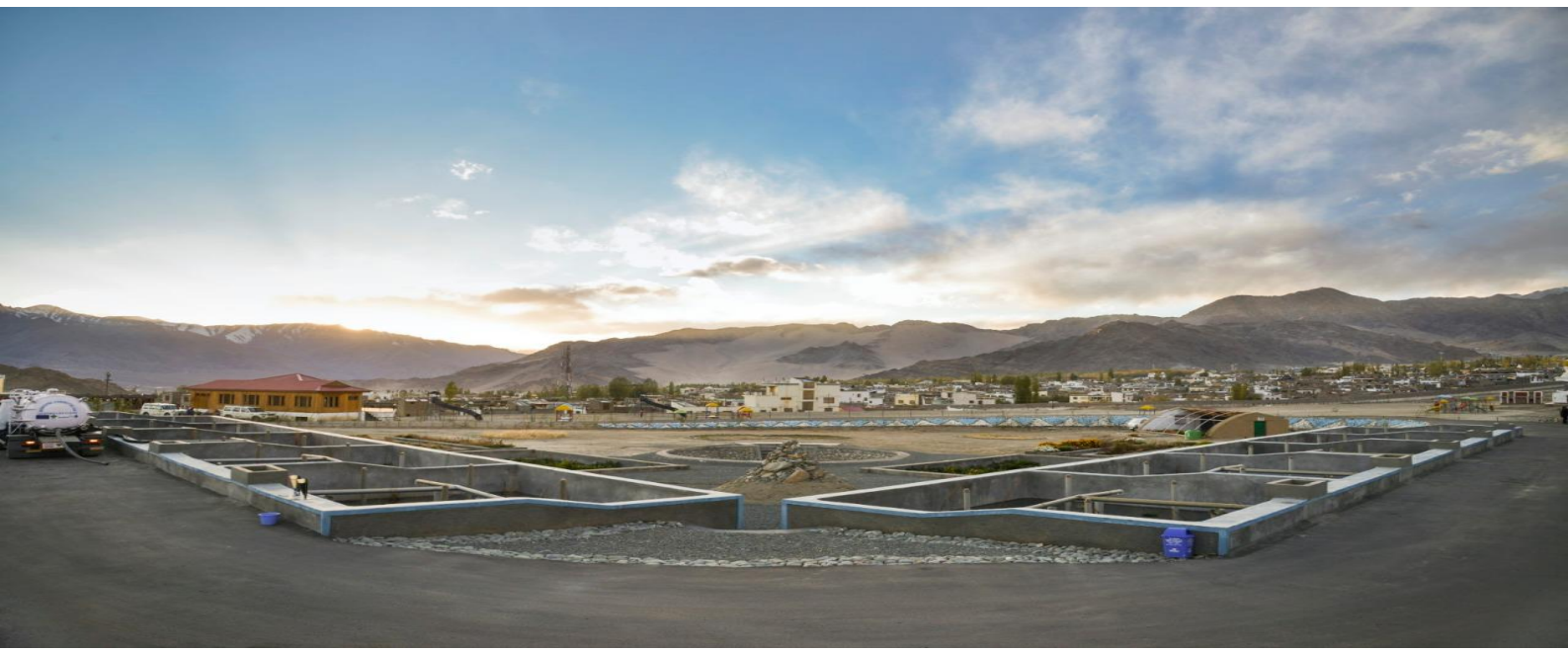
# Operation and Maintenance Manual for Faecal Sludge Treatment Plant - Planted Drying Beds based systems



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# 1. Introduction

## 1.1 Background

Faecal sludge management (FSM) is rapidly developing and gaining acknowledgement across whole world these days making it as one of the economical and sustainable solution for the sanitation problems of the world.

In most of the nature based Faecal Sludge Treatment Plants (FSTP) in India, ease of construction, capital cost and reuse infrastructure is taken in consideration in great significant in order to ensure a holistic approach to environmental sanitation. However, one should remember that a FSTP that is operated and maintained efficiently has the potential to be productive and lasts long. Operation and Maintenance (O&M) tasks becomes crucial once the plant is commissioned and is observed from the past experiences that the performance of treatment plant directly depends upon how well and regularly it is operated and maintained. The day-to-day operational tasks are adopted for smooth functioning and upkeep of treatment plant and these tasks are simple which requires basic training.

This Manual is intended for use by the operators/caretakers and maintenance personnel, to facilitate them to carry out the routine specific tasks. This Manual has been prepared focusing on the detailed operation and maintenance related activities that needs to be carried out to ensure effective and efficient performance of all the different treatment infrastructure that are present in the FSTP.

**Operational** tasks are referred to those activities which are required to run/ operate the FSTP as well as the correct handling and usage of facilities by the operator/caretaker. **Maintenance** on the other hand, comprises of planned and regular activities which are needed to keep the FSTP working. Maintenance activities will require skills, tools and spare parts. This document focuses mainly on maintenance aspect and highlights only specific operational issues which affects the smooth operation of FSTP.

