Alkaline treatment*
   - *Ammonia treatment*
   - *Incineration*
   - *Anaerobic digestion*
   - *Black soldier fly larvae*
   - *Vermicomposting*
   - *Pelletizing (for example, Bioburn pelletizer, LaDePa)*
   - *Thermal drying (for example, solar drying)*
   - *Storage*
   - *Co-treatment with wastewater (for example, anaerobic baffled reactor, waste stabilization ponds, planted gravel filter)*
   - *Fish ponds*
   - *Plant ponds*

3. If applicable, ask, "Are all of these treatment technologies appropriate to treat faecal sludge?" Cross off technologies that are only applicable for wastewater treatment. Explain to participants that treatment technologies designed for wastewater are not necessarily appropriate for treating faecal sludge.

   - *For example, activated sludge process, trickling filter, sequencing batch reactor or anaerobic baffled reactor (this may be suitable for the liquid fraction of faecal sludge after dewatering).*

- *Explain that technologies often fail because they were not designed for the specific characteristics of faecal sludge (presented in the Lesson Plan: Design Approach). If technologies are transferred from wastewater, they will not necessarily work for this reason. Ongoing operation and maintenance (presented in Lesson Plan: Operation and Maintenance) is also important.*

4. Explain that these are some technologies for treating faecal sludge. They have different treatment objectives, treatment products, and level of technology development. More technologies will be introduced in this lesson.
5. Present the lesson description or learning outcomes.

Treatment Technologies **65 minutes**

1. Tell participants that the following activity is an introduction to faecal sludge treatment technologies. Participants will learn about a treatment technology's objectives, how pathogens are inactivated, and the products. They will also learn the level of technology development (what experience there is with this technology). Tell the participants that they will not be learning about the engineering design details, such as energy, space, and cost. Some technology details are available in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*.
2. Explain that there are four treatment stations around the room. Each station represents a treatment objective (Dewatering, Stabilization/Nutrient Management, Pathogen Inactivation, Other). At each station there are a number of treatment technology fact sheets.
3. Explain that in pairs, participants will go to the different stations, review the fact sheets and fill out their Treatment Technologies Table. They will have to find out what are the treatment objectives, pathogen inactivation mechanisms, level of development and the treatment products. Participants will have 2 minutes for each technology.
4. Explain that the fact sheets include 2 pages. The first page has images and a brief description of the technology. The second page has more details:
   - *A diagram showing what goes into the treatment technology, the treatment products, and what the treatment products can be used for. This does not mean that the faecal sludge is safe to use. The faecal sludge will require further treatment depending on the use. Note: sludge is described as liquid, dewatered or dry.*
   - *A rating of all treatment objectives.*
     - *Pathogen inactivation and dewatering are rated as low, medium or high.*
     - *Stabilization / nutrient management is listed as "yes" or "no".*
     - *The main treatment objective is rated as "high". A less important objective is rated as "medium". If there is a minor treatment objective, it is rated as "low".*
   - *A list of the different pathogen inactivation mechanisms.*
   - *The level of development: innovative, transferring, and established.*
     - *Established technologies have been designed and implemented specifically for faecal sludge.*

- *Transferring technologies have been adapted from wastewater treatment or another sector such as animal feed or biomass fuel production.*
- *Innovative technologies are currently being researched, developed, and piloted.*

5. Hand out the Treatment Technologies Table and an Icon Key to every participant. Ask participants to go to a treatment technology poster in their pairs. There should be one pair at each poster. After 2 minutes, ask the pairs to move to the next treatment technology. After all the participants have completed all the treatment factsheets, ask them to return to their seats.
6. Ask participants, "Do all technologies have the same treatment objectives?"
   - *No, treatment technologies have different treatment objectives. Some treatment objectives focus only on dewatering (for example, settling tanks, unplanted drying beds). Some technologies focus only on pathogen inactivation (for example, lime treatment). Some treatment technologies have several treatment objectives (for example, Co-composting).*
7. Ask participants, "Which treatment technologies inactivate pathogens to a safe level?"
   - *There are no technologies that inactivate pathogens to a safe level. Ammonium and alkaline treatment do inactivate pathogens, but these are transferring technologies that have not been widely implemented in faecal sludge management. Co-composting also focuses on pathogen inactivation by increasing temperature, but it is difficult to reach high temperatures. More research is required.*
8. Ask participants, "Do all treatment technologies have the same options for use?"
   - *No, treatment technologies produce different treatment products. Some treatment technologies produce stabilized sludge, dewatered sludge or dry sludge. Others produce protein, biofuels, or effluent for irrigation. Some treatment technologies can produce a treatment product which can be used in several markets. For example, unplanted drying beds produce sludge which can be used as a soil conditioner for agriculture or forestry, a biofuel or to produce building materials.*
9. Ask participants, "Are all technologies well established?"
   - *No, some are established, but some are transferring technologies and others are innovative technologies that require more research.*

10. Explain that to effectively treat faecal sludge, several treatment technologies may be needed in a particular order. Explain that usually you will first need to dewater and then stabilize and inactivate pathogens. Give a few examples.
    - *To compost liquid sludge, you will first need to dewater the sludge and then compost it.*
    - *To use faecal sludge from a pit latrine to grow edible crops, you can't just use vermicomposting because it doesn't inactivate pathogens to a high level. You will probably need to co-compost, use additives or simply store the faecal sludge for a longer period of time.*
    - *To use faecal sludge to make briquettes, you need dry sludge that has not been stabilized. You may need to dewater faecal sludge and then dry it.*

11. Tell the participants that besides these technical factors (such as, treatment objective, treatment product, level of technology development) many other factors influence the choice of technologies. Ask participants, "What factors may influence the selection of a treatment technology?" Record responses on "*Other Factors for Technology Selection*" flip chart.
    - *Cost*
    - *Environmental factors (for example, soil type, climate, groundwater level, geography)*
    - *Local resources (for example, human and financial resources)*
    - *Power requirements (such as, consider how electricity shortages will impact the operation of the technology)*
    - *Space availability*
    - *Land requirements*
    - *Economic considerations*
    - *Legal regulations*
12. Explain that some these other factors will be further discussed during the workshop and that these are all critical components of an integrated planning approach (for example, legal framework)
13. Refer participants to Chapter 5 of the book *Faecal Sludge Management: Systems Approach for Implementation and Operation* for more information about technologies. See the planning and management sections of the book for other important design variables to consider.

Optional: Risk Management **5 minutes**

1. Explain that there are several barriers that can be put in place to avoid the spread of faecal pathogens when managing a treatment facility.
2. Ask participants to stand up if their barrier can reduce this risk (see Lesson Plan: Risk Management). Ask them to explain why.
3. Ask participants, "Are there any other barriers that could be put in place when managing a treatment facility?"
    - Use protective equipment
    - Restrict access
    - Monitoring
    - Effluent management
    - Siting
    - Keep site clean
    - Handwashing
    - Cleaning tools
    - Training

Exercise Book **10 minutes**

1. Handout the Treatment Technologies Table – Solutions to each participant.

2. Ask the case study groups to return to their Exercise Book and complete Section 5: Faecal Sludge Treatment Technologies. Groups will list their treatment objectives, select treatment technologies and create a treatment process.

Optional Review Activity: What Technology Am I? **10 minutes**

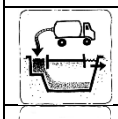
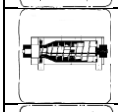
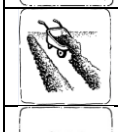
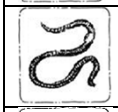
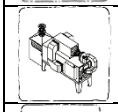
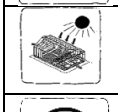
1. Tape one "What Technology Am I?" card to the back of every participant. Explain that the objective is to identify which treatment technology they have on their back by asking others only yes or no questions. Provide an example of a yes/no question. Explain that participants can only ask one question to each person. When the participants have guessed their treatment technology, take the card off of their back and give them another card. Continue the activity for 5 minutes

Review **5 minutes**

1. Ask participants to find a partner from another case study group. Ask participants to share the treatment process their group recommended and why.

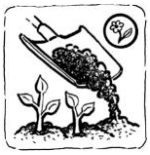
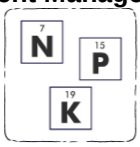
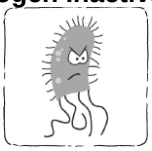
Reflections on Lesson

Activity: Treatment Technologies Table

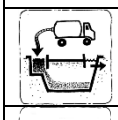
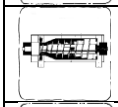
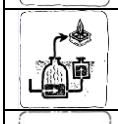
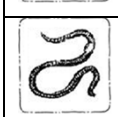
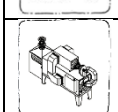
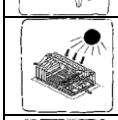
	Treatment technology	Treatment objectives	Treatment products	Pathogen inactivation mechanisms	Level of technology development
	Settling-thickening				
	Mechanical dewatering				
	Unplanted drying beds				
	Planted drying bed				
	Co-composting				
	Deep row entrenchment				
	Alkaline treatment				
	Ammonia treatment				
	Incineration				
	Anaerobic digestion				
	Black soldier fly larvae				
	Vermicomposting				
	Pelletizing				
	Thermal drying				
	Storage				
	Co-treatment with wastewater				

	Treatment technology	Treatment objectives	Treatment products	Pathogen inactivation mechanisms	Level of technology development
	Fish pond				
	Plant pond				

Activity: Icon Key

Treatment objectives	Use	Level of technology development
Dewatering 	**Agriculture, horticulture** 	**Established** 
Nutrient Management 	**Biogas** 	**Transferring** 
Stabilization 	 **Solid fuel**	**Innovative** 
Pathogen Inactivation 	**Irrigation** 	
	Aquaculture 	
	Construction (building materials) 	
	Forestry 	
	Livestock 	

Activity: Treatment Technologies Table – Solutions

	Treatment technology	Treatment objectives	Treatment products	Pathogen inactivation mechanisms	Level of technology development
	Settling-thickening	Dewatering	Liquid sludge Effluent with pathogens	Storage	Established
	Mechanical dewatering	Dewatering	Dewatered sludge with pathogens Effluent	None	Transferring
	Unplanted drying beds	Dewatering	Dewatered or dry sludge with pathogens Effluent	Dehydration UV light Storage	Established
	Planted drying bed	Dewatering Stabilization/Nutrient management	Plants Dry stabilized sludge with pathogens Effluent	Dehydration UV light Storage	Established
	Co-composting	Pathogen inactivation Stabilization/Nutrient management	Dewatered stabilized sludge with low pathogens Effluent	Temperature Storage	Established
	Deep row entrenchment	Stabilization/Nutrient management	Plants Trees	Storage	Established
	Alkaline treatment	Pathogen inactivation	Liquid/Dewatered sludge with low pathogens	pH	Transferring
	Ammonia treatment	Pathogen inactivation	Liquid sludge with low pathogens	Complex reactions (more research required)	Innovative
	Incineration	Pathogen inactivation Dewatering Stabilization/Nutrient management	Ash Biofuel	Temperature	Transferring
	Anaerobic digestion	Stabilization/Nutrient management	Liquid stabilized sludge with / without pathogens Biogas	Storage	Transferring
	Black soldier fly larvae	Stabilization/Nutrient management	Dewatered stabilized sludge with pathogens Black soldier fly larvae	Storage	Innovative
	Vermicomposting	Stabilization/Nutrient management	Dewatered stabilized sludge with pathogens Worms Effluent	Storage	Innovative
	Pelletizing	Pathogen inactivation (when combined with another technology)	Dried sludge pellets	None	Transferring
	Thermal drying	Dewatering Pathogen inactivation	Dry sludge with pathogens	Temperature Dehydration Storage	Transferring
	Storage	Pathogen inactivation	Dry sludge with low pathogens	Storage	Established
	Co-treatment with wastewater	Depends	Treated effluent	Depends	Transferring

	Treatment technology	Treatment objectives	Treatment products	Pathogen inactivation mechanisms	Level of technology development
	Fish pond	Stabilization/Nutrient management	Fish Liquid sludge Effluent with pathogens	Storage	Innovative / Transferring
	Plant pond	Stabilization/Nutrient management	Aquatic plants Liquid sludge Effluent with pathogens	Storage	Innovative / Transferring

Review Activity: What Technology Am I?

Co-composting	**Vermicomposting**
Black Soldier Fly Larvae	**Planted Drying Bed**
Unplanted Drying Bed	**Thermal Drying**
Thermal Drying	**Mechanical Dewatering**
Alkaline Treatment	
Ammonia Treatment	**Pelletizing**
Incineration	**Anaerobic Digestion**
Settling-Thickening	**Deep Row Entrenchment**

Fish Pond	Plant Pond

Lesson Plan: Operation and Maintenance

45 minutes

Lesson Description

This lesson presents an overview of common operation and maintenance challenges of faecal sludge faecal sludge treatment facilities. Participants will brainstorm appropriate solutions to overcome operation and maintenance challenges, including how to prevent receiving industrial sludge. The lesson presents the importance of developing and implementing monitoring programs.

Learning Outcomes

At the end of this session participants will be able to:

1. Identify common operational challenges of faecal sludge treatment facilities.
2. Discuss the importance of a monitoring plan to ensure a faecal sludge treatment facility is operating as designed.
3. Discuss methods of ensuring that industrial sludge is not discharged at faecal sludge treatment facilities.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape

Optional:

- □ PowerPoint: Operation and Maintenance
- □ Computer and projector

Preparation

- □ Review Chapter 11: Operation, Maintenance and Monitoring of Faecal Sludge Treatment Facility in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*
- □ Draw two columns with the headings "*Operation*" and "*Maintenance*" on flip chart paper
- □ Write the heading "*Operation and Maintenance Challenges*" on flip chart paper
- □ Write the headings "*Improve Financial Viability*", "*Prevent Equipment Failure*", "*Improve Material Supply Chains"*, and *"Prevent Contamination from Industrial Sludge"* on 4 separate pieces of flip chart paper
- □ Optional PowerPoint: Operation and Maintenance
  - Review the PowerPoint presentation
  - Print the speaker's notes

- Check that the projector is working
- Cue the PowerPoint on the computer

Introduction **5 minutes**

Option A: Group Discussion (takes less time)

1. Ask participants, “What do you own that keeps breaking down or getting broken?” Ask participants to share their experience. Ask, “What could you have done to prevent the breakage?”
   - Car or motorbike
   - Oven
   - Pump
   - Smart phone screen
2. Explain that faecal sludge treatment facilities also break down if they are not maintained. This can be very dangerous for public health and the environment.
3. Share the lesson description or learning outcomes.

Option B: Presentation (takes more time)

1. Use PowerPoint: Operation and Maintenance to show a few pictures of broken or abandoned faecal sludge treatment facilities.
2. Ask participants, “Why are all these treatment facilities failing?” This can be a rhetorical question.
   - *If the treatment facility is properly designed, then poor operation and maintenance will always be the reason for failures.*
3. Share the lesson description or learning outcomes.

Operation and Maintenance **10 minutes**

1. Explain the difference between a faecal sludge treatment technology and a faecal sludge treatment facility.
   - A faecal sludge treatment facility is a combination of different faecal sludge treatment technologies.
2. Ask participants, “What is the difference between operation and maintenance?”
   - *Operation: All the activities that are required to ensure that a faecal sludge treatment facility delivers treatment services as designed.*
   - *Maintenance: All the activities that ensure long-term operation of equipment and infrastructure.*

3. Ask participants, “What are some common operation activities for faecal sludge treatment facilities? What are some common maintenance activities?” Record responses on the “*Operation and Maintenance*” flip chart table. Complete the list of activities if any are missing.

Operation	Maintenance
• Adding sludge on to drying beds • Removing sludge from settling tanks • Removing sludge from drying beds • Controlling and emptying screening process • Processing (for example, mixing during composting, adding lime) • Collecting and further treating or disposing effluent • Storing and selling the treatment products	• Cleaning • Controlling corrosion • Repacking and exercising valves • Oiling and greasing mechanical equipment (for example, pumps) • Servicing mechanical equipment (for example, clearing pump screen) • Controlling vegetation and pests

Challenges and Solutions 30 minutes

1. Optional: Use PowerPoint to show the treatment failure photos if you haven’t done so in the introduction.

2. Ask participants, “What are common challenges of faecal sludge treatment facilities?” Encourage participants to share local challenges of treatment facilities. Record responses on the *“Operation and Maintenance Challenges”* flip chart. Complete the list of challenges if any are missing.
   - *Lack of financial viability*
   - *Equipment failure (for example, pumps)*
   - *Weak material supply chains*
   - *Poor operation and maintenance by service contractors (for example, removing sludge from ponds or tanks)*
   - *Contamination from industrial sludge*
   - *Electricity shortages*
   - *Low capacity of staff*
   - *Climate (for example, rainfall)*
   - *Smells*
3. Explain that there are many operation and maintenance challenges, but we will only focus on the most common ones. Circle the following challenges on the flip chart.
   - *Lack of financial viability*
   - *Equipment failure*
   - *Weak material supply chains*
   - *Contamination from industrial sludge*

4. Explain that toxic compounds (for example, heavy metals) are not usually a concern when dealing with domestic faecal sludge. Any toxic compounds in faecal sludge typically come from industries, which is why industrial sludge should not be accepted at treatment facilities. Some contamination can occur from households, if for example batteries are disposed in the latrine, but this should be minimal and can be prevented through educational campaigns.
5. Ask participants, "Why is it important to keep industrial sludge out of a faecal sludge treatment facility?"
   - *It is important to keep pollutants that jeopardize treatment out of the treatment facility (for example, high or low pH, solids, biological activity) and product quality (for example, heavy metals).*
   - *Heavy metals are not removed during the treatment process, so it is important to avoid contamination of faecal sludge in the first place.*
6. Explain that the participants will now identify solutions to these four challenges.
7. Tell the participants that there are 4 flip charts posted around the room: (1) Improve financial viability, (2) Prevent equipment failure, (3) Improve material supply chains and (4) Prevent contamination from industrial sludge. Divide the participants into 4 groups and ask them to stand beside one flip chart.

   Note: Mix the groups. Make sure the groups are not the same as the case study groups. It is important for participants to meet and work with others.
8. Give the participants 2 minutes to write solutions on the flip chart paper. After 2 minutes, ask the groups to rotate to the next flip chart paper. They should read what is there and only write new things down. Repeat 2 more time. Once participants return to the flip chart they started at, ask them to review and discuss what was written by the other groups.
9. Summarize key solutions to overcome these common challenges.

Improve financial viability	Prevent equipment failure	Improve material supply chains	Prevent contamination from industrial sludge
• Identify financial flows within the entire treatment process • Set appropriate sanitation taxes or discharge fees • Investigate or change market for treatment product • Investigate role of public-private partnerships	• Introduce Standard Operating Procedures (SOPs) for all equipment and treatment processes • Introduce a monitoring plan for treatment facilities • Set servicing (maintenance) intervals • Introduce servicing contracts • Increase servicing intervals	• Use materials that are produced or obtained locally • Use equipment with locally available spare parts • Use equipment which can be repaired locally • Establish supply chains	• Monitor the influent to the treatment facility • Identify "upstream" sources of industrial sludge • Record the origin, volume and special characteristics of faecal sludge in a manifest system • Randomly measure the pH of faecal sludge during discharge • Train faecal sludge treatment operators on the physical

			inspection of sludge samples

10. Explain that a key solution to overcome all operation and maintenance challenges is to develop and implement a detailed operation and maintenance plan and a monitoring program This ensures is the operation and maintenance plan is being successfully implemented.
11. Ask participants, “Why do we monitor?”
    - *To identify if a faecal sludge treatment facility is not operating as designed, and take immediate action to correct the problems.*
    - *This is the same as maintaining our human health. For example, using a scale tells you your weight. When you are overweight this is an indicator that you are eating too much or not exercising enough. Weight is not a direct measure of those things, but is an indicator that we should alter our lifestyle. By monitoring the treatment facility, we develop indicators that the facility is working well or not working well. Then we respond by doing maintenance and revisiting our operation and maintenance plan.*
12. Optional: Use PowerPoint: Operation and Maintenance to present key parameters for monitoring faecal sludge treatment.

Review **2 minutes**

1. In pairs, ask participants to discuss one new thing they learned.

Reflections on Lesson

Lesson Plan: Collection and Transport

70-95 minutes

Lesson Description

Participants learn about different manual and mechanized methods to collect faecal sludge from on-site sanitation technologies and transport the faecal sludge for treatment. Through a group discussion or role-play activity the participants experience challenges that are often encountered during faecal sludge collection and transport. As well, they discuss solutions on how the challenges could be overcome.

Learning Outcomes

At the end of this session participants will be able to:

1. Describe faecal sludge collection and transport process from a household to a treatment facility.
2. Identify suitable faecal sludge collection and transport methods for the local context.
3. Identify challenges and solutions for improving faecal sludge collection and transport.

Materials

- □ Flip chart paper
- □ Tape
- □ Markers
- □ Large bucket filled with dirty water
- □ Case Studies and Faecal Sludge Management Exercise Book
- □ PowerPoint: Collection and Transport
- □ Computer and projector
- □ Activity Answer Key: Collection and Transport Challenges and Solutions (1 for trainer)

Optional:

- □ Activity: Tasks of a Collection and Transport Service Provider (1 per participant)
- □ Activity: Role-Play (1 copy)
- □ Activity: Collection and Transport Challenges (1 copy)

Preparation

- □ Review Chapter 4: Methods and Means for Collection and Transport of Faecal Sludge in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*
- □ Write the heading "*Collection and Transport Tasks*" on flip chart paper
- □ Print the Activity Answer Key: Collection and Transport Challenges and Solutions (1 copy) for you to use as a reference

- □ Optional: Print the Activity: Tasks of a Collection and Transport Service Provider (1 per participant)
- □ Challenges Option A: Write the headings "*Service Fee", "Thick Sludge", "Solid Waste", "Distance", "Discharge Fee*" and "*Household Access*" on separate pieces of flip chart paper
- □ Challenges Option B: Print Collection and Transport Challenges (1 for trainer)
- □ Optional: Write the learning outcomes on flip chart paper
- □ PowerPoint: Collection and Transport
  - Review the PowerPoint presentation
  - Print the speaker's notes
  - Check that the projector is working
  - Cue the PowerPoint on the computer

Introduction 5 minutes

1. Put a bucket of water mixed with dirt in the middle of the room. Tell the participants that this represents a bucket of faecal sludge. Ask the particpants to form a circle around the bucket, then ask, "How would you empty the faecal sludge from this bucket? How would you transport the faecal sludge?"
   - □ *Emptying: Shovel, hand, manually operated pump (such as, Gulper), vacuum out, do not empty (such as, transport in the bucket), empty contents onto floor*
   - □ *Transport: Carry by hand, pushcart, pickup or truck*
2. Tell the participants that they have to transport the bucket from one participant to the other, all the way around the circle, without spilling any. Tell them they need to do it as fast as possible.
3. After the activity, discuss if any of the water was spilled.
4. Ask the participants, "How would you feel if that bucket was full of faecal sludge?"
   - □ *Disgusted, like my health is in danger*
5. Present the lesson description or learning outcomes.

