

Participant Handbook

Sector
Sanitation

Sub-Sector
Faecal Sludge Treatment

Occupation
**Operation & Maintenance
Technician**

Reference ID: SGJ/Q6404

**Operation & Maintenance
Technician**

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If we have to move India towards
development then Skill Development
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About this book

Why faecal sludge management?

In most of the urbanized areas in developing countries excreta are disposed of in facilities located on the housing plot itself. Whether these facilities are septic tanks, dry latrines, bucket latrines, communal toilets, or other types, they all accumulate faecal sludge, which needs to be removed periodically. If this sludge is not adequately managed, there are negative impacts on the urban environment and public health may result in:

- Environmental pollution is caused by effluents of not regularly de-sludged septic tanks or community toilets;
- Large amounts of faecal sludge removed from sanitation facilities are dumped indiscriminately into the environment due to lack of disposal facilities;
- Faecal sludge is used in an unhygienic way in agriculture because no sludge treatment is available.

All these problems can be avoided by proper management of faecal sludge, which may include adequate de-sludging of sanitation facilities, safe handling, and transport of sludge, treatment of sludge, and its safe disposal or reuse. Faecal sludge treatment plants are dedicated treatment plants for treating faecal sludge and septage from on-site sanitation systems which are conveyed usually through desludging vehicles (such as suction trucks, tractors etc.). Operating and maintaining the faecal sludge treatment plants (FSTPs) is an essential requirement for managing faecal sludge.

Faecal sludge treatment plants (FSTPs) require ongoing and appropriate operation and maintenance (O&M) activities in order to ensure long-term and efficient functioning. O&M activities are at the interface of the technical, administrative, and institutional frameworks that enable sustained FSTP function. “Operation” refers to all the activities that are required to ensure that an FSTP delivers treatment services as designed, and “maintenance” refers to all the activities that ensure long-term operation of equipment and infrastructure.

Background to preparation of the handbook

The Urban Management Centre (UMC) is the Technical Support Unit to support the convergence between Deendayal Antyodaya Yojana, National Urban Livelihood Mission and Swachh Bharat Mission-Urban of the Ministry of Housing and Urban Affairs (MoHUA). UMC is supporting preparation of Qualification Packs (QP) and National Occupational Standards (NOS) for work-force under the Faecal Sludge and Septage Management (FSSM) Sector. One of the QPs is on FSTP operation and maintenance technician. The training for this QP will be done through a network of skill training providers. For this purpose, there is a need to prepare a training module for training organisations and a participants’ handbook.

In the preparation of this handbook and trainers’ manual UMC has been supported by the Consortium for DEWATS Dissemination Society (CDD Society). CDD Society is one of the leading organisations in the FSSM Sector. It has been instrumental in setting up India’s first stand-alone faecal sludge treatment plant (FSTP) in Devanahalli, Karnataka in November 2015. This has been one of the key milestones in FSSM Sector as it set an example for dedicated faecal sludge treatment plants in many towns of the country.

What is the scope of this handbook?

This handbook is a step to step guidebook for the operation and maintenance technicians of faecal sludge treatment plant. This handbook will help to understand the importance and role of operations and maintenance for faecal sludge treatment plants. It will provide the details of critical activities and support factors to include starting with the design and planning phases. This handbook will act as a guidebook for effective monitoring and operations and maintenance plan to ensure treatment performance.

Who is this handbook for?

This manual intends to provide practical guidance to the operation and maintenance technicians responsible for the faecal sludge treatment plant.

How to use this handbook?

The handbook has elaborative guidelines on undertaking certain procedures common to all FSTPs irrespective of technology used. The handbook starts with explaining the concept of faecal sludge management with approaches for treatment. In this handbook, step by step operation and maintenance processes are described, and the possible actions are defined. It is meant to be a checklist for all the activities that are necessary to be conducted irrespective of the technology used in the treatment plant. Each chapter is followed by an exercise to enable self-learning for the users.

Introduction

Key Learning Outcomes

At the end of this programme, you will be able to facilitate students to:

- Know each other and build rapport with fellow participants and the trainer
- Express the expectations and takeaway at the end of the course
- Learn and follow health and safety procedures
- Know responsibilities of FSTP O&M Technician
- Understand about carrying out day to day operations of FSTP
- Understand about carrying out routine maintenance of FSTP
- Aware of work effectively in a team
- Learn communication skills
- Understand employability & entrepreneurship skills
- Identify the abbreviations of FSTP and FSSM Value chain

Timeline

Total time needed for facilitation: 200 hours

- Theory: 60:00 hours
- Practical: 140:00 hours

Training Methodology

- Participant handbook
- Class room with audio video system
- Various videos related to FSTP
- White board
- Pen

Unit 1.1 About the Programme

Unit Objectives

At the end of this unit, you will be able to facilitate students to:

- Know each other and build rapport with fellow participants and the trainer
- Talk about their expectations and takeaway after the course completion
- Carry out health and safety procedures
- Know responsibilities of FSTP O&M Technician
- Understand about carrying out day to day operation of FSTP
- Understand about carrying out routine maintenance of FSTP
- Aware of work effectively in a team
- Know communication skills

- Understand employability & entrepreneurship skills
- Identify the abbreviation of FSTP and FSSM Value chain
- Evaluate their calendar and learning plan

Explain

- Duties of FSTP O&M Technician
- Carrying out day to day operation of FSTP
- Carry out routine maintenance of FSTP
- Comply with health and safety procedures

Unit 1.2 About the FSTP O&M Technician

Unit Objectives



At the end of this unit, you will be able to facilitate students to:

- Discuss about overview on FSSM activities and FSTP
- Explain roles and responsibilities of a FSTP O&M Technician
- Evaluate day to day operations of FSTP
- Explain the routine maintenance of FSTP
- Explain the health and safety procedures
- Describe the personal attributes of FSTP O&M Technician

Say



- What do you understand by the term FSTP and various processes in the FSSM value chain

Unit 1.3 About the QP NOS

Say



A set of National Occupational Standards (NOS), aligned to a job role, called Qualifications Pack (QP), would be available for every job role in each industry sector. These drive both the creation of curriculum and assessments. These job roles would be at various proficiency levels and aligned to the National Skill Qualifications Framework (NSQF). Example would be Qualifications Pack for job roles such as Septic Tank Technician, Desludging Operator, FSTP O&M Technician, Safai Karmacharis and Waste Pickers.



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List of abbreviations

ASP	Activated Sludge Process	OSS	On-site sanitation systems
CPR	Cardiopulmonary resuscitation	pH	Per hydrogen
DEET	Diethyl-meta-toluamide	PPE	Personal Protective Equipment
E. coli	Escherichia coli	PVC	Polyvinyl chloride
FS	Faecal Sludge	QP	Qualification Pack
FSSM	Faecal Sludge & Septage Management	SBR	Sequential Batch Reactor
FSTP	Faecal Sludge Treatment Plant	SCBA	Self-contained Breathing Apparatus
MBBR	Moving bed biofilm reactor	SOP	Standard Operating Procedure
mg/l	Milligram per litre	SRS	Septage receiving station
MPN	Most Probable Number	STP	Sewage Treatment Plant
NSDC	National Skill Development Council	TDS	Total Dissolved Solids
NSQF	National Skill Qualification Framework	UASB	Upflow Anaerobic Sludge Blanket
O&M	Operation and Maintenance		

Glossary

Aerobic conditions: These are conditions in which microorganisms convert organics into carbon dioxide and new biomass in the presence of oxygen

Ammoniacal nitrogen: It is a measure for the amount of ammonia in the faecal sludge.

Anaerobic conditions: These are conditions in which microorganisms convert organics into methane in the presence of oxygen

Beaker: A beaker is a generally cylindrical container with a flat bottom. Most also have a small spout (or "beak") to aid pouring, Beakers typically come with a scale to aid in measuring the liquid in it.

Biosolids: It is the solid component derived from the faecal sludge

Blackwater: Domestic wastewater coming from toilets. It is a mix of urine, faeces, flush water, dissolved toilet paper and anal cleansing water.

Biological Oxygen Demand: It is the indicative amount of oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at a certain temperature over a specific time period.

Centrifuge: This is the force that acts on the body in a direction away from the centre, which contributes to making the body try to fly away.

Chemical Oxygen Demand: The indicative amount of oxygen that can be consumed by decomposition of organic matter and the oxidation of inorganic compounds such as nitrite and ammonia in a given solution. It is commonly expressed in mass of oxygen consumed over volume of solution which in SI units is milligrams per litre.

Cesspool: It is an underground container for the temporary storage of liquid waste and sewage

Cesspool vehicle/ desludging vehicle: A vehicle used to empty/ desludge from a containment system of faecal sludge and transport the sludge for treatment and/or disposal.

Conductivity: It is the measure of the ease at which an electric charge or heat can pass through a material.

CPR: Cardiopulmonary resuscitation (CPR) is an emergency procedure that combines chest compressions often with artificial ventilation in an effort to preserve intact brain function restore spontaneous blood circulation and breathing in a person who is not breathing. This measure is to be done until professional medical help arrives.

Desludging: The process of emptying of sludge from a containment system

E. coli: It is a type of bacteria that normally lives in human intestines. It's also found in the gut of some animals. Some strains of these bacteria can cause diarrhoea.

Effluent: The liquid component in faecal sludge and the liquid component coming out of septic tanks.

Faecal coliform: It is a type of bacteria originating in intestines of humans and other warm-blooded animals.

Faecal Sludge (FS): It is the raw, partially digested combinations of excreta and blackwater³, in a slurry or semi-solid form, with or without greywater.

Faecal Sludge & Septage Management (FSSM): Faecal sludge management refers to safe management and handling of faecal waste from containment to end-use or disposal of faecal sludge from on-site sanitation systems (OSS).

Faecal Sludge Treatment Plant (FSTP): It is a specialised treatment plant to treat the faecal sludge

Gumboots: These are waterproof boots covering from toe to just below the knee.

Glass tube sludge sampler: It is a device to visualise and measure the sludge accumulation in a chamber.

Greywater: Domestic wastewater from all the sources (kitchen, bathroom, washbasin, car washing) except toilets.

Helminth eggs: These are parasitic worms. Roundworms, hookworms and tapeworms are types of helminths. Infection from helminths can cause physical, nutritive and nutritional impairment young, developing children. intestinal worms

Humidity: The amount of water vapour in the air

Imhoff Cone for sampling: It is a device to measure the settleable solids in the sludge.

Inventory: Complete list of items

Lock-out-tag out: It is a procedure to be followed in order to ensure that an electrical equipment is off its source of electric supply. This procedure is followed while performing maintenance activities.

Mineralisation: The process of breaking down of organic substances in the faecal sludge is degraded into inorganic substances.

MPN: It is a method used to estimate the concentration of viable microorganisms in a sample

National Skill Development Council (NSDC): It is a not-for-profit public limited company set up by the Ministry of Finance, Government of India, as Public-Private Partnership (PPP) model. NSDC aims to promote skill development by catalyzing the creation of large, quality and for-profit vocational institutions.

National Skill Qualification Framework (NSQF): It is a competency-based framework created by NSDC that organizes all qualifications according to a series of levels of knowledge, skills and aptitude

On-site sanitation systems (OSS): It is a sanitation system in which excreta and wastewater are collected and stored at the site of generation. OSS can also be designed to treat the excreta and wastewater at the source.

pH: It is a measure of the hydrogen ion concentration of a solution

Personal Protective Equipment (PPE): PPE are a group of clothing, helmets, goggles or other garments or equipment designed to protect the user from infection or injury.

Precipitation: In the context of weather and climatic conditions, precipitation refers to any product of the condensation of atmospheric water vapour that falls under gravity. The main forms of precipitation include drizzle, rain, sleet, snow, graupel and hail.

Pyrolysis: It refers to the thermal decomposition of materials at elevated temperatures in an inert atmosphere.

Qualification Pack (QP): Qualification pack is a set of National Occupational Standards (NOS) designed by NSDC with alignment to a job role.

Salvage Value: It is the resale value of the damaged equipment as scrap or for any other purpose

Settleable solids: It is the portion of the suspended solids which are of sufficient size and weight to settle in a given period of time, usually one hour.

Septage Receiving Station (SRS): A septage receiving station is an interface between desludging trucks and the treatment plant for receiving the sludge safely into the treatment plant.

Sewage Treatment Plant (STP): Treatment plant dedicated to removing contaminants from domestic wastewater

Standard Operating Procedure (SOP): It is a set of step-by-step instructions compiled to help workers carry out complex routine operations.

Total Dissolved Solids: It is a measure of the dissolved, combined content of all inorganic and organic substances present in a liquid in molecular, ionized, or micro-granular (colloidal sol) suspended form.

Total Fixed solids: It is the sum of suspended solids and dissolved solids in a given mixture that contains both a liquid and an insoluble phase component.

Total Solids: It is a measurement of solids in a liquid that includes the combination of total dissolved solids and total suspended solids

Total Suspended Solids: Total suspended solids (TSS) is a measure of suspended particles, that are not dissolved, in a sample of water.

Underground drainage system/ Sewers: Also called sewerage network, these are piped network used to convey wastewater from the source of origin to point of treatment and/ disposal.



1. Introduction

- 1.1 Who is a FSTP operation and maintenance technician?
- 1.2 Job description of FSTP operation & maintenance technician
- 1.3 Skill requirement for operation and maintenance technicians



Chapter 1: Introduction

1.1 Who is an FSTP operation and maintenance technician?

According to the Qualification Pack (QP) of National Skill Development Council (NSDC), FSTP operation & maintenance technician is responsible for carrying out the day-to-day operations of a faecal sludge treatment plant (FSTP), which is a special type of treatment plant where the faecal waste coming out of toilet containment units like septic tank and pits is being treated. The technician is also responsible for routine maintenance of pumps, engines, motors, filters, bar screens, valves, pipes and any other equipment used in FSTP.

“Operation” refers to all the activities that are required to ensure that an FSTP delivers treatment services as designed. On the other hand, “maintenance” refers to all the activities that ensure long-term operation of equipment and infrastructure (Basan & Robbins, 2014). Irrespective of the size and technology of the treatment plant, a number of crucial tasks need to be carried out as a part of the O&M (Operation and Maintenance).

1.2 Job description of FSTP operation & maintenance technician

The following is the job description of operation & maintenance technician as mentioned in the Qualification Pack for “FSTP Operation and Maintenance Technician”. **Refer to Annex 1: Qualification Pack on FSTP O&M Technician**



Job Role

FSTP Operation and Maintenance Technician

NSQF² Level

4

Minimum Educational Qualifications

ITI or equivalent

Maximum Educational Qualifications

Not Applicable

Prerequisite License or Training

N/A

Minimum Job Entry Age

18 years

Experience

Nil

Applicable National Occupational

Compulsory

Standards (NOS)

SGJ/N6606: Carry out operation of FSTP

SGJ/N6607: Carry out routine maintenance of FSTP

SGJ/N6411: Maintain personal health & safety while operating FSTP

SGJ/N0120: Work effectively with co-workers

Performance Criteria

As described in the relevant Occupational Standards (OS) units


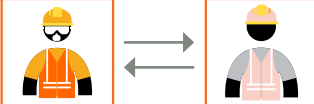






Role Description

The Faecal Sludge Treatment Plant (FSTP) operation and maintenance technician is responsible for carrying out the day-to-day operations of the FSTP. He /She is also responsible for repair and maintenance of pumps, engines, motors, filters, bar screens, valves, pipes, and any other equipment used in FSTP.