This manual was thus developed to provide the operator with a better understanding of the 3 W's and 1 H (Where, When, Why and How) of Operation and Maintenance of FSTP for its successful functioning. The 3 W's are specifically:

- **What** activities need to be carried out and the detailed process description
- **When** to schedule the activities
- **Where** to conduct the activities (pertaining to the treatment modules)

## 1.2 Objective

The main objective of this manual is to be used as a reference document by a person or entity responsible for operation and maintenance of the FSTP in order to

- Carry out tasks related to operation and maintenance for up keeping the FSTP
- Transfer knowledge about the functioning of different component of FSTP to the operators and users
- Ensure compliance of FSPT with effluent standards for safe reuse or disposal of treated wastewater

- Save time and cost by minimizing instances of system breakdowns and while troubleshooting to ensure long-term-functionality of treatment modules.

## 1.3 Content

This Manual contains operation and maintenance process descriptions for the suggested technical solutions for the different components of faecal sludge treatment that is adopted at Sircilla. It includes guidelines and suggestions on:

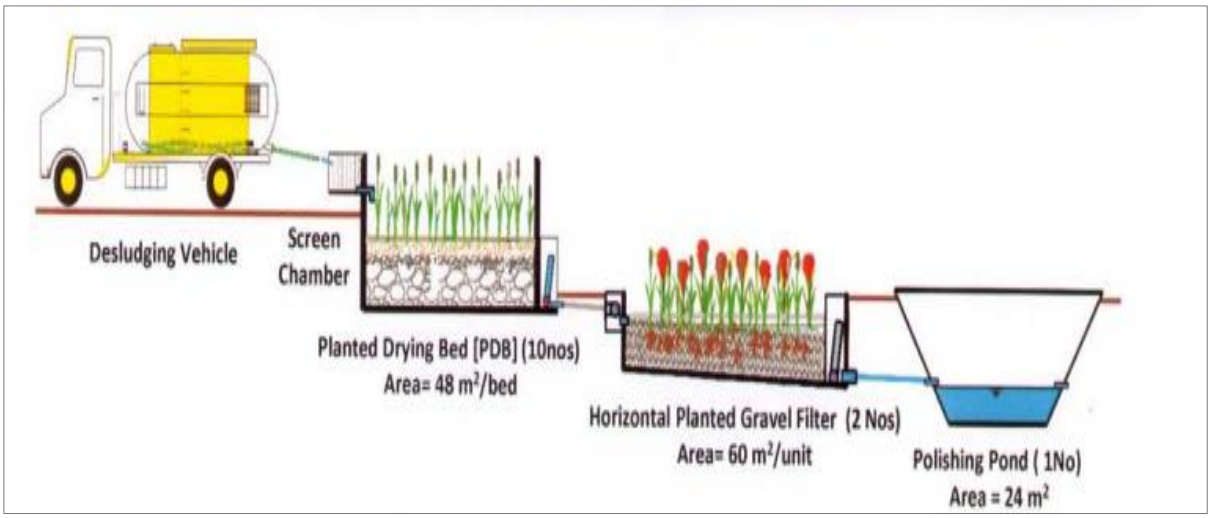
a. Brief Introduction of treatment units
b. Regular and periodical maintenance activities
c. Safety rules
d. Activity schedules for operation and maintenance tasks

## 1.4 Target Users

This Manual has been written for the person(s) responsible for or involved in the upkeep of systems provided. These may include Engineers and Operators of the FSTP at Leh.

# 2. Overview of FSTP-

Figure 1: Showing the treatment overview.




## 2.1 Pre-treatment

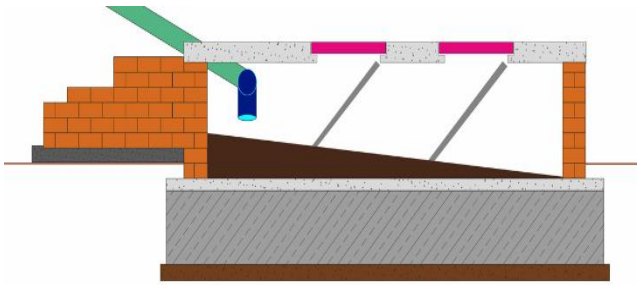


Figure 2: Screening chamber

The desludging truck carrying FS will be directed to a receiving station inside the treatment facility. FS receiving station consists of pre-treatment facility with screening chamber, where the discharged FS is screened so that large and inorganic solid wastes are trapped in this using a vertical screen. The solid waste that are screened in this chamber is removed regularly and dumped along with municipal solid waste into a landfill arrangement made by the municipality.

## 2.2 Planted sludge drying beds

A planted sludge drying bed is a simple, permeable bed filled with several drainage layers that, when loaded with sludge, collects percolated leachate and allows the sludge to dry by percolation and evapo-transpiration.
Approximately 60% to 80% of the sludge volume drains off as liquid or evaporates.