Collection and Transport Methods 10 minutes

1. Use Power Point: Collection and Transport to present all the different methods. Encourage participants to ask questions throughout the presentation.
2. Explain that the most commonly used collection and transport methods are vacuum trucks or manual emptying with buckets or shovels. Sometimes manual emptying includes pumps (such as the Gulper) combined with a pushcart or pickup.
3. Explain that faecal sludge collection is not only about the technology, but the interaction among different stakeholders.

Collection and Transport Tasks — 15 minutes

1. Explain to participants that they are first going to discuss what is a collection and transport service from a household to a treatment facility. They will then discuss common challenges and potential solutions.
2. Tell participants that the next activity will explore the tasks of a collection and transport service provider. In groups, they will have to write down all the different tasks of a service provider from the household to the faecal sludge treatment facility. They will have 5 minutes to complete the activity.

   Optional: Ask a few groups to pretend that they are an individual who manually empties pits with a shovel by themself, and the other groups to pretend that they are a team of workers with a vacuum truck. You can compare the tasks between the two scenarios and highlight that the fundamental tasks are the same regardless of the method.

3. Divide participants into groups of 4-5 people. Options: Provide flip chart paper and markers to each group, or use the Activity: Tasks of a Collection and Transport Service Provider.
4. After 5 minutes, ask one group to share the different tasks of a service provider to the large group. Record responses on the "*Collection and Transport Tasks*" flip chart. Ask the following groups to add any tasks that have not been mentioned. Make sure participants don't repeat what has already been said. Fill in any missing tasks. Optional: Do activity as a large group to save time.

   - *Go to the household. Bring all required equipment.*
   - *Meet the customer to arrange logistics and inform them of the service*
   - *Tell them the fee or negotiate with the customer*
   - *Put on personal protective equipment*
   - *Locate the on-site sanitation technology*
   - *Determine the access point of the on-site sanitation technology.*
   - *Open the on-site sanitation technology cover*
   - *Remove solid waste, if necessary*
   - *Empty the on-site sanitation technology*
   - *Evaluate the condition of the on-site sanitation technology*
   - *Close and secure the on-site sanitation technology*
   - *Clean the area arrund the on-site sanitation technology*
   - *Do a final inspection and report any issues to the customer*
   - *Transport the faecal sludge to a treatment facility or safe disposal site*

5. Use PowerPoint: Collection and Transport to describe a typical service.

Challenges and Solutions — 25-45 minutes

Option A: Group Discussion

1. Explain that participants are now going to brainstorm solutions to overcome common service provider challenges. Options depending on time: Read out each challenge

and discuss as a large group. Or divide the participants into small groups and assign 1-2 challenges for each group to discuss and then share as a large group. Use the Activity Answer Key: Collection and Transport Challenges and Solutions, to review key information as participants discuss each challenge.

2. Read Challenge 1: The household does not have enough money to pay for the collection and transport service. Neighbours are complaining of the smell. What can be done? Record responses on the "*Service Fee*" flip chart.
3. Read Challenge 2: The sludge is too thick for the collection and transport service to pump out. The on-site sanitation technology is close to overflowing. What can be done? Record responses on the "*Thick Sludge*" flip chart.
4. Read Challenge 3: There is too much solid waste in the on-site sanitation technology. The solid waste is likely to damage the emptying equipment. Therefore, service providers are hesitant to empty the on-site sanitation technology or charge a high fee. What can be done? Record responses on the "*Solid Waste*" flip chart.
5. Read Challenge 4: The household is located far away from a faecal sludge treatment facility. Households cannot afford the fee charged by the service providers because of their transport costs to the treatment facility. What can be done? Record responses on the "*Distance*" flip chart.
6. Read Challenge 5: The household is located in an informal settlement. The pathways are too narrow and not maintained. It is difficult for a vacuum truck to access the household. What can be done? Record responses on the "*Household Access*" flip chart.
7. Read Challenge 6: The faecal sludge treatment facility (owned by the public sector) is charging a discharge fee. Private service providers cannot afford this fee. As a result, they illegally dump the faecal sludge into the street, nearby canal, river or lake. Sometimes they dump the faecal sludge into a sewer manhole, which is not a sustainable option as it can cause wastewater treatment facilities to fail. What can be done? Record responses on the "*Discharge Fee*" flip chart.
8. Explain that we will discuss many of these solutions in more detail throughout the rest of the day.

Option B: Role-Play (will take more time to facilitate) 45 minutes

1. Explain to participants that they are going to first role-play an optimal faecal sludge collection and transport service. The scenario will then be repeated several times, but each time new challenges will be added. As a large group, we will discuss solutions to overcome these challenges.
2. Ask 4 or 5 participants to volunteer for the role-play. Decide who will play the following roles: (1) On-site Sanitation Technology Owner, (2) Collection and Transport Service Manager, (3) Collection and Transport Service Worker, and (4) Faecal Sludge Treatment Facility Manager. The emptying service uses a sludge truck to empty on-site sanitation technologies. Remind the participants that the first scenario is an optimal faecal sludge collection and transport service. There are no challenges.

Trainer Tip: To save time, identify the volunteers during the break and hand out their roles in advance for them to prepare. Also explain to the volunteers how much time they have to act out the role-play so that they don't take up more time than you have.

3. Give the participants 3 minutes to read their role and plan their skit. In the meantime, hand out the challenges to the other participants. They will be asked to read out the challenges, after the optimal scenario is acted out.
4. Ask the actors to briefly present their role.
5. Action! Ask the actors to act out the perfect scenario.
6. Explain that faecal sludge collection and transport services are often faced with challenges. Ask the actors to redo the skit including the challenges. They can improvise or end the skit if they don't know how to deal with the challenge. All participants will then discuss solutions to overcome the challenge.
7. Ask one participant in the audience to read out their challenge. Explain that there is no easy solution for tackling these challenges. Solutions need to be carefully investigated and piloted before implementation. Use the Activity Answer Key: Collection and Transport Challenges and Solutions, to review key information as participants discuss each challenge.
8. Explain that we will discuss many of these solutions in more detail throughout the rest of the day.

Optional: Risk Management **5 minutes**

1. Explain that there are several barriers that can be put in place to avoid the spread of faecal pathogens when emptying pits and transporting sludge. These barriers focus on protecting the people emptying the pit, the household, and the local community.
2. Ask participants to stand up if their barrier can reduce these risks (see Lesson Plan: Risk Management). Ask them to explain why.
3. Ask participants, "Are there any other barriers that could be put in place when emptying pits and transporting sludge?"

- Use protective equipment
- Handwashing
- Cleaning tools
- Keep site clean
- Use containers with good lids
- Training
- Deworming

Exercise Book **10 minutes**

1. Ask the case study groups to return to their Exercise Book and complete Section 6: Faecal Sludge Collection and Transport. Participants will identify the collection and transport service providers and the technologies they use. They will then identify the main challenge for collection and transport and solutions to overcome this challenge. They have 10 minutes.

Review **5 minutes**

1. Ask participants to find a partner from another case study group. Ask participants to share their main challenge and a solution their group recommended and why.

Reflections on Lesson

Activity Answer Key: Collection and Transport Challenges and Solutions

Challenges	Solutions
(1) The household does not have enough money to pay for the collection and transport service. Neighbours are complaining of the smell.	• Recommend manual emptying or manually operated pump services: They may be more affordable. Note: Commonly, per volume of faecal sludge, manual emptying (and transport) is more expensive than motorized emptying (and transport). By paying for part of the faecal sludge to be removed, they are delaying, but not eliminating, the problem. • Introduce a sanitation tax: This is a regular fee (for example, in the water tariff) collected in exchange or to subsidize a faecal sludge collection and transport service. For example, everyone could have required annual inspections and emptying. This is done in the Philippines. Consider that faecal sludge collection and transport for the poor may need to be subsidized. • Pay in instalments: Poor households commonly cannot afford to pay the high one-time costs of motorized collection and transport. The public sector and/or private service providers could offer households the option to pay in installments. • Install transfer stations: Reducing the distance faecal sludge needs to be transported may reduce collection and transport fees and make them more affordable for households. Trainer note: Be careful when providing this as a solution. Clarify that this is a possible solution, but it is still in the stage of innovative technology without actual field experience other than a few pilots.
(2) The sludge is too thick for the collection and transport service to pump out. The on-site sanitation technology is close to overflowing.	• Add water to the sludge: This will make the top layer easier to pump out. • Recommend manual emptying services: They can empty thick sludge. • Recommend emptying more frequently.

Challenges	Solutions
(3) There is too much solid waste in the on-site sanitation technology. The solid waste is likely to damage the emptying equipment. Therefore, service providers are hesitant to empty the on-site sanitation technology or charge a high fee.	• Charge extra for the removal of solid waste. Explain to the households that the emptying fee would be lower if no solid waste would be disposed into the on-site sanitation technology. • Recommend manual emptying services. • Create awareness on the importance of not putting solid waste inside an on-site sanitation technology. • Provide solid waste management solutions.
(4) The faecal sludge treatment facility (owned by the public sector) is charging a discharge fee. Private service providers cannot afford this fee. As a result, they illegally dump the faecal sludge into the street, nearby canal, river or lake. Sometimes they dump the faecal sludge into a sewer manhole, which is not a sustainable option as it can cause wastewater treatment facilities to fail.	• Construct a faecal sludge treatment facility in a more central location: This will reduce transport costs for service providers and lower the fee for households. • Introduce a sanitation tax: This is a regular fee collected in exchange or to subsidize faecal sludge collection and transport service. • Organize services for the whole area where this household is located: This will make servicing this community more affordable. • Recommend or establish small-scale service providers: They may be located closer and therefore may be more affordable. However, they still need a location to discharge the sludge. • Install transfer stations: Reducing the distance faecal sludge needs to be transported may reduce fees and make them more affordable for households. Trainer note: Be careful when providing this as a solution. Clarify that this is a possible solution, but it is still in the stage of innovative technology without actual field experience other than a few pilots.
(5) The household is located far away from a faecal sludge treatment facility. Households cannot afford the fee charged by the service providers because of their transport costs to the treatment facility.	• Recommend manual emptying and transport services: They will have better access to the on-site sanitation technology. • Improve the quality of the road. • Assess the possibility of decentralized faecal sludge treatment.

Challenges	Solutions
(6) The household is located in an informal settlement. The pathways are too narrow and not maintained. It is difficult for a vacuum truck to access the household.	• Increase the fee charged to households to cover the discharge fee. • Foster communication between the public sector and the private service providers to discuss how this can be resolved. • Subsidize faecal sludge treatment/discharge fee: The public sector could subsidize faecal sludge treatment or the discharge fee. The revenues for this subsidy could come from a sanitation tax. • Sell faecal sludge treatment products: Revenues from treatment products could be used to offset the treatment costs and potentially reduce the discharge fee.

Optional Activity: Tasks of a Collection and Transport Service Provider

Step-by-Step Tasks of a Collection and Transport Service Provider
1. Go to the household. Bring all the required equipment.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14. Transport the faecal sludge to a treatment facility.

Option B Activity: Role-Play

On-site Sanitation Technology Owner
Role: You are the owner of an on-site-sanitation system (like a latrine or septic tank) that needs to be emptied. You have contacted a private service provider to come to your home. Listen to the service provider and improvise. *The highlighted sections are the steps you are involved in.
Tasks of the Collection and Transport Service
1. Go to the household. Bring all required equipment.
2. Meet the customer to arrange logistics and inform them of the service.
3. Tell them the fee or negotiate with the customer.
4. Put on personal protective equipment.
5. Locate the on-site sanitation technology.
6. Determine the access point of the on-site sanitation technology.
7. Open the on-site sanitation technology cover.
8. Remove solid waste, if necessary.
9. Empty the on-site sanitation technology.
10. Evaluate the condition of the on-site sanitation technology.
11. Close and secure the on-site sanitation technology.
12. Clean the area around the on-site sanitation technology.
13. Do a final inspection and report any issues to the customer.
14. Transport the faecal sludge to a treatment facility.

Collection and Transport Service Worker

Role: You work for the collection and transport service. You listen to the manager's recommendations and empty the on-site sanitation technology.

*The highlighted sections are the steps you are involved in.

Tasks of the Collection and Transport Service

1. Go to the household. Bring all required equipment.
2. Meet the customer to arrange logistics and inform them of the service.
3. Tell them the fee or negotiate with the customer.
4. Put on personal protective equipment.
5. Locate the on-site sanitation technology.
6. Determine the access point of the on-site sanitation technology.
7. Open the on-site sanitation technology cover.
8. Remove solid waste, if necessary.
9. Empty the on-site sanitation technology.
10. Evaluate the condition of the on-site sanitation technology.
11. Close and secure the on-site sanitation technology.
12. Clean the area around the on-site sanitation technology.
13. Do a final inspection and report any issues with to the customer.
14. Transport the faecal sludge to a treatment facility.

Collection and Transport Service Manager
Role: You lead the service team. You are in charge of communicating with the client and giving directions to your team. You are leading the role-play. Remind your team of their tasks if they forget. *The highlighted sections are the steps you are involved in.
Tasks of Collection and Transport Service
1. Go to the household. Bring all required equipment.
2. Meet the customer to arrange logistics and inform them of the service.
3. Tell them the fee or negotiate with the customer.
4. Put on personal protective equipment.
5. Locate the on-site sanitation technology.
6. Determine the access point of the on-site sanitation technology.
7. Open the on-site sanitation technology cover.
8. Remove solid waste, if necessary.
9. Empty the on-site sanitation technology.
10. Evaluate the condition of the on-site sanitation technology.
11. Close and secure the on-site sanitation technology.
12. Clean the area around the on-site sanitation technology.
13. Do a final inspection and report any issues to the customer.
14. Transport the faecal sludge to a treatment facility.

Faecal Sludge Treatment Facility Manager

Role: You are responsible for communicating with the private service providers that arrive at the treatment facility. You ask questions and accept or decline their access to your site.

*The highlighted sections are the steps you are involved in.

Tasks of Collection and Transport Service

1. Go to the household. Bring all required equipment.
2. Meet the customer to arrange logistics and inform them of the service.
3. Tell them the fee or negotiate with the customer.
4. Put on personal protective equipment.
5. Locate the on-site sanitation technology.
6. Determine the access point of the on-site sanitation technology.
7. Open the on-site sanitation technology cover.
8. Remove solid waste, if necessary.
9. Empty the on-site sanitation technology.
10. Evaluate the condition of the on-site sanitation technology.
11. Close and secure the on-site sanitation technology.
12. Clean the area around the on-site sanitation technology.
13. Do a final inspection and report any issues to the customer.
14. Transport the faecal sludge to a treatment facility.

Optional Activity: Collection and Transport Challenges

The household does not have enough money to pay for the collection and transport service. Neighbours are complaining of the smell. *What can be done?*

The sludge is too thick for the collection and transport service to pump out. The on-site sanitation technology is close to overflowing. *What can be done?*

There is too much solid waste in the on-site sanitation technology. The solid waste is likely to damage the emptying equipment. Therefore, service providers are hesitant to empty the on-site sanitation technology or charge a high fee. *What can be done?*

The faecal sludge treatment facility (owned by the public sector) is charging a discharge fee. Private service providers cannot afford this fee. As a result, they illegally dump the faecal sludge into the street, nearby canal, river or lake. Sometimes they dump the faecal sludge into a sewer manhole, which is not a sustainable option as it can cause wastewater treatment facilities to fail. *What can be done?*

The household is located far away from a faecal sludge treatment facility. Households cannot afford the fee charged by the service providers because of their transport costs to the treatment facility. *What can be done?*

The household is located in an informal settlement. The pathways are too narrow and not maintained. It is difficult for a vacuum truck to access the household. *What can be done?*

Lesson Plan: Stakeholders

60-70 minutes

Lesson Description

This lesson identifies common stakeholders in faecal sludge management. Participants will evaluate the influence and interest of the different stakeholders. They will also discuss different ways of engaging with stakeholders.

Learning Outcomes

At the end of this session participants will be able to:

1. Discuss why stakeholder analysis and engagement is critical for faecal sludge management.
2. Identify potential stakeholders in faecal sludge management.
3. Characterize stakeholders based on their levels of interest and influence.
4. Discuss participation levels to engage stakeholders based on their interest and influence.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape
- □ Sticky notes
- □ Participation Levels Drawings (1 set)

Optional:

- □ Case Studies and Faecal Sludge Management Exercise Book

Preparation

- □ Review Chapter 15: Stakeholder Analysis and Chapter 16: Stakeholder Engagement in the in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*.
- □ Write the heading "*Stakeholder Characteristics*" on flip chart paper
- □ Write the heading "*Influence*" on flip chart paper

- □ Write the heading "*Interest-Influence Matrix*" on flip chart paper. Draw the following table underneath:

	Low Influence	High Influence
Low Interest	Unlikely to be closely involved	May oppose
High Interest	Require special effort to participate and meet needs	Should be closely involved to ensure support

- □ Print the Participation Levels Drawings (1 set). Tape them on a wall from lowest to highest involvement.
- □ Optional: Write the learning outcomes on flip chart paper

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Introduction **3 minutes**

1. We go to a lot of meetings throughout our lifetime and even in one day alone. We have meetings with family members, friends, and at work. There are good meetings and there are bad meetings.
2. Ask participants, "How do you feel after a good meeting?"
   - *Efficient*
   - *Informed*
   - *Motivated*
   - *Empowered*
   - *Influential*
3. Ask participants, "How do you feel after a bad meeting?"
   - *Useless*
   - *I've wasted a lot of time*
   - *Bored*
   - *Anxious*
4. How do you feel if you have not been invited to an important relevant meeting?
   - *Confused*
   - *Disheartened*
   - *Defeated*
   - *Angry*
5. Explain that it's important to meet with all relevant stakeholders throughout the sanitation planning process and engage with them appropriately. Sanitation planning is a very delicate process. It should be inclusive and not upset anyone.
6. Present the lesson description or learning outcomes.

Stakeholder Analysis **40 minutes**

1. In groups ask participants to list all the stakeholders that are part of faecal sludge management on sticky notes. They have 5 minutes.
2. After 5 minutes, ask participants to stick all the sticky notes in on the wall. There will be a lot of repitition. Participants should try and regroup the stakeholders. As the facilitator, you should also help regroup the stakeholders. Read out the stakeholders that the participants identified. Complete the list if any stakeholders are not mentioned.
    - *Municipal government authorities (for example, mayor, technical services, municipal police)*
    - *Regional and national government authorities*
    - *Utilities (for example, public, semi-private or private)*
    - *Traditional authorities and influential leaders (for example, ethnic leaders, neighborhood leaders, religious leaders)*
    - *Private service providers*
    - *Organizations active in sanitation (for example, community-based organizations [CBOs], nongovernmental organizations [NGOs], universities and research centres, donor agencies)*
    - *Potential users of treatment products (for example, farmers, breeders, fuel consumers)*
    - *Households*
3. Ask participants, “What do you want to know about the stakeholders to determine who to engage in the different parts of the planning process, and to what degree?” Record responses on the “*Stakeholder Characteristics*” flip chart.
    - *Interest*
    - *Strengths*
    - *Weaknesses*
    - *Opportunities and threats*
    - *Relationships between stakeholders*
    - *Capacity building needs*
    - *Experience in faecal sludge management*
4. Explain that once this information is collected, it is important to categorize stakeholders by interest and influence. Ask participants, “What is the difference between influence and interest?”
    - *Influence: Power that stakeholders have on the project (for example, decision making, implementation)*
    - *Interest: Stakeholders whose needs, constraints and problems are a priority in the strategy*

Note: The word “interest” can be confusing. Participants may think of how interesting (exciting) a topic is to the stakeholders. Make sure to clearly define these words. Add the definitions on a flip chart paper if necessary. Clarify that it is their interest in the outcome of the project. You can also use the word “impact” instead of interest. “Influence” can also be confusing. Explain that “influence” is a technical term used throughout the sector, which is why it’s being used here.

5. Use flip chart to present the influence-interest matrix. Explain that it is a useful tool to categorize the stakeholders. This ensures that important stakeholders with little influence are given a voice.
6. Ask participants, “What factors may affect the influence that stakeholders have?” Record responses on the “*Influence*” flip chart.
    - *Social, econonmic and social status*
    - *Hierarchy (command and control, budget holders)*
    - *Leadership (for example, charisma, political, familial)*
    - *Control of strategic resources*
    - *Possession of specialist knowledge (for example, engineering staff)*
    - *Negotiating position*
    - *Degree of organization (especially for informal groups)*
7. Pick a few sticky notes and ask participants where they would place the stakeholders on the matrix.
    - *Certain minorities and low-income groups often have low influence and are not given a voice, like manual service providers, low-income households and farmers. Stakeholders with little influence and may see stakeholder meetings as a waste of money and time. Often, households lack influence, although they bear most of the costs, if not all, of the service.*
    - *The influence and interest of the different governmental institutions are sometimes not easy to assess, especially if the institutional framework for faecal sludge management is not clear.*
    - *Municipal authorities are usually key stakeholders, both in terms of influence and interest.*
8. Tell participants that they will now work on their case study to identify and categorize stakeholders according to their influence and interest. Ask the case study groups to return to their Exercise Book and complete Section 8: Stakeholders. They will list the stakeholders involved in faecal sludge management in their case study and complete the influence-interest matrix. Give the participants 15 minutes to complete this section.
9. After 15 minutes, discuss how characterizing stakeholders is an iterative activity throughout the planning process. Stakeholders may gain or lose interest and influence as the planning process unfolds and decisions are made.
10. Ask participants, “Why is it important to do a stakeholder analysis?”
    - *Understand how people think and act*

- *Understand who has what interest and who is influential in supporting or in blocking, delaying or rejecting the project*
- *Identify conflicts of interest between stakeholders*
- *Identify relationships that should be improved or strengthened*
- *Structure knowledge about stakeholders and share it with others*
- *Understand how to deal with different people*

11. Explain that this tool works well to identify initial stakeholders. You will identify additional stakeholders throughout the project, including hidden influences. As you identify new stakeholders, use the tool to decide the level of interest and inflluence the group has.

Stakeholder Engagement **15 minutes**

1. Ask participants, “So what comes next after doing the stakeholder analysis?”
   - *Develop a stakeholder engagement or involvement strategy*
2. Ask participants, “What does stakeholder engagment mean?”
   - *Defining the participation level of people in the process and how to best answer their needs*
3. Ask participants, “Why is it important to engage stakeholders well?”
   - *Build a system that functions well and meets sanitation objectives*
4. Discuss that choosing how to engage stakeholders means choosing the appropriate participation level. The level of participation depends on what needs to be achieved with the targeted stakeholders. For example, households may be consulted once through a brief informal discussion to find out their faecal sludge management needs. In comparison, collection and transport service providers may be all gathered for a meeting to understand their routes to locate an accessible treatment plant.
5. Introduce the Participation Levels Drawings. Explain that these are ranked in order from lowest to highest involvement. Start with the lowest participation level. Ask participants to describe each participation level and give examples of activities. Explain that they are not often well understood, which leads to poor participatory planning processes. Option: Do this activity in smaller groups.
   1. *Information: one-way communication (media campaigns, radio, poster, letter)*
   2. *Consultation: two-way communication (personal meetings, focus groups, telephone call)*
   3. *Collaboration: mediation, working together to make decisions (meeting, learning exchange, participatory workshops)*
   4. *Empowerment: make own decisions, take responsibility*
6. Ask the participants to identify which participation levels can be used for each part of the interest-influence matrix. Use sticky notes and place them on the “Interest-Influence Matrix” flip chart.