¹https://www.nsdcindia.org/sites/default/files/SGJQ6404_Faecal_%20Sludge_Treatment_Plant%20_O%26M_Technician_v1_06_12_2018.pdf

² National Skill Qualification Framework

Table 1: Sample Job Description

	Job Role Faecal Sludge Treatment Plant Operator	Nature of Work Full time	Qualifications Essential ITI; but candidate with Diploma qualification in civil/Mechanical engineering will have an advantage.
Roles			
	<p>The FSTP operator is for responsible for coordinating with the Cesspool vehicle and all activities related to receiving load at the plant.</p>		<p>Once the safe connection is ensured; operator must instruct the truck operator to open the valve to half position to maintain smooth flow, which aids in collecting sample as well as to prevent the solid waste from escaping the screen.</p>
	<p>Operator should instruct the truck operator to stop the valve if any splashing or blockages in the screen occur.</p>		<p>Removal of rags, napkins from modules at regular interval.</p>
	<p>Operator is responsible securing and safely storing the harvested dried sludge in the allotted storage area.</p>		
		<p>Trimming of the plants in the treatment plant (which are part of treatment modules, if applicable) and also carry out the landscaping activities in the plant on timely basis.</p>	<p>Carry out Module Specific activities as specified in the protocol.</p>

The above job description can include additional responsibilities such as:

1. Carry out the day to day operations of the FSTP (apart from those already mentioned in the job description)
2. Carry out on-site repair and maintenance work of the FSTP.
3. Maintain personnel health and safety while working in the plant (including oneself) and that of the treatment plant
4. Working effectively with the co-workers
5. Arrange for the visits made by authorised visitors to the plant.

1.3 Skill requirement for operation and maintenance technicians

The following are the core, generic and professional skills required for FSTP operation & maintenance technician as mentioned in the Qualification Pack (QP) for “FSTP Operation and Maintenance Technician”.

A Core Skills / Generic Skills

Writing Skills - The individual on the job needs to know and understand how to:



- Fill up relevant documents
- Prepare and write detailed document and reports
- Record readings of various parameters in the prescribed format

Organising Skills - The individual on the job needs to know and understand how to:

- Keep all the tools in an organised manner so as to avoid accidents
- Keep all the work environment safe and clean

Reading Skills - The individual on the job needs to know and understand how to:



- Read relevant reports and publications
- Read and understand relevant policies
- Read from different sources: books, screens in machines and signage.
- Read and understand financial documents
- Read and understand FSTP operational manual /guidelines
- Read internal information documents sent by internal teams

Oral Communication Skills - The individual on the job needs to know and understand how to:

(Listening & Speaking)

- Express statements or information clearly so that team members can understand
- Participate in and understand main points of simple discussions
- Respond appropriately to queries
- Communicate with industries and customers to understand and analyse various strategies, demand and limitation in the market
- Communicate effectively with supervisor, peers and subordinates

B Professional Skills

Decision making - The user/individual on the job needs to know and understand how to:

- Follow organization rule-based decision-making process
- Take decisions with systematic course of actions and/or response
- Report potential sources of danger and emergency
- Wear appropriate safety gear to avoid an accident
- Analyse critical points in day to day tasks and identify control measures to solve the issue.
- Handle issues in case the superior is not available (as per the authority matrix defined by the organization).

Plan and Organize - The user/individual on the job needs to know and understand how to:

- Complete tasks efficiently and accurately within stipulated time
- Work constructively and collaboratively with others
- Coordinate with multidisciplinary stakeholders
- Plan health & safety schedule
- Maintain health

Customer Centricity - The user/individual on the job needs to know and understand how to:

- Understand limitations of the customers/client
- Identify the spending trends of customers/client
- Communicate courteously with others in a polite manner
- Follow organization code of conduct.
- Manage relationships with public with intent of satisfying its requirements for service delivery.

Problem solving - The user/individual on the job needs to know and understand how to:

- Recognize problems and search for solutions
- Choose best methods to complete assigned tasks
- Approach relevant authority when required
- Approach local authorities, in case of emergency (police, doctor etc.)

Analytical Thinking - The user/individual on the job needs to know and understand how to:

- Apply domain knowledge / observations and data to select course of action to perform tasks related to formulation of the business plan
- Analyze day to day experience to correct future course of action
- Apply domain knowledge, observations and data to select course of action to perform tasks

Critical Thinking - The user/individual on the job needs to know and understand how to:

- Critically evaluate the information obtained from other departments and stakeholders
- Ask questions for better understanding

Reflective Thinking - The user/individual on the job needs to know and understand how to:

- Learn from past mistake regarding use of hazardous tools and equipment



2. Introduction to Faecal Sludge Treatment Plant Operation

- 2.1 Define faecal sludge, septage and sewage
- 2.2 Define Faecal Sludge Treatment Plant (FSTP) and its components
- 2.3 Types of faecal sludge treatment approaches



Chapter 2: Introduction to Faecal Sludge Treatment Plant Operation

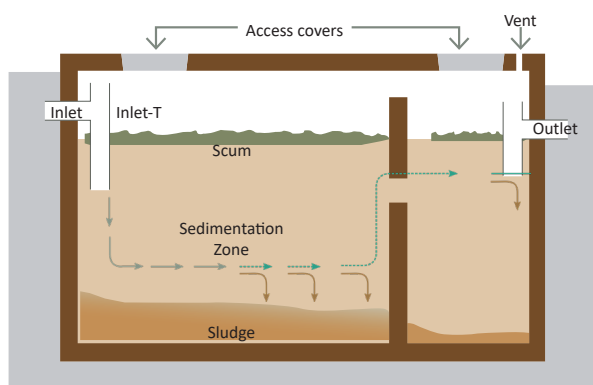
Unit Objectives: At the end of this unit, you will be able to:

- Recognize various component of Faecal Sludge Treatment Plant(FSTP)
- Recall role of administrative management in FSTP operation
- Recall working knowledge of handling repair and maintenance tools
- Identify personal protective equipment

Effective sanitation solutions are critical in preventing environmental pollution. Constructing toilets is the first step towards it. However, without effective management of the liquid waste coming out of the toilet, the objective of preventing environmental pollution cannot be met. Hence, the toilets need to be connected to a proper containment/ conveyance and treatment system. Given the high cost of underground sewerage systems, **on-site sanitation systems (OSS)** like septic tanks and pits are used to contain the faecal waste from the toilets.

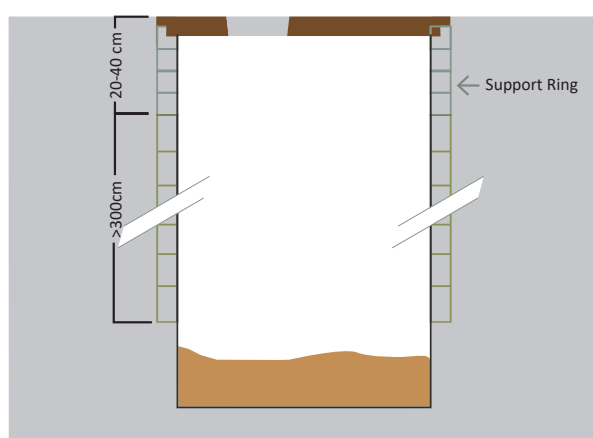
On-site sanitation is a system of sanitation where storage facilities are contained within the plot occupied by a dwelling and its immediate surrounding. For some systems (e.g., twin-pit latrines), faecal matter is treated on site by extended in-pit consolidation and storage. With other systems (e.g., septic tanks and single-pit), the sludge has to be collected and treated off-site.

Common types of on-site sanitation systems in India and their description



Septic tank

A septic tank is a watertight chamber made of concrete, fibreglass, PVC or plastic, through which blackwater and greywater (*refer footnote*) flows for primary treatment. Settling and anaerobic processes reduce solids and organics, but the treatment is only moderate.



Single Pit

The single pit is one of the most widely used sanitation technologies. In this, excreta, along with anal cleansing materials (water or solids) are deposited into a pit. Lining the pit prevents it from collapsing and provides support to the superstructure. As the single pit fills, two processes limit the rate of accumulation: leaching and degradation, urine and water percolate into the soil through the bottom of the pit and wall, while microbes degrades part of the organic fraction. Hence, as the single pit is used, rate of accumulation is low.

Source: *Compendium of Sanitation Systems and Technologies*, (Compendium of Sanitation Systems and Technologies, 2014)

Blackwater is the wastewater coming from toilets

Greywater is the wastewater coming from all the household sources apart from toilets. It includes water from wash basins, bathing, cleaning, kitchen etc.

The faecal waste accumulated in the OSS is called **faecal sludge (FS)**. Faecal sludge comprises all liquid and semi-liquid contents accumulating in these systems. These liquids are generally several times more concentrated in suspended and dissolved solids than wastewater. It needs to be periodically emptied and treated at a specialized treatment plant called faecal sludge treatment plant (FSTP). FS may be treated in such special treatment plants (called FSTPs) or co-treated with sludges produced in sewage treatment plant . The person involved in carrying out the day to day operation & maintenance technician of FSTP is called **FSTP operation & maintenance technician**.

Faecal sludge management refers to safe management of faecal waste infrastructure from containment to end use or disposal of faecal sludge from on-site sanitation systems (OSS). This includes the safe storage, collection, transport, treatment and end-use or disposal of faecal sludge. This can be better described through the graphic below:

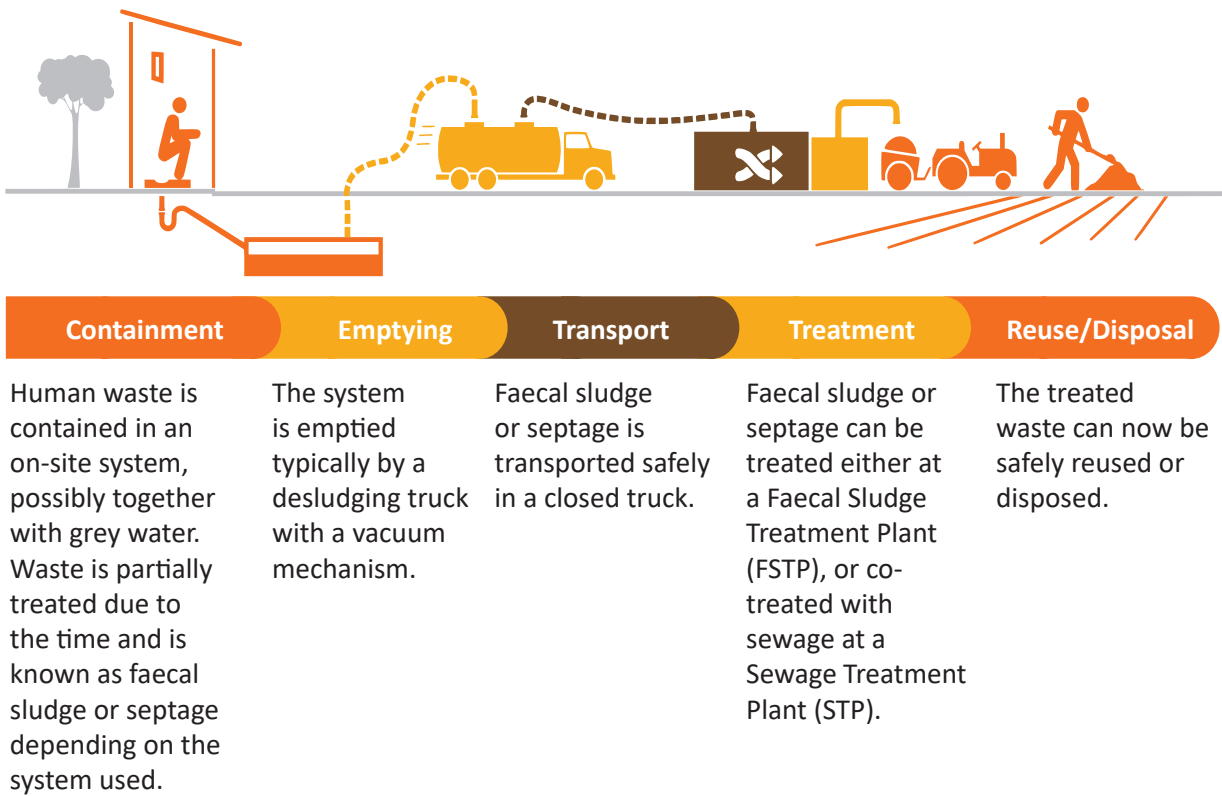


Figure 1: Sanition Value Chain.

Source: Water, Sanitation and Hygiene, BMGF, 2010.

2.1 Definition of faecal sludge, septage and sewage

Faecal sludge is raw, partially digested combinations of excreta and blackwater³, in a slurry or semi-solid form, with or without greywater⁴. It is the solid or settled contents of OSS. Generally, faecal sludge has 3 main components as below:

- Scum – floats on top and is generally where the living bacteria treat the waste
- Effluent – the semi-treated liquid that comprises the majority of the material in the septic tank
- Sludge – solids which collect at the bottom of the tank

³ Blackwater: The mixture of urine, faeces and flushwater along with toilet paper and anal cleansing water
⁴ Greywater: Water from the kitchen, laundry and bathing (but not toilets)

The physio-chemical characteristics of the faecal sludge will vary depending on the size and type of on-site sanitation system, design, (emptying) interval and the local climatic conditions of the place where the tank is located, the quantity and quality of water supplied and the type of wastewater originating from the household (which is user specific).

“Septage” is the liquid and solid material that is pumped from a septic tank, cesspool, or such on-site treatment facility after it has accumulated over a period of time. Usually, septic tank retains 60% - 70% of the solids, oil, and grease that enter it. The scum accumulates on the top and the sludge settles to the bottom comprising 20% - 50% of the total septic tank volume when pumped. In this sense, septage is a subset of faecal sludge.

Sewage on the other hand is the liquid waste matter that is transported through the sewers underground drainage system. Normally, this is a combination of blackwater and greywater. Thus, sewage is domestic (household) wastewater in totality.

Difference between sewage and faecal sludge & septage

Due to combination of blackwater and greywater and the fact that sewage is transported over considerable distance through sewers, it is characteristically different from faecal sludge and septage. Faecal sludge and septage, on the other hand, deals only with excreta and blackwater originating from toilets and contained in on-site sanitation systems. Due to this stage of containment over a period of time, the faecal sludge and septage can usually be partially digested.

2.2 Define Faecal Sludge Treatment Plant (FSTP) and its components

Faecal sludge treatment plants are dedicated treatment plants for treating faecal sludge and septage from on-site sanitation systems which are conveyed through desludging trucks.

Any FSTP, irrespective of technology has the following stages:

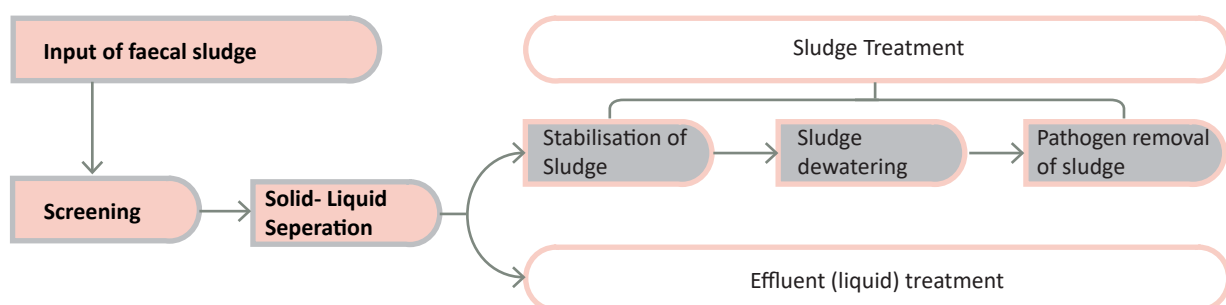


Figure 2: Process flow of faecal sludge treatment

Screening

It is the first stage of FS treatment where impurities are removed by means of physical separation. At this stage, large solid objects such as municipal solid waste and grit are removed. The oil and grease traps are installed at this stage if the incoming faecal sludge is expected to have a lot of oil and grease in it. This may be the case if the containment systems in the area also hold greywater (specially kitchen water) along with faecal sludge.