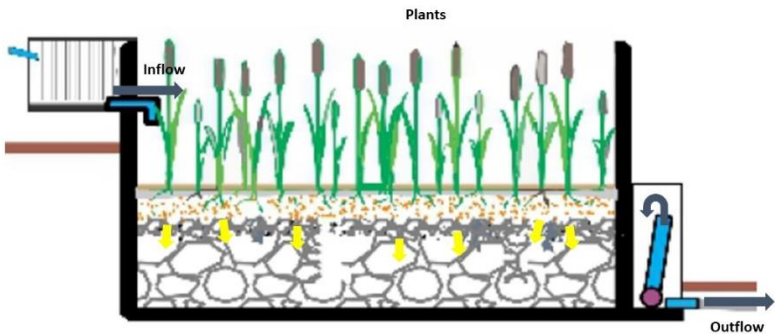



Figure 3: Planted sludge drying beds

The sludge, however, needs to be further stabilized or sanitized. Additional treatment by composting may be foreseen for the dried sludge before it can be safely disposed or used as a nutrient-rich soil amendment in agriculture. The percolate still contains pathogens and needs to be treated further before discharge into open environment. Fresh sludge can be directly applied on to the previous layer only until the

prescribed overall sludge height of 700 mm is reached. The plants, in addition to transpiration provide a degree of stabilization to the sludge. The drying beds are relatively easy to construct and simple to maintain. Canna indica, Cyperus papyrus and Colocasia are some of the plants that can be used for planting in the beds.

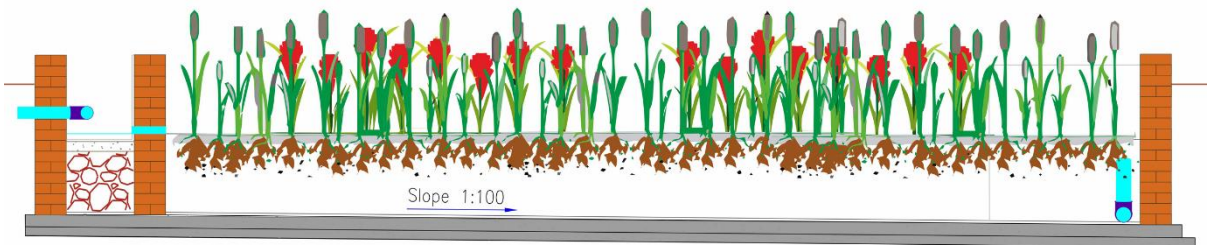



Figure 4: Planted gravel filter

Further, the liquid is subjected to aerobic treatment in a horizontal planted gravel filter. Here nutrients like ammonia and phosphate present in the liquid is removed along with colour and odour that is present in the liquid.

### 2.3 Polishing Pond

Polishing is the tertiary and final effluent wastewater treatment stage before the wastewater can eventually be discharged into natural water bodies. Polishing process involves removal of remaining suspended solids and biological oxygen demand (BOD) that may be left after secondary effluent treatment. Treated liquid will have no colour, smell and solids in it

# 3. Daily Operations

The treatment plant is designed to handle only faecal sludge and not chemical or industrial waste of any kind. To ensure that the FSTP runs at its full capacity without adversely impacting the performance of the plant in the long run it is essential to perform some checks and daily operations. In this section, day- to- day operational activities with respect to each treatment modules are listed.

## 3.1 Receiving station

**Task 1: Co-ordination with the Desludging Operator**

1. Operator/ engineer in-charge of FSTP should co-ordinate with the desludging operator on the arrival of FS to the plant
2. Prepare the plant to receive the FS

**Task 2: Data collection**

1. Operator/ engineer in-charge of FSTP should collect the following data. These data to be entered in a plant register:
    a. Date
    b. Load number
    c. Operator (private/ government)
    d. Source of sludge

   e. Time of arrival (hh:mm)
   f. Time of departure (hh:mm)
   g. pH
   h. Temperature (ºC)
   i. Imoff cone value (ml)
2. Collect the sample from outlet of the truck in a jar
3. Check for pH and colour of the collected sample
   a. pH: 6.5- 8
   b. Colour: dark black, grey, brownish, brownish- black, greenish- black, yellowish-black
4. If the pH and colour of FS is within the above-mentioned range and colour, allow FS into the screening chamber. If not reject the load.

**Task 3: Decanting**

Outlet of the desludging truck should be connected to the inlet of the screening chamber through a flexible pipe and FS to be released into the pre-treatment module.

## 3.2 Screening chamber

**Task 1: Cleaning of screens**

Cleaning of screens in important to avoid clogging and overflow from the chamber. Following are the steps for cleaning:

1. Open the manhole covers of screening chamber and collect the solids accumulated at screens. Trowel/ hand rake should be used to collect the trash into a basket and transfer it to large trash bins
2. Ensure solids do not spill outside the chamber
3. Clean the bars using water and broom and close the manholes with covers
4. Following are the equipment's to be used:
   a. Trowel/ hand rake
   b. Basket
   c. Personnel protective equipment (gloves, mask, shoes, etc.)
5. Following precautions needs to be taken:
   a. Operators should follow the safety rules before performing the tasks mentioned in chapter 6
   b. The waste collected from screening chamber to be disposed at a municipal solid waste collection facility

Figure 5: Showing cleaning of screens

## 3.3 Planted sludge drying bed

Water level in planted sludge drying beds is regulated by an outlet mechanism called as swivel pipe. If water is retained more than required, it may flood the treatment module and if less, then the plants will not survive. To ensure enough water is retained in the module, swivel pipe should be aligned at the right angle and height. Hence it is necessary to check the swivel pipe on daily or alternate day basis to ensure the hassle-free operations. Following are the steps to be followed to carry out this task:

