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)**

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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

1. 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.
2. Share the lesson description or learning outcomes.

**Option B: Presentation (takes more time)**

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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.*

1. 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.*

1. 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*

1. 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*

1. 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.
2. 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.*

1. Explain that the participants will now identify solutions to these four challenges.
2. 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.

1. 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.
2. 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 |

1. 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.
2. 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.*

1. 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**