Solid-liquid separation	This process may be needed if the faecal sludge has very high-water content. At this stage the solids are separated from the liquid portion by settling them down. The solids coming out of this unit may still have a lot of water content (around 80-85% moisture content) in it and will need further dewatering.
Sludge treatment	<ul style="list-style-type: none"> • Stabilisation: Stabilisation is the process in which the bio-degradable part the faecal sludge is bio-degraded. • Dewatering: Dewatering is the process in which the sludge is dewatered or dried. • Pathogen removal: This is the stage at which pathogens (such as bacteria, virus, parasites etc.) are inactivated and/or destroyed.
Effluent treatment	The effluent or liquid coming out from various treatment processes are collected and treated at this stage

The treatment technologies for different stages of treatment are shown below:

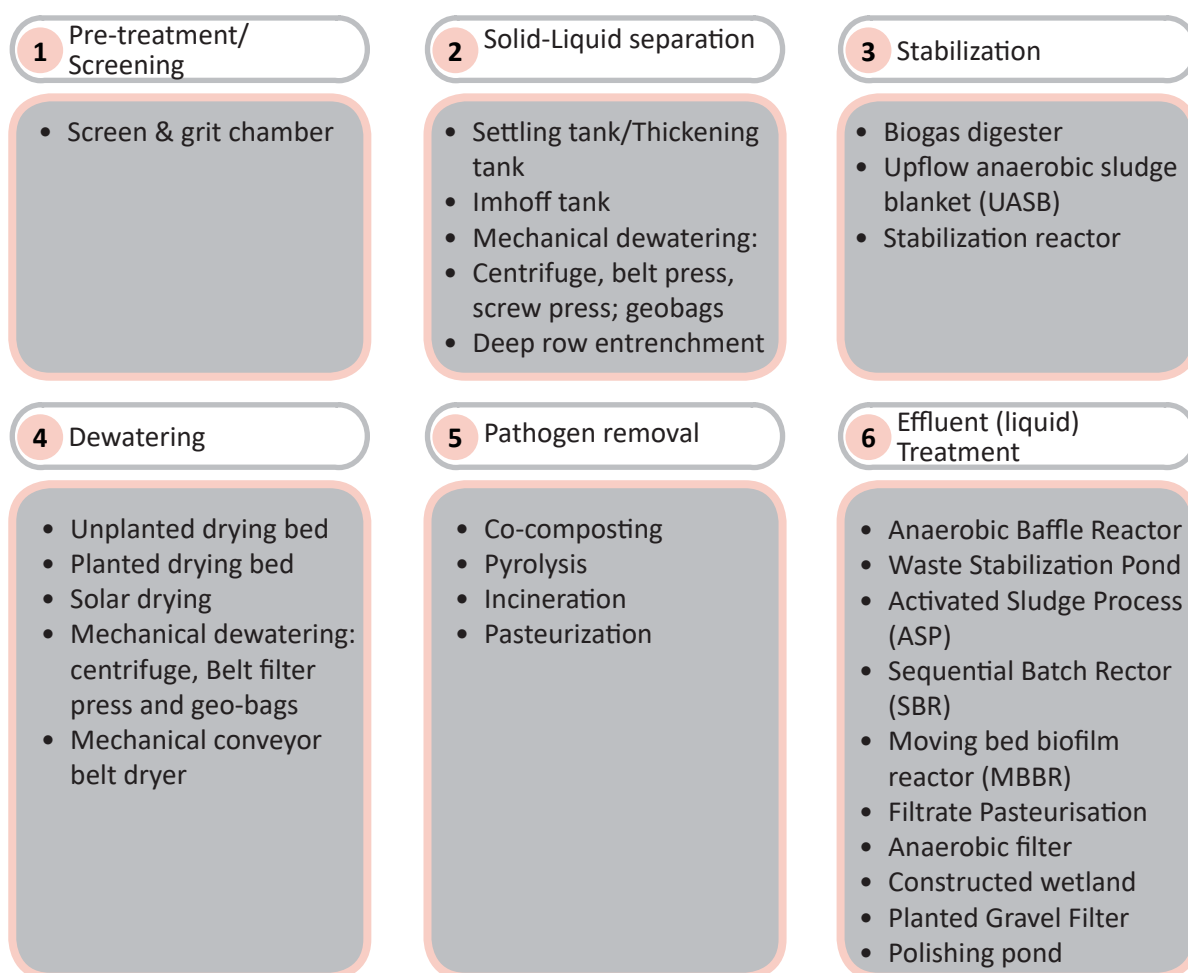


Figure 3: Treatment technologies for different stages of treatment

Some of the above technologies perform multiple functions. For example: Centrifuge, belt press, screw press and geo-bags can be used for both solid-liquid separation and dewatering.

Stages such as solid-liquid separation and stabilisation can be bypassed if the incoming sludge has less water content and is already stabilised. These treatment technologies or plant machineries are discussed in detail in **Types and Description of treatment units/ technologies, page 23-32**

2.3 Types of faecal sludge treatment approaches

Faecal sludge treatment approaches can be broadly divided into 2 categories:

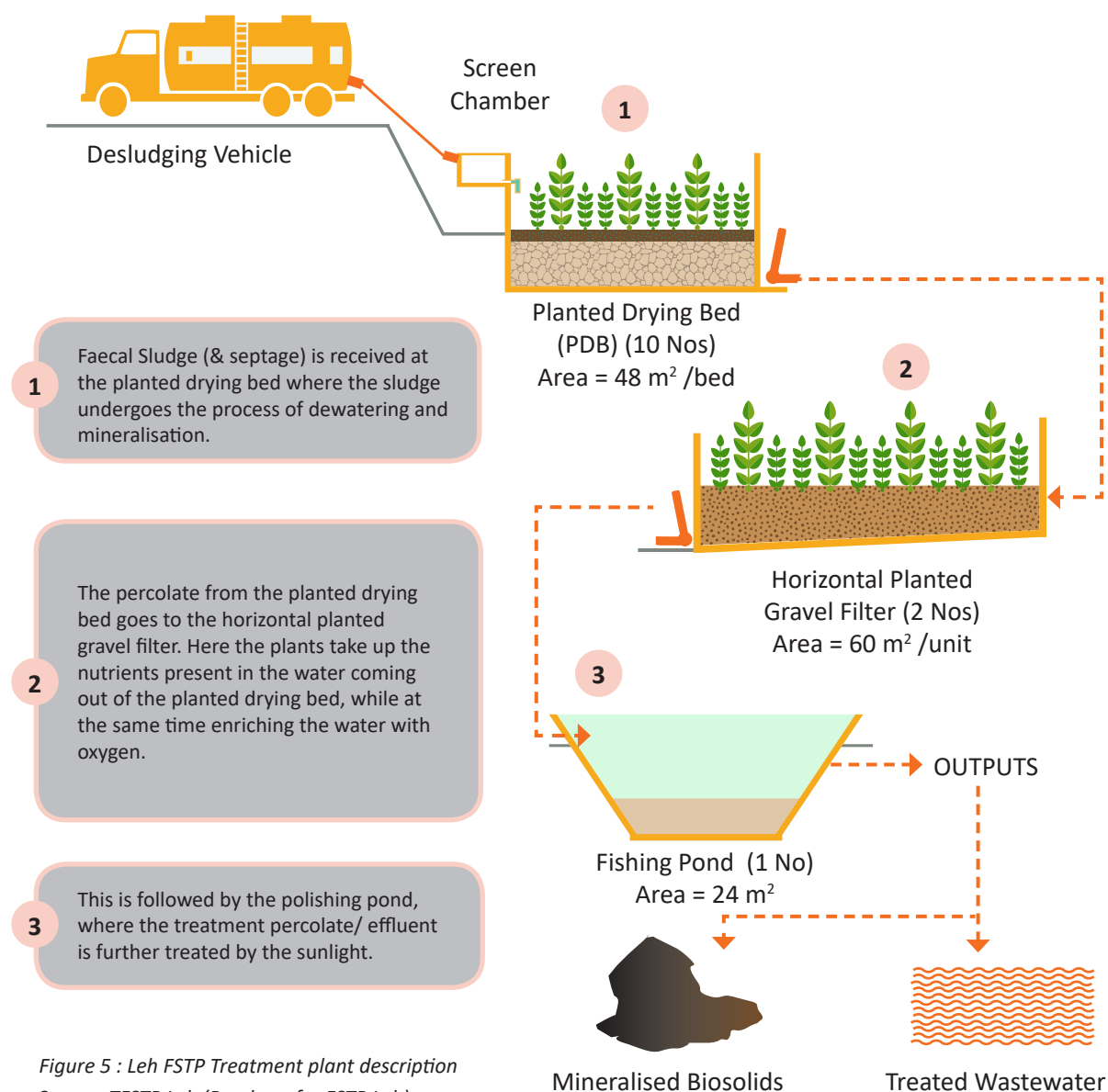
1. Nature-based treatment approach
2. Mechanised treatment approach

2.3.1 Nature-based treatment approach

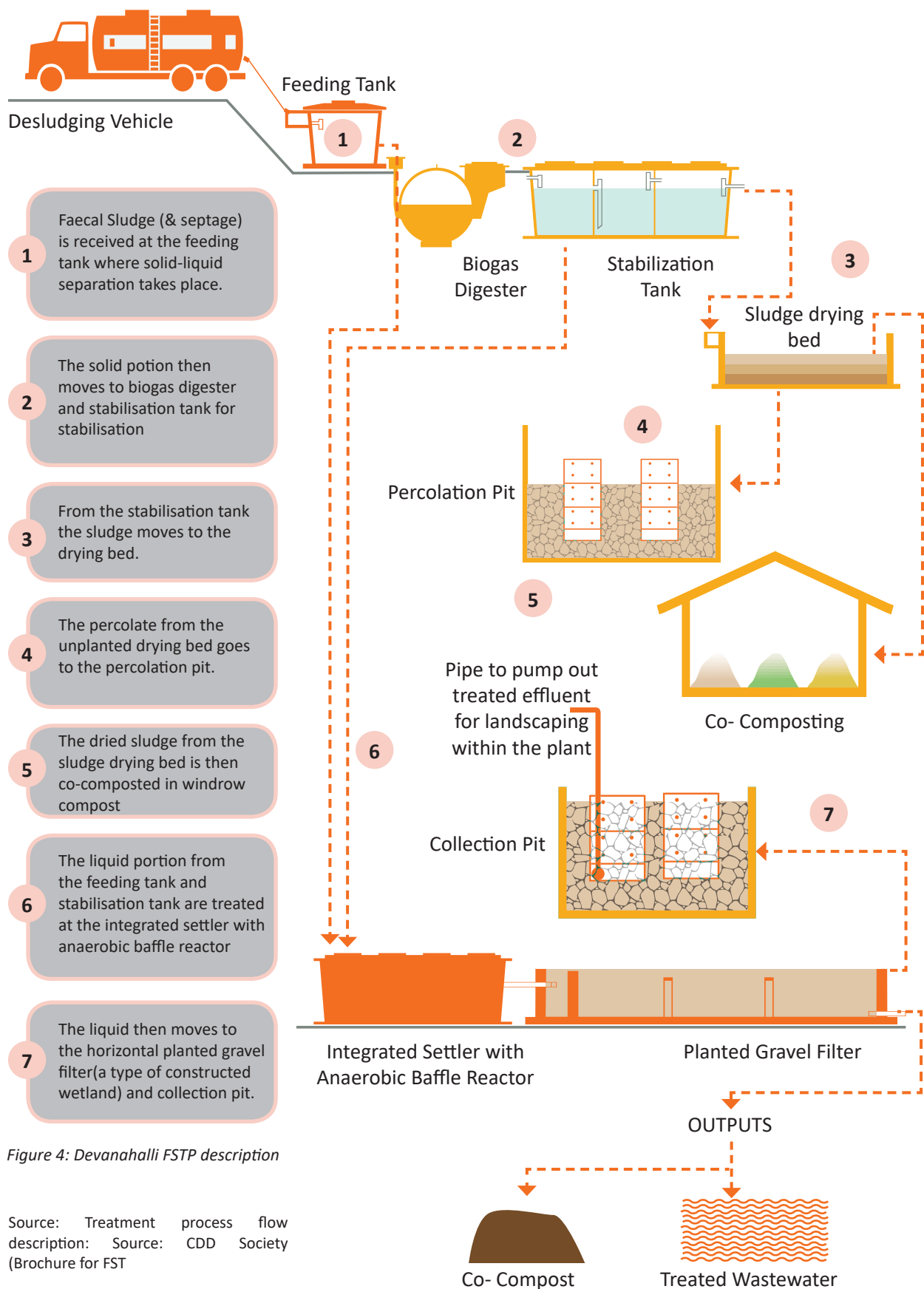
This treatment approach relies primarily on natural processes like gravity, biological digestion, sun-rays (for drying and UV treatment) and composting for treatment. In such treatment plants, there is little to no use of electricity, pumps, motorised equipments and chemicals for treatment of faecal sludge. However, this type of treatment approach usually requires a larger land area.

The following are two examples of nature-based treatment approaches used in faecal sludge treatment plants:

1. Faecal sludge treatment plant at Leh, Jammu & Kashmir

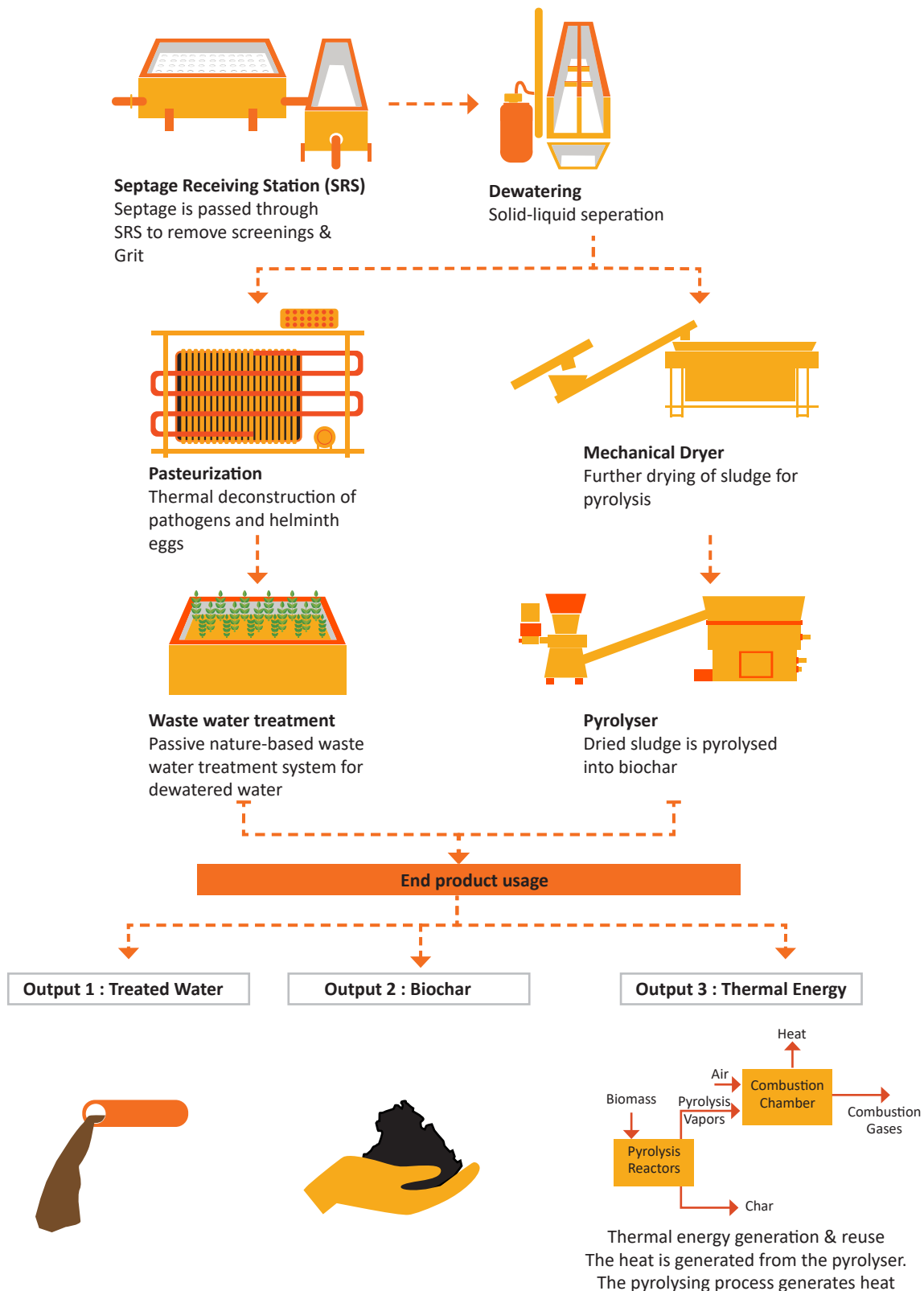


2. Faecal sludge treatment plant at Devanahalli, Karnataka



2.3.2 Mechanised treatment approach

This treatment approach relies primarily on mechanised equipments for treatment. These treatment plants run on power/energy. They use chemicals like polymers and use equipments like pumps, motors, dryers, sludge press etc. The treatment plants are usually controlled by sophisticated control mechanisms. This treatment approach usually needs relatively smaller land area and can handle huge quantities. The following is a type of a treatment plant using mechanised treatment approach:



This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. In the top left corner, the word "Notes" is written in a bold, orange font. The rest of the page is empty, providing space for writing.