1. Open the manhole cover of the outlet chamber
2. Check if the swivel pipe top is at 60-80 cm from the bottom of the outlet chamber
3. If the swivel pipe top is not at the desired level, lower or raise it until the top of the swivel pipe is at required level from the bottom of the outlet chamber
4. If there is no water flow from top of the swivel pipe, check for leakage at the swivel pipe joint at the bottom
5. Following are the equipment's to be used:
    a. Measuring tape
    b. Personnel protective equipment (gloves, mask, shoes, etc.)
6. Following precautions needs to be taken:
    a. Operators should follow the safety rules before performing the tasks mentioned in chapter 6

## 3.4 Planted gravel filter

**Task 1: Check swivel pipe level**

Water level in planted gravel filter is regulated by an outlet mechanism called as swivel pipe. If water is retained more than required, it may flood the treatment module and if less, then the plants will not survive. To ensure enough water is retained in the module, swivel pipe should be aligned at the right angle and height. Hence it is necessary to check the swivel pipe on daily or alternate day basis to ensure the hassle-free operations. Following are the steps to be followed to carry out this task:

1. Open the manhole cover of the outlet chamber
2. Check if the swivel pipe top is at 50cm from the bottom of the outlet chamber
3. If the swivel pipe top is not at the desired level, lower or raise it until the top of the swivel pipe is 50cm from the bottom of the outlet chamber
4. If there is no water flow from top of the swivel pipe, check for leakage at the swivel pipe joint at the bottom

5. Following are the equipment's to be used:
    a. Measuring tape
    b. Personnel protective equipment (gloves, mask, shoes, etc.)
7. Following precautions needs to be taken:
    a. Operators should follow the safety rules before performing the tasks mentioned in chapter 6

## 3.5 Polishing Pond

**Operating the pumps**

Water pumps are used in one place in post treatment module. To ensure there is no back flow or overflow of treated wastewater and further not to have foul smell due to stagnation of water in the tanks, it needs to be pumped regularly either to reuse or dispose. Following are the steps to follow:

1. Operate the pumps as per the instruction from the vendor
2. Following are the equipment's to be used:
    a. Personnel protective equipment (gloves, mask, shoes, etc.)
3. Following precautions needs to be taken:
    a. Operators should follow the safety rules before performing the tasks mentioned in chapter 6

# 4. Regular/ Periodical Maintenance Tasks

Apart from the daily operational activities, there are several maintenance activities that needs to be carried out for smooth functioning of the FSTP. In this chapter all the maintenance tasks related to all the treatment modules are listed down.

## 4.1 Screen Chamber

**Maintenance Task 1- Repaint/ replacement of screens:**

Once in 3-4 years or whenever the screens are corroded and not in a condition to use, it should be repainted or replaced. Following are the steps involved in the activity:

1. Remove the screens
2. Wash the screen using fresh water
3. Paint the screens with anticorrosive paints/ Replace with new ones as per drawings
4. Fix back the screens in the same position
5. Close the manholes with cover
6. If screen plate is highly corroded, replace entire plate with new one
7. Following are the equipment's to be used:
    a. Paint brush
    b. Paint
    c. Water pipe
    d. Personnel protective equipment (gloves, mask, shoes, etc.)
8. Following precautions needs to be taken:
    a. Operators should follow the safety rules before performing the tasks mentioned in chapter 6
    b. While cleaning the screening chamber, ensure that no sludge is entering into the screening chamber

## 4.2 Planted Sludge Drying Bed

**Maintenance Task 1: removal of dried sludge**

Once the sludge in beds are dried enough as per the design time (5 Years) , then the dried bio-solids are supposed to be removed and stored in the sludge storage house for further treatment or endues. Following are the steps involved in removing the dried sludge from drying beds:

1. Remove the dry sludge by hand wearing gloves and by trowel. Collect it in a plastic basket and transfer it to a wheel barrow and trailer.
2. Transport the dried solids using wheel borrows and trailer to the sludge storage house
3. Get the wheel borrows and trailer back to the drying bed
4. Perform steps 1 and 2 until the bed is completely emptied (08-1 m depth)
5. Following are the equipment's to be used:
    a. Trowel
    b. Plastic basket
    c. Wheel borrows and trailer
    d. Personnel protective equipment (gloves, mask, shoes, etc.)
6. Following precautions needs to be taken:
    a. Operators should follow the safety rules before performing the tasks mentioned in chapter 6

During the removal of last layer of the sludge, operator must be careful of not removing the dried sludge along with the sand.

**Maintenance Task 2 - Weed removal and trimming of plants.**

When the plants in the drying beds is overcrowded, dried leaves will fall over the filter media which will not be visible. Further to make sunlight fall on the sludge layer, drying beds look aesthetically good, plants in the beds needs to be trimmed once in a month or whenever there is an excess growth. Following are the steps involved in carrying out the activity:

1. If plants in beds has grown excessively and blocking the sunlight trim them
2. Following are the equipment's to be used:
    a. Garden scissors
    b. Stick
    c. Garden rake
    d. Plastic basket
    e. Personnel protective equipment (gloves, mask, shoes, etc.)
3. Following precautions needs to be taken:
    a. Operators should follow the safety rules before performing the tasks mentioned in chapter 6
    b. Ensure there are no rodents/snakes/spiders/ants present in the drying beds.