	Low Influence	High Influence
Low Interest	Unlikely to be closely involved Information	May oppose Consultation-Information
High Interest	Require special effort to participate and meet needs Consultation-Empowerment	Should be closely involved to ensure support Consultation-Collaboration-Empowerment

7. Explain that the next step is to select and use the specfic tools (for example, meetings, site visits, workshops) most appropriate for each stakeholder. The engagement strategy will need to be adapted as the planning process develops.

Optional: Exercise Book **10 minutes**

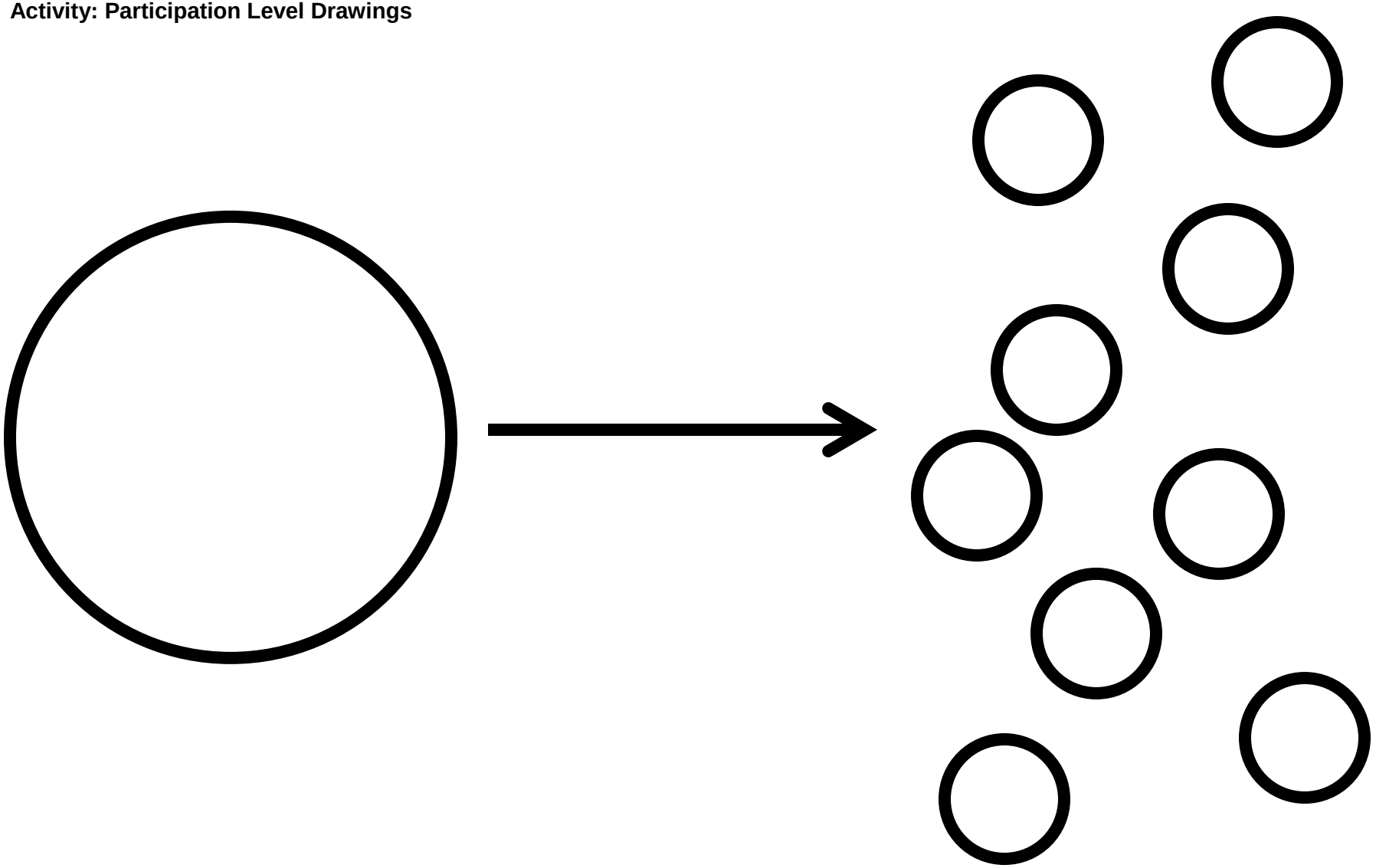
1. Ask the case study groups to return to their Exercise Book and complete Section 7: Stakeholders. Participants will identify the stakeholders and use a matrix to classify them according to their interest and influence. They have 10 minutes.

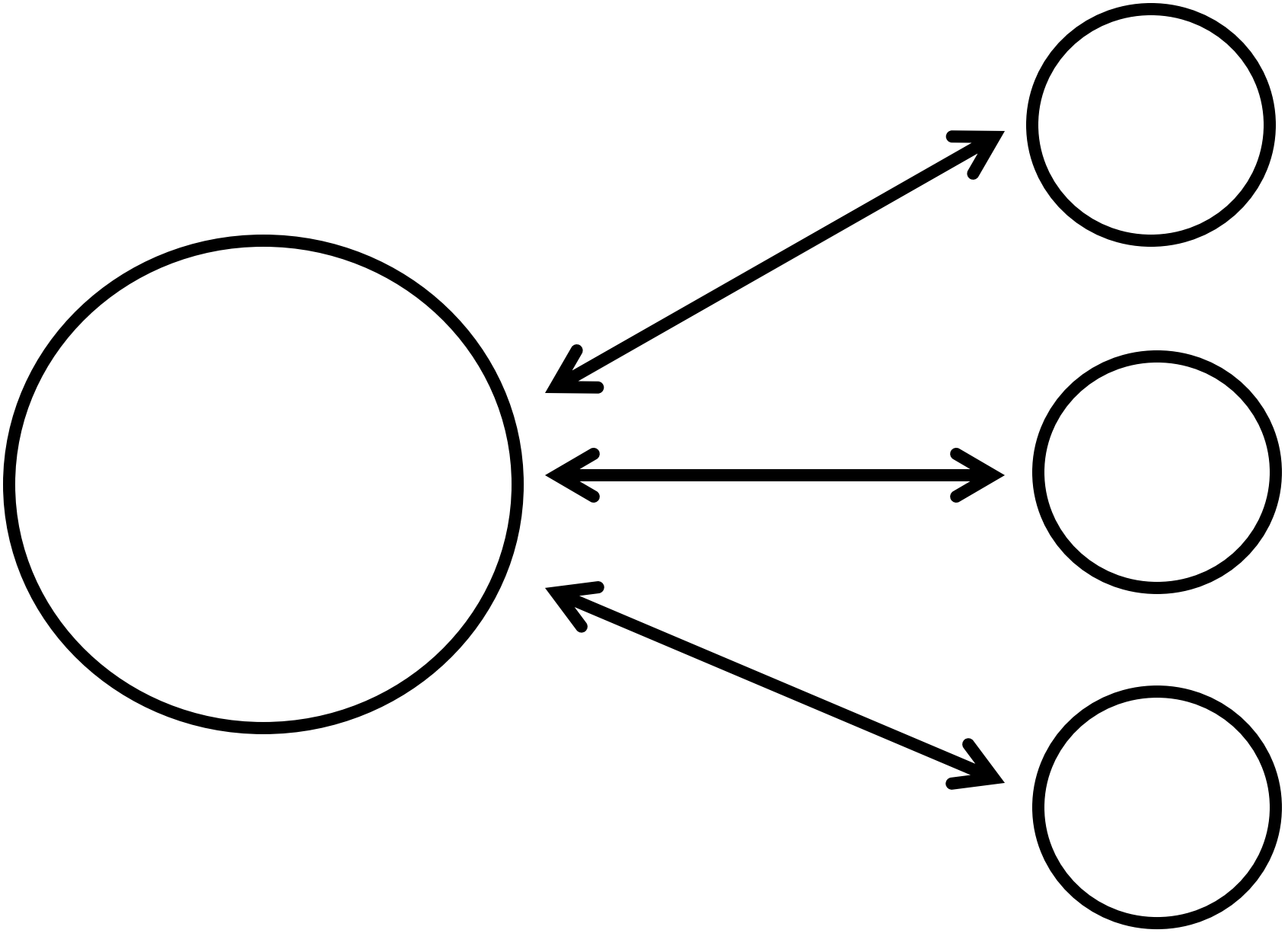
Review **2 minutes**

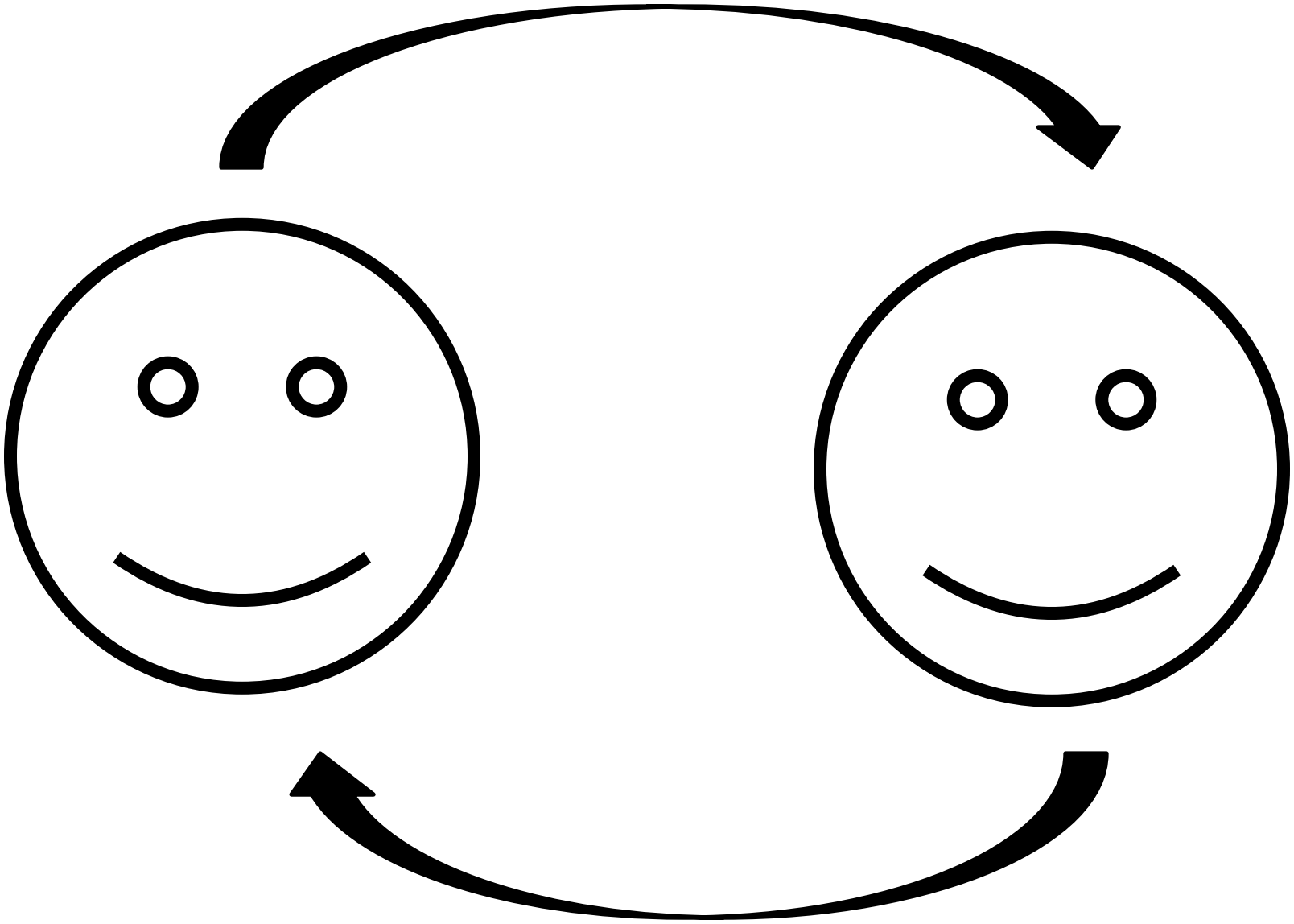
1. In pairs, ask participants to list the four participation levels and create an easy way to remember all four levels.
   - *Information, Consultation, Collaboration, Empowerment.*

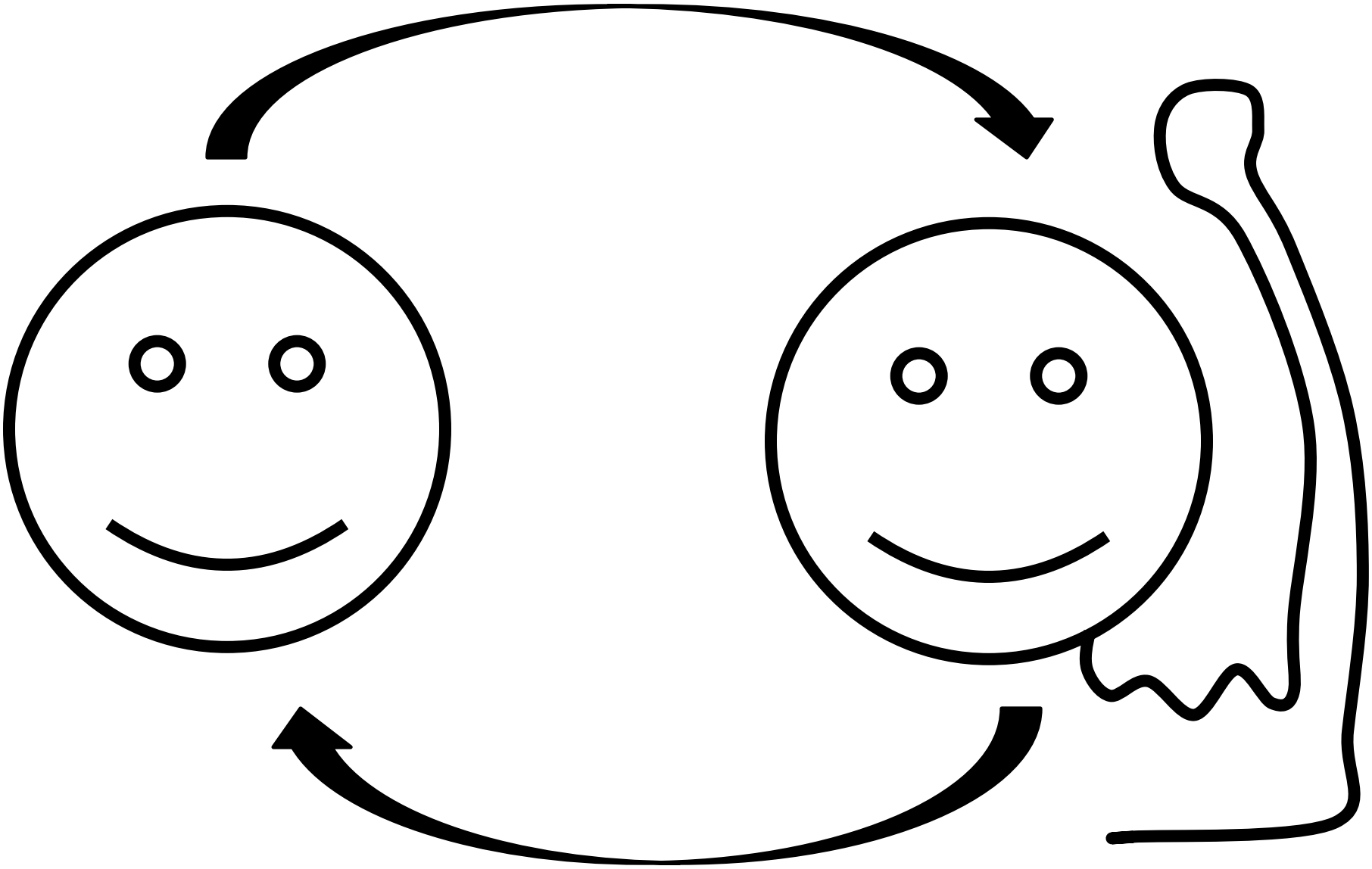
Reflections on Lesson

Activity: Participation Level Drawings









Lesson Plan: Financial Transfers

60 minutes

Lesson Description

This lesson introduces financial transfers in faecal sludge management. Participants learn about different financial flow models for faecal sludge management services. They identify different stakeholders in the faecal sludge management service chain and how they relate to each other from a financial perspective.

Learning Outcomes

At the end of this session participants will be able to:

1. Identify stakeholders involved in financial transfers in faecal sludge management.
2. List different types of financial transfers that play a role in faecal sludge management.
3. Identify different financial flow models for faecal sludge management.
4. Discdiscuss the complexity of stakeholders and financial interactions in faecal sludge management.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape
- □ Case Studies and Faecal Sludge Management Exercise Book
- □ Activity: Financial Flow Models (1 per 2 participants)
- □ Financial Flow Model Descriptions (1 for trainer)
- □ PowerPoint: Financial Transfers
- □ Computer and projector

Optional:

- □ Activity: Financial Transfer Definitions (1 per participant)

Preparation

- □ Review topic in Chapter 12: Institutional Frameworks for Faecal Sludge Management and Chapter 13: Financial Transfers and Responsibility in Faecal Sludge Management Chains in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*
- □ Write the heading "*Stakeholders Involved in Financial Transfers*" on flip chart paper
- □ Print out the Financial Flow Models activity (1 per 2 participants)
- □ Print Financial Flow Model Descriptions (1 for trainer)
- □ Optional: Print out the Financial Transfer Definitions (1 per participant)

- □ PowerPoint: Financial Transfers
  - Review the PowerPoint presentation
  - Print the speaker's notes
  - Check that the projector is working
  - Cue the PowerPoint on the computer

Introduction 5 minutes

1. Ask participants, "When you buy vegetables in a store, where does the money go afterwards?" If needed, hold some cash in your hand and pretend to buy a product from one of the participants.
   - *Pay farmers*
   - *Pay staff*
   - *Pay bills*
   - *Pay taxes*
2. Explain these are called financial transfers. Financial flows are all financial transfers in a service chain.
3. Explain that stakeholders involved in financial transfers are the people who pay or receive money for a product or service. Ask participants, "Who are the stakeholders in this example?
   - *Consumers who buy the vegetables, farmers, store owners, store staff, government*

Stakeholders Involved in Financial Transfers 5 minutes

1. Ask participants to think back to the previous lesson on stakeholders. Ask, "Who on this list of stakeholders pays money for receiving faecal sludge management services or receives money for providing faecal sludge management services?" Record the responses on the "*Stakeholders Involved in Financial Transfers*" flip chart. Add any stakeholders that may be missing.
   - *Households with an on-site sanitation technology that needs periodic faecal sludge removal*
   - *Private service providers: Operate on a for-profit basis*
   - *Community-based organizations (CBOs) or nongovernmental organizations (NGOs): Operate on a not-for-profit basis, often provide services in areas where private service providers or governments are unwilling or unable to operate*
   - *Government authorities: Responsible for the rules and regulations, collecting taxes, may also provide faecal sludge management services*

- *Public utilities: Responsible for operating and maintaining public infrastructure (like faecal sludge treatment facilities, water supply, wastewater treatment or electricity)*
- *Users of faecal sludge treatment products*

2. Use PowerPoint slides about Financial Flow Models to give an overview of the different ways that the sanitation service chain can be organized. Explain that there are different ways that the sanitation service chain can be organized.
   - *There are many ways for stakeholders to organize the faecal sludge management service chain.*
   - *Systems that have more stakeholders involved will be more complex, regardless of who the stakeholders are.*
   - *Since the entire sanitation service chain is interlinked, it is essential that the roles and responsibilities of the stakeholders are clearly defined. One of the main reasons for faecal sludge management failure is the overlapping and unclear responsibilities.*
   - *This is different than wastewater management where the wastewater is transported via the sewer and frequently only one stakeholder is in charge of the entire system.*

Financial Transfers **15 minutes**

1. Explain that within a faecal sludge management system, money is exchanged between the stakeholders for different activities. This happens at different orders of magnitude (for example, a few dollars to thousands of dollars), and with different frequencies (for example, daily, yearly). Ask participants, “What are some examples of how is money is transferred in faecal sludge management?” Collect a few answers before starting the next activity.
2. Explain the different types of financial transfers.

   Option A:

Hand out the Activity: Financial Transfer Definitions. Call out each financial transfer one by one and ask participants to identify the definition from the list. This is important to understand the financial models.

- *1 = G*
- *2 = E*
- *3 = H*
- *4 = F*
- *5 = C*
- *6 = A*
- *7 = I*
- *8 = D*
- *9 = B*

Option B:

Use PowerPoint: Financial Transfers to briefly explain the different types of financial transfers.

- *Budget support: Financial transfer between stakeholders to partly or fully cover a stakeholder's operating budget.*
- *Capital investment: One-time financial transfer made at the beginning of a project to cover materials, labour, and associated expenses (for example, for a vacuum truck or a faecal sludge treatment facility).*
- *Discharge fee: Financial transfer made by collection and transport service providers in exchange for permission to discharge faecal sludge at some type of facility, like a treatment facility.*
- *Discharge incentive: The opposite of a discharge fee. A financial transfer to the collection and transport service in exchange for discharging faecal sludge at some type of facility.*
- *Operating license: (also known as a discharge license) Financial transfer made by a stakeholder in exchange for permission to operate in a certain area (for example, collection and transport service).*
- *Emptying fee: Financial transfer between the household and a service provider in exchange for collecting and transporting faecal sludge from an on-site sanitation technology.*
- *Operation and maintenance: Financial transfer that must be paid regularly to operate and maintain equipment like pumps, trucks, and hoses.*
- *Purchase price: Financial transfer between one stakeholder to another in exchange for becoming the sole owner of a good (for example, a treatment product).*
- *Sanitation tax: Financial transfer collected once or regularly in exchange for an environmental service, such as a sewer or water connection or emptying of faecal sludge from an on-site sanitation technology.*

Financial Flow Models **20 minutes**

1. Explain to participants that they are going to discover five different financial flow models. These are based on existing case studies and theoretical examples. It is important to note that there is no single faecal sludge management model that has proven to be effective in all situations.
2. Use the PowerPoint: Financial Transfers to explain how to read a financial flow model diagram.
   - *The different components of the faecal sludge management system are shown on the upper part of the diagram in blue.*
   - *The associated stakeholder is indicated below in green.*
   - *The type of financial transfer is indicated by a yellow oval.*

- *The direction of the arrow between the stakeholders indicates the direction of the payment.*

3. Use PowerPoint to show and explain Model 1 from the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*, Figure 13.3, page 279.
    - *The household pays a private service provider an emptying fee to remove faecal sludge from their on-site sanitation technology.*
    - *The private service provider pays a discharge fee to the public utility in exchange for accepting and treating the faecal sludge.*
    - *The public utility is paid a purchase price from a faecal sludge treatment product.*
4. Ask participants, "What are the potential negative consequences of this model?"
    - *Private service provider charges a higher emptying fee to customers to pay for the discharge fee, and thus excludes the poorest who can't afford the fee.*
    - *The private service provider avoids paying the discharge fee and illegally discharges faecal sludge directly into the environment.*
    - *The public utility has no support from the government – less administrative supervision and poor quality of treatment and adherence to regulations.*
5. Show and explain Model 2 from the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*, Figure 13.7, page 283.
    - *The household pays a private service provider an emptying fee for removing faecal sludge from their on-site sanitation technology.*
    - *The private service provider pays an operating license (or discharge license) to the government authority for unlimited (or semi-limited) permission to discharge faecal sludge at the public utility.*
    - *The government authority is paid a sanitation tax from the household.*
    - *The government authority provides budget support to the public utility.*
    - *The public utility is paid a purchase price from a faecal sludge treatment product user.*
6. Ask participants, "How does this model reduce the negative consequences of the previous model?"
    - *The private service provider does not have to pay a discharge fee each time they bring faecal sludge to the public utility. This may reduce the illegal discharge of faecal sludge into the environment.*
    - *The public utility receives budget support from the operating license (or discharge license) and sanitation tax. This could be increased revenue compared to the previous discharge fee.*
    - *The government authority receives information on faecal sludge management services, such as the number of on-site sanitation technologies emptied or vacuum trucks operating in a certain area.*

- *The government authority recognizes and formalizes faecal sludge management services. This is the first step for improving the sector, setting industry standards, and improving working conditions.*

7. Explain that a financial model itself does not always have to change if it is not functioning properly. The negative consequences of the first model can also be addressed through other measures, for example, improving enforcement.
8. Tell the participants they will work in pairs. They will be given 5 financial models (including these 2 that were just explained) and brief descriptions of each model. Their task is to match the financial model to the corresponding definition. Tell participants that they should also give names to each model to help them remember the financial flow of the model. They have 5 minutes to complete the activity.