3. Operation of Fecal Sludge and Treatment Plant

- 3.1 Operation of septage receiving station
- 3.2 Commonly used treatment units / technologies and equipments
- 3.3 Sample testing of septage at FSTP
- 3.4 Maintain the test record
- 3.5 Monitoring the working of FSTP
- 3.6 Daily activities & log sheet for reporting
- 3.7 Preparing the relevant reports, and provide recommendations for optimizing the FSTP
- 3.8 Housekeeping of FSTP
- 3.9 Inspection
- 3.10 Exercise
- 3.11 Summary



Chapter 3: Operation of Fecal Sludge and Treatment Plant

Unit Objectives: At the end of this unit, you will be able to understand how to:

- Collect sludge sample from sludge vacuum tank and deliver to laboratory for testing
- Carry out visual inspection of equipment and septage receiving station at FSTP
- Facilitate calibration of process control and instrumentation system at FSTP
- Operate septage receiving station
- Monitor overall working of FSTP
- Prepare daily log sheet and other relevant reports/records
- Clean sludge receiving station and equipment in use

Once the FSTP is constructed, the treatment process and the plant design is fixed but it is the responsibility of the O&M technician to effectively operate the plant in order to produce desired results. Day to day operations can be defined as simple tasks that enable smooth functioning and upkeep of the treatment plant. Fulfilment of these tasks promptly by a skilled O&M technician i.e. you, ensures that the plant functions efficiently for a long time.

This set of day to day operations describes how the treatment facility and equipment should be used, and the standard procedure outlines the step-by-step tasks that you need to perform

The tasks which are common to all FSTP models include:

A At septage receiving station

- Receiving septage
- Maintaining logbook
- Cleaning of screen chamber and grit chamber

D Monitoring tasks

- Periodic checking of blockages in pipes
- Periodic checking of sludge height level
- Ensure free flow

B Operating plant machineries and equipment so that they function as designed

E Reporting activities for the FSTP O&M and management of treatment end-products

C Sample testing

- Collection of samples
- Analysis of sample
- Record keeping

F Maintaining cleanliness of the exterior and interior of FSTP

G Inspection work

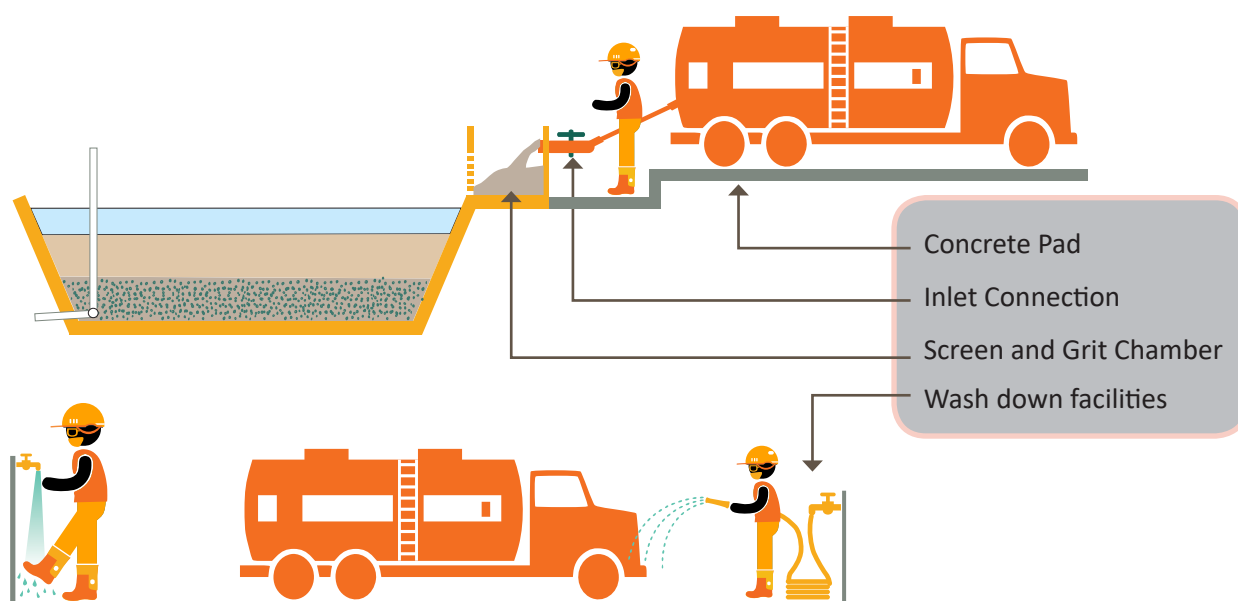
⁶ Faecal Sludge Management (FSM) book - Systems Approach for Implementation and Operation

3.1 Operation of septage receiving station

This chapter covers the description of septage (& faecal sludge) receiving station, steps to be followed for discharging faecal sludge (& septage) at FSTP and a set of guiding principles to protect your health and safety and maintain the performance of treatment units.

3.1.1 Septage receiving station

A septage receiving station is an interface between desludging trucks and the treatment plant for receiving the sludge safely into the treatment plant. They usually have the following features:



Every FSTP has a unit which acts like a receiving station into the FSTP. This can be one of the treatment modules (such as the screen and grit chamber) or can be a tank solely for the purpose receiving the sludge.

The septage receiving station should be operated on only during the operational hours of the treatment plant. The septage receiving station typical consists of a concrete pad for the truck to park, an inlet connection for the truck to connect, a screen and grit chamber for removing solid waste and grit and wash down facilities for the personnel (O&M technician, truck operator and any other person involved), equipment, truck and clean any spillage, if any.

3.1.2 Checklist for things to be done

The following checklist provides a list of all the required steps/tasks to ensure routine operations and maintenance of septage receiving station. This simple tool can help you get organized by knowing what needs to be done in the receiving station.

⁷ Also called as suction emptier truck/cesspool truck/septic tank & pit cleaning truck/vacuum suction truck

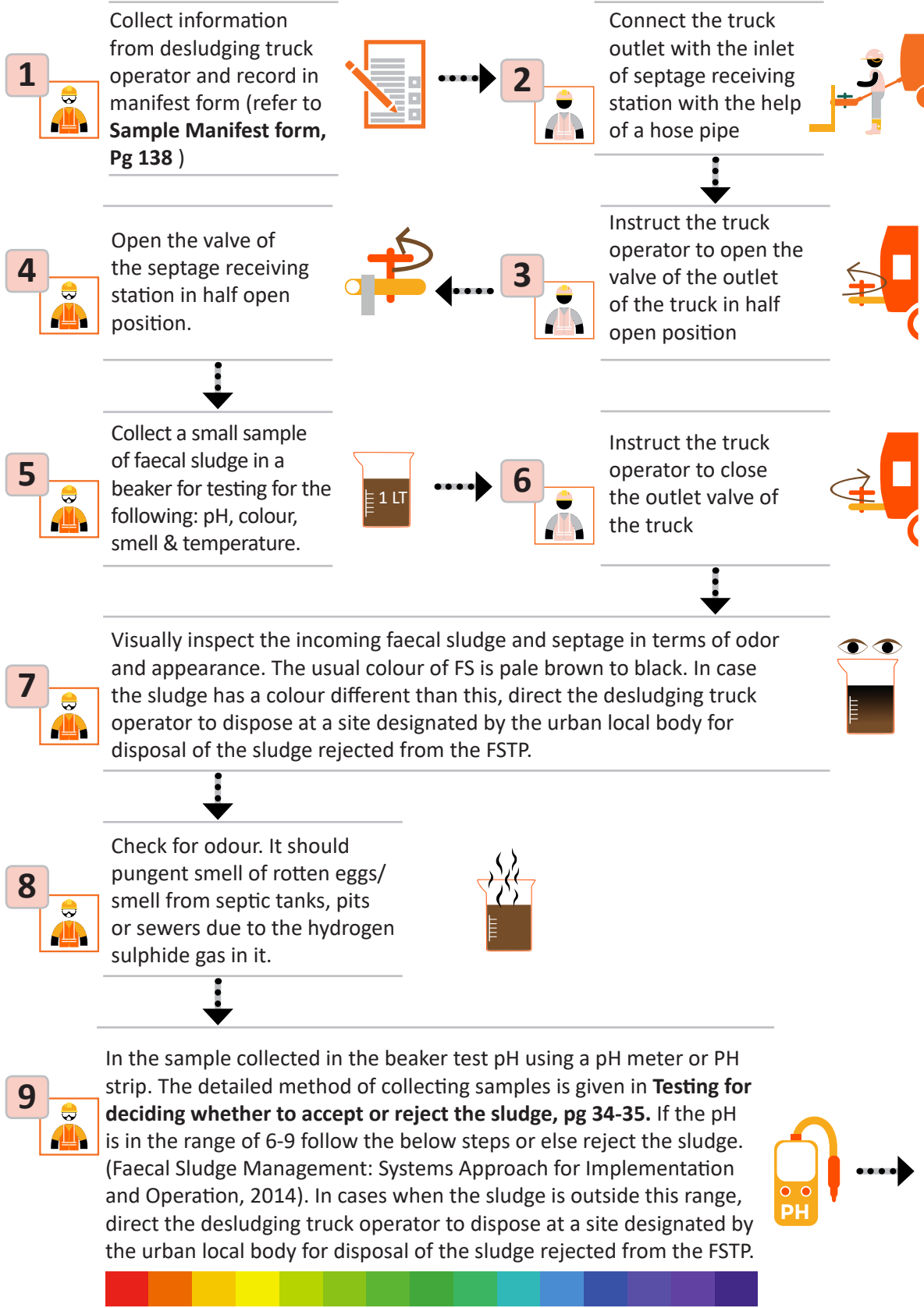


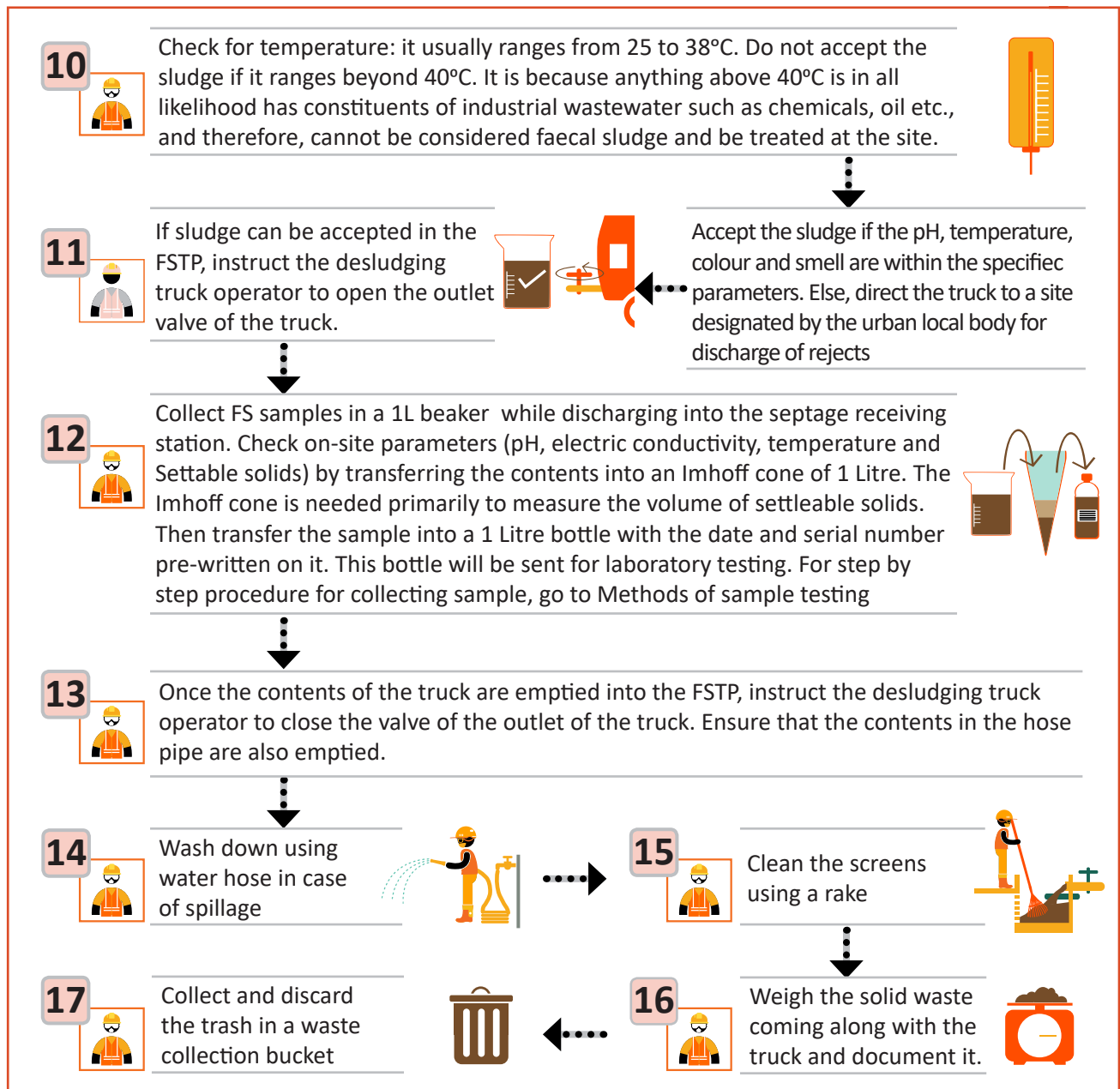
FSTP O&M
Technician



Desludging
truck operator

STEPS





3.1.3 Do's and Don'ts

Do's

- 1** Do wear personal protective equipment before handling faecal sludge & septage
- 2** Do wash your hands or use hand sanitizer after discharging faecal sludge & septage into the receiving station
- 3** Do test the sludge content in desludging truck prior to discharge

3

Do wash away any spillage during discharge with water hose



4

Do be careful and attentive at all times while working at the FSTP



Dont's

1

Do not smoke while working at the FSTP.



2

Do not allow unauthorized person to enter the FSTP



3

Do not allow discharge of faecal sludge if it the pH range deviates from 6 to 9. In such cases the sludge should be disposed at a site designated by the urban local body for disposal of the sludge rejected from the FSTP.

4

Do not allow discharge of faecal sludge if it has an unusual colour. The colour should vary from deep brown to black. In such cases when the sludge is outside the above colour range, direct the desludging truck operator to dispose at a site designated by the urban local body for disposal of the sludge rejected from the FSTP.



5

Do not let animals ransack the waste collection bucket

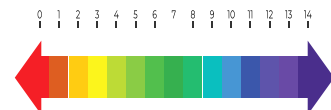


6

Do not delay disposing solid waste collected in FSTP. Give it daily to the authorised waste collector.