**Maintenance Task 3- Replacing of filter material**

Filter material plays a key role in the treatment of FS in the drying beds. Over a period of 5-6 years, it can be observed that the filter material will be chocked with solids that comes with FS which will result in inefficient treatment. In general it is recommended to replace with new filter material, however one can choose to remove the existing filter material, wash and restore them. Following are the steps involved in carrying out the activity:

1. Take out all the sludge if any remaining as mentioned in section 3.4, task-1
2. Remove the sand layer from the bed using shovel and transported to disposed safely or stored in a safe place on a plastic sheet for washing and reusing
3. The sand used for replacing filter media should be free from silt and clay
4. Remove rest of the filter media and store them separately on a plastic sheet as per their grade if it needs to be washed. Transport the filter material, if it has to be disposed off
5. Washed material should be placed back as per the drawing provide by the consultant
6. Once ensuring sand is free from silt and clay, should be placed on drying beds to 150 mm thickness
7. Following are the equipment's to be used:
    a. Shovel
    b. Plastic sheet
    c. Fresh water or treated water from final collection tank
    d. Personnel protective equipment (gloves, mask, shoes, etc.)
8. Following precautions needs to be taken:
    a. Operators should follow the safety rules before performing the tasks mentioned in chapter 6

## 4.3 Horizontal Planted Gravel Filter

**Maintenance Task 1 - Weed removal and trimming of plants.**

When the plants in the PGF is overcrowded, dried leaves will fall over the filter media which will not be visible. These dried litter will rot over the media and clog the water flow in them. Further to make sunlight fall on the filter media, PGF look aesthetically good, plants in the PGF needs to be trimmed once in a month or whenever there is an excess growth. Following are the steps involved in carrying out the activity:

Figure 6 : Picture showing trimming of plants in HPGF

4. Check for presence of dead leaf litter or/and weed inside the horizontal planted gravel filter
5. If the dead leaf litter or other litter is present, remove it manually or using an appropriate tool
6. If plants in HPGF has grown excessively and blocking the sunlight trim them
7. Following are the equipment's to be used:
   f. Garden scissors
   g. Stick
   h. Garden rake
   i. Plastic basket
   j. Personnel protective equipment (gloves, mask, shoes, etc.)
8. Following precautions needs to be taken:
   c. Operators should follow the safety rules before performing the tasks mentioned in chapter 6
   d. Ensure there are no rodents/snakes/spiders/ants present in the HPGF.

**Maintenance Task 2- Cleaning of filter media**

Filter material plays a key role in this treatment module. Over a period of 5-6 years, it can be observed that the filter material will be chocked with solids that comes with FS which will result in inefficient treatment. In general it is recommended to replace with new filter material, however one can choose to remove the existing filter material, wash and restore them. Following are the steps involved in carrying out the activity:

1. Block the inlet and outlet of the PGF
2. Remove the large filter media that is present at the inlet, outlet and at the centre of the PGF
3. Wash the large media using wire brush and store them separately

4. Remove the filter media from inlet side of the PGF and store them separately on a plastic sheet as per their grade for washing
5. Flood the PGF with water
6. Arrange the large media at the inlet of the PGF
7. Use fresh water or treated wastewater to wash the filter media
8. Shift the media from outlet side of the PGF to inlet side using shovel by simultaneously washing
9. Arrange the large media at the centre of the PGF
10. Shift the washed media that was stored outside the PGF into outlet side of the PGF
11. Empty the water from the PGF which is dirty after washing
12. Allow the wastewater from AF to flow into the PGF
13. Following are the equipment's to be used:
    a. Shovel
    b. Plastic sheet
    c. Wire brush
    d. Fresh water or treated water from final collection tank
    e. Personnel protective equipment (gloves, mask, shoes, etc.)
14. Following precautions needs to be taken:
    a. Operators should follow the safety rules before performing the tasks mentioned in chapter 6

## 4.4 General Tasks

**Maintenance Task 1- Checking and replacement of broken pipes**

All the plumbing arrangements including the inter connection of the treatment module needs to be checked for any leakages. This will avoid any clogging or foul smell around the treatment module and will ensure smooth functioning of FSTP. Following are the steps to be followed:

1. Check for the any damaged/broken pipes. This can be visually identified with any leakages or smell.
2. If there are any pipes broken bring this notice to supervisor or whoever in charge.
3. Replace the damaged pipe with new pipe of same diameter and specification.
4. Follow the drawings in fixing important pipes.