9. Hand out the activity. After 5 minutes, discuss the answers as a large group.
   - *Model 1 = E*
   - *Model 2 = C*
   - *Model 3 = B*
   - *Model 4 = D*
   - *Model 5 = A*
10. Ask participants, “Why are there so many different financial transfers models in faecal sludge management?” Summarize the key messages:

   - *There are many possible financial transfer models for faecal sludge management.*
   - *One of the reasons that faecal sludge management has not been widely implemented is because it is financially and politically complex.*
   - *There are a number of stakeholders (for example, household, private service providers, nongovernmental organizations, public utilities, government authorities, treatment product users) who have a financial interest in faecal sludge management.*
   - *Faecal sludge management services are not normally provided by one stakeholder. It is more commonly a collection of stakeholders who are responsible for different parts of the service chain. Payments must be made each time responsibility is transferred from one stakeholder to another along the service chain. This makes faecal sludge management very complex.*
   - *A special set of financial and political conditions are needed to allow each stakeholder to do their tasks and allow a complete sanitation service chain to exist*.

Exercise Book **10 minutes**

1. Ask the case study groups to return to their Exercise Book and complete Section 8: Financial Transfers. Participants will identify the current financial transfers and financial flow model. They will identify one way to improve the model. They have 10 minutes.

Review **5 minutes**

1. Ask participants to find a partner from another case study group. Ask them to share how they would improve the current financial transfer model for their case study.

Reflections on Lesson

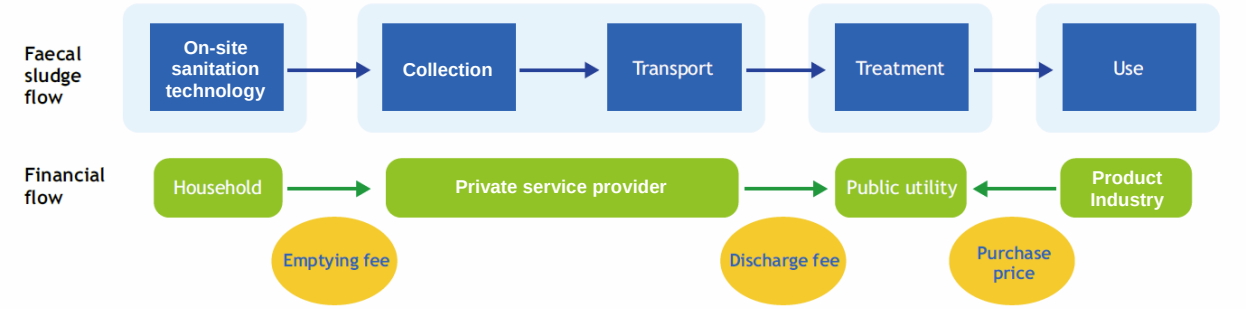
Activity: Financial Transfer Definitions (Option A)

Match each type of financial transfer with its definition below:

Type of Financial Transfer	Definition
1. Budget support _____	A. Financial transfer between the household and a service provider in exchange for collecting and transporting faecal sludge from an on-site sanitation technology.
2. Capital investment _____	B. Financial transfer collected once or regularly in exchange for an environmental service, such as a sewer or water connection or emptying of faecal sludge from an on-site sanitation technology.
3. Discharge fee _____	C. Financial transfer made by a stakeholder in exchange for permission to operate in a certain area (for example, collection and transport service).
4. Discharge incentive _____	D. Financial transfer between one stakeholder to another in exchange for becoming the sole owner of a good (for example, a treatment product).
5. Operating license _____	E. One-time financial transfer made at the beginning of a project to cover materials, labor and associated expenses (for example, for a vacuum truck or a faecal sludge treatment facility).
6. Emptying fee _____	F. The opposite of a discharge fee. A financial transfer to the collection and transport service in exchange for discharging faecal sludge at some type of facility.
7. Operation and maintenance _____	G. Financial transfer between stakeholders to partly or fully cover a stakeholder's operating budget.
8. Purchase price _____	H. Financial transfer made by collection and transport service providers in exchange for permission to discharge faecal sludge at some type of facility, like a treatment facility.
9. Sanitation tax _____	I. Financial transfer that must be paid regularly to operate and maintain equipment like pumps, trucks, and hoses.

Activity: Financial Flow Models

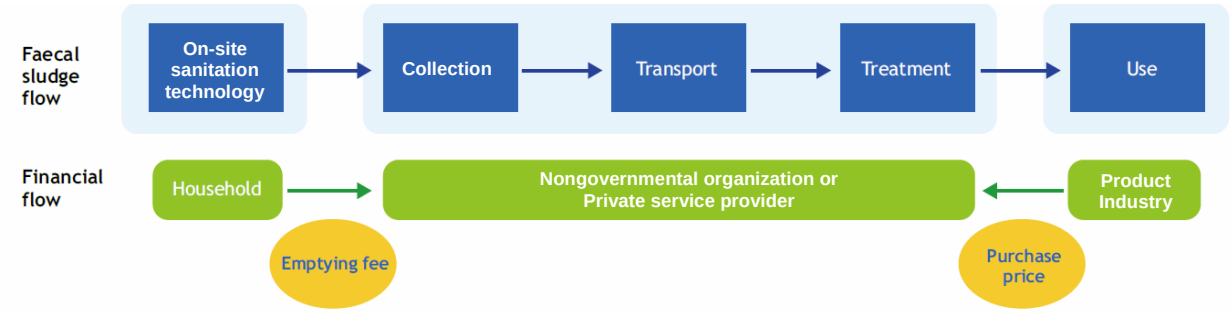
Model 1:



Which financial flow model is this?: ____

What name would you give this model?: _____

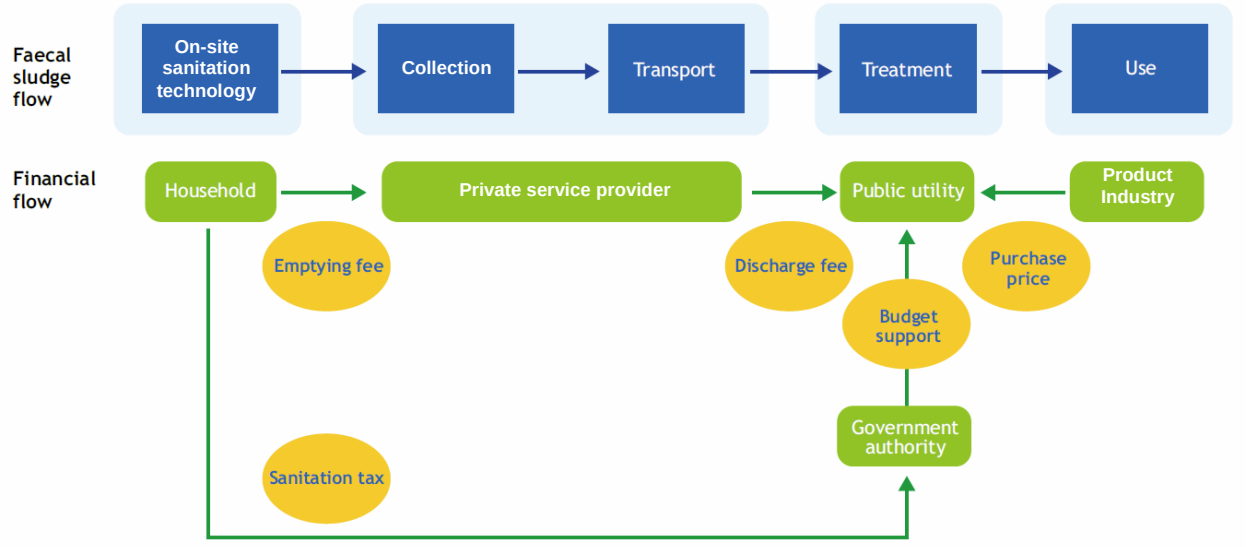
Model 2:



Which financial flow model is this?: ___

What name would you give this model?: _____

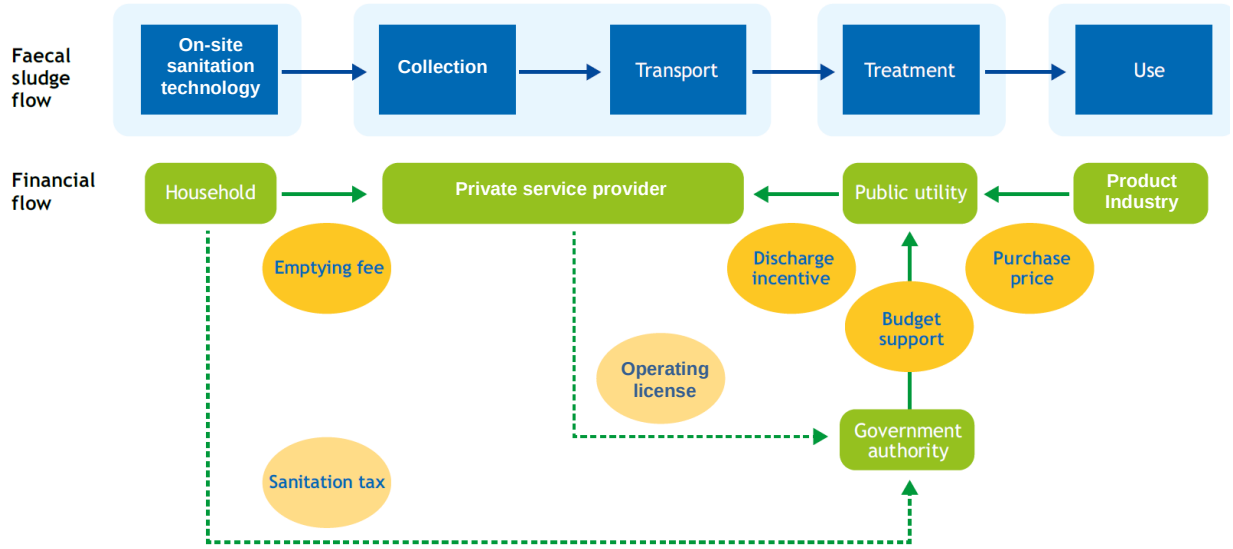
Model 3:



Which financial flow model is this?: ____

What name would you give this model: _____

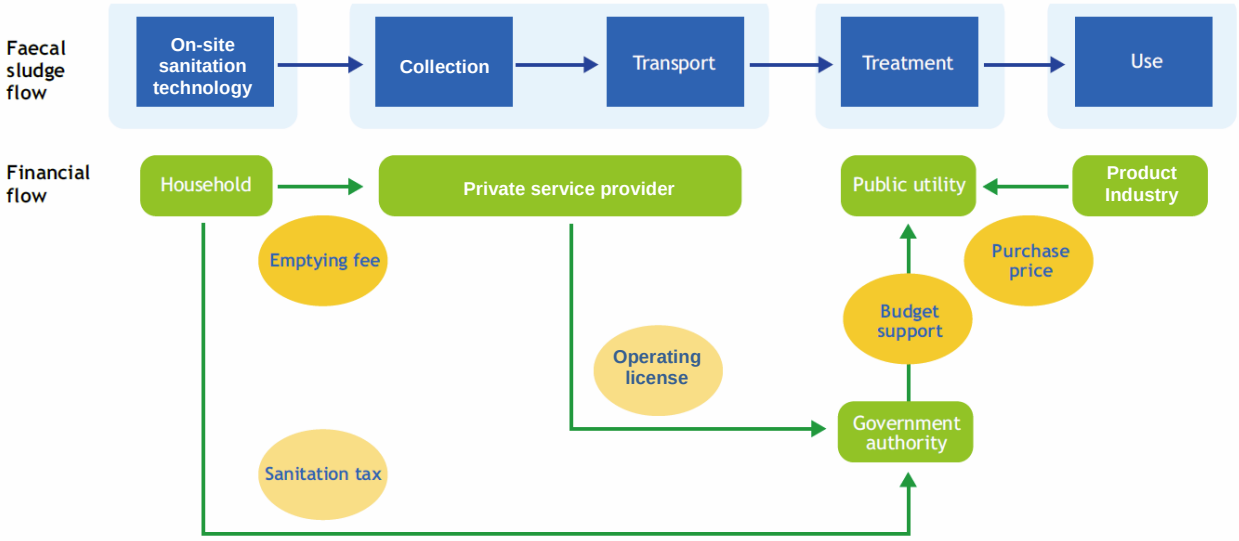
Model 4:



Which financial flow model is this?: ____

What name would you give this model?: _____

Model 5:



Which financial flow model is this?: ____

What name would you give this model?: _____

Financial Flow Model Descriptions

Model	Financial Transfers
A	• Households pay an emptying fee to a private service provider. • Private service providers buy operating licenses (or discharge licenses) from government authority. This licence allows them to operate collection and transport services and discharge faecal sludge without a fee at the treatment facility. • Households pay a sanitation tax to the government authority. • Government authority provides budget support to the public utility. • Public utility sells faecal sludge treatment products.
B	• Households pay an emptying fee to a private service provider. • Households pay a sanitation tax to the government authority. • Government authority provides budget support to the public utility. • Private service provider pays a discharge fee to the public utility for faecal sludge treatment. • Public utility sells faecal sludge treatment products.
C	• Households pay an emptying fee to a private service provider or nongovernmental organization (NGO). • Farmers and industries buy faecal sludge treatment products.
D	• Households pay an emptying fee to a private service provider. • Private service providers buy dumping licenses from the government authority. This licence allows them to operate collection and transport services. • Public utilities pay a discharge incentive to private service providers that discharge faecal sludge at the treatment facility. • Households pays a sanitation tax to the government authority. • Government authority provides budget support to the public utility. • Public utility sells faecal sludge treatment products.
E	• Households pay an emptying fee to a private service provider. • The private service provider pays a discharge fee to the public utility. • Public utility sells faecal sludge treatment products.

Lesson Plan: Legal Framework

40 minutes

Lesson Description

This lesson introduces the importance of having a specific legal framework for faecal sludge management. Participants discuss common challenges and identify solutions to overcome some of these challenges.

Learning Outcomes

At the end of this session participants will be able to:

1. Discuss the importance of having a legal framework for faecal sludge management.
2. Discuss the challenges with legal frameworks for faecal sludge management.
3. Discuss solutions to overcome legal challenges in faecal sludge management.

Materials

- □ Flip chart paper
- □ Tape
- □ Markers
- □ Activity: Government Departments (1 for every of 3-4 people)
- □ Activity: Government Departments Solution (1 copy)
- □ Case Studies and Faecal Sludge Management Exercise Book

Preparation

- □ Review topic in Chapter 12: Institutional Frameworks for Faecal Sludge Management in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*
- □ Write the heading "*Legal Framework Challenges*" on flip chart paper
- □ Print Activity: Government Departments Activity (1 for every 3-4 people)
- □ Print Activity: Government Departments Solution (1 for trainer)

Introduction **5 minutes**

1. Ask participants, "Has anyone read regulations or consulted with a lawyer? How did you find the experience?" You might get a mix of opinions.
   - *Overwhelming*
   - *Time-consuming*
   - *Expensive*
   - *Confusing*
   - *Outdated*

2. Ask participants, “What is a legal framework?”
   - *All the laws that apply to your activity*
3. Explain that understanding the legal framework can be confusing if you have not been trained or gone to law school. That is why we often consult with law professionals when we have questions about the legal framework. Some professionals can explain the laws to you in a simple way. However, sometimes the laws themselves are very confusing. The legal framework for faecal sludge management is no exception to this challenge.
4. Present the lesson description or learning outcomes.

Legal Framework **20 minutes**

1. Ask participants, “Why is it important to have a legal framework specific for faecal sludge management?”
   - *Ensure effective faecal sludge management*
   - *Protect public health and the environment from risks linked to faecal sludge management*
   - *Regulate and enforce the roles and responsibilities of each stakeholder throughout the entire sanitation service chain*
2. Explain that it is important to analyze and understand the existing legal framework for faecal sludge management. This will allow a better understanding of how the government expects the sector to perform its functions. To do so, it is important to talk to the appropriate government departments involved.
3. Explain that participants will be divided into small groups and given a list of scenarios. They need to identify one or more government departments they would approach for more information on the regulations for that specific scenario. The answers can be based on existing government departments or ones they believe should exist. Participants have 5 minutes to complete the activity.

   Note: Participants will not be able to cover all the scenarios in 5 minutes. They should cover as many scenarios as they can in any order.

   Divide participants into groups of 3 or 4 people. Hand out the Activity: Government Departments.
4. Explain that analyzing the existing legal framework can be very difficult. For example, there are often lots of different government authorities involved and they may have overlapping or conflicting responsibilities. Write “many government departments” on the “*Legal Framework Challenges*” flip chart.
5. Ask participants, “What other legal framework challenges exist?” Record responses on the “*Legal Framework Challenges*” flip chart. Provide a faecal sludge management example for each challenge. Ask participants if they have faced any of these challenges.
   - *Outdated regulations: For example, a municipality wants to increase access to sanitation through subsidized construction of on-site sanitation technologies. However, town planning regulations ban pit latrines and implicitly, latrine*

emptying. This example still exists in Dar Es Salaam, Tanzania, and is a hangover from colonial times.

- *Overly strict regulations adapted from other contexts: Effluent standards, for example, are sometimes taken directly from World Health Organization (WHO) guidelines or from developed industrialized countries' regulations without being adapted to the local context. This has led to the construction of overly complex wastewater treatment plants that are not affordable to operate and not always appropriate for treating faecal sludge. The treatment plants ends up being more polluting than a simpler treatment technology with a slightly lower effluent quality would be.*
- *No existing laws for innovative technologies: For example, only certain treatment technologies are included in the regulations and there is no law on piloting innovative technologies. Another example, a legal framework that only recognizes a sewer system as a sanitation technology. The faecal sludge management service chain falls outside the law and therefore cannot be regulated.*
- *Other gaps in regulation: For example, overall legislation allowing for the establishment of an autonomous sanitation department at the municipal level. However, the necessary regulations in subsidiary legislation (delegation of responsibilities) are lacking, so such departments cannot be established (for example, Mozambique).*
- *Poor enforcement of regulations: For example, in Indonesia the conventional approach to regulation had to be replaced by a voluntary system.*
- *Corruption: This happens at the collection and transport level, as well as at the treatment plant. At the treatment plant, dumping fees may be unaccounted for. In Accra, for example, the Lavender Hill dumping site has $500,000 per year of unaccounted dumping fees. Another example is municipal or utility tanker drivers taking on "private" work. They use the municipal equipment, take the money from the customers, and may share some of it with the management team. This leads to a high use of emptying equipment, but low income for the maintenance of the equipment.*

6. Explain that although it is difficult to work within a legal framework, there are options. Ask participants, "What would you do if the laws didn't seem to work in favor of your project?"

   - *Critically review the laws. Laws are not usually black or white; you can consult with key stakeholders to see if an idea fits into the legal framework.*
   - *If certain laws or standards need to change, you can expose key decision-makers to your reasoning through field visits and scientific seminars. This is a long process and should involve local universities and research institutions.*

     The process usually involves:

     1) *Get politicians interested in a previously unrecognized sanitation approach*
     2) *Technical work to draft the content*
     3) *Legal drafting – can lead to mistakes due to non-technical background of lawyers*
     4) *Approval from politicians*
     5) *Enactment*

A project manager for the Water and Sanitation Program (WSP) program of the World Bank who worked on changing regulation in Maputo, Mozambique, explained that it took 1 year (step 1), 2 years (step 2), 6 months (step 3), ongoing (step 4).

- *Negotiate an agreement with the relevant authorities to legally make an exception to a project. This is called a moratorium. The success of the project could help eventually change the law or standards. For example, the law on dumping fees was lifted for small faecal sludge management operators developing services for low-income areas in Maputo, Mozambique.*

7. Ask participants, "What key messages did you learn in this lesson?" Summarize the key messages:

- *A specific legal framework is necessary for effective faecal sludge management, to protect public health and the environment, and to regulate and enforce the roles and responsibilities of each stakeholder throughout the entire faecal sludge management service chain*

Exercise Book **10 minutes**

1. Ask the case study groups to return to their Exercise Book and complete Section 9: Legal Framework. Participants will list the laws and regulations from their case study, and will identify the key challenges in the legal framework.

Review **5 minutes**

1. Ask participants to find a partner from another case study group. Ask participants to share one gap in the legal framework for their case study.

Reflections on Lesson

Activity: Government Departments

Scenarios	Possible Government Departments
You are the project manager for the design and construction of a new faecal sludge treatment plant. You need to identify potential sites for the treatment plant.	
You are designing a faecal sludge treatment plant. You need to find out the requirements for the level of treatment required for use in agriculture.	
You are designing a faecal sludge treatment plant. You need to find out the quality of the effluent required for discharge in a local stream.	
You want to treat faecal sludge with black soldier fly larvae. You need to find out if you are allowed to use this treatment technology.	
You are a financial consultant. You need to find the regulations on sanitation taxes and fees.	
You want to use faecal sludge as a soil conditioner. You need to find out if this allowed.	
You want to construct a faecal treatment plant. You need to find out what materials you are allowed to use.	
You want to start a faecal sludge collection and transport company. You need to find out what facilities and personal protection equipment you need to provide for your staff.	
You want to start a faecal sludge collection and transport company. You need to find out if it is mandatory to discharge the faecal sludge at an officially approved site.	
You are interested in starting a faecal sludge management company, but are unsure of future demand. Who can tell you what relevant public policies and plans are applicable?	
You are interested in starting a faecal sludge management company. You need to register the company.	