Ideal for
discharge 6
to 9



3.2 Commonly used treatment units / technologies and equipments

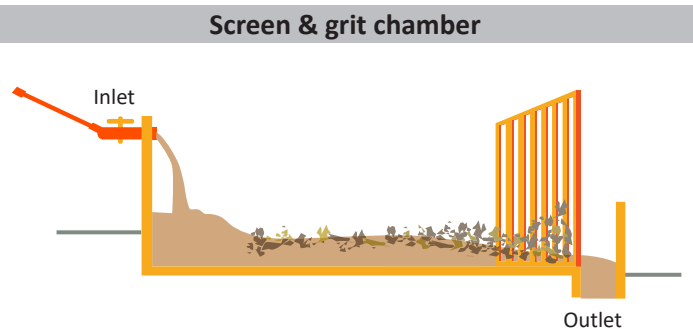
This module will introduce you to

- Description of treatment units/ technologies and equipment's
- Rules for safe handling as Do's and Don'ts

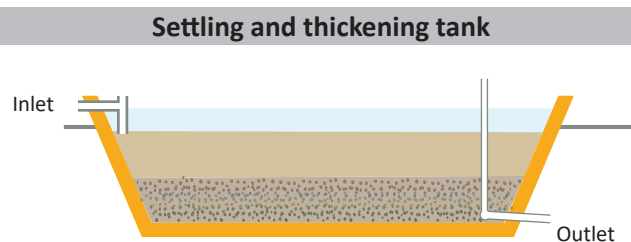
The objective of treatment units/ technologies is to treat the sludge, eliminate the smell and colour, stabilize the sludge and make it fit for disposal or reuse. The objective of the plant equipment is to aid in the daily operations of the treatment plant.

3.2.1 Types and description of treatment units/ technologies

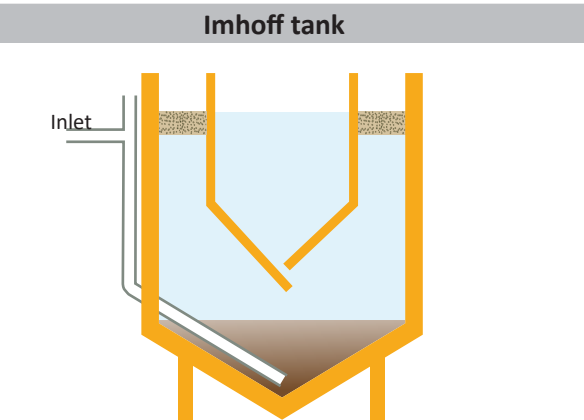
Screening is typically the first step of primary filtration of any wastewater or faecal sludge treatment facility. Screen & grit chamber removes waste and large solid objects from the wastewater/ faecal sludge, thereby preventing clogging. **(Refer Pg. 54)**



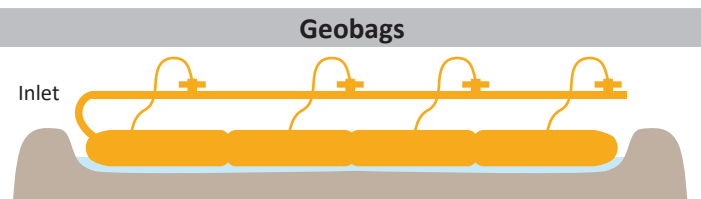
This unit helps in solid-liquid separation at the FSTP Inlet. Settling-thickening tanks for FS treatment are rectangular tanks, where FS is discharged into an inlet at the top of one side and the supernatant exits through an outlet situated at the opposite side, while settled solids are retained at the bottom of the tank, and scum floats on the surface.



This unit helps in solid-liquid separation using gravity thickening at the FSTP. This is a high-rised tank where sludge settles at the bottom during the period of retention. The biogas produced during the anaerobic digestion process rises to the top. The tank has inclined walls and a slot at the bottom, which allows the sludge to slide down to the centre into the digestion compartment. The gas transports sludge particles to the water surface, creating a scum layer. T-shaped pipes or baffles are used at the inlet and the outlet to reduce velocity and prevent scum from leaving the system.



This unit helps in dewatering at the FSTP. It is a mechanical process in which FS is put into the geobag and water squeezed out from it



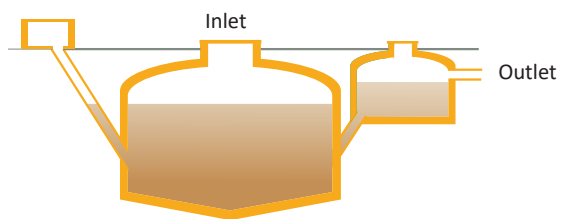
In this method, faecal sludge is disposed in deep trenches and covering them with soil. Trees are then planted on top, which benefit from the organic matter and nutrients that are slowly released from the FS.

Deep-row entrenchment



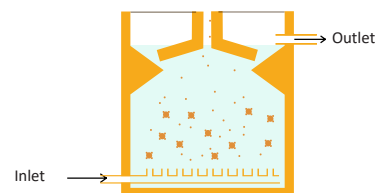
This unit helps in stabilisation or digestion of the faecal sludge. Biogas digesters create anaerobic conditions i.e. conditions characterised by the lack of oxygen. The organics in the FS degrade due to the presence of anaerobic microbes. This process of digestion/ degradation by the microbes results in the production of biogas that can be used for energy generation.

Biogas digester



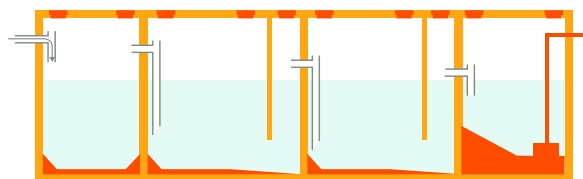
This unit helps in stabilisation or digestion of the faecal sludge (FS). FS enters the UASB from the bottom, and flows upward. A suspended sludge blanket filters and treats the FS as the sludge flow through it.

Upflow Anaerobic Sludge Blanket (UASB)



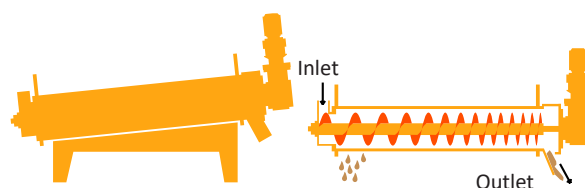
This unit helps in solid-liquid separation and stabilization of faecal sludge. It is a tank with baffles which retains the sludge for a specific duration of time, depending on the characteristics of the faecal sludge in the area, to allow digestion of the easily biodegradable component in the sludge.

Stabilization reactor



This unit helps in dewatering of faecal sludge. Sludge is placed inside the centrifuge while it rotates at a high speed. This centrifugal forces accelerates the sedimentation process, thereby, allowing the solids to settle out at the centrifuge walls, after which it is pressed and concentrated. Thereafter, the liquid and solid fractions come out of the unit separately.

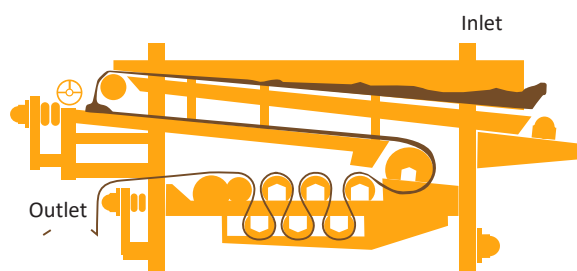
Centrifuge



This unit helps in dewatering of faecal sludge. The water is squeezed out of the sludge as it is compressed between two belts. The system consists of:

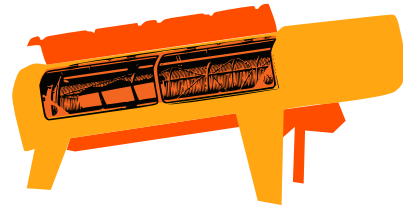
- a gravity drainage zone where the sludge is deposited and conveyed on a porous and mobile belt;
- a compression zone where a second belt is applied on the upper layer of the sludge,
- a zone where the belts are separated and the dewatered sludge is released.

Belt filter press



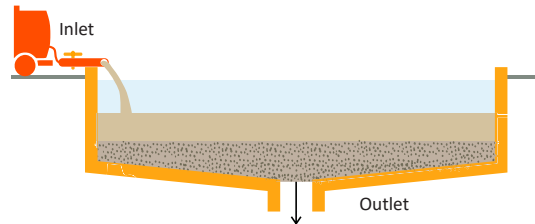
Screw Press

This unit helps in dewatering of faecal sludge. A screw press consists of a rotational screw placed in a perforated cylinder. The sludge is loaded at one end, it gets pressurised due to a diminishing distance between the screw and the cylinder, and the water that is squeezed out through the pores in the cylinder. The dewatered sludge comes out at the other end.



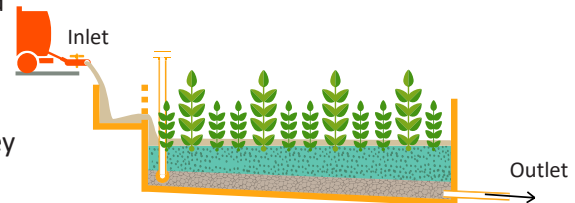
Unplanted Drying Beds

This unit helps in dewatering the faecal sludge. An unplanted drying bed is a simple, permeable bed made of layers of sand and gravel. This drying bed when loaded with sludge, collects percolated leachate and allows the sludge to dry by evaporation.



Planted Drying Beds

This unit helps in dewatering and mineralizing the faecal sludge as well as stabilization of solids. Planted drying beds are similar to unplanted drying beds but they have plants growing out of them. This provides the added benefit of transpiration and enhanced sludge treatment due to the plants. The key improvement of the planted bed over the unplanted bed is that the filters do not need to be deslugged after each feeding/drying cycle. Fresh sludge can be directly applied onto the previous layer; the plants and their root systems maintain the porosity of the filter.



Greenhouse solar drier

In this method, a greenhouse roof is created over an unplanted drying bed. The "Greenhouse Effect" is achieved by trapping the moisture released from the sludge for certain period which allows the incoming solar radiation from the atmosphere to warm up the air. The resultant temperature inside the greenhouse is above what it would be outside. The unit also has an air circulation and ventilation mechanism to remove the excess moisture laden air in the greenhouse. The increase in temperature and removal of excess moisture reduces the time required for drying.



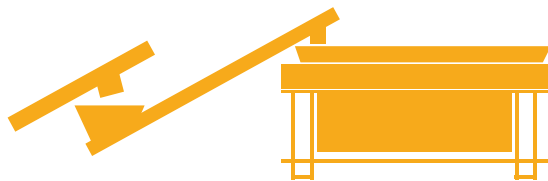
Co-composting

This system is used mainly for inactivation of pathogens present in the faecal sludge. Faecal sludge is co-composted with municipal solid waste at specific condition to get compost.



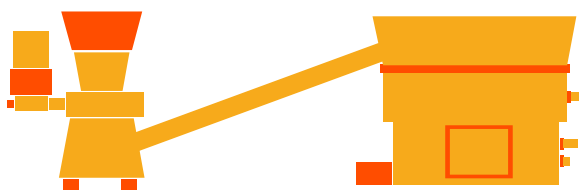
Mechanical conveyor belt dryer

The main purpose of the mechanical dryer is to further dry the dewatered sludge and reduce moisture. The Dryer operates at a temperature of about 60-70 degree Celsius. The moisture content in sludge after dryer reduces to 35 - 40%.



Pyrolysis

This technology decomposes dried sludge into gas and biochar in 10-15 minutes by heating it at 850°C



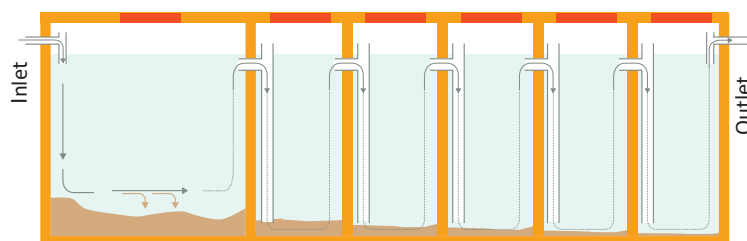
Incineration

Incineration of faecal sludge is a form of disposal which involves the burning of faecal sludge at temperatures between 850-900°C.



Anaerobic Baffle Reactor

This unit helps in reducing organic load from the effluent. It can also be used in cases of highly diluted (low strength) faecal sludge for stabilization



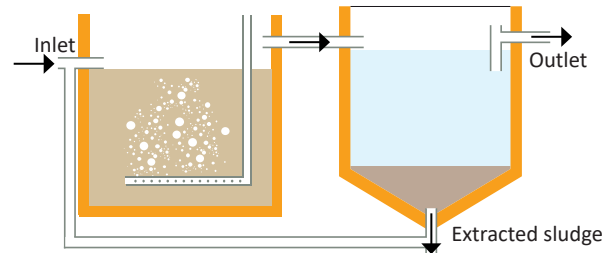
Waste Stabilisation pond

This is a method of treatment of the effluent (liquid) coming out of the faecal sludge using a series of ponds.



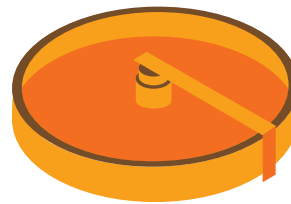
Activated Sludge Process

This is a method of treatment of the effluent (liquid) using aeration and a combination of bacteria and protozoa. This unit is usually used when there is an existing STP treating wastewater and sludge is added to it. ASP systems comprises of multiple tanks where the effluent is treated by means of different processes.



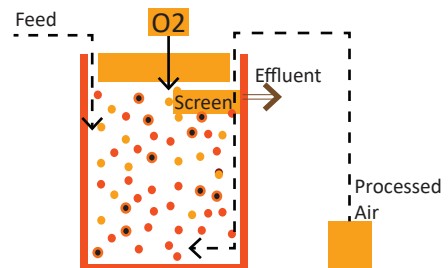
Sequential Batch Reactor

This is a method of treatment of the effluent (liquid) using a type of activated sludge process called sequential batch reactor (SBR). Unlike other ASP systems, in SBR all the processes for treating the effluent take place in one tank.



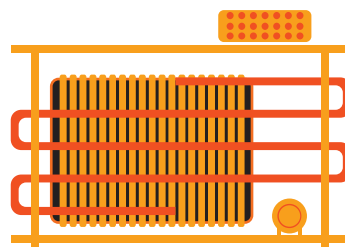
Moving bed biofilm reactor (MBBR)

This method of effluent (liquid) treatment uses aeration and biofilms (collective of one or more types of microorganisms) to treat the effluent. MBBR system consists of an aeration tank (similar to an activated sludge tank) with special plastic carriers that provide a surface where a biofilm can grow.



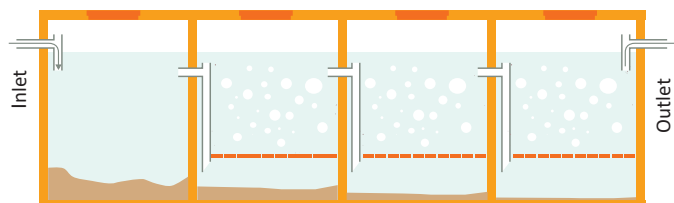
Pasteurisation

In this system, the filtrate or percolate is heated to 85 degree Celsius for 30 sec for pathogen kill (including helminths eggs).



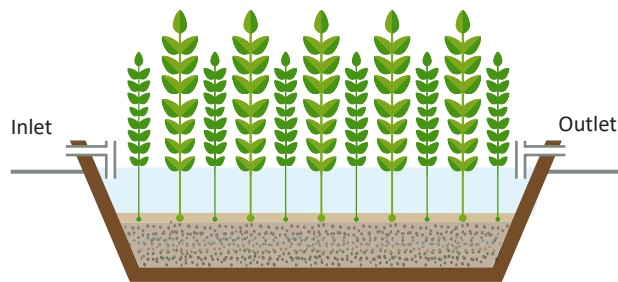
Anaerobic Filter

This method treats the effluent (liquid) using anaerobic filtration. As the effluent flows through the filter, particles are trapped and organic matter is degraded by the active biomass that is attached to the surface of the filter material.



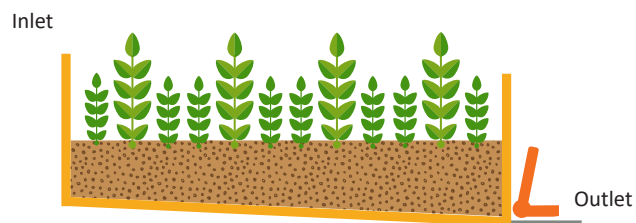
Constructed Wetland

It is an artificial wetland created to treat the effluent (liquid component). It uses certain species of plants to absorb and treat the effluent.