**Maintenance Task 2- Checking and fixing of damaged structure**

Since most of the treatment modules are onsite constructed modules, some of them can accidentally get damaged while operations. Hence the modules should be checked for any physical damages once in a month. Following are the steps to be followed:

1. Check for the any damaged structure. This can be visually identified with any leakages or smell.
2. If there are any structures damaged bring this notice to the plant engineer or whoever is in-charge.
3. Fix the damage as soon as possible

# 5. Emergency Response Procedures

Improperly treated faecal sludge carries infections bacteria, viruses, parasites and toxic chemicals. Human contact with raw or improperly treated sewage can lead to serious health problems. If the FSTP works as designed then there is a reduced risk to public health or environment, however during emergencies, there can be increased risks. The purpose of this section is to minimize the potentially damaging effects of spills, valve failure, leakages in the system. This section details out the types and level of emergencies and the specific responses for each. These are usually out of the ordinary event and not part of the day to day operations of the FSTP.

**Emergencies that can occur at the FSTP**

- Spillage from the desludging truck
- Valve breakdown
- Overflow from any treatment module

**These have been detailed out in the following section:**

## 5.1 Spillage from truck

Spillage is due to failure of outlet valve of desludging vehicle or wrong operation of outlet valve of the desludging vehicle. Following could be reasons how this is happening:

1. Damage of the desludging vehicle's outlet valve during feeding
2. Desludging vehicle outlet valve stuck in open position during feeding
3. Spillage from the hose pipe used for feeding of faecal sludge

Emergency response could be:

1. Desludging vehicle operator should close the outlet valve according to their standard operations
2. If the above step does not work, connect the hose pipe of the desludging vehicle to the inlet pipe of the SC so that the sludge is bypassed to the FSTP
3. To clean the spilled sludge, pour soil over the sludge or disinfect it with bleaching powder. Leave it for at least 2 hours and then clean it with water

## 5.2 Valve breakdown

Valve breakdown is due to Failure of outlet valve of desludging vehicle or wrong operation of outlet valve of the desludging vehicle. Following could be reasons how this is happening:

1. Failure of valve may happen due to solid waste/ debris stuck at the valve's opening
2. Damage to the valve may also happen due to wrong operations of the valve by the operator and turning the valves in the wrong direction forcefully.

Following are the emergency responses:

1. FS has spilled near the valve, clean the spilled sludge performing the following steps.
2. Pour soil over the sludge. Leave it for at least 2 hours.
3. Using the shovel collect all the soil mixed with sludge in a plastic bowl.
4. Dispose this sludge in the SDB.
5. Report the problem to the TMC.
6. Repair or replace the valve if necessary

## 5.3 Overflow of water from any treatment module

This can occur at the module outlet or the inlet of the next downstream module is clogged. This can happen due to excessive accumulated scum or sludge as well as debris blocking the pipes or modules. Crushed or frozen modules or damage in the pipes connecting the various modules or excessive inflow of water into the module due to flooding may also be responsible for this kind of issue. Emergency response could be:

1. Stop the flow into the module immediately if any
2. Clear the blockage in the pipes using the iron bar and pumped water. Insert the iron bar in the outlet pipe of the module and force the pumped water
3. Check if any debris is stuck in between outlet of the module and inlet of downstream module. If found, try to push it to the next module using the iron bar and collect the debris from the inlet of downstream module
4. Check for damage/ crushing of pipe. Fix them for smooth functioning of FSTP

## 5.4 Solids moving into HPGF from AF

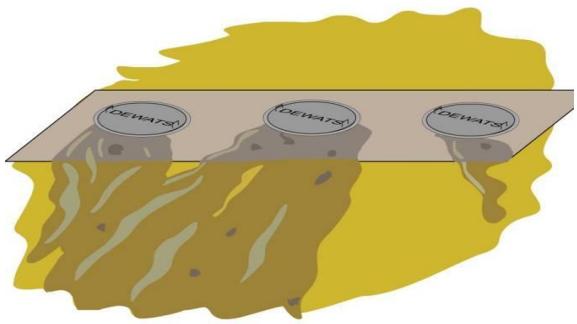
Since the percolate of drying beds come with high solids content, ABR and AF may be inefficient in its removal. This can also occur Due to high inflow rate into IS from SDB solids in the IS chambers may move with the water into the HPGF and not desludging the IS chambers on time as prescribed in the maintenance plan. During this situation, follow the instruction from Chapter 4, section 4.6, task-2

## 5.5 Emergencies by Symptoms of the System

These emergencies are usually the result of inappropriate operation like excessive inflow to the system, Improper desludging, but can also be symptoms of external influences like earthquakes, Tsunami, heavy rain.

**Emergency-1: Overflow of a wastewater from system**

Figure 7: Wastewater Overflow



Overflow of wastewater from the modules will occur if the outlet is clogged or any intrusion of water into the module. Clogging can happen due to garbage being flushed, excessive accumulated scum or sludge as well as debris blocking the pipes or modules. Further, crushed or frozen modules/ pipes or excessive inflow of water into the module due to flooding may also be responsible for this kind of issue. Maintenance action to be taken up immediately is desludging the excess water by pumping it out of the FSTP or into the drying beds

**Emergency-2: No or very little wastewater inflow to a module**

This can occur when the module inlet or the upstream module is clogged. Clogging can happen due to garbage entering the system, excessive accumulated scum or sludge as well as debris blocking the pipes or modules. Crushed or frozen modules/pipes may also be responsible for this kind of issue. Check if wastewater is produced at the sources. Check the inlet pipe for obstructions.