Activity: Government Departments – Solutions

Scenarios	Possible Government Departments
You are the project manager for the design and construction of a new faecal sludge treatment plant. You need to identify potential sites for the treatment plant.	- Municipal planning department - Water resources agency - Environment authority
You are designing a faecal sludge treatment plant. You need to find out the requirements for the level of treatment required for use in agriculture.	- Ministry of works/water/sanitation - Ministry of health - Ministry of agriculture - Environment authority
You are designing a faecal sludge treatment plant. You need to find out the quality of the effluent required for discharge in a local stream.	- Environment authority - Water resources agency - Municipal planning department
You want to treat faecal sludge with black soldier fly larvae. You need to find out if you are allowed to use this treatment technology.	- Ministry of works - Ministry of agriculture
You are a financial consultant. You need to find the regulations on sanitation taxes and fees.	- Municipal legislation/regulations - Ministry of finance - Ministry of local government
You want to use faecal sludge as a soil conditioner. You need to find out if this allowed.	- Ministry of agriculture - Ministry of health
You want to construct a faecal treatment plant. You need to find out what materials you are allowed to use.	- Municipal building inspectorate - Municipal planning department - Ministry of works - Ministry of works/water/sanitation
You want to start a faecal sludge collection and transport company. You need to find out what facilities and personal protection equipment you need to provide for your staff.	- Ministry of work/labour - Ministry of water/sanitation - Ministry of health
You want to start a faecal sludge collection and transport company. You need to find out if it is mandatory to discharge the faecal sludge at an officially approved site.	- Municipal council - Environment authority
You are interested in starting a faecal sludge management company. You need to find out if you are legally allowed to start your own company.	- Municipal commerce department - Ministry of trade and industry - Registrar of companies - Municipal sanitation department
You are interested in starting a faecal sludge management company. You need to register the company.	- Ministry of trade and industry - Registrar of companies - Municipal council - Environment authority

Lesson Plan: Integrated Planning

30 minutes

Lesson Description

This lesson introduces the importance of an integrated planning approach for faecal sludge management. It provides an overview of the integrated planning process for faecal sludge management. Participants will learn the importance of having an adaptive, innovative, and integrated planning process. Case studies are used to illustrate how integrated planning has been used in different countries.

Learning Outcomes

At the end of this session participants will be able to:

1. Discuss the importance of integrated planning for faecal sludge management.
2. Discuss what is included in the planning process for faecal sludge management.
3. Identify three key characteristics of a planning framework for faecal sludge management.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape
- □ Handout: Faecal Sludge Management Planning from A to Z (1 per participant)
- □ PowerPoint: Integrated Planning
- □ Computer and projector

Preparation

- □ Review topic in Chapter 17: Planning Integrated Faecal Sludge Management Systems in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*
- □ Write the heading *"Faecal Sludge Management Integrated Planning"* on flip chart paper
- □ Write the heading "*Characteristics of Planning*" on flip chart paper with the following bullet points underneath: *Adaptive, Innovative, Integrated*
- □ Print the handout Faecal Sludge Management Planning from A to Z, if possible print on larger than normal paper so that it is easier for participants to read (1 per participant)
- □ PowerPoint: Integrated Planning
  - Review the PowerPoint presentation
  - Print the speaker's notes
  - Check that the projector is working

- Cue the PowerPoint on the computer

Introduction 3 minutes

1. Ask participants, “What do you do before going to the market to buy food?”
   - *Check what food you already have*
   - *Check how much money you have*
   - *Think about what meals you want to make*
   - *Think about a new recipe you would like to try*
   - *Ask other family members what meals they would like*
   - *Ask guests what they like and don’t like*
2. There is a lot of planning involved in simple tasks such as going to the market. If you don’t plan correctly, you may not have enough food, have too much food, miss ingredients for your meal, or choose food that everyone dislikes.
3. Explain that faecal sludge management also requires extensive planning, otherwise there will be negative consequences.
4. Present the lesson description or learning outcomes.

Integrated Planning 25 minutes

1. Ask participants, “What is the goal of faecal sludge management planning?”
   - *Transform a complex faecal sludge management situation into a well-organized and coordinated management framework that can be implemented and be successful and sustainable over the long-term*
   - *Develop clear plans that can also help to source funding from donors*
2. Ask participants, “What does the word integrated mean?”
   - *To put together parts or elements and combine them into a whole*
3. Explain that we have learned about the separate parts or elements of faecal sludge management over the past 2 days. Now we need to combine them into an integrated plan and understand how they are connected and influence each other. Ask “What things have you learned about faecal sludge management that need to be considered as part of an integrated plan?”
   - *Treatment objectives, technologies, operation and maintenance (O&M), stakeholders, financial transfers, legal framework*
4. Ask participants, “Why is it important to have an integrated plan for faecal sludge management?”
   - *Successful sanitation projects in low-income countries are few. Failed projects are the norm rather than the exception. In most cases, the reason is because of the lack of integrated planning.*

- *People often focus on the physical infrastructure, but technologies are only one part. Common reasons for failure are the implementation of infrastructure without consulting the key stakeholders or without planning adequate operation, maintenance, and financial transfers.*
- *If the enabling environment for faecal sludge management does not exist in the first place, then it needs to be developed as part of an integrated plan. An enabling environment is the legal framework, financial transfers, political environment, and cultural context that contribute to the feasibility and success of faecal sludge management.*

5. Ask participants, "What is included in an integrated planning process for faecal sludge management?" Record responses on the *"Faecal Sludge Management Integrated Planning"* flip chart. The following are some examples:
   - *Assessment of initial situation*
   - *Stakeholder analysis and engagement*
   - *Locating faecal sludge treatment plant sites*
   - *Quantification and characterization of faecal sludge*
   - *Selection of emptying, transport, and treatment technologies*
   - *Capacity building*
   - *Ongoing operation and maintenance (O&M)*
   - *Financial transfers*
   - *Legal framework*
6. Explain that we do not have time to go into further detail on planning. For more information on planning, participants can read the planning section of the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*, Sanitation 21 and CLUES. All of these resources are available online for free download.
   - *Sanitation 21: This planning framework at the city-level was co-authored with Eawag-Sandec, International Water Association (IWA) and German Cooperation (GIZ). It aims to achieve a vision for sanitation improvements which:*
     i. *Is shared between different stakeholders within the city.*
     ii. *Has a comprehensive sanitation development plan that corresponds to users' demands and the different physical and socio-economic conditions.*
     iii. *Has a supportive enabling environment with regards to policy and governance for promoting the implementation of proposed components of the plan.*
     iv. *Has adequately managed and maintained facilities and infrastructure, supported by the capacity building actions required.*
   - *CLUES: The Community-Led Urban Environmental Sanitation (CLUES) approach was developed by Eawag-Sandec. It presents comprehensive guidelines for the planning and implementation of environmental sanitation infrastructure and*

services in poorly represented urban and peri-urban communities. It emphasizes the participation of all stakeholders from an early stage in the planning process. It proposes 7 planning steps and 3 cross-cutting tasks for an integrated planning process, focusing on the enabling environment which is required for sustainable interventions.

- *"Faecal Sludge Management Planning from A to Z": The book Faecal Sludge Management: Systems Approach for Implementation and Operation proposes a logical framework for faecal sludge management projects. It structures and links together the activities of faecal sludge management planning and matches them with the 'traditional' project phases and the participatory planning stages of CLUES and Sanitation 21.*
- *There are many other planning resources that have been developed by other organizations:*
  - *Faecal Sludge Management Toolbox from the Asian Institute of Technology (www.fsmtoolbox.com)*
  - *Faecal Sludge Management Tools from the World Bank (http://www.worldbank.org/en/topic/sanitation/brief/fecal-sludge-management-tools)*
  - *Sustainable Sanitation and Water Management Toolbox from SEECON (http://www.sswm.info/)*
  - *Excreta Flow Diagrams from SuSanA (http://sfd.susana.org/)*

7. As an example of a planning document, hand out Faecal Sludge Management Planning from A to Z to each participant.
8. Explain that a planning framework should be adaptive, innovative and integrated. Use the "*Characteristics of Planning*" flip chart to discuss these key characteristics.
   - *Adaptive: Improve based on monitoring outcomes/performance; change according to preferences; adapt to growing cities; flexible; continually being improved in an iterative fashion.*
   - *Innovative: No existing city-wide models of success to follow; no one size fits all; requires innovation*
   - *Integrated: Faecal sludge management is not mainly about technology. It requires an integrated approach to management, planning and technology. It also requires a series of communications/actions among stakeholders at each step in the service chain.*
9. Use PowerPoint: Integrated Planning to present examples of integrated planning from South Africa and the Philippines.
   - *Durban key points:*
     - *Durban is complex. They have an area covered by sewer, and also a huge peri-urban area. It is also growing rapidly.*
     - *Durban is adaptive. When solutions do not work, they try other new ones.*
     - *Durban is innovative. They are trying all sorts of new solutions that have not previously been implemented.*

- *Durban is integrative: eThekwini Municipality has a strong unit for water and sanitation with a strong collaboration for doing applied research.*

- *Philippines: They have realized and acknowledged that there is not one correct way to manage faecal sludge. They are adapting their management strategies to fit each local context.*

Review **2 minutes**

1. In pairs, ask the participants to think of a way to remember the three key characteristics of planning: Adaptive, Innovative, Integrated.
2. Optional depending on time: Ask the pairs to share their response with the large group.

Reflections on Lesson

Handout: Faecal Sludge Management Planning from A to Z

FSM planning from A to Z

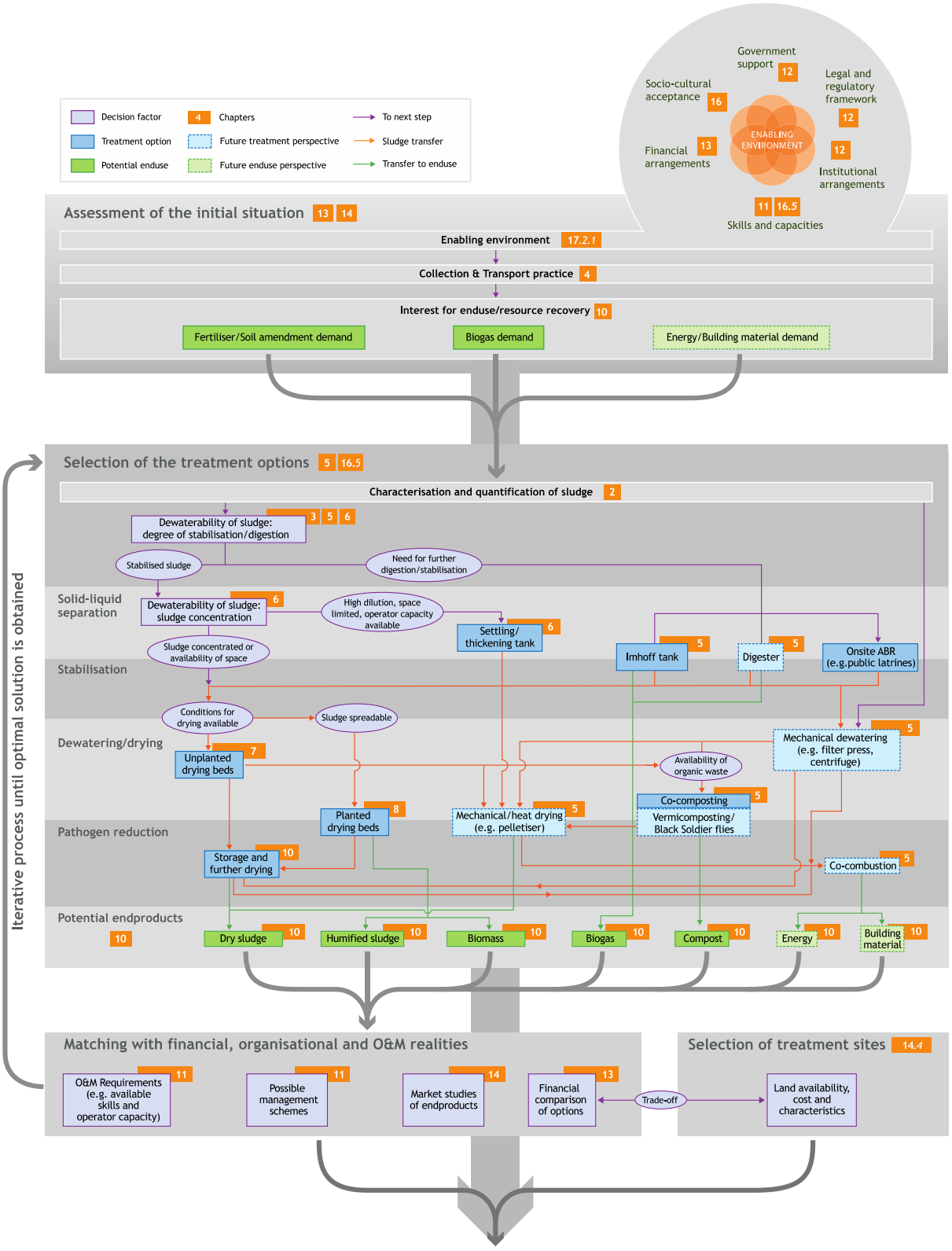
Standard project phases		Activities	Outcomes	Chapters	Participatory stages: CLUES	Participatory stages: SAN21
Exploratory study	A	Preliminary assessment of the initial situation and first inventory of stakeholders	Overview of the situation; facilitators are identified	14 15	Process ignition	Establish a city sanitation task force
		Inception report				
Preliminary (pre-feasibility) studies	B	Identification and preliminary characterisation of the stakeholders and their relationships	All stakeholders are identified and characterised	15	Launch of the planning process	Understand the existing context
	C	Initial launching workshop, including field visit with all the stakeholders	Stakeholders are sensitised to sanitation reality and aware about the project's objectives	16.5		
	D	Assessment of: - Sanitation practice and needs, reuse interests - Institutional setup, government support - Legal and regulatory framework - Existing organisational modes - City structure and heterogeneity of sanitation practices - Existing financial flows - Climate	Sanitation practices are identified, as well as urban heterogeneity; Strengths, weaknesses, opportunities and threats are identified (SWOT analysis); The enabling environment is described	14	Detailed assessment of the current situation	
	E	Selection of potential organisational modes	Orientation of the process towards realistic options	12		
	F	Identification of sites for treatment	Stakeholders have indicated existing and potential sites	14.4		
	G	Characterisation and selection of key stakeholders	Stakeholder who have interest in and/or influence on the process are identified	15.4 to 15.5		
		Preliminary studies report				
Feasibility study	H	Quantification and characterisation of sludge	Process leaders know what has to be treated	2	Identification of service options	Identify viable solutions
	I	Characterisation and selection of sites	Appropriate sites are selected	14.4		
	J	Preselection of combinations of technologies, organisational modes and financial mechanisms	Scenarios are elaborated	5,11,12, 13,15,17		
	K	Detailed evaluation of selected options, including: - Requirements of technology combinations, pros and cons, O&M - Organisational mode and institutional setup; roles & responsibilities; contractual arrangements - Capital and operation costs, financial mechanisms, estimated budget - Skills required to run each system - Environmental impact assessment	System scenarios are evaluated and optimised	4-17		
	L	Preliminary presentation of the results to the key stakeholders	Stakeholders are consulted and agreement is secured	16		
	M	Final selection of system options		17		
	N	Workshop : Validation of chosen options by all the stakeholders	Proposals are validated by all stakeholders	16.5		
	O	Reassessment of key stakeholders according to the validated options	Influence and interest of stakeholders are reassessed according to the previous decisions	15.5		
		Feasibility study report				
Detailed project development	P	Detailed project development (Action Plan): - Detailed design of the treatment plant - Detailed definition of roles & responsibilities - O&M management plan with clear allocation of costs, responsibilities and training needs - Conventions between stakeholders, securing financial and institutional mechanisms - Strategy for control and enforcement - Definition of needs for capacity building and job creation - Definition of contracts and bidding processes - M&E strategy for the implementation phase - Timeline for implementation with distinct phases and an itemised implementation budget	The Action Plan is written; The whole system is described in detail	11 12 13 16 17	Development of an Action Plan	Elaborate Strategic Plan
	Q	Workshop : Presentation of the Action Plan	The Action Plan is validated by all stakeholders	16.5		
	R	Reassessment of key stakeholders according to Action Plan	Roles and responsibilities of stakeholders are redefined according to the Action Plan	15.5	Implementation of the Action Plan	Prepare for implementation
		Detailed Project Document				
Implementation	S	Recruitment of contractors for building and O&M		11		
	T	Organisation of the sector, transfer of roles & responsibilities	FS management is transferred to the corresponding stakeholders	11,12,13,16		
	U	Capacity building / information campaigns	Awareness is raised among users; Capacity is built where needed	16		
	V	Monitoring of construction	Building according to state-of-the-art is ensured	11		
	W	Reassessment of key stakeholders before inauguration of the FSTP	Capacity of stakeholders to deal with their new roles and responsibilities is assessed	15.5		
	X	Start-up of the system	The FSTP is brought to its state of equilibrium; stakeholders have acquired the necessary skills	11		
	Y	Official inauguration ceremony	The FSTP is officially transferred to the city authorities / private entrepreneurs			
M&E	Z	Monitoring of the running system (technical stability, satisfaction of stakeholders, cost recovery)	The system is monitored to ensure its sustainability	11		

CAWST

eawag aquatic research

Sandec
Sanitation, Water and Solid Waste for Development

Selecting a context-appropriate combination of faecal sludge treatment technologies



Lesson Plan: Improvement Plan

50 minutes

Lesson Description

This lesson acknowledges the difficulty of implementing a complete sanitation service chain. Participants will develop an incremental improvement plan to reduce faecal transmission routes and implement a sanitation service chain.

Learning Outcomes

At the end of this session participants will be able to:

1. Analyze risks and barriers to improve faecal sludge management within a community.
2. Develop an incremental improvement plan, including first and later steps.

Materials

- □ Flip chart paper
- □ Markers (3 colours)
- □ Tape
- □ Risk Management Scenarios (1 for each group)
- □ Analyzing Barriers Matrix (1 for each group)

Optional:

- □ PowerPoint: Improvement Plan
- □ Computer and projector

Preparation

- Read Module 4 (Develop and implement an incremental improvement plan) of *WHO Sanitation Safety Planning: Manual for safe use and disposal of wastewater, greywater, and excreta (2015).* Note: Sanitation Safety Planning is currently more relevant to wastewater than faecal sludge.
- Check that you have the Risk Management Tables from the risk management lesson plan.
- Print Analyzing Barriers Matrix (1 for each group of 3 to 5 people)
- Print and cut Risk Management Scenarios (1 for each group of 3 to 5 people)
- If using PowerPoint: Improvement Plan
  - Review the PowerPoint presentation
  - Print the speaker's notes
  - Check that the projector is working
  - Cue the PowerPoint on the computer

Introduction 5 minutes

1. Ask participants to imagine they sold all their belongings to buy land and build a house. It will take about 5 years to build their house. In pairs, tell participants to discuss what their priorities would be in the first year of building their house. Share some responses as a large group.

2. Explain that putting in place effective faecal sludge management is like building a house. There are many steps to build a house. All steps are important to reach your end goal. You need to plan, save money, borrow money, slowly build as resources become available, and continually maintain the house once it is built. Faecal sludge management will take longer than building a house. It can take years to decades to put in place. There needs to be planning, funding, building the capacity of all stakeholders, construction, implementation, and continual monitoring.
3. Explain that every action is valuable to improve faecal sludge management. Implementing a quality sanitation service chain from start to finish takes a long time and a lot of planning. However, all plans start with small actions and first steps.
4. Develop an incremental improvement plan to help prioritize steps to effectively reduce faecal transmission routes.

Improvement Plans 40 minutes

1. Tell participants they will use the risk management scenarios from the Risk Management lesson plan (if applicable). In the activity, they had identified disease transmission risks, who was at risk and appropriate barriers to reduce the risks. In this lesson, particants will sort the barriers according to their potential impact on disease transmission and how easy it is to implement. This will help the groups develop an incremental improvement plan.

2. Tell participants to return to their risk management groups. Hand out their Risk Management Tables and Scenarios.
3. Participants have 5 minutes to read over their scenario and their list of risks and barriers. For this activity, participants should imagine that this scenario is common within the whole community. They can add any other barriers they would put in place, including specific components of the sanitation service chain.
4. After 5 minutes, explain to participants that they will sort the barriers into those that have a “big impact”, “medium impact” and “small impact” on disease transmission as well as those that are “easy to do”, “possible to do” and “difficult to do”. For example, wearing shoes might have a big impact on reducing disease transmission in areas where farmers use faecal sludge for agriculture. In contexts where most of the community members wear shoes and faecal sludge is not used for agriculture, this might be a low impact barrier. Another example, it might be easy to put in place a fence to restrict access to a treatment facility; however, it might be more difficult to change individual behaviours, such as wearing shoes.

5. Hand out the Analyzing Barriers Matrix to each group. Participants should write down the barriers in the matrix. They have 15 minutes.

6. After 5 minutes, ask participants to look over their matrix and develop an incremental improvement plan. Discuss which barrier they would introduce first, second and third. They can write their plans on a flip chart paper or use three different colour markers to circle the barriers on their matrix. They have 10 minutes to develop their incremental improvement plan. For example, often with faecal sludge management:
   - *First there are trucks emptying and transporting faecal sludge, but there is not treatment facility.*
   - *Then treatment technologies are built (for example, drying beds), but there is no effluent treatment for the first few years.*
   - *Gradually the sanitation service chain expands to include all steps of faecal sludge management.*
7. After 10 minutes, ask the groups, “What were some of the first barriers you chose to address in the improvement plan? Why did you choose those barriers?”
   - *Barriers that have a big impact and are easy to do should be targeted first.*
   - *One difficult barrier with a big impact might be worth focusing on rather than many easy, low impact barriers.*
   - *Although faecal sludge management may take a long time to implement, safer disposal may be the only option to reduce certain risks immediately.*
8. Ask the groups, “What were some of the barriers you chose to address later in the improvement plan? Why did you choose to address those barriers later?”
   - *Barriers that require a lot of planning, stakeholder involvement and funding are usually a long-term strategy. These need to be included in the incremental improvement plan so all activites are linked together to reach the faecal sludge management goal.*
9. Optional: Use the presentation to show an example of an improvement plan from the sanitaiton safety plan.

10. Remember to encourage the participants that every step (no matter how small) is valuable and needed, to improve faecal sludge management. Participants should end this lesson feeling that they can do something immediately and work towards longer-term solutions.

Review **5 minutes**

1. Ask participants to find a partner. Identify a Person A and a Person B. Person A is a defeated sanitation planner – they will never be able to implement faecal sludge management for their community or town, it is impossible. Person B is an optimistic colleague. Person A must act defeated. Person B must motivate Person A by explaining the value of an incremental improvement plan.

Reflections on Lesson

Activity: Risk Management Scenarios

Scenario A: Transporting Faecal Sludge

An informal emptying service has been contacted by a client to empty their pit latrine. The two emptiers put on their work boots, shorts and a t-shirt. They start emptying the pit using shovels and buckets. Once a bucket is full, they empty it in a large bin located on a cart. They use this cart to transport the sludge. The buckets have no lids and faecal sludge spills out as they carry them. Once they are done emptying the pit, they agree on a price with the owner and shake their hand. They bring back all their tools to the cart and push the cart through the town.