Horizontal planted gravel filter

It is a type of a constructed wetland in which the effluent coming from various treatment units is treated. The effluent flows horizontally below the surface of the filter bed, through the root zone of the plants. Oxygen reaches the filter through the natural surface gas exchange and through the roots of the plants. In exchange, plants take up the nutrients present in the effluent.



Polishing Pond

Polishing pond is a shallow aerobic pond. This pond is mainly used for enriching the oxygen in the wastewater and elimination of pathogens by exposing water to UV radiation of sun rather than removal of organic pollution like BOD.



3.2.2 Types and description of equipment to be used

Rake and Broom



Used for cleaning the bars of screen chambers and other areas of the FSTP

Trowel



Used for removing the trash from screens and bars and putting into waste collection bucket

Bucket



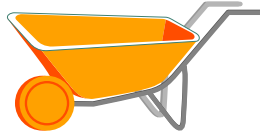
Used for collecting trash

Gum boots



Used as protective gear while operating on sludge drying beds and disposing the sludge at the sludge disposal point.

Wheel barrow



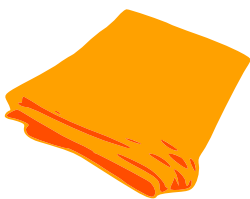
For transferring dried sludge from drying beds to storage house

L- Shovel, straight shovel



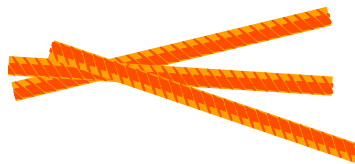
Used for moving and cleaning filter materials and removing the dried sludge from the drying bed

Plastic sheet



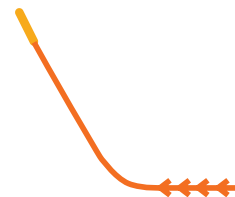
Used for moving and cleaning filter materials and removing the dried sludge from the drying bed

Steel wire/ rod



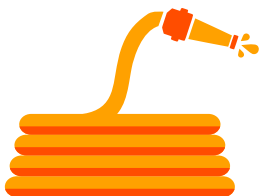
Used for removing any obstructions in the pipe

Long steel sieve



Used for removing any obstructions in the pipe

Water pipe/hose



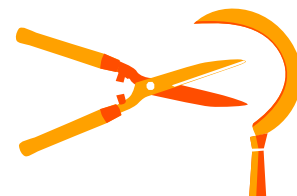
Used for flushing any area with pressurized water

Measuring tape



Used for checking any levels

Garden scissors, Sickle



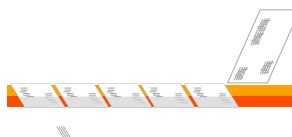
Used for trimming, harvesting and removing weeds from drying beds, landscaping etc.

L- Brush



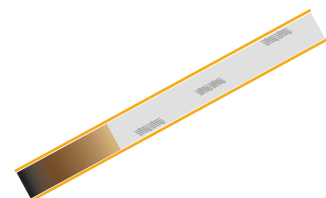
Used for trimming, harvesting and removing weeds from drying beds, landscaping etc.
Used for checking any blockages in pipes (vent pipes)

Long stick wrapped white cloth

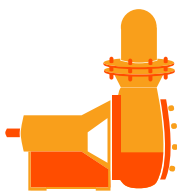


Used for checking sludge level in septic tank and treatment modules

Glass tube sludge sampler



Used for checking sludge level in septic tank and treatment modules
Used for measuring sludge levels in treatment modules

Desludging pump

Used for desludging solidified sludge from the bottom of treatment modules

Screw driver

Used for unscrewing the screens from screening chamber at the time of replacement

Sample collection equipment

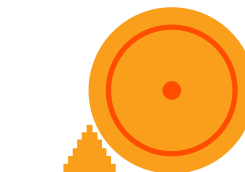
Icebox - Used for collecting FS sample for laboratory tests

Personal protective Equipments (masks, gloves etc.)

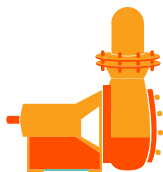
Should be used during operating and monitoring activities at the FSTP

First aid

Fully stocked first aid kit should be available all the time at the FSTP

Wheel chocks

Used for stopping the vehicle from moving when parked

Pumps

Pumps are used in an FSTP for various purpose. They can help in transferring the sludge in between units in case of a level difference, adding chemicals in a controlled way to the plant etc.

Hammers

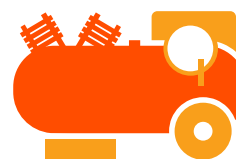
Hammers will be useful in various maintenance and house-keeping activities

Generators

Generator are used as a source of in-situ power supply to meet part or entire energy requirement of the treatment plant. The hours of operation is on need basis. These are to be operated as instructed in the User Manual provided by the manufacturers.

Blowers

Blowers are part of the aerobic (oxygen using) treatment units for effluent. These are a typical feature in activated sludge process. Blowers are used to increase the supply of oxygen for the microorganisms present in it. These are to be operated as instructed in the operation and maintenance manual for the particular FSTP you are working in.

Compressors

Air compressors are used for agitation in the effluent to keep the solids in suspension and to supply oxygen support to the processing bacteria. These are to be operated as instructed in the operation and maintenance manual for the particular FSTP you are working in.

3.2.3 Do's and Don'ts

Do's for plant machineries

1

Do keep all maintenance holes covered when not in operation



2

Do check for rust and damage of treatment units and replace/clean it



3

Do clean clogged inlet and outlet valves when there is less or no flow



4

Do collect samples at inlet and outlet of each treatment unit for tests



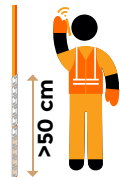
5

Do check sludge height for desludging of treatment units



6

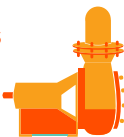
Do call for desludging services when sludge height from bottom of plants is more than 50cm.



7

Do operate the pump as instructed by the vendor or service provider

INSTRUCTIONS



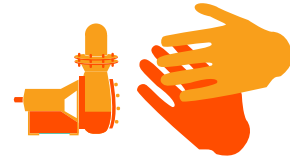
8

Switch off mechanical units such as pumps and dewatering units while cleaning



9

Wear gloves while cleaning machines



Don'ts for plant machineries

1

Don't leave open chambers unattended



2

Don't clean machines using bare hands



Do's for equipment

1

Do clean equipment and tool after each use



2

Do check first aid kits every 3 month to replace supplies that have expired



3

Do check for wear and tear in personal protective equipments



Do's for equipment

4

Do keep water hose at its designated place after use to avoid tripping or slipping hazards



5

Read the instructions in the User Manual provided by the manufacture before operating any equipment.

**Dont's for equipment**

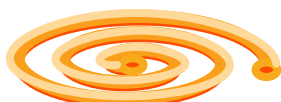
1

Do not work/ insert hand into moving parts of an equipment while in operation

**Dont's for equipment**

2

Do not keep the hose pipes scattered



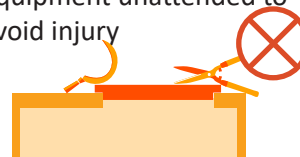
3

Don't use defective personal protective equipments



4

Don't leave sharp tools or equipment unattended to avoid injury



3.3 Sample testing of septage at FSTP

Sampling and analysis of sludge is very important to monitor the treatment process and also to check whether the final effluent adheres to standards. Your role as O&M technician is to collect faecal sludge samples to

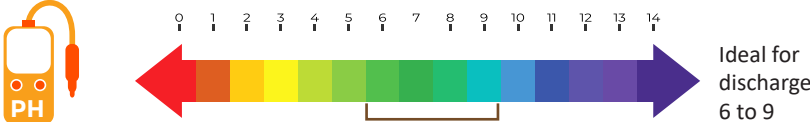

- Approve or reject faecal sludge (& septage) arriving into FSTP
- Facilitate monitoring

This session will assist you in

- Collection and analysis of faecal sludge samples as per standards
- Reporting and record keeping of results

3.3.1 Parameters to be tested on-site

Following are the list of parameters that can be tested on-site: (Scoping paper: Development and validation of protocol for testing faecal sludge and decentralised wastewater technologies Centre for Science and Environment, 2017)

Sr. no.	Test parameter	Unit
1	<p>pH: pH (potential hydrogen) is a measure of the acidity (< 7) or alkalinity (> 7) of sludge. The pH is measured with a probe immediately at the sampling point (faecal sludge and septage receiving station) to determines whether to accept or reject the sludge from discharging into FSTP. As mentioned in unit 3.1 the acceptable pH range is 6 -9.</p> 	
2	<p>Conductivity: EC (electrical conductivity) is one way to measure inorganic materials, including calcium, bicarbonate, nitrogen, phosphorus, iron, sulphur and other ions, present in sludge. It is measured by placing a conductivity probe in the sample and measuring the flow of electricity between the electrodes.</p> 	°s/mc

Sr. no.	Test parameter	Unit
3	Temperature: Temperature is an important parameter in understanding and predicting rates of biological activity, treatment processes and pathogen die-off. Temperature is measured with a probe immediately after sampling.	Degree °C
4	Settable solids: This is useful to derive the sludge volume index, an indicator for the tendency of activated sludge to thicken or to become concentrated during sedimentation/thickening process ⁹	ml/g



⁹ Source: <http://www.owp.csus.edu/glossary/sludge-volume-index.php>

3.3.2 Parameters to be tested at accredited laboratory

Following are the list of parameters that will be sent for laboratory analysis:

Sr.no.	Test parameter	Unit of measurement
1	Solids (dissolved)	mg/l
2	Solids (fixed)	mg/l
3	Solids (volatile)	mg/l
4	Suspended solids	mg/l
5	Total solids	mg/l
6	Ammoniacal nitrogen	mg/l
7	Biochemical Oxygen Demand	mg/l
8	Chemical Oxygen Demand	mg/l
9	Phosphate (Total)	mg/l
10	E-coli	MPN
11	Helminths egg	MPN
12	Nitrates	mg/l
13	Settleable Sulphates	mg/l

3.3.3 Methods of sample testing

As O&M technician, you need to be thoroughly trained for sampling as handling faecal sludge (& septage) involves health risks. You must adhere to the following steps mentioned below for collecting samples.

The samples are to be collected for three purposes: allowing discharge into the FSTP, testing on-site parameters and laboratory analysis for monitoring the treatment efficacy of the FSTP.

For allowing sludge discharge into the FSTP
Testing for on-site parameters



At receiving station

Frequency of collection: Every load

For laboratory analysis



At inlet of receiving station and outlet of each treatment module or stage

Frequency of collection: Twice a week

Testing the safety of the incoming sludge for the FSTP

Faecal sludge originates from on-site sanitation systems (OSS) such as pits and septic tanks. Ideally, these systems should be connected to only toilets. However, there are instances in which wastewater from other parts of the household or the institution (such as hospitals, laboratories, educational institutes) are also connected to OSS. This can potentially change the characteristics of the faecal sludge making it untreatable at the faecal sludge treatment plant. Similarly, in places where there is excessive use of chemical agents (such as acid) to clean toilets, there is a chance that the characteristics of faecal sludge has changed and cannot be treated at the FSTP. Hence, testing incoming faecal sludge is essential before accepting it into the treatment plant. The main parameter tested at is pH and colour.

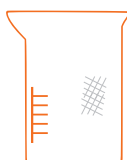
1

Wear personal protective equipment, especially uniform, gloves and boots



2

Take a 1 Litre beaker



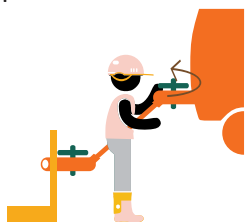
3

Connect the outlet of truck with the inlet of septage (& faecal sludge) receiving station



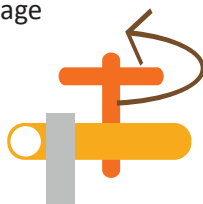
4

Instruct the desludging truck driver to open the valve of the outlet in half open position to allow discharge of sludge into FSTP



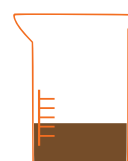
5

Half open the valve of the inlet of the receiving station to obtain laminar flow of discharge. It will help in collection of sample without any spillage



6

Collect a small sample of faecal sludge in the beaker



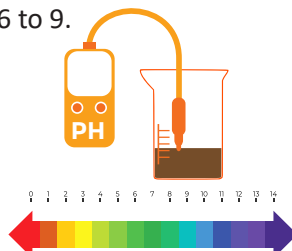
7

Instruct the truck operator to close the valve of the truck



8

Test to check the pH using a pH meter. The pH value should be in the range of 6 to 9.



9

Check temperature. It should not be above 40°C i.e. the temperature at which the biological activity starts to reduce.



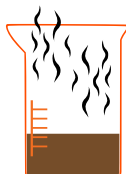
10

Visually inspect the colour: it should range from dark brown to black.



11

Inspect the odour: it should smell of like rotten eggs and/ or like smell from septic tanks and pits



12

Accept the sludge if the pH, temperature, colour and smell all are within the specified parameters. Else, direct the truck to a site designated by the urban local body for discharge of rejects.

13

If the faecal sludge can be accepted into the treatment plant, then pour the faecal sludge into the receiving station



14

Proceed to testing on-site parameters of the sludge as given in **Sampling for on-site parameters and laboratory testing of incoming sludge**

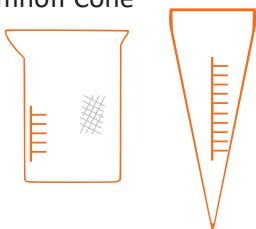
Sampling for on-site parameters and laboratory testing of incoming sludge

This step has to be conducted only for the sludge that is determined to be suitable for discharge at the FSTP.

On-site parameters such as pH, electric conductivity, temperature and sludge volume index are crucial in improving the understanding the characteristics of incoming sludge. This can help in feeding into improving the treatment efficiency of the plant.

1

Take a fresh and clean 1 Litre beaker and a 1 Litre Imhoff Cone



2

Wear personal protective equipment, especially uniform, gloves and boots.

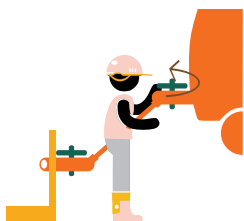


3

Check the safety of the sludge for disposal at the faecal sludge treatment plant as referred to in **Refer to Table 6 Testing safety of the incoming sludge for the FSTP. Pg 34,35**

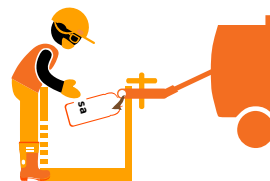
4

Instruct the desludging truck operator to open the valve.



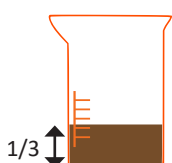
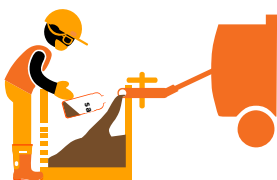
5

Hold the sample bottle in front of the inlet of Septage (& faecal sludge) receiving station



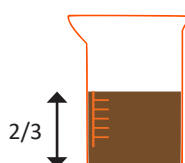
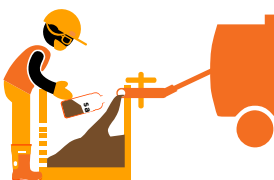
6

Fill only 1/3 of the volume of the beaker while emptying the first 1/3 of the FS present in the desludging truck. Then withdraw the sample beaker. Keep checking the watch glass of the truck to start again while the another 1/3rd is being emptied.



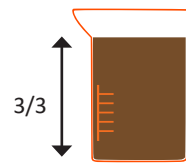
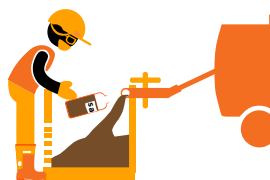
7

Fill another 1/3 of the volume of beaker in the while emptying the 2nd 1/3rd of the FS present in the desludging truck. Now you have 2/3 of the volume of the beaker filled. Then withdraw the sample beaker. Keep checking the watch glass of the truck to start again while the another 1/3rd is being emptied.