**Emergency-3: Bad odour emanating from one or more module(s)**

This can occur due to the damaged or blocked vent pipe which releases biogas and odour in a noticeable way. Accumulated scum or garbage may also release a bad smell. This can happen due to garbage being entered into the system or excessive accumulated scum. External influences may damage the vent pipes such as birds, insects or other things may obstruct the vent pipes. To solve issues with bad odour, perform the task “Ensuring functionality of the Vent pipes” at all the modules mentioned in chapter 3, section 3.7, task-2

# 6. Safety Measures

This section gives a brief detail about the basic Do's and Don'ts in relation to the safety measures which needs to be taken while performing the O&M related activities.

a. **General Site Safety**
   - **Do** be careful and observant at all times
   - **Do** ensure manholes are suitably covered or supervised when no operation and maintenance activity is being performed.
   - **Don't** leave open chambers unattended

b. **Personal Safety Precautions**
   - **Do** wash your hands and disinfect them after completion of tasks. Find a clean space away from the system to eat and drink.
   - **Do** use proper clothing (long sleeved shirt, long trousers, shoes and gloves, apron, mask) while maintaining the system.
   - **Do** keep a first aid kit, lime or concentration of chlorine solution, hand wash and hand sanitizer, spare gloves, masks should always be kept in the vehicle/ treatment plant
   - **Do** properly protect wounds from getting in contact with wastewater.
   - **Do** wash clothes, gloves and boots after conducting the activity. The maintenance provider should change into off-duty clothes on completion of desludging and wash and disinfect the clothes used while desludging before the next use.
   - **Do** avoid coming in contact with the wastewater.
   - **Do** Keep yourself hydrated when working inside the sludge pasteurization unit
   - **Don't** be barefoot or bare handed while handling sludge and performing the O&M activities
   - **Don't** eat or drink during work.

c. **Proper Disposal of waste**
   - **Do** put the waste like scum, used gloves, masks and paper towels in suitable garbage bags.
   - **Do** ensure that the waste from the operation and maintenance tasks are collected at least 10 meters away from any wells or other water bodies, so that it cannot leach into the ground and water.
   - **Do** ensure that the garbage cannot be ransacked by animals.
   - **Do** bring the garbage from operation and maintenance tasks to an official collection facility, where it is disposed of in a safe way.
   - **Don't** wait longer than necessary to dispose of garbage.
   - In case there is a spillage, the spill has to be cleaned by the operator either by sucking up the spill by the vacuum pump into the tank or if that is not possible to cover it with lime. In case that is not possible, then the spill should be washed and the wash water should be directed to a covered drain and chlorine should be sprayed on the spill area.
   - **Don't** dispose garbage at unofficial dumping locations.
   - **Don't** burn garbage to get rid of it.

## 6.1 Site Precautions

1. Materials and supplies used at a plant site should be stored in a neat and orderly manner at the site to prevent them from falling off of shelves
2. Junk parts removed from the treatment module should be disposed of in a proper manner

3. Spare parts used in the operation of the faecal sludge treatment plant should be kept in a neat and orderly manner with the item labelled to indicate on what piece of equipment the spare part is to be used
4. Do not allow paper and other lighter combustible materials to accumulate in the treatment plant premises to prevent them from getting into the treatment modules and causing fire
5. Do not store flammable liquids such as gasoline and diesel fuel in the treatment plant premises where they may cause a fire or leak onto the floor causing hazardous working conditions
6. Pay strict adherence to "No smoking" signs
7. Do not accumulate oily rags and papers as they can spontaneously combust under the proper conditions
8. Consider the size and weight of any object before attempting to lift or move the object. Do not lift any materials that cannot be handled comfortably. If necessary, take obtain assistance or wait until assistance is available
9. When carrying objects near treatment modules take extra care to avoid falling in the tanks or dropping objects into the tanks
10. Employees should use tools suitable for the job in progress and only those in good condition
11. Hoses, extension cords and ropes not in use should not be left where operating personnel might trip over them and possibly fall into a tank
12. Indoor areas shall have adequate lighting

Use carbon dioxide or halon compressed gas extinguishers to control fires

**Figure 8: Safety Precautions**

## 6.2 Medical emergency/ First Aid

In the case of sudden onset of medical condition characterized by acute symptoms of sufficient severity such that the absence of medical attention could reasonably be expected to result in: placing the patient's health in serious jeopardy, serious impairment to bodily functions or serious dysfunction of any bodily organ or part.

The following steps need to be followed while administering first aid

1. Keep the victims lying down
2. Examine the victim- look for serious bleeding, lack of breathing and poisoning
3. Keep the victim warm
4. Send someone to call a physician or ambulance
5. Remain calm. Do not be rushed into moving the victim unless absolutely necessary
6. Never give an unconscious victim anything to eat or drink
7. If there is a crowd, keep it away from the victim
8. Ensure the victim is comfortable
9. Don't allow the victim see his injury
10. Give artificial respiration if required

First Aid: The First Aid Tool box should contain the following items. Unnecessary and out of date items should not be placed in the first aid box.