Scenario B: Using Excreta as a Fertilizer

A farmer applies faecal sludge onto their field to increase the yield of the crops. They get the sludge from their latrine pit. The farmer works barefoot. They carry the faecal sludge in a bucket and pour it around their plants. It is difficult to aim the sludge with the bucket. The faecal sludge splashes and goes onto the plants. Children are often playing in the fields. They help the farmer harvest the crops. The farmer then sells the food at the local market.

Scenario C: Disposing of Faecal Sludge

A family has paid for an emptying service to empty their pit latrine. The service only empties the pit. It is up to the family to dispose of the sludge. There is some space in the backyard to dig a pit and bury the sludge. Two family members start digging a pit using a shovel. They put on boots, shorts, a t-shirt, and a mask to avoid the bad smells. They pour the faecal sludge into the pit and cover the pit with a thin layer of soil. They place a stick on the pit to let the children know not to walk on top of the pit. They return the tools to the house.

Activity: Analyzing Barriers Matrix

	Small Impact	Medium Impact	Big Impact
Easy to Do			
Possible to Do			
Hard to Do			

Lesson Plan: Case Study Review

40-60 minutes

Lesson Description

This lesson is a review of the case studies and exercise books. Groups will present their recommendations for improving their sanitation service chain. Participants provide feedback to the groups based on the risks and opportunities they identify.

Learning Outcomes

At the end of this session participants will be able to:

1. Discuss their recommendations for the case study.
2. Discuss the opportunities and risks of each group's faecal sludge management service chain.

Materials

- □ Flip chart paper
- □ Markers
- □ Case Studies and Faecal Sludge Management Exercise Book

Preparation

- □ Place a flip chart paper and markers at each group table.

Introduction 3 minutes

1. Divide participants into pairs (preferably not pairs from the same group). Ask the pairs to discuss the sentence: "There are many opportunities and risks in implementing a faecal sludge management service chain." Debrief their discussions with the large group.

2. Explain that we will provide constructive feedback on each group's faecal sludge management service chain. Explain that we want to identify the opportunities and risks involved in implementing each group's recommendations.
3. Present the lesson description or learning outcomes.

Case Study 35-55 minutes

1. Tell participants that they will have 2-5 minutes to present their recommendations for improving their faecal sludge management service chain. Afterwards, participants will have 4 minutes to ask questions to the group.

2. Explain that the groups should use the flip chart paper and markers to draw their faecal sludge management service chain with their recommendations. They should include all the different components and recommendations they discussed in their Faecal Sludge Management Exercise Book. They have 5 minutes to draw.
3. Ask each group to present their recommendations for improving their faecal sludge management service chain. After 2 minutes, ask the other participants if they have any questions for the group. Remind participants to think about the opportunities and risks involved with the selected faecal sludge management service chain.

Review **2 minutes**

1. Divide participants into pairs (preferably not pairs from the same group). Ask the pairs to discuss the sentence: “There is no perfect faecal sludge management service chain.”

Reflections on Lesson

Lesson Plan: Action Planning

40-60 minutes

Lesson Description

Participants consider their next steps after the workshop. Choose between two options for participants to develop an action plan, to make the best use of their new knowledge and skills.

Learning Outcomes

At the end of this session participants will be able to:

1. Discuss immediate, easy steps that you can take to improve faecal sludge management.
2. Develop an action plan for next steps after the workshop.

Materials

- □ Flip chart paper
- □ Tape
- □ Markers

Optional:

- □ Option A: Action Plan Table (1 per participant or group)
- □ Option B: Action Plan Table (1 per participant or group)

Preparation

- □ Option A: Draw the following Action Plan Table on flip chart paper or print it out (1 per participant or group):

Activity	Deadline	Responsible Person	Support Required
1.			
2.			
3.			
4.			
5.			

□ Option B: Write the following Action Plan Table on flip chart paper or print it out (1 per participant or group):

What information was valuable?	How do you plan to use this information?	When do you plan to use this information?	How can you share this information with others?
1.			
2.			
3.			
4.			
5.			

Introduction 5 minutes

1. Explain that the overall goal for this workshop is for participants to be able to apply concepts of sustainable faecal sludge management in the places they work. They are going to identify doable actions to start working towards this goal.
2. Ask participants, "What is the importance of creating a plan to achieve your goal?"
   - *A plan helps us to focus on what we need to do to achieve the goal.*
   - *A plan provides milestones for us to measure progress against.*
   - *A plan gives motivation by showing that the goal is realistic and achievable.*
3. Present the lesson description or learning outcomes.

Create an Action Plan 30-50 minutes

1. Explain that every action is valuable to improve faecal sludge management. Implementing a quality sanitation service chain from start to finish takes a long time and a lot of planning. However, all plans start with small actions and first steps.
2. Ask participants, "What are some immediate, small first steps that you can take to improve faecal sludge management where you work?"
   - *Read one chapter of the book Faecal Sludge Management: Systems Approach for Implementation and Operation.*
   - *Find out who is responsible for faecal sludge management in your city.*
   - *Download the methodology for making an 'Excreta Flow Diagram' for their city.*
   - *Enroll in a Faecal Sludge Management course.*
   - *Identify private service providers that are collecting and transporting faecal sludge and support them to be doing it safely. For example, work with the providers to ensure workers are using personal protective equipment.*

Option A:

1. Show the "Action Plan Table" flip chart and explain the columns.

2. Ask the participants to group together with other people who work in the same city or on the same project. Participants may also choose to work alone.
3. Hand out the Action Plan Table and markers to each group.
4. Ask the groups to write down 3–5 steps they plan to take after the workshop. Emphasize that the steps should be realistic and practical. Encourage the participants to be as specific as possible. Tell the participants they have 20 minutes to create their plan.
5. Optional depending on time: Share the action plans as a large group.

Option B:

1. Show the “Action Plan Table” flip chart and present the 4 questions. Ask the participants to reflect on the questions individually for a few minutes.
2. Ask the participants to group together with other people who work in the same city or on the same project.

3. Hand out the Action Plan Table and markers to each group.
4. Ask the groups to respond to the questions in the table. Emphasize that the steps should be realistic and practical. Encourage the participants to be as specific as possible. Tell the participants they have 20 minutes to create their plan.
5. Optional depending on time: Share the actions plans as a large group.

Review **5 minutes**

1. Ask each group to discuss the following questions:

   “On a scale of 1-10, rate how committed you are to implementing your plan.”

   “What will you do with your plan to make sure that you implement it?”

Reflections on Lesson

Option A: Action Plan Table

Activity	Deadline	Responsible Person	Support Required
1.			
2.			
3.			
4.			
5.			

Option B: Action Plan Table

What information was valuable?	How do you plan to use this information?	When do you plan to use this information?	How can you share this information with others?
1.			
2.			
3.			
4.			
5.			

Lesson Plan: Workshop Closing

30-60 minutes

Lesson Description

This lesson closes the workshop by asking participants to reflect on their learning, conduct a self-assessment, review the learning outcomes, and complete a final evaluation. The workshop certificates are distributed to the participants and closing remarks are made.

Learning Outcomes

1. End of workshop self-assessment and reflection.
2. Review learning outcomes to see if they were met.
3. Complete a final evaluation of the workshop.
4. Distribute certificates and make closing remarks.

Materials

- □ Self-assessment flip chart from Day 1
- □ Group Learning Expectations flip chart from Day 1
- □ Markers
- □ Tape
- □ Certificates (template available from CAWST and Eawag-Sandec in workshop training materials)
- □ Final evaluations (See Appendix 2: Tools, template also available from CAWST and Eawag-Sandec in workshop training materials) (1 per participant)
- □ Camera

Optional:

- □ Participant CDs or USB flash drives with workshop materials
- □ Sticker dots for self-assessment
- □ Tool: Word in a Hat (1 word per participant)
- □ Hat or other container (for Word in a Hat Review)
- □ Scissors
- □ Paper
- □ Ball of string

Preparation

- □ Print certificates and sign them if necessary. Double check the names and make sure each participant has a certificate.
- □ Print final evaluations (See Appendix 2, 1 per participant)
- □ Optional: Prepare the participant CDs or USB flash drives (1 per participant)

□ Optional: Review Tool: Word in a Hat. Write important words or terms on pieces of paper for Word in a Hat review or use sample words at the end of this Lesson Plan.

Optional Depending on Time: Review **15 minutes**

1. Use the Word in a Hat activity to review important lessons learned during the workshop. Pass the hat around the circle. Each participant or pair pulls a piece of paper out of the hat. They have to explain what the word means, or tell the group what they have learned about it. You can estimate that it will take about 1 minute per participant for this activity (for example, it will take about 20 minutes for 20 participants to explain their words).

Self-Assessment **5-10 minutes**

1. Ask the participants to place stickers (or use markers) again on the self-assessment chart from the workshop opening. To save time, ask participants to do this on the break.
2. Discuss the results with the entire group. Ask participants if they think the workshop was a success or not. Why or why not?

Group Learning Expectations **5 minutes**

1. Review the Group Learning Expectations from the first day and see if all of them were addressed. If not, quickly cover the answers, give options for participants to find the information they were looking for, or identify next steps for follow-up.

Further Training and Resources **5 minutes**

1. Tell the participants that Eawag-Sandec makes their publications and other resources freely available on their website. These resources include:
   - *The book that this workshop was based on, Faecal Sludge Management: Systems Approach for Implementation and Operation http://www.sandec.ch/fsm_book*
   - *All of our other FSM publications, reports and methods www.sandec.ch/fsm_tools*
   - *"Introduction to Faecal Sludge Management" will be coming out in Spring 2017, and is the fourth Massive Open Online Course (MOOC) of the e-Learning program "WASH in Developing Countries". It will be a five week course with a focus on what can actually be done to work towards solutions to faecal sludge management in developing countries. The other courses include Household Drinking Water, Solid Waste Management and Sustainable Environmental Sanitation Planning. The course will be available from Coursera free of charge, and all the MOOCs are available on the Eawag-Sandec YouTube Channel (https://www.youtube.com/channel/UCdDwnhvbqp2qMN1D4XyS8nA).*

- *www.sandec.ch Many other relevant publications from Household Drinking Water, Solid Waste Management and Sustainable Environmental Sanitation Planning including the Compendium of Sanitation Systems and Technologies*

2. Tell the participants that CAWST has 3 other sanitation-related workshops and resources available at http://resources.cawst.org on the following topics:

   - *Environmental Sanitation: Environmental sanitation aims to protect and promote human health and well-being by providing a clean environment and breaking the cycle of disease. Environmental sanitation is more than just building latrines. It takes a broader look at the community and addresses different, but interconnected, aspects, including human and animal excreta management, solid waste management, vector control and domestic wastewater management.*
   - *Latrine Design and Construction: Focuses on the first two components of the sanitation system - user interface and excreta storage. The workshop gives participants experience selecting appropriate latrine parts, such as the toilet, slab, superstructure, and pit, tank or chamber. It also addresses technical and environmental topics including siting latrines and sizing latrine pits. Modifying latrines to make them accessible for different user groups, including children, women, and people with limited mobility, is discussed. Aspects of hygiene, such as handwashing and menstrual hygiene, are also discussed as they relate to sanitation.*
   - *Sanitation Implementation: Focuses on what it takes to implement a successful sanitation project. It includes a framework for implementing projects that helps ensure all key components for success have been addressed. The resources explain the theory behind changing people's behaviour, and ways projects can effectively influence behaviour. Guidance and tools are also provided to assist with selecting and combining different approaches to increase project success.*

3. There are other faecal sludge management courses and tools:

   - *Asian Institute of Technology Faecal Sludge Management Online Course: the first course was facilitated in Spring 2016 and they are planning to deliver future courses. This is a certified e-learning course for practitioners working or planning to work in sanitation or faecal sludge management. (http://www.fsmonlinecourse-ait.com)*
   - *UNESCO-IHE Online Course on Faecal Sludge Management: The objective of the course is to gain an understanding of all of the required aspects for the design and operation of a comprehensive faecal sludge management (FSM) system. The course is designed for professionals who deal with planning, promoting, designing, operating or managing faecal sludge for residents in urban, peri-urban, slum or rural areas, in low income countries and beyond. (https://www.unesco-ihe.org/online-course-faecal-sludge-management)*
   - *Asian Institute of Technology Faecal Sludge Management Toolbox: the toolbox was developed for city planners, donors, and consultants who are planning faecal sludge management at the city level. There are a variety of tools to use at different stages of planning. There are also example policies, terms of reference and advocacy tools (www.fsmtoolbox.com)*

- *World Bank Faecal Sludge Management Tools: World Bank has developed some tools to diagnose fecal sludge management status and to guide decision-making. These tools don't provide pre-defined solutions, as the many variables and stakeholders involved demand interventions specific in each city, and should be seen within the context of integrated urban water management. (http://www.worldbank.org/en/topic/sanitation/brief/fecal-sludge-management-tools)*
- *Sustainable Sanitation and Water Management Toolbox: This toolbox was developed by SEECON to highlight the need for holistic approaches and to consider the entire water cycle from source to sea, and back. It puts human influence on the water and* nutrient *cycle at the centre. The tools include fact sheets, presentations, and planning, processing and implementation tools. (http://www.sswm.info/)*
- *Excreta Flow Diagrams: An excreta flow diagram (also often described as shit flow diagram, SFD) is a tool to readily understand and communicate visualizing how excreta physically flows through a city or town. It shows how excreta is or is not contained as it moves from defecation to disposal or use, and the fate of all excreta generated. (http://sfd.susana.org/)*

4. Optional: Tell the participants that all of the workshop materials, references and additional resources used will be given to them electronically (CD or USB flash drive).

Optional Depending on Time: Participant Appreciation **15 minutes**

This is a chance to express appreciation to the participants, and for them to express positive feedback to each other.

1. Make your final comments on the workshop and the participants.
2. Explain that each participant will complete a workshop evaluation, so they will have a chance to share their feedback about the workshop confidentially.
3. Allow time here for participants to make any final comments to each other or about the workshop in general. You can let whoever wishes to speak address the group, or use one of the options below.

   Option A: Writing on Backs

   Tape a piece of paper on each participant's back. Each participant then writes on every other person's back something they like, admire or appreciate about that person. When they have all finished, participants can take their papers home with them as a reminder.

   Note: This option should not be used with cultures where touch between opposite gendered individuals is considered inappropriate.

   Option B: Networking Game

   Ask the participants to form a circle. Randomly pass a ball of string from one person to another to form a web. While passing the ball, each participant shares how they can share information or work together in the future.

Option C: How Do You Feel?

Ask each person to say what they feel at the end of the workshop:

"I feel _____ because _____." OR "My favorite part was _____."

Final Evaluations — 10 minutes

1. Hand out final evaluations and ask everyone to complete one. To save time, the evaluations can be completed during lunch or after the workshop is finished. Make sure to collect the evaluations before the participants leave the workshop!

Optional: Group Photo — 10 minutes

1. Arrange to have somebody take a group photo with the trainers and participants. To save time, the photo can be taken during lunch or one of the breaks.
2. Optional: Arrange to have the photo taken the day before, if you wish to include the photo on the participant CD or USB flash drive.

Certificates — 10 minutes

Option A:

Hand out the certificates randomly. Ask each participant to present the certificate they were given to the person whose name is on the certificate. When they hand the person the certificate, have them say something positive about the person. For example, something they appreciated about or learned from that person during the workshop.

Option B:

Randomly hand out the certificates face down to each participant. Ask the participants to check in secrecy whose certificate they have been given. Ask each participant to say something positive about the person whose name appears on the certificate (without saying the name of that person). Have the group guess who that person might be. Have the person give the recipient their certificate.

Option C:

You hand out the certificates to each recipient. This is the fastest option and may be more appropriate in certain countries. It also allows an opportunity for individual photos.

Reflections on Lesson and Workshop Overall

Review Tool: Word in a Hat

Excreta	**Faecal sludge**
Operation and maintenance	**On-site sanitation technology**
Knowledge gap	**Risk management**
Protective measures	**Pathogen inactivation**
Financial transfers	**Legal framework**
Use	**Disposal**
Sanitation service chain	**Treatment objectives**
Effluent	**Treatment technologies**

Lesson Plan: Field Trip

½-1 day

Lesson Description

A field trip gives participants the opportunity to see faecal sludge management in a realistic setting and apply their new knowledge. A field trip can be arranged to observe local latrine designs and fecal sludge characteristics as well as various faecal sludge collection, transport, treatment, use and disposal technologies.

Learning Outcomes

At the end of the field trip participants will be able to:

1. Identify local faecal sludge management technologies and describe their operation.
2. Identify local faecal sludge management stakeholders.
3. Identify different ways faecal sludge management is implemented locally.
4. Discuss faecal sludge management practices.

Materials

- □ Flip chart paper
- □ Markers
- □ Tape

Optional:

- □ Camera
- □ Notebook and pen
- □ Food and water for the participants
- □ First aid kit

Preparation

- □ Ask the host organization to select appropriate sites for the field trip that is close to the workshop location. If possible, try to find a location that highlights both good and bad practices for various aspects of faecal sludge management, including collection, transport, treatment, use and disposal.
- □ If required, ensure permission is granted and set up transport and logistics with the host
- □ If required, organize any food or water needed for the participants
- □ If possible, visit the sites ahead of time and identify different faecal sludge management practices
- □ If possible, prearrange for some stakeholders to participate so that participants can interview them
- □ Optional: Write a list of items participants should bring with them on flip chart paper

- □ Optional: Write the learning outcomes on flip chart paper

Introduction 5 minutes

Give the participants this introduction well before leaving on the field trip – even the day before – to give them time to prepare.

1. Explain to the participants where you will be going and what you will do there.
2. Explain the learning outcomes and what you want the participants to get out of the field trip.
3. Explain any ground rules for the field trip (for example, respectful behavior when visiting people's homes, what to do in an emergency, where to find the first aid kit if needed).
4. Explain how long it will take, when you will be back, what the participants should bring, and any other logistical arrangements.

Field Trip ½ - 1 day

1. Before leaving on the field trip or before conducting any activities upon arrival, review the relevant aspects that you want participants to pay attention to, such as technologies, stakeholders, implementation and different practices.
2. Note: if you are not visiting faecal sludge management facilities but rather wastewater treatment (for example, DEWATS) facilities, you will need to clearly describe the differences between the two.
3. Conduct the field visit.
4. Optional: Take photos during the field trip if appropriate. Capture photos of "good" situations (for example, latrine emptiers using personal protective equipment), and "learning opportunities" (for example, observations of poor faecal sludge management practices like sludge that has been dumped). Share the photos with participants after the field trip. For example, you could include the best photos on the participant CD or USB, or show them as a review tool on the projector screen when you get back to the classroom.
5. Record key learning points as they are discovered during the field trip. You can use these to help with the review.

Review 15 minutes

1. Debrief with the large group at the end of the field trip. Conduct the review in the field in a quiet location, in the vehicle on the way back, or when you return to the classroom.
2. Ask participants, "What have you learned today?" Highlight any "learning opportunities" that were observed and summarize the key learning points.

3. Use one of the review tools in Trainer Manual Appendix 1, such as Apples and Onions. Ask participants to share one thing they liked about the field trip, and one thing that could be improved.

Reflections on Lesson

July 2016

Trainer Manual

CAWST
Centre for Affordable Water and Sanitation Technology

eawag
aquatic research

Sandec
Sanitation, Water and Solid Waste for Development

Introduction to Faecal Sludge Management

Appendix 1: Workshop Materials

Table of Contents

1.1 General Equipment and Materials Checklist

General equipment and materials are needed daily for workshop delivery.

Equipment / Material	Quantity	Lesson Plan #	✓
Computer or laptop	1	All	
LCD projector	1	All	
External computer speakers	1	All	
Extension cord(s)	1	All	
Camera	1	All	
Markers	1 box	All	
Scissors	1	All	
Printer Paper	1 pack	All	
Flip chart (or large pieces of paper)	1-2 pads	All	
Tape	1 roll	All	
Name tags	1 per participant	1	
Pens	1 per participant	1	
Notebooks	1 per participant	1	
Sticker dots	1 package, multi-coloured	1	
Sticky notes	4 stacks	13	
Optional: CDs or USB flash drives	1 per participant	20	

1.2 Other Equipment and Materials Checklist

Some equipment and materials required for this workshop must be found locally in advance. Some equipment and materials are optional depending on how you use the lesson plans. Check the lesson plans and determine which of the following equipment and materials you will need.

Equipment / Material	Quantity	Lesson Plan #	✓
Items made from plastic (bucket, ball, stapler, pen)	4	7	
Glass of dirty water	1	10	
Large bucket filled with dirty water	1	12	
Optional: Hat or other container	1	20	
Optional: Ball of string	1	20	
Optional: Onion	1	20, review exercise	
Optional: Apple	1	20, review exercise	
Optional: First aid kit for field trip	1	21	
Optional: Food and water for participants during field trip		21	

1.3 Printed Materials Checklist

Print the following materials in advance of the workshop, depending on the lesson plans you use.

Equipment / Material	Quantity	Lesson Plan #	✓
Faecal Sludge Management Participant Materials (for example, *Faecal Sludge Management: Systems Approach for Implementation and Operation)*	1 per participant	1	
Sanitation Service Chain Posters	1 set	2	
Optional: Sanitation Service Chain Diagram	1 per pair	2	
Optional: Faecal Sludge Management Challenges Activity	1 per pair	3	
Risk Management Scenarios	1 per group of 3-5 participants	4	
Risk Management Table	1 per group of 3-5 participants	4	
Multi-Barrier Activity	1 card per participant	4	
Optional: Design Approach Posters	1 set	5	
Case Studies	1 per participant	6	
Faecal Sludge Management Exercise Book	1 per participant	6	
Activity: Treatment Products and Uses	1 per group of 2-3 participants	7	
Activity: What is Faecal Sludge?	1 per group of 4-5 participants	8	
Activity: Excreta Icons	2 sets	8	
Activity: Pathogen Inactivation	1 per pair	9	
Optional: Activity: Faecal Sludge Components	1 set	9	
Activity: Small Group Activity	1 per group of 3-4 participants	9	
Treatment Technologies Table	1 per participant	10	
Icon Key	1 per participant	10	
Treatment Technologies Table – Solutions	1 per participant	10	
Treatment Technology Fact Sheets	1 set	10	

Equipment / Material	Quantity	Lesson Plan #	✓
Optional: Activity: What Technology Am I?	1 card per participant	10	
Activity Answer Key: Collection and Transport Challenges and Solutions	1 for trainer	12	
Optional: Activity: Tasks of a Collection and Transport Service Provider	1 per participant	12	
Optional: Activity: Role-Play	1	12	
Optional: Collection and Transport Challenges	1	12	
Participation Levels Drawings	1 set	13	
Activity: Financial Flow Models	1 per 2 participants	14	
Financial Flow Model Descriptions	1 for trainer	14	
Optional: Activity: Financial Transfer Definitions	1 per participant	14	
Activity: Government Departments	1 per group of 3-4 participants	15	
Activity: Government Departments Solution	1 for trainer	15	
Handout: Faecal Sludge Management Planning from A to Z	1 per participant	16	
Risk Management Scenarios	1 per group of 3-5 participants	17	
Analyzing Barriers Matrix	1 card per participant	17	
Action Plan Table	1 per participant	19	
Workshop Final Evaluation	1 per participant	20	
Certificates	1 per participant	20	

1.4 Videos Checklist

Videos are used as optional learning aids in some lessons. Because the internet may not be available during the workshop, or the connection may not be strong, we recommend downloading the videos to your computer before the workshop.