8

Fill the remaining 1/3 volume of beaker while the last 1/3rd of the FS present in the desludging truck is being emptied.



9

Pour the contents into an Imhoff cone and test the on-site parameters.



Skip to point 14 if laboratory analysis is not to be done for the existing sample

10

1. Test for on-site parameters i.e. pH using a pH meter, Electric conductivity using EC meter, Sludge volume index using an Imhoff cone, Temperature using a thermos meter. While pH, electric conductivity and temperature can be measured right away, wait for an hour to calculate the settleable solids which will be used to calculate volume index. Procedure for measuring settleable solids
2. Fill an Imhoff cone to the one-litre mark with a well-mixed sample.
3. Allow sample to settle in the Imhoff cone for 45 minutes.
4. Gently stir the sample with a glass rod to release the suspended matter clinging to the sides of the Imhoff cone.
5. Let sample settle for an additional 15 minutes.
6. At this point, one hour has passed. Record the volume of settleable solids (in millilitres) in the Imhoff cone.

Note: Do not include any floating solids or any voids in the settled solids as settleable matter (Standard Method for Settleable Solids)

11

Once the sample is taken and on-site parameters are analysed, put the samples into a fresh and clean 1 Litre sample bottle with pre-written the sample ID. Sample ID should be in the following format:

**Receiving station/
DD-MM-YYYY/ Load
Number/ Time of sample
collection**

12a

Close the lid of the bottle tightly



13a

Keep the sample bottle in an ice box for transportation to the laboratory.



12-13 b

If laboratory testing is not needed, then pour the sample back into the receiving station.



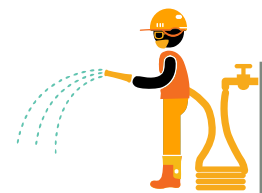
14

Wash and clean all the devices and equipment, and store in a clean and dry place



15

Wash the sampling area with clean water and make sure to leave a clean environment around the sampling site before leaving.



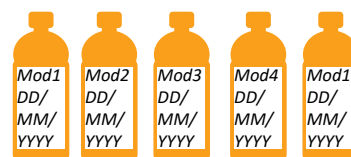
Sampling for sending for laboratory analysis

Regular laboratory analysis of the following forms an essential part of the monitoring of the performance of the FSTP:

- incoming sludge
- the outlet of each treatment module
- outlet of the FSTP

1

Take as many clean 1 Litre sample bottles as the number of outlets from which sample needs to be collected. This is assuming that for incoming sludge sample has been already taken as a part of composite sampling of the incoming sludge as referred to in the previous section. Else, take the composite sample of the incoming sludge as described in the previous section. **Label all the bottles with the sample ID in the following format: Treatment module /DD-MM-YYYY**



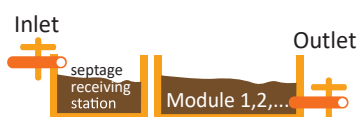
2

Wear personal protective equipment



3

Take samples from the inlet of the septage receiving station and the outlets of all the subsequent modules.



4

Once it is done, seal/close it properly and label the sample bottle with the following information

1. Sample Identification (ID) number (module name and date of arrival)
2. Collection time and date
3. Sample location (example: Outlet of PGF)

5

Keep the sample bottles in an ice box for transportation to the laboratory.



6

Maximum transport time to the laboratory is 6 hours and samples should be processed within 2 hours of receipt at the laboratory



7

Wash and clean all the devices and equipment, and store in a clean and dry place



8

Wash the sampling area with clean water and make sure to leave a clean environment around the sampling site before leaving.

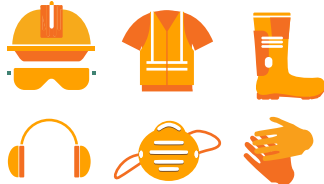


3.3.4 Do's and don'ts

Do's

1

Wear personal protective equipment



2

Handle samples with care to avoid spillage



3

Perform hand hygiene in case of contact with the faecal sludge, **Refer Pg 72**



4

Clean up the sampling area after use



5

Store samples in ice box and transport to the laboratory in the ice box itself



6

Clean equipments after use



Don'ts

1

Do not touch with bare hands and foot



3.4 Maintain the test record

Maintaining the test record can help to understand the treatment efficiency at each stage of treatment and identify areas of malfunction. A test record should include the following information:

General information:

- Date and time of sample collection
- location
- Method of sampling
- Name of technician
- Name of analyst

Characteristics: On-site, given in section 3.3.1 above

Sample ID	Sampling Date	Parameter	Value	Unit
		Color		
		Odor		
		pH		
		EC		mS/cm
		Temperature		°C
		TDS		Ppt

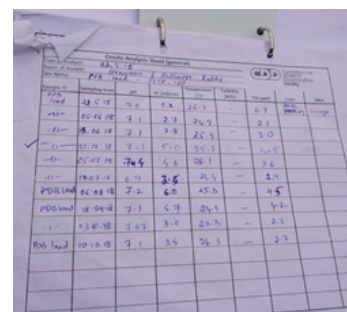


Figure 7 Sample test record sheet,
Source: CDD Society

Characteristics: Lab, given in section 3.3.2 above

Sample ID	Sampling Date	Parameter	Value	Unit
		Solids (dissolved)		mg/l
		Solids (fixed)		mg/l
		Solids (volatile)		mg/l
		Suspended solids		mg/l
		Total solids		mg/l
		Ammoniacal nitrogen		mg/l
		Biochemical Oxygen Demand		mg/l
		Chemical Oxygen Demand		mg/l
		Phosphate (Total)		mg/l
		E-coli		MPN
		Helminths egg		MPN
		Nitrates		mg/l
		Settleable Sulphates		mg/l

3.5 Monitoring the working of FSTP

Monitoring the working of an FSTP involves supervision of the ongoing activities to ensure that they are on-course and are meeting the plant objectives and goals. It is a long-term process of gathering information with regards to the plant performance, use of resources, employees, finance and make any needed corrections accordingly. As the FSTP O&M technician, you will use this information for internal communication to optimize the working of FSTP.

3.5.1 Checklist for things to be monitored by FSTP O&M Technician

Key elements	Description	Source of data
Monitoring of physical-chemical and microbiological parameters	If lab analysis reveals that standards are not met, then operational decisions can be taken to identify the issues and rectify them. Method of procuring data is given in section 3.3	Lab analysis reports

Refer: 3.3 - Sample testing of septage at FSTP, Page 32-39

Key elements	Description	Source of data
Reporting and Record keeping	It includes information on the operation and maintenance of the FSTP like daily operating records, the operators log book, manifest reports; disaster response and emergency recovery records; preventative and corrective maintenance records including the equipment-maintenance log books and store room supply reports; compliance reports including field and analytical data, correspondence from regulatory officials; and employee records, such as employee schedules, time sheets and injury reports. Details are given in the next section 3.6	Logbook
Reception monitoring report	Reception reports track the total number of loads delivered, the time, date and driver's name and other records related to FS deliveries to the plant Refer to Sample Manifest Form , pg 138 given in the Annexure	Logbook
Treatment unit operation sheet	Treatment unit operation sheets are used to record the quantity of FS loaded and the operational activities performed in each treatment unit. Refer to Sample format for Operation & Maintenance report , pg 140, given in the annexure	Manifest form and logbook
Plant security and safety ¹⁰	Protect the FSTP from unauthorized entry, maintain the safety of FSTP workers and ensure safe operations of plant machineries and equipments	Plant security policy, Guidelines on health and safety, record of personal protective equipment, emergency report form
Monitoring of finance plan	It monitors the operating cost of the plant and revenue generation from sale of end products, methods to procure tools and equipment, funds for repairs and breakdown etc.	Logbook

Source: (Faecal Sludge Management: Systems Approach for Implementation and Operation, 2014)

3.6 Daily activities & log sheet for reporting

The effective operation and maintenance of an FSTP requires a detailed and structured monitoring plan. As the O&M technician of the plant, you have to provide adequate information to continuously optimize the plant performance. You must keep accurate record of all daily activities and, monitor the occurrence of malfunctions. This will help you in identifying fluctuations in the operation of the facility and operational problems that may occur periodically, review the effectiveness of mitigation measures that may have been used to correct past operating problems, and to optimise the O&M procedures. (Faecal Sludge Management: Systems Approach for Implementation and Operation, 2014)

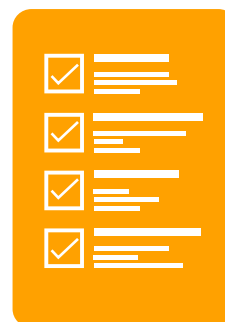
3.6.1 List of things to be recorded

Following is the list of things that should be recorded, Refer to section **3.6.2** and Annexure for the forms:

- Overview of FSTP
 - Total no. of operating days since the commissioning of plant
 - Total volume of FS arrived till date (m³)
 - Total number of loads or trips made to FSTP
 - Plant utilization or under-utilization details in percentage (Current capacity utilisation of plant/ capacity of the plant * 100)

Refer: 3.5 - Monitoring the working of FSTP, page 40-41

- Manifest form Refer **Sample Manifest form**, page 138
- Employee records such as employee schedule, time sheet and injury report
- Log book Refer **Components of logbook**, in next section
- Measurement of quantity and type of screens collected in screening chamber
- Preventive and corrective measures taken for plant machineries and equipment
- Store room supply reports
- Sampling analysis at inlet and outlet of treatment units



Apart from the above-mentioned points, you also need to record weather conditions, any equipment malfunctions, operating problems, important phone messages, security information and actions taken in response to unusual circumstances. (Faecal Sludge Management: Systems Approach for Implementation and Operation, 2014)

3.6.2 Components of logbook

The Log book is the most important record for an FSTP. This log book provides a written record of management and operation of the plant. Components of logbook can be divided into following elements:

Day	Months	No. of loads	Volume of sludge in litres	Type of desludging truck		Dry sludge generated in kgs	End product generated
				Private	Government		
	January						
	February						
	March						
	April						
	May						
	June						
	July						
	August						
	September						
	October						
	November						
	December						

Refer: Sample Manifest form, page 138

- Manifest details, for format go to **Sample Manifest Form** in the annexure
 - Date and time of arrival
 - Type of agency (private or government)
 - Name of agency
 - Source of faecal sludge (& septage)
 - House owner name and contact details
 - Type of containment system at source (pits/septic tanks)
 - Specifications of structure (rings/stone masonry)
 - Date of desludging at source
 - Quantity of FS discharged
 - Age of FS
 - Time required to discharge
 - pH of sample

Operator Name	Vehicle details			Driver details			Desludging truck operator locality
	Type	Capacity	Vehicle Registration number	Name	Contact no.	License no.	

Rows to be added as per number of loads received.

Table 2: Sample format for recording details of desludging vehicle

Sr. No.	Date	No. of loads rejected	Type of agency	Reason for rejection

Table 3 Sample format for recording details of rejected loads

Sample ID	Color	Odor	pH	TDS	Conductivity	Settleable solids, ml	Presence of Oil/Grease Yes/No	Presence of Silt/Sand Yes/No

Table 4 Sample format for recording on-site parameters of the sludge

- Weather conditions
 - Temperature
 - Humidity
 - Precipitation

Date	Temperature, oC		Humidity		Precipitation, ml
	6 am	2 pm	6 am	2 pm	

Table 5 Sample format for recording weather conditions

Treatment Unit	Date of valve operation	State of valve (half open/full open)	Time taken to flow to next unit	Volume of liquid dis-charged	Rate of flow

Table 6 Sample format for recording flow of liquid from one treatment unit to next treatment unit

Treatment unit	Time of de-sludging	Time taken to de-sludge	Volume of sludge de-sludged	Sludge type

Table 7 Sample format for recording desludging treatment units

- Revenue generation details
 - Total quantity of end product (compost/bio solid/treated water) sold
 - Revenue from sale of end products

Sr. No.	Date	Name of the buyer	Product category	Purpose	Quantity sold	Cost per unit	Total amount collected	Amount collected by	Remarks

Table 8 Sample format for recording revenue from sale of end products

3.3.4 Do's and don'ts

Do's

1

Do update the logbook every 24 hours



2

Do keep the logbook in a safe place



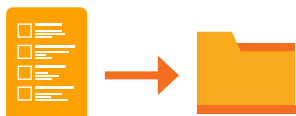
3

Do take photographs in case of accidents or hazards when possible



4

Do convert hardcopy data into digital file at regular intervals of 1 month or 15 days as per the convenience of the FSTP Manager



5

Do share logbook data with plant manager



6

Do collect the sample of sludge and send to the laboratory for test



7

Do update the stock register



8

Do wear PPE while working at the FSTP



Don't's

1

Don't misrepresent the data in logbook



3.7 Preparing the relevant reports, and provide recommendations for optimizing the FSTP

The operation and maintenance of an FSTP involves a detailed understanding of treatment processes and the requirements of each treatment unit. This understanding along with relevant theoretical information in the form of reports can help in optimising the plant performance and monitor the effluent quality. These structured reports give comprehensive information about the plant infrastructure, operations, employees and finance.

3.7.1 Type of reports which need to be prepared

You need to prepare reports on the following

Quality of treatment:

Quality report is prepared to check whether the final treated water meets the standards specified by the state and central government. It basically comprises of lab reports and on-site FS analysis. Refer **Sample format for Quality testing report, Pg 139**

Operational expenditure and revenue generation:

This report gives the ongoing cost of running the FSTP. It includes the cost of regular operating and inspection activities, water and electricity cost, incidental maintenance activities (plumbing charges, replacement of tools and equipments) and salaries and wages of FSTP workers. This report can also help you keep a track on the sale of end products. Refer **Sample format for Operational expenditure and revenue report, pg 139**

Refer: *Sample format for Quality Testing Report, Page 139*

Sample format for Operational expenditure and revenue report, Page 139

O&M activities:

This is a detailed document used to record the quantity of FS loaded into each treatment unit, the operational activities performed (e.g. load of FS or extraction of end products), the operational variable applied (e.g. mixing ratio of fresh to stabilised sludge, the addition of lime), the quantity of end products and wastes extracted, and the consumables required. Refer **Sample format for of Operation & Maintenance report**, page 139




3.8 Housekeeping of FSTP

Housekeeping in an FSTP is important to control or eliminate workplace hazard and ensures efficient operation and maintenance of the treatment plant site. An unkept, messy and dirty FSTP can make the FSTP look neglected; these conditions may lead to incidents such as







1. tripping over loose objects lying on floors
2. slipping on greasy surfaces
3. wet or dirty surfaces
4. hurting yourself with sharp tools
5. falling of poorly stacked items or misplaced material

To avoid these hazards, you must maintain a schedule of housekeeping activities which are to be carried out regularly (daily/weekly/monthly). You must ensure that every worker follows this schedule and performs his duty along with cleaning his workspace before the end of his shift.

3.8.1 Checklist for cleanliness and frequency

Description	Frequency
Dust and dirt removal <ol style="list-style-type: none"> 1. Sweeping floors 2. Manual cleaning of shelves, lockers, cupboards 	Daily
Cleaning of toilet <ol style="list-style-type: none"> 1. Washing the floors and walls of the toilet 2. Maintaining sanitary ware 3. Maintaining supply of hand wash, soap, towels disinfectants etc. 	Daily
Weed removal and trimming of plants <ol style="list-style-type: none"> 1. Remove dead leaf litter or weed growth manually or using appropriate tool (scissors, sickle) 2. Trim excess growth of plants using appropriate tool (scissors, sickle) 	Once in a month or whenever is needed

Refer: *Sample Manifest form*, page 138

Description	Frequency
<p>Cleaning of polishing pond</p> <ol style="list-style-type: none"> 1. Empty the treated water present in the polishing pond 2. Use a brush to clean the interior walls and floor of the pond 3. Remove all the weeding and litter manually using the knife, trowel, shovel and bucket 	<p>Once in a month or whenever it needed</p>
<p>Tools and equipment</p> <ol style="list-style-type: none"> 1. Clean tools and equipment after each use 2. Return and store the tools and equipment at its designated place 	<p>After every use</p>
<p>Routine desludging of treatment unit: desludging is required when the sludge height level reaches 50 cm</p> 	<p>As and when required</p>
<p>Solid waste: Collect solid waste generated in a dustbin and dispose it regularly</p> 	<p>Daily or weekly as per the municipal arrangement</p>
<p>Lighting</p> <ol style="list-style-type: none"> 1. Replace fused or malfunctioning lights 2. Light sourced to be cleaned 	<p>whenever necessary</p>
<p>Mosquito repellent spray has to spread to control mosquito</p> 	<p>Once in 2 days</p>

3.8.2 Do's and Don'ts

Do's

1

Wear personal protective equipment



2

Do keep the cleaning tools and detergents at a designated, clean and dry place



3

Do wash your hands thoroughly after any cleaning activity



4

Do update the daily, weekly and monthly logbook



5

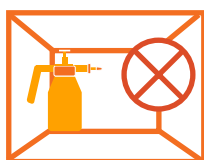
Do follow the report structure for reporting



Don'ts

1

Do not spray DEET (mosquito repellent spray) in enclosed areas



2

Do not mishandle harmful chemicals



3.9 Inspection

Inspection and examination are required for the following purpose:

- To prevent any problems for occurring in the plant
- To identify existing or potential problems in the treatment unit
- To locate the position of problems
- To provide clear, concise and meaningful reports to supervisor regarding the problem

These activities often minimise reactive interventions to emergency situations, which tend to be more complex and expensive.