First Aid Box

1. Band-aid, scissors, cotton
2. Adhesive plasters of assorted sizes
3. Disinfection lotions/powder
4. Eye wash cup
5. Unused sealed twin blade razor
6. Cotton Gauze
7. Crepe Bandages
8. Analgesic (ointment/cream/gel/spray)
9. Anti-allergic medicine
10. Antacid

## 6.3 List of safety, personal protective equipment and tools

Along with the safety precautions, there are several tools and equipment's that are necessary to successfully upkeep the FSTP in its optimum quality of operation. Below are the list of equipment along with the images that should be procured for carrying out the operation and maintenance activities at the FSTP

| Sl. No | Equipment Name | Image |
|---|---|---|
| **1.** | Bucket |  |

| | | |
|---|---|---|
| **2.** | Trowel |  |
| **3.** | Gloves |  |
| **4.** | Mask |  |
| **5.** | Shoes (Gum boots) |  |
| **6.** | Wheelbarrow |  |
| **7.** | Shovel |  |
| **8.** | Garden Scissors |  |
| **9.** | Wooden Pole |  |
| **10** | Fishnet mesh |  |
| **11.** | Measuring tape |  |
| **12.** | Broom |  |

| | | |
|---|---|---|
| **13.** | Mechanised tiller and trailer |  |
| **14.** | Ladder |  |
| **15.** | Torch |  |
| **16.** | Rake |  |
| **17.** | First Aid kit |   |
| **18.** | Plastic Sheet |  |

# 7. Activity and Checklists

This chapter shows the activity and time checklists of activities that needs to be carried out by an operator for proper O&M of different infrastructures.

**Table 2: Showing the checklist for O&M activities**

| Task | Frequency | Date | Responsible Person Name | Signature |
|---|---|---|---|---|
| **Module: Screening Chamber** | | | | |
| Cleaning of screens in Screening chambers | *Daily* | | | |
| Repaint/Replacement of screens | *Once in 5 years* | | | |
| Ensure free flow of water | *Once in two weeks* | | | |
| **Module: Planted Drying Bed** | | | | |
| Removal of dried sludge | *Once in a year* | | | |
| Replacing of filter material | *Once in 5 years* | | | |
| **Module: Planted Gravel Filter** | | | | |
| Checking swivel pipe level | *Once in a month* | | | |
| Removal of weeds and trimming plants | *Once in a month* | | | |
| **Module: Polishing Ponds** | | | | |
| Checking pressure gauges | *Daily* | | | |
| Checking Pump | *Daily* | | | |

**Table 3 : Daily Maintenance chart for O&M activities**

| No. | Activity | Daily |
|---|---|---|
| **1** | ***Screening Chamber*** | |
| 1.1 | Cleaning the screening chamber | |
| 1.2 | Proper disposal of solid waste from screening chambers | |
| 1.3 | Emptying of solid waste from collection units/dustbins | |
| 1.4 | Painting of bar screen and screening chamber | |
| 1.5 | Checking of cracks in screening chamber | |
| 1.6 | Cleaning of inlet and outlet pipe | |
| **2** | ***Feeding pipes*** | |
| 2.1 | Cleaning the feeding pipes inlet | |
| 2.2 | Anti-rust painting of support angles | |
| 2.3 | Checking of feeding pipes leakage | |
| **3** | ***PDB*** | |
| 3.1 | Cleaning the solid waste at PDB surface | |
| 3.2 | Cleaning the perforated pipe | |
| 3.3 | Checking of cracks in PDB wall | |
| 3.4 | Checking the plants growth | |
| 3.5 | Checking of ventilation pipe remove | |
| 3.6 | Plant Harvesting | |
| **4** | ***PDB Outlet Register*** | |
| 4.1 | Cleaning of register | |
| 4.2 | Checking the leakage of swivel pipe | |
| 4.3 | Cleaning of swivel pipe | |

| | | |
|---|---|---|
| 4.4 | Cleaning the path of water flow from register to the PGF | |
| **5** | ***PGF*** | |
| 5.1 | Cleaning the inlet distribution channel | |
| 5.2 | Checking of pebbles on PGF | |
| 5.3 | Cleaning the swivel pipe | |
| 5.4 | Cleaning the Outlet register and Inspection Chamber | |
| 5.5 | Check Plant Growth | |
| 5.6 | Plant Harvesting | |
| 5.7 | Removal of Solid Waste | |
| **6** | ***Polishing Pond*** | |
| 6.1 | Cleaning of cascade system | |
| 6.2 | Cleaning of PP | |
| 6.3 | Checking of submersible pump | |
| 6.4 | Emptying and cleaning of PP | |
| 6.5 | Maintenance of Fountain | |
| 6.6 | Aeration | |
| **7** | ***Other Maintenance*** | |
| 7.1 | Cleaning of site | |
| 7.2 | Checking of lights at site | |
| 7.3 | Checking of plumbing pipes | |
| 7.4 | Cleaning of soak pit | |
| 7.5 | Cleaning of store room | |
| **8** | ***Site Office*** | |
| 8.1 | Office Cleaning | |

| | | |
|---|---|---|
| 8.2 | Toilet cleaning | |
| 8.3 | Operators Room Cleaning | |
| 8.4 | Uniform Laundry | |