Video or Audio	**Link** Available online at:	**Lesson Plan #**	✓
Video	https://www.youtube.com/watch?v=9avo-Y4DLy0	3	

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Trainer Manual

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Introduction to Faecal Sludge Management

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1 Appendix 2: Tools & Evaluations

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1.1 Tool: Word Wall

What is it?

A word wall is an ongoing, organized display of key words that provides visual reference for participants throughout the workshop. These words are used often by trainers and participants during a variety of activities.

Why use it?

This tool can be used to:

- Support the teaching of key words and subject-specific terminology
- Provide visual clues and reference for participants who are not strong in the language of the workshop
- Help participants remember connections between words and concepts

How to use it

Building a Word Wall can be easily integrated into the workshop activities. Key words and/or terminologies that relate to the lesson can be added gradually as they are introduced. A Word Wall should be organized in a way that is useful to participants with additions reflecting the skills or concepts being taught.

Often, Word Walls are organized alphabetically, with words written on paper, and taped to the wall. Trainers are encouraged to be creative is designing a word wall so that it engages the students and enhances their learning.

Some possible variations of Word Walls may include the following:

- Using different-coloured paper or markers helps to distinguish concepts and words belonging to different lessons
- Adding a picture or photograph to give further clarification for visual learners or participants who are second language learners
- Adding the definition for the words

Adapted from Government of Ontario, Canada (no date). Think Literacy. Retrieved from: www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy/files/thinklitwordwalls.pdf

1.2 Review Activities

You can use these activities to review material at the end of a session or the end of a day. You could also use these tools first thing in the morning as a fun way to review the previous days' material and get everybody's brains functioning and focused for the day.

Keep in mind the literacy level of the group as you choose activities. Not all of these activities may be appropriate for groups with low literacy levels. However, you can change most activities to suit your group. For example, use pictures instead of written words; ask participants to discuss with others or draw instead of writing.

A Tell B

At any time during the workshop think of a relevant question for reviewing topics previously discussed. Tell participants to turn to their neighbour and decide on who will be A and who will be B. Get A to answer the question to B, and then get B to answer the question to A. This gives each person a chance to speak to a partner while their partner listens. You can extend this activity by calling upon some pairs to share their learning and ideas with the whole class OR get the participants to swap partners and exchange their ideas again to extend the activity.

Big Mouth

Get the group to break off into pairs. Ask a question about one of the topics recently covered in the workshop. Every person begins to talk at once answering the question. The participants must talk continuously without pausing - trying to talk the longest. As soon as one of the participants takes a pause they must stop talking and see how long their partner can continue for.

Charades

On a small piece of paper write out the words or phrases that have to do with workshop topics. Make sure the terms have already been covered in the course. Ask a participant to come up and randomly choose one without looking, and then act out their phrase without talking or writing. The other participants guess out loud what the person is acting. Whoever guesses correctly is the next person to act out a word. Make sure that each participant has a turn to act.

Finger Review

Come up with a few true or false review questions. Pose each question to the group asking them to answer by raising their fingers in front of their chest. Raise one finger for true and all five for false. This allows all participants to answer the questions and allows you to easily and quickly assess how well the participants understand the material. This activity allows participants to keep their answers confidential.

Flashcards

Create a set of flashcards that list a topic on one card with the corresponding characteristics of that topic written on another card. Give each participant one card and have them find the person holding the corresponding card.

Graffiti Wall

Write different review topics on separate pieces of flipchart paper. For example:

- Local and Global Issues
- Risk Management
- Faecal Sludge Use (Resource Recovery)
- Treatment Technologies

Tape the pages on the walls around the room where they can be written on. Divide the participants into groups of 2 or 3 and start each group at a different topic. Give them about one minute per topic to write as much as they can think about and then tell them to move onto the next one. They should read what is there and only write new things down. As the pages fill up you may have to give them more time at each sheet. Once participants return to the sheet they started at, get them to walk around the room and read the sheets to see what they forgot, remembered or are surprised about.

Learning Ball Game

Have the group standing in a circle. Ask a participant to throw a ball to another participant. That person must say something new that they learned that day.

Mime (Silent Role Play)

After a practical session (or possibly classroom information) ask participants to turn to a partner and silently explain the concept or the steps of the session using actions.

Paper Airplane Quiz Game

Write a series of questions related to the workshop content that has already been covered. Divide the participants into small groups. Give each group a piece of paper, and ask them to make a paper airplane. Arrange a hoop or finish line out of wire, tape, rope or two chairs. Explain that when you ask a question, the first group to throw their airplane through the hoop (or over the finish line / between the chairs) gets to answer the question. If they answer incorrectly, the other groups may discuss and come to consensus on an answer. Keeping points for correct answers is optional.

Paper Cabbage

Prepare review questions and put each question on its own piece of paper. Take the first question and crunch it into a ball, take the next one and wrap it around the first one. Continue wrapping the ball of paper until all the questions are part of the ball. Get all the participants to stand in a circle. Start music, or clap your hands if there is no music available. The participants pass the cabbage around the circle, or throw it to each other. Periodically stop the music or clapping. When the sound stops the person who is holding the cabbage opens the outside paper and answers the question that is written on it. The game continues until all the layers have been unwrapped.

Quiz Game

Write a series of questions related to the workshop content that has already been covered. Divide the participants into two groups. Each group sends one person up to the front to answer a question. First person to hit the 'buzzer' (the buzzer can just be a sticky note, or an object they can grab) gets to answer the question. If they answer incorrectly, the entire other team gets to discuss and come to consensus on an answer. If the other team answers incorrectly, the first person gets to consult his/her entire team to try again. Each team sends up a different person for the second question, and so on.

Alternatively, ask the entire team a question and allow them to consult and answer within a specified time limit (say 30 seconds). If they answer incorrectly, the other team gets to try to answer. Points can be assigned for each correct answer.

Think Pair Share

At any time during the workshop come up with a relevant question for reviewing topics previously discussed. Tell participants to think about the answer on their own for half a minute to two minutes depending on the complexity of the question. Tell them they are welcome to write down some of their thoughts. Once enough time has lapsed, ask them to turn to a partner and share their answers. This encourages participants to discuss their thoughts and gain confidence in their knowledge. This also allows quieter participants to speak up and share. To extend this activity call upon some pairs to share their learning and ideas with the whole class OR get the participants to swap partners and exchange their ideas again to extend the activity.

What am I?

Pick a topic from the workshop. On pieces of paper, write down examples from that topic or print pictures. Stick one word or picture to each participant's back, so that they cannot see it. Then ask participants to walk around the room, asking each other questions to try to figure out what is on their back. The questions they ask can only be answered by "yes" or "no". The game continues until everyone has figured out what they are.

Word in a Hat

Write words related to the workshop on pieces of paper (one word per paper). Place the words in a hat (or other container). Pass the hat around the circle. Each participant pulls a piece of paper out of the hat and has to explain what the word means, or tell the group what they have learned about it.

1.3 End of Day Evaluation Tools

Alligator Arms

Ask participants to stand with their arms sticking out in front of them, palms touching like an alligator's mouth. One topic at a time, ask participants how valuable each topic covered in the workshop that day was. Arms wide apart (one arm up and one arm down) means it was very valuable, arms closed together in front means it wasn't at all valuable, plus anywhere in between.

Similarly, a scale can be used by sitting, standing, and standing with arms raised in the air.

Apples and Onions

If possible purchase an apple and an onion. Explain that the apple represents something positive about the day; it could be something new they learned or something they enjoyed. The onion represents something they wish to change about the day: it could be something they found confusing or difficult to do, or it could be something they want to change or learn more about. Sitting in the circle, give a participant an apple and an onion and have them say something about the day for each.

The apple and onion is than passed along the circle until everyone has had a chance to express themselves

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Plus/Change

Ask each participant to say one positive (plus) thing about the day, and one thing they would change. This can also be done on paper – give each participant a small piece of paper; on one side they write something positive, on the other side something that could be changed in future.

Scales

Write the numbers 1, 5, 10 on a piece of paper and post them along the wall as a continuum. Inform the participants that a 1 is low, a 5 is medium, and a 10 is high. Ask questions about the sessions that were conducted such as:

- How valuable did you find the disease transmission lesson?
- How useful was the latrine technology activity?
- Did you enjoy the menstrual hygiene role play?

After each question have participants stand along the scale to indicate how they felt about each topic.

1.4 Written Evaluations

Written evaluations can be used at the end of the day, or as a formal evaluation at the end of the workshop. The following are examples of evaluations that can be used at the end of each day or mid-week.

1.4.1 End of Day Evaluation 1

Name (optional):_____

Tell us about today…

1. The most important or useful things that I learned today are:

2. A question that I have from today is:

3. The part of the day that I liked best was:

4. The part of today that I liked the least or didn't find useful was:

1.4.2 End of Day Evaluation 2

Name (optional):_____

Think about the workshop so far. Finish the following sentences:

Something I am really excited to have learned is…

I feel…

I was surprised…

I was wondering…

I realized…

I appreciated…

I felt challenged…

I am clearer about…

Tomorrow I would like…

Any additional comments are welcome here:

1. Did the workshop meet your expectations? *(Please check only one box.)*

Completely [ ] Partially [ ] Not at all [ ]

Please explain – why or why not?

2. How relevant was the workshop to your organization or project's needs? *(Please check only one box.)*

Very Relevant [ ] Somewhat Relevant [ ] Not Relevant [ ]

Please explain:

3. Trainer 1: _____

How would you rate the following? *(Please check only one box for each statement.)*

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a.	The trainer was well prepared.	[ ]	[ ]	[ ]	[ ]	[ ]
b.	The trainer was knowledgeable about the content.	[ ]	[ ]	[ ]	[ ]	[ ]
c.	The trainer was approachable and friendly.	[ ]	[ ]	[ ]	[ ]	[ ]
d.	The trainer encouraged an engaging, participatory and interactive learning environment.	[ ]	[ ]	[ ]	[ ]	[ ]
e.	The trainer created an inclusive and respectful learning environment.	[ ]	[ ]	[ ]	[ ]	[ ]
f.	Overall, I am satisfied with the trainer.	[ ]	[ ]	[ ]	[ ]	[ ]

Trainer 2: _____

How would you rate the following? *(Please check only one box for each statement).*

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a.	The trainer was well prepared.	[ ]	[ ]	[ ]	[ ]	[ ]
b.	The trainer was knowledgeable about the content.	[ ]	[ ]	[ ]	[ ]	[ ]
c.	The trainer was approachable and friendly.	[ ]	[ ]	[ ]	[ ]	[ ]
d.	The trainer encouraged an engaging, participatory and interactive learning environment.	[ ]	[ ]	[ ]	[ ]	[ ]
e.	The trainer created an inclusive and respectful learning environment.	[ ]	[ ]	[ ]	[ ]	[ ]
f.	Overall, I am satisfied with the trainer.	[ ]	[ ]	[ ]	[ ]	[ ]

4. How would you rate the following? *(Please check only one box for each item.)*

	Poor	Fair	Good	Very Good	Excellent
Classroom Activities	[ ]	[ ]	[ ]	[ ]	[ ]
Handouts	[ ]	[ ]	[ ]	[ ]	[ ]
Workshop Content	[ ]	[ ]	[ ]	[ ]	[ ]
Facilities and Location	[ ]	[ ]	[ ]	[ ]	[ ]

5. How useful was the workshop for learning about faecal sludge management?

Very useful [ ] Somewhat useful [ ] Not useful [ ]

Please explain:

6. How would you rate the depth of information on these topics? *(Please consider this was an introductory workshop on faecal sludge management.)*

	Too Little	Enough	Too Much
Introduction to Faecal Sludge Management	[ ]	[ ]	[ ]
Local and Global Issues	[ ]	[ ]	[ ]
Design Approach	[ ]	[ ]	[ ]
Faecal Sludge Use	[ ]	[ ]	[ ]
Quantification and Characterization	[ ]	[ ]	[ ]
Treatment Objectives	[ ]	[ ]	[ ]
Treatment Technologies	[ ]	[ ]	[ ]
Operation and Maintenance	[ ]	[ ]	[ ]
Collection and Transport	[ ]	[ ]	[ ]
Stakeholders	[ ]	[ ]	[ ]
Financial Transfers	[ ]	[ ]	[ ]
Legal Framework	[ ]	[ ]	[ ]
Integrated Planning	[ ]	[ ]	[ ]
Improvement Plan	[ ]	[ ]	[ ]
Risk Management	[ ]	[ ]	[ ]
Case Studies	[ ]	[ ]	[ ]

7. What actions do you plan to take following the workshop? *(Please check all that apply.)*

[ ] Do nothing
[ ] Share what you learned with others
[ ] Apply what you learned in your work
[ ] Apply what you learned in your personal life

Other:

8. What was the biggest strength of the workshop?

9. What was the biggest weakness of the workshop?

10. Do you have other comments about the workshop, CAWST or would like more information about a specific topic?

11. Are you a woman or man?

[ ] Woman [ ] Man

Name (Optional): _____ Organization (Optional): _____

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Appendix 3: Exercise Book

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Exercise Book

Name:

Date:

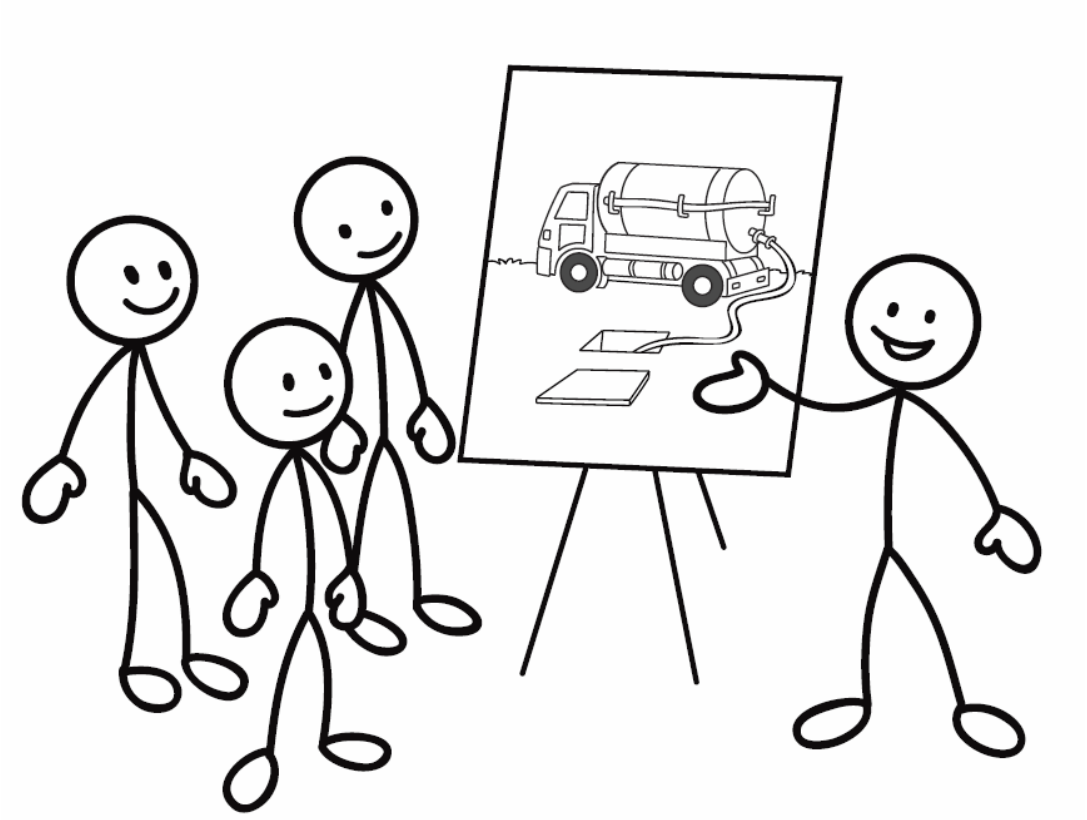


Table of Contents

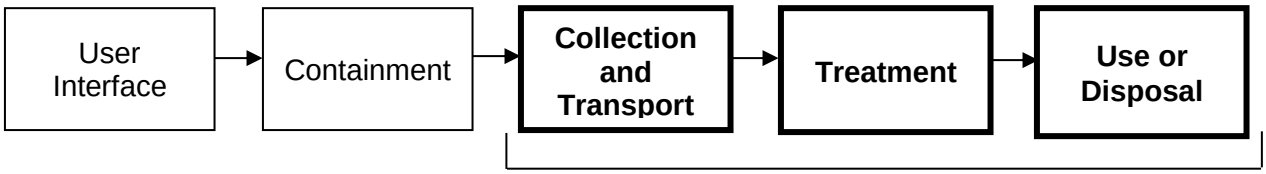
1 Introduction

This is your Faecal Sludge Management Exercise Book. You will apply your knowledge from the workshop to design an integrated faecal sludge management system. You will select technology options that you think will work best for your case study while considering implementation challenges.

The objective of this exercise is to provide an overview of the complexity of integrated faecal sludge management systems. This should reinforce the importance of integrated planning for your own work in the sanitation sector.

The five components of the sanitation service chain are illustrated in the following diagram:

Sanitation Service Chain



To design a component of your sanitation service chain, you can draw or tape a picture of the selected technology in the box on each page. To see what the different technologies look like, you can look at the illustrations in the book *Faecal Sludge Management: Systems Approach for Implementation and Operation*, or the cards at the end of this Exercise Book.

There will likely be more than one appropriate technology for each component – there is not a "right" answer. If you wish to select more than one technology, you may put more than one option on the page, or ask for additional worksheets.

2 Case Study Profile

What is the name of your consultancy? _____

Location: (for example, city, town, country; rural, peri-urban or urban)

Scale of Implementation: (for example, city, district, community)

Climate: (for example, time of rainy and dry seasons, average temperature)

Soil Conditions and Groundwater: (for example, permeability, highest annual groundwater level)

Other Important Information:

Draw a picture of the project location and scale of implementation here:

3 Faecal Sludge Use (Resource Recovery)

What products are being used now that could be replaced by resource recovery from faecal sludge? (for example, plants to feed animals, fish meal using black soldier fly larvae). Draw or list all the possible uses in the box below.

Discuss the following factors and how they influence your choice when selecting a use for treated faecal sludge. Write how you plan to collect more information, if the case study does not provide the necessary information.

Health risks	**Environmental impact**
Social factors	**Competition**

Regulation	Treatment technologies required

What is your recommended treatment product and its use?

4 Faecal Sludge Characterization

Write a general description of faecal sludge characteristics for each of the different types of on-site sanitation technologies (for example, pit latrines, septic tanks, public toilets) in your case study. Take into consideration factors that can influence the sludge characteristics, such as type of technology, storage duration, water and solid waste added to the system, infiltration rates, and climate.

On-site Sanitation System #1: _____

Characteristics:

On-site Sanitation System #2: _____

Characteristics:

On-site Sanitation System #3: _____

Characteristics:

5 Faecal Sludge Treatment Technologies

What are your treatment objectives? (for example, to reduce pathogens, to dry the sludge)

Create a faecal sludge treatment process that meets your objectives, sludge characteristics, and desired product. Draw or tape the treatment technology or treatment process below.

6 Faecal Sludge Collection and Transport

Identify the faecal sludge collection and transport service providers and the technologies they use.

Collection	**Transport**

Identify the main challenge for collection and transport services. List technical, managerial, planning and institutional solutions to overcome this challenge.

Main Challenge

Solutions to Overcome this Challenge

7 Stakeholders

Identify the stakeholders, in your case study:

Use the Influence-Interest matrix to classify the stakeholders according to their interest and influence.

Influence-Interest Matrix

	Low Influence	**High Influence**
Low Interest		
High Interest		

8 Financial Transfers

Identify the current financial transfers between the stakeholders.

Payment from: _____ Payment to: _____

Payment from: _____ Payment to: _____

Payment from: _____ Payment to: _____

Payment from: _____ Payment to: _____

Payment from: _____ Payment to: _____

Payment from: _____ Payment to: _____

Payment from: _____ Payment to: _____

Draw the current financial flow model of your case study.

Financial Flow Model

How would you improve the financial flow model?

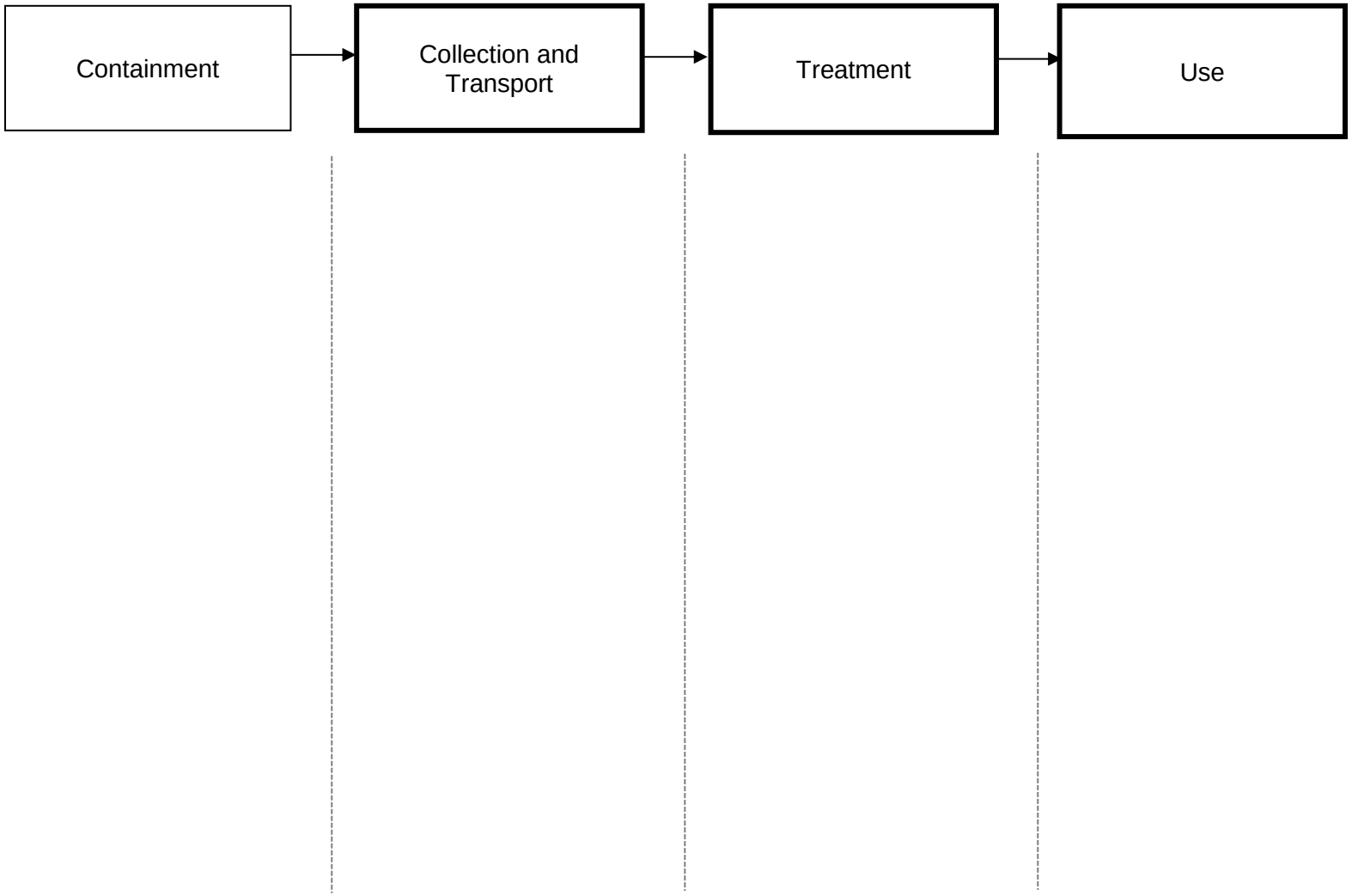
9 Legal Framework

List the existing laws and regulations that are provided in the case study:

Identify the key challenges in the legal framework (for example, gaps, implementation of the policies):

10 Sanitation Service Chain

Explain the sanitation service chain from your case study with your recommendations. Use this as a tool to present your case study discussion and recommendations to the large group.

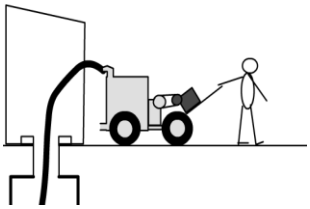
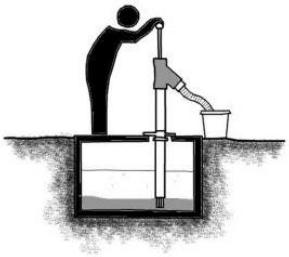
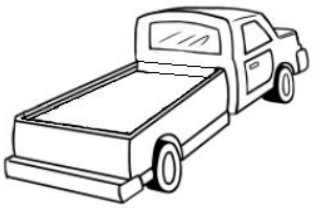
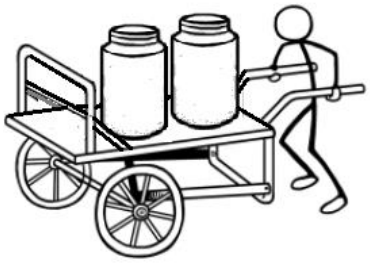


11 Technology Cards

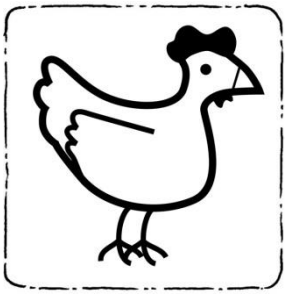
Containment

Pit Latrine  (Credit: AKVO)	Ventilated Improved Pit (VIP) Latrine  (Credit: AKVO)	Composting Chamber  (Credit: modified from AKVO)
Holding Tank  (Credit: AKVO)	Septic Tank  (Credit: AKVO)	Aqua Privy  (Credit: AKVO)
Dehydrating Chamber  (Credit: AKVO)	Removable Container  (Credit: modified from AKVO)	Other

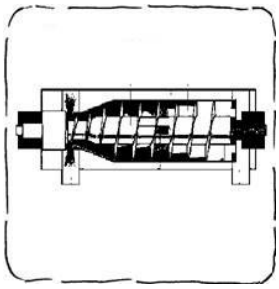
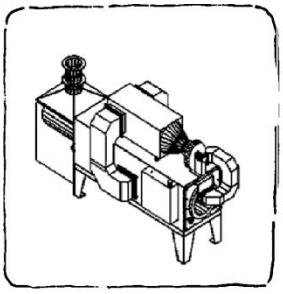
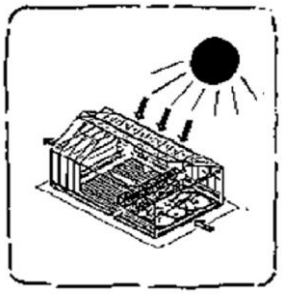
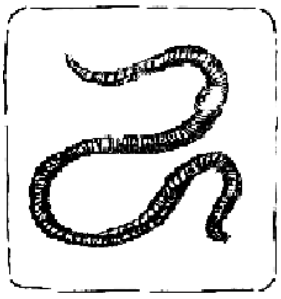
Collection and Transport

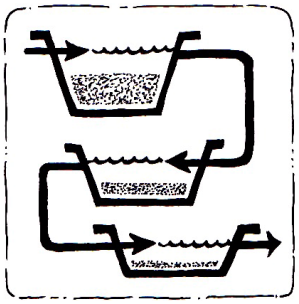
Vacuum Truck  (Credit: AKVO)	Small Motorized Pump  (Credit: UN-Habitat)	Manually Operated Pump  (Credit: SSWM)
Manual Emptying  (Credit: modified from AKVO)	Motorized Transportation 	Human-Powered Transportation 
Other	Other	Other

Use

Energy (solid fuel and gas)  (Credit: AKVO) 	Agriculture, horticulture  (Credit: AKVO)	Aquaculture  (Credit: AKVO)
Irrigation  (Credit: AKVO)	Livestock feed 	Forestry 
Construction (building materials) 	Other	Other

Treatment

Settling-thickening  (Credit: AKVO)	Unplanted drying beds  (Credit: AKVO)	Planted drying Beds  (Credit: AKVO)
Mechanical Dewatering 	Pelletizing 	Thermal drying 
Co-composting  (Credit: AKVO)	Incineration 	Anaerobic digestion  (Credit: AKVO)
Black soldier fly larvae 	Vermicomposting 	Storage 

Alkaline treatment 	Co-treatment with wastewater  (Credit: AKVO)	Deep row entrenchment  (Credit: Modified AKVO)
Ammonia treatment 	Other	Other

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Introduction to Faecal Sludge Management

Appendix 4: Case Studies

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Faecal Sludge Management Case Study: Kampala, Uganda

You work for the National Water & Sewerage Corporation (NWSC). You have been asked to propose treatment technologies for a new faecal sludge treatment facility located in the Nalukolongo area in Kampala, Uganda. The population is 200,000 people (see Figure 2). Kampala is one of the most forward thinking cities implementing faecal sludge management. They hope to continue that tradition with the new treatment facility in the Nalukolongo area.

Note: This case study is based on actual conditions in Kampala; however, some information has been changed for this workshop.

City Profile

Kampala is the capital of Uganda, in East Africa. The city has a population of 1.7 million people. A picture of a typical urban, poor neighborhood in Kampala is shown in Figure 1. Kampala was constructed around seven hills. Areas of the city in the valleys between hills have a high groundwater level with seasonal flooding, especially in the rainy season (March-May; October-December). Despite the hills, most of Kampala has a reliable water supply. Soil conditions in Kampala are very variable.

Figure 1: Urban poor neighborhood in Rubaga district, Kampala

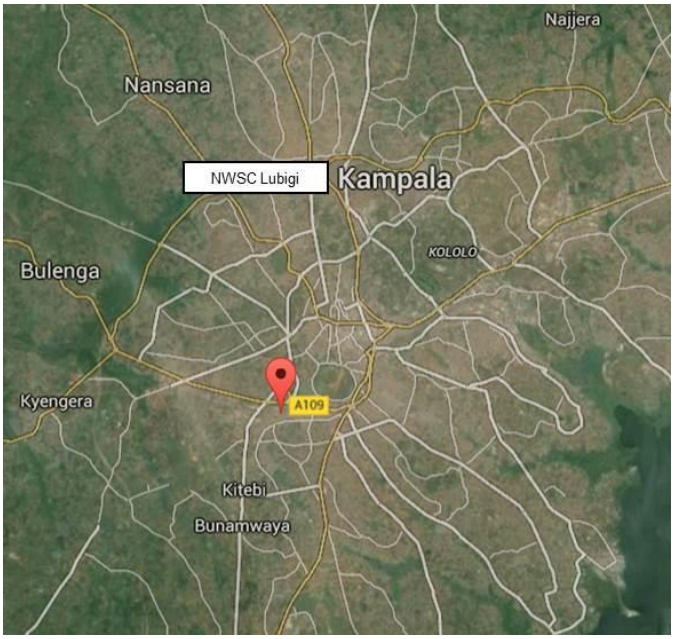

Figure 2: Nalakulongo (labelled with red tag) is located in the south-west of Kampala

Economic Profile

Kampala region is also the economic hub of Uganda. Economic details of the Kampala region are included in Table 1.

Table 1: Economic details of Kampala region

Energy
- Charcoal is the major cooking fuel for households and institutions. Two small companies are producing chardust briquettes from agricultural waste as an alternative to wood-based charcoal.
- Electricity demand is more than electricity generation.

Food production
- Kampala region has numerous poultry, fish, and cattle farms.
- Kampala is surrounded by agricultural areas including tea, bananas, cassava and sweet potatoes. Most are smallholder farms largely utilizing manual labour.

Building materials
- There are several large-scale brick production companies. These use coffee husk and other solid biofuels to meet their energy demand.
- A cement company is located 200 km south of Kampala.
- Both in brick and cement production, biofuels demands around Kampala are > 30 tons/day. Biofuels are fed automatically into the kilns.

Sanitation Profile

In Kampala, the sanitation needs of 94% of the population are met by on-site sanitation technologies (70% pit latrines, 28% septic tanks, 3% public toilets).
In the Nalukolongo area, septic tanks provide sanitation for residents with a medium to high income. Similar to public toilets, the septic tanks are connected to the water supply, fully lined and well-managed. Faecal sludge is collected and transported regularly. Septic tanks are also frequently connected to the kitchen and bathroom. In contrast, pit latrines meet the sanitation needs of the informal areas of Nalukolongo, which account for 60% of the population. These informal areas have poor accessibility and sanitation infrastructure (including solid waste management). They are also affected by seasonal flooding. Half of the pit latrines in the Nalukolongo area are unlined. (Some people line a pit with bricks, blocks or stones to prevent the pit from collapsing. Unlined pits may collapse, depending on the soil type.)

Legal Framework

In Uganda, sanitation legislation and regulation falls under three ministries:

- The Ministry of Water and Environment (MoWE): Responsible for sanitation policies and regulation.
- The Ministry of Health (MOH): Responsible for household sanitation and sanitation promotion.
- The Ministry of Education and Sports (MoES): Responsible for the construction and management of school sanitation.

Policies issued by the ministries are implemented by other government authorities, including:

- Kampala Capital City Authority (KCCA): Responsible for providing faecal sludge collection and transport services.
- National Water & Sewerage Corporation (NWSC): Responsible for faecal sludge treatment (in addition to providing water and sewerage services).
- National Environmental Management Authority (NEMA): Responsible for licensing and monitoring faecal sludge collection, transport, and treatment.

Collection and Transport

In Kampala, faecal sludge is mostly collected by vacuum trucks. Five vacuum trucks are operated by KCCA which only collect faecal sludge from institutions such as schools, prisons and police stations. Other service providers include about 60 privately-operated vacuum trucks. All of the trucks belong to two different professional associations called the Kampala Private Emptiers Association (KPEA) and Private Emptiers Association (PEA).

In recent years, the nongovernmental organization (NGO) Water for People has made many efforts in improving sanitation in Kampala. Water for People helped established around six Gulper entrepreneurs which can collect thick faecal sludge from areas with limited road access. Gulper entrepreneurs transport faecal sludge on pickup trucks and tricycles.

Challenges of faecal sludge collection include heavy traffic, large distance between treatment facilities, lack of quality spare parts, and formally recognizing the service (such as, licensing). Current research at the Makerere University in Kampala aims to provide adequate solutions for some of these collection and transport challenges.

Figure 3: Gulper entrepreneur

Figure 4: Stakeholder meeting at NWSC

Treatment and Use

Currently about 600 m^3 of faecal sludge is collected each day. The faecal sludge is treated at the Lubigi facility in the north of the city (see Figure 2). The treatment facility is operated by NWSC and they charge a discharge fee. The Lubigi facility was designed by a private engineering company and funded by an international development bank. The development bank is contributing to the construction of more faecal sludge treatment facilities in the coming years.

All of the treated faecal sludge is currently sold for 8 USD/ton to farmers as a soil conditioner in agriculture. The price is low compared to the price of protein or biofuel. It appears that there is high demand for soil conditioner, even though monitoring (for example, pathogens, heavy metals) of the treated sludge quality is minimal.

Faecal Sludge Management Case Study: Khulna, Bangladesh

You work for a nongovernmental organization (NGO) in Khulna, Bangladesh. Faecal sludge management is virtually non-existent. Currently, 100% of the faecal sludge is discharged without adequate treatment into the urban environment. This has significant public and environmental health impacts. You are supporting the Khulna City Corporation (KCC) and Community Development Committee (CDC) to develop a faecal sludge management system. You have been asked to select treatment technologies for a decentralized faecal sludge treatment facility located in Khulna.

Note: This case study is based on actual conditions in Khulna; however, some information has been changed for this workshop.[1]

City Profile

Khulna is located in southwest Bangladesh, in the delta of the Ganges River. The city has a population of 1.5 million people. The rainy season occurs from May to October. Temperatures range between 12° and 35°C. The city has sandy soil with a high infiltration rate and high groundwater levels of less than one metre below the surface. There is a significant risk of groundwater contamination, and most of Khulna's water supply comes from groundwater sources. The city is also affected by climate change and cyclones.

Figure 5: Proposed location of faecal sludge treatment plant in Khulna.

[1] Gunanwan, A., Schoebitz, L., Strande, L. Khulna, Bangladesh: Sanitation service delivery context analysis and mapping of excreta flows along the sanitation service chain and throughout the city. Eawag/Sandec, December 2015

Economic Profile

Khulna is an economic hub in the region. Economic details of the Khulna region are included in Table 1.

Table 2: Economic details of Khulna region.

Energy
▪ In urban Khulna, 84% of the population has access to electricity.
▪ Biomass is the primary cooking fuel, only 6% of the entire population has access to natural gas.
▪ Agricultural residues, animal dung and leaves are often used for cooking in rural areas.
Food production
▪ Economy of the region is mostly agriculture (for example, rice, wheat and barley).
▪ Bangladesh is unable to meet its nutrient requirements for agricultural production. Most fertilizer is imported.
▪ Shrimp and prawn farming is an important industry.
Industries
▪ Jute mills are a major industrial sector. They require large amounts of electricity and solid biofuels.
▪ Several cement industries are located in the region.
▪ About 4,500 small-scale brick kilns are in operation in Bangladesh, consuming large quantities of fuel such as coal, firewood and other biomass.

Sanitation Profile

There is no sewer system in Khulna. The sanitation needs of 90% of the population are met by on-site sanitation technologies (61% septic tanks, 29% pit latrines). The other 10% of the population discharges excreta directly into the environment (such as, “hanging latrines” or two boards suspended over a waterway).
Greywater from the kitchen and bathroom is frequently connected to septic tanks. Soak pits are uncommon and septic tank overflow is usually connected to open drains. It is common to find solid waste in pit latrines. On-site sanitation technologies are frequently flooded due to high groundwater tables. Because of the sandy soil, on-site sanitation technologies are usually lined or semi-lined. (Some people line a pit with bricks, blocks or stones to prevent the pit from collapsing.) Lined systems fill up more quickly and are emptied more frequently.

Legal Framework

In Bangladesh, there are two institutions responsible for sanitation legislation:

- The Ministry of Local Government and Cooperatives (MLGRDC): Responsible for development of water supply and sanitation
- The Local Government Division: Responsible for implementing policies, strategies, plans and regulations, as well as coordination and monitoring

In Khulna, policies issued by these institutions are implemented by other sanitation stakeholders, including:

- Khulna City Corporation (KCC): Responsible for providing basic sanitation services, including faecal sludge management
- Khulna Water Supply and Sewerage Authority (KWASA): Responsible for providing water and sewerage services
- Khulna Development Authority (KDA): Responsible for implementing urban planning agendas (for example, enforcing the building code for constructing septic tanks)
- Community Development Corporation (CDC): Provides some faecal sludge collection services.

Collection and Transport

Faecal sludge is only collected from around 5% of all on-site sanitation technologies. 2% of these systems are emptied mechanically by two vacuum tractors operated by KCC, and three vacutugs operated by the CDC (see Figure and 3). Faecal sludge from the remaining 98% of the systems (if collected) is collected manually by around 150-200 “sweepers”. These service providers use mainly shovels and buckets, without any personal protection equipment (see Figure). Faecal sludge collected by KCC, CDC, and the manual service providers comes from both pit latrines and septic tanks.

Manual services are preferred because the systems are more thoroughly emptied. Septic tanks are very commonly emptied by a group of manual service providers. Even where mechanical equipment is used, manual service providers often empty the denser sludge at the bottom.

Most of the collected faecal sludge (around 100 m^3/day) is discharged untreated into open spaces or water bodies. A key reason for this is the large distance to the legal discharge location in Rajbandh, which is 10 km away from Khulna (see Figure 1). Other challenges include demand for mechanical collection services, low number of mechanical faecal sludge trucks and formalization of faecal sludge collection services (for example, manual faecal sludge collection commonly happens during the night).

Figure 2: Tank with vacuum pump towed by tractor for faecal sludge collection (Credit: Arief Gunawan)

Figure 3: Vacutug for faecal sludge collection (Credit: Arief Gunawan)

Figure 4: Manual faecal sludge collection (Credit: Arief Gunawan)

Treatment and Use

There is no faecal sludge treatment facility in Khulna. Currently, some of the collected faecal sludge is discharged in deep trenches located in Rajbandh next to the sanitary landfill. The trenches do not provide adequate faecal sludge treatment. It is unknown if a discharge fee is being charged when the faecal sludge is discharged. Record keeping is very poor. Currently, very small quantities of untreated faecal sludge are used informally as soil conditioner or for production of biogas. The recently published National Strategy for Water Supply and Sanitation (2014) encourages use of faecal sludge through the sale of compost (soil conditioner) and other potential products.

Your NGO supports a decentralized faecal sludge treatment facility in the peri-urban area of Khulna, to decrease transport distances. Faecal sludge collected by KCC, vacutugs and manual service providers could be discharged at this facility.

Faecal Sludge Management Case Study: Dakar, Senegal

You work at the National Sanitation Utility of Senegal (ONAS) in Dakar, Senegal. You have been asked to propose treatment technologies for the extension of the faecal sludge treatment facility at Cambérène (see location of Cambérène in Figure 1) in Dakar.

Note: This case study is based on actual conditions in Dakar; however, some information has been changed for this workshop.

City Profile

Dakar is the capital of Senegal located in West Africa. The population is 2.5 million people. Dakar is on a peninsula with limited space to expand, and has undergone rapid urbanization. Dakar is semi-arid with two distinct rainy seasons: November to May and July to October. There is seasonal flooding because of poor stormwater management. Temperatures range from 18° to 31°C. Dakar has sandy soils with high infiltration rates. The groundwater level is greater than five metres below the surface.

Figure 1: The location of Cambérène within Dakar. The city centre of Dakar is in Dakar-Plateau.

Economic Profile

The region of Dakar is an important economic hub in West Africa. Selected economic details of the Dakar region are included in Table 1.

Table 3: Economic details of Dakar region

Energy

- Electricity, gas, and charcoal are the main cooking fuels for households and institutions. Charcoal is trucked into Dakar over long distances.
- A cement company is located in Dakar with a biofuel demand of several hundred tons per day. Biofuels are fed automatically into the cement kiln. Other industries use electricity or liquid fuels.

Food production

- Dakar has a considerable amount of urban farming, including sheep, goats and chickens.
- Soils in the area are poor and do not have enough organic material.
- Chicken farmers buy fishmeal as animal feed.
- Farmers of cattle and goats require animal fodder which has a high seasonal variability in supply.

Water

- Water is piped from >200 km to Dakar from the Senegal River in northern Senegal. Therefore, rainwater harvesting and water reclamation is practiced.

Sanitation Profile

In Dakar, the sanitation needs of 70% of the population are met by on-site sanitation systems. These are mostly cistern and pour flush toilets connected to a septic tank. Water supply and solid waste services are reasonably reliable.
Sanitation fees are paid by the household in two ways. Firstly, households pay for faecal sludge collection by private service providers. Secondly, households pay a sanitation tax to ONAS. This sanitation tax is used to support the operation of the faecal sludge treatment facilities (see Treatment and Enduse below).

Legal Framework

In Senegal, sanitation legislation and regulation is mainly under four ministries[2]:

- The Ministry of Hydraulic and Sanitation: Responsible for development of policies in the field of hydraulics and sanitation. Responsible for the supervision of ONAS (see below).
- The Ministry of the Environment and Sustainable Development: Responsible for the compliance of discharge standards.
- The Ministry of Health and Social Action: Responsible for the control of diseases such as cholera and malaria.
- Ministry of Planning and Local Government: Responsible for development of policies in decentralization and local government.
- National Sanitation Utility of Senegal (ONAS) and municipalities: Responsible for providing wastewater and faecal sludge management services

[2] Ndoula, J., Schoebitz, L., Sonko, E. h. M. Strande, L. Bignona, Senegal: Sanitation service delivery context analysis and mapping of excreta flows along the sanitation service chain and throughout the city. Eawag/Sandec March 2016.

Collection and Transport

In Dakar, faecal sludge is collected by private service provides with over 100 vacuum trucks and manually using shovels and buckets. Vacuum truck operators are organized in an association. Most vacuum trucks have been used for more than 10 years and are imported from Europe. Manually collected faecal sludge is frequently dumped close to the house (see Figure). The vacuum trucks transport the faecal sludge for discharge at a treatment facility. There is a strong professional association of vacuum truck drivers, and they have an office within ONAS. Heavy traffic (see Figure), waiting times at treatment facilities, and lack of spare parts to repair the vacuum trucks are challenges of faecal sludge collection and transport.

As part of a project funded by the Bill & Melinda Gates Foundation, ONAS implemented a call centre. This means that household customers call the ONAS call centre to request collection service. ONAS then directs calls to three service providers who make a bid for the price of the collection service. The goal is to help to reduce collection costs and increase service quality and accountability through competition.

Figure 2: Manually faecal sludge collection and dumping in Dakar.

Figure 3: Traffic congestion in Dakar.

Treatment and Use

Currently, service providers collect 1,500 m^3/day of faecal sludge. The faecal sludge is discharged and treated for a discharge fee at three faecal sludge treatment plants located in Cambérène, Rufisque and Niayes. These treatment facilities were previously operated by ONAS, but have been recently contracted to a private company comprising of different vacuum truck operators. The current faecal sludge collection is greater than the treatment capacity. Therefore, the treatment facility at Cambérène needs to be extended to treat more faecal sludge.

Currently, small amounts of treated faecal sludge are sold at a low price to farmers and horticulturists as a soil conditioner or so they can produce compost. The private treatment facility operator would like to increase and formalize large-scale use of faecal sludge as part of the expansion of Cambérène. The goal is to use the income from the sale of the product to partly offset the operating costs of the facility.