3.9.1 Define inspection activities of FSTP

Inspection activities include checking for any abnormalities in the operation of treatment units, deformation or damage to facilities, defects in piping system etc. You should inspect the relevant locations for the following:

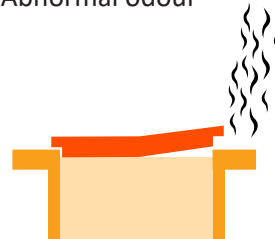
Corrosion, wear, damage or crack in the facility



Damage in covers, deformation of maintenance hole, buried maintenance hole



Abnormal odour



Clogging and overflowing



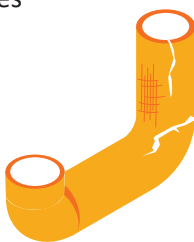
Cracked wires



Cracks in concrete



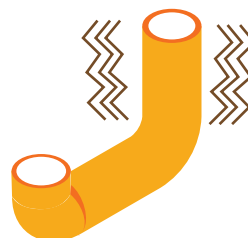
Discoloured and brittle pipes



Leaking Pipes



Abnormal vibration/sound



Sparks/ heating



3.9.2 Checklist of operation related inspection activities

The following checklist list downs activities that need to be carried out for inspection work

Task	Frequency	Date	In charge
Ensure proper cleaning of screen chamber	Every day		
Repaint/replacement of screen	Once in 3-4 years		
Ensure free flow of water from each treatment unit	Once in a month or whenever it is needed		
Removal of dried sludge	As per design period		
Cleaning of filter material	Once in 5-6 years or whenever it is needed		
Ensure functionality of vent pipes	Once in a month or whenever it is needed		
Checking sludge level	Every day		
Check accumulation of scum	Every day		
Check growth of weeds in and around treatment units	Once in a week		

3.10 Exercise

- Name the tool used for measuring sludge height in treatment units
Select the right Answer:
Please provide options to select
 -
 -
 -
- Name the tool used for trimming plants in PGF and PDB
Please provide options in all the questions
 -
 -
 -
- Name two on-site parameters that needs to be checked by O&M technician
- Name two major components of log book
 -
 -

True or False

- | | |
|---|--|
| 1. Allow discharge of faecal sludge if pH is 10 | |
| 2. Screen chamber is the last stage of FS treatment | |
| 3. Report to plant manager if there is a crack in the settling tank | |
| 4. Smoking while inspection work is allowed | |
| 5. Update the logbook every week | |
| 6. Desludging is required when sludge height reaches 50 cm | |
| 7. Plastic sheet is used for cleaning clogged pipes | |
| 8. Electrical conductivity is a part of on-site parameters | |
| 9. Mosquito repellent is used for inspection work | |

3.11 Summary

This chapter gives you information on the following list

- Standard procedure for receiving of faecal sludge (& septage) at the FSTP
- List of tools and equipment used in various types of FSTP
- Standard procedure for sample testing of faecal sludge
- Importance of operation and monitoring of various types of FSTP
- Things to be recorded
- Types of reports to be prepared for proper operation and maintenance of FSTP
- Cleanliness procedure in various types of FSTP
- Inspection of various types of FSTP

Notes

[illegible]



4. Carry out routine maintenance of FSTP

- 4.1 Plant equipment for which routine repair and maintenance is needed
- 4.2 Inspection of the equipment at FSTP
- 4.3 Replacement of the damaged equipment
- 4.4 Preparing a report on repair and maintenance activities
- 4.5 Ensuring the cleanliness of the equipment
- 4.6 Handling the repair and maintenance (R&M) tools
- 4.7 Exercise
- 4.8 Summary



Chapter 4 : Carry out routine maintenance of FSTP

Unit Objectives:

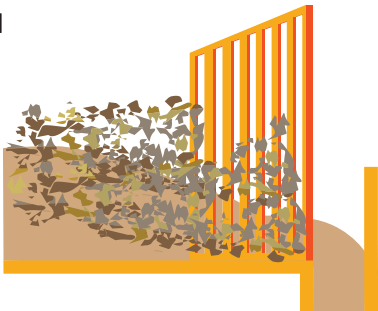
At the end of this unit, you will be able to:

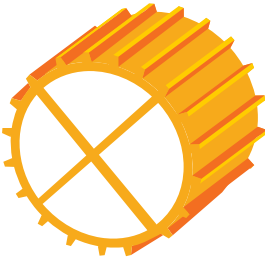
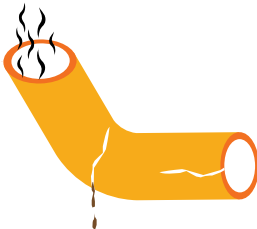
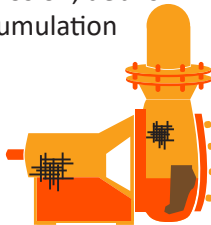
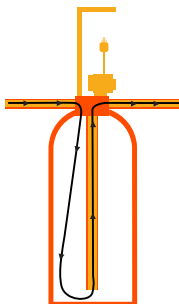

- Inspect equipment at FSTP for any damage i.e hose pipe, bucket, glass tube, plastic sheet, shovel, rake, etc.
- Carry out replacement of damaged equipment
- Monitor facility and equipment in order to identify leak
- Repair equipment if leak is identified
- Monitor malfunctioning of FSTP by testing inlet and outlet sample of sludge
- Perform routine maintenance activities for motor bearing, flanges used at FSTP
- Perform greasing of moving parts
- Change oil in generator, machines and equipment
- Prepare routine maintenance record of major and minor activities
- Perform routine cleaning of work area and equipment used at the FSTP






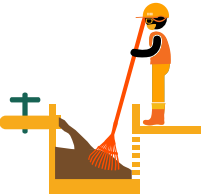

4.1 Plant equipment for which routine repair and maintenance is needed

Plant machineries and equipments require constant maintenance to keep it in good working condition. Conversely, poorly maintained machineries and equipments run inefficiently and results in breakdowns which are costly to repair or replace. Following section lists down the plant equipment which require regular repair and maintenance work. It specifies the issues faced and the steps to be followed for solving the issues.

4.1.1 List of the equipment, issues faced and corrective measures

Plant machinery/ Equipment	Issues faced	Corrective measures
Screening mesh: It requires very less maintenance, however regular removal of solids from the chamber needs to be ensured in order to avoid clogging and overflow from the chamber.	Clogging and over flowing 	Cleaning of screen chamber: <ol style="list-style-type: none"> 1. Open the maintenance hole covers of Screen chamber. 2. Collect the solids accumulated at screens using the trowel and put them in a bucket. 3. Clean the bars using water and rake 4. Close the maintenance holes with covers Replacement of screen chamber: <ol style="list-style-type: none"> 1. Unscrew 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 maintenance holes with cover 6. If screen plate is highly corroded, replace is entire plate with new one

Plant machinery/ Equipment	Issues faced	Corrective measures
Filter media in treatment units: Filter material need to be cleaned to avoid clogging of wastewater through the treatment system		<p>Cleaning of filter material in treatment unit (Anaerobic filter)</p> <ol style="list-style-type: none"> 1. Open the maintenance holes covers of the unit 2. Force water above the filter materials using a pump. 3. Meanwhile, use a sludge pump to dewater the filter chamber through the desludging pipe 4. Repeat the steps 3 or 4 times till you pump out clear water. 5. Place the maintenance holes cover back over the maintenance holes.
Wastewater pipes: maintenance activities include checking and replacement of broken pipes. All the pipes of treatment modules need to be checked once a month. Vent Pipes: Vent pipes must be check for any blockage or choking.	Odor, gas and liquid leakage and clogging 	<ol style="list-style-type: none"> 1. Check for any leakages or smell coming out of pipes. This indicates damaged or broken pipe 2. If there are any pipes broken inform the 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.
Pumps: to keep pumps running properly, a regular maintenance schedule should be implemented and followed. It will also increase the lifespan of the pumping system	Corrosion, debris accumulation 	<ol style="list-style-type: none"> 1. Remove all wiring and clean the pump 2. Check pump volute for any damage 3. Check for any clogged debris and clean as required 4. Follow the guidelines provided by the vendor for operating the pump
Sand and Carbon filter		<ol style="list-style-type: none"> 1. Backwashing is required twice in a day, in this process treated water is pumped back into the filter system which cleans the filter media by removing accumulated particles. 2. Refilling of sand and filter media is required whenever there is a drastic reduction in flow rate from the outlet of the filter. Follow the guidelines provided by the vendor to replace the sand and carbon (charcoal) filled in the treatment unit.
Maintenance tools used for cleaning such as rake, trowel, brooms, shovel, sieve, steel rod and garden scissors	Wear and tear, broken or damaged 	<ol style="list-style-type: none"> 1. Clean all the tools directly with clean water, do not use any chemicals 2. After that apply a light film of oil to prevent rust on tools.

Plant machinery/ Equipment	Issues faced	Corrective measures
Equipment for taking samples	Broken utensils, trouble in calibration of pH meter, electrical conductivity probe, thermometer etc. 	<ol style="list-style-type: none"> 1. If there are any broken items report to supervisor or whoever in charge. 2. Replace the damaged item with a new one of same specification.
Personal Protective Equipment	Wear and tear, broken or damaged goggles and masks, torn uniform etc. 	<ol style="list-style-type: none"> 1. If there are any broken items report to supervisor or whoever in charge. 2. Replace the damaged item with a new one of same specification.
Wheel chocks to prevent vehicles from moving when parked	Wear and tear, damage 	Replacement
Disinfectants, barriers and bags for cleaning up activity	Broken or damaged 	Replacement
Control panels	Burned out, defective buttons, requirement of upgrades 	Service repair and replacement (if required)
Treatment units	Unhygienic environment leads to breeding of mosquitos and bad odor 	<ol style="list-style-type: none"> 1. Remove unwanted growth of weeds/grass 2. remove accumulation of scum in treatment units 3. Spray mosquito repellent to avoid mosquito nuisance 4. Follow housekeeping rules mentioned in unit
Plant Machinery/ Equipment: Machines and moving part	Friction 	<ol style="list-style-type: none"> 1. Check of the level of grease and lubricants in the machine. Switch off the machine and apply grease and lubricants 2. Change the oil periodically in machines as directed by the manufacturer

4.1.2 Dos and don'ts

Do's

1

Before performing the maintenance work on a mechanical equipment, switch it off, unless stated otherwise by the manufacturer.



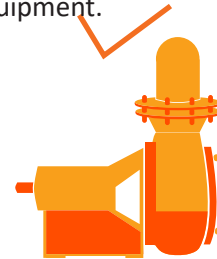
2

Read the maintenance/ cleaning/ repair instructions in the User Manual provided by the manufacture before performing the maintenance work on any equipment.



3

Do oversee the correct operation of the equipment.



4

Do use good lubricants to reduce friction around any moving part.



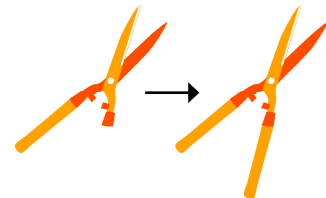
5

Do check for signs of wear and tear such as vibration, high temperature, cracks, loose bolts etc.



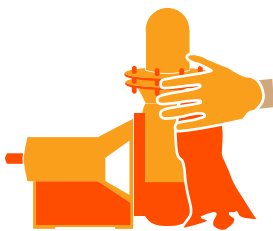
6

Do quickly perform replacement of any broken equipment.



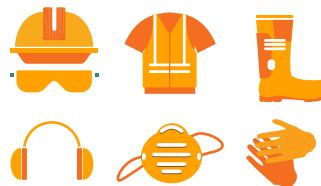
7

Do keep machineries clean



8

Do maintain clean environment



9

Do conduct regular inspection



Don't's

1

Do not carry out maintenance activity when the pumps are in operation



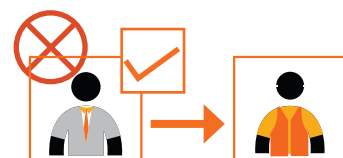
2

Do not use damaged tools



3

Do not carry out work without the knowledge/ permission of the plant manager



4.2 Inspection of the equipment at FSTP

During inspection of the FSTP, you will verify that all plant machineries and equipment are in correct working order.

Inspection activities are generally a type of preventive maintenance with the aim of minimizing or preventing cases of breakdowns in plant machineries and equipments. The aim is to detect any potential failures and carry out minor repairs works to avoid major operating failures.

Following is a list of inspection activity:

- Inspect inlet and outlets of treatment modules
- Inspect free flow of water in distribution pipes, percolation collection pipes and vent pipes
- Inspect the condition of tools and equipment
- Inspect the condition of safety equipment and repair and replace as needed
- Inspect the cleanliness of the plant
- check if there is growth of grass/weed in and around treatment units
- check if garbage bins are routinely emptied
- check cleanliness of toilets and wash areas
- Inspect if there is accumulation of scum in treatment unit
- Inspect the treatment efficiency by checking sample reports weekly.
- Inspect all the light fixtures in FSTP: lighting in operator's room, FSTP premises lighting etc.

4.2.1 Things to be recorded

Your work is to examine each equipment and plant machinery of the FSTP and record its status in the Inspection report. The inspection report shall include

- Time, date, subject of inspection
- Description of breaks, breakdowns, problems, bypasses, pump failures, occurrences, emergencies, complaints and/or intervening factors
- Record of the remedial action or follow up action taken to correct all of the above issues
- Name of the inspector or technician who is entering the details in the report

(Faecal Sludge Management: Systems Approach for Implementation and Operation, 2014)

Daily Inspection Report					
Technician Name					
Date of inspection					
Time of inspection					
Name of equipment	Status	Problem description	Repair activity performed	Status after repair	Expenses (if any)

Table 9: Sample format for recording daily inspection report

4.3 Replacement of the damaged equipment

There are a number of factors that need to be checked before deciding whether to replace or repair an equipment or tool. For example, when only a part of the equipment is damaged which can be repaired at negligible costs, you may decide to go for repair works only. Two parameters are generally taken into consideration:

Cost of repair :

- Includes removal and disposal of damaged part, replacement cost of damaged part with installation and testing, manpower cost

Cost of replacement :

- Includes disposal cost, salvage value (i.e. estimated resale value of an asset at the end of its useful life), capital cost of equipment, installation and testing charge, training of staff prior to operation

4.3.1 What are replacement activities?

The activities which need to be done for procuring a replacement of an equipment for reasons such as the equipment is completely damaged, the equipment has reached the end of its useful life etc. are called as replacement activities.




4.3.2 Whom to request?

The plant manager or the in-charge should be requested to make necessary arrangement for the supply of new equipment or machinery.

4.3.3 Checklist for replacement of equipments

Steps	Checklist
First step: Inspection of the equipment	<input type="checkbox"/>
Second step: Evaluation of the damaged or malfunctioning equipment	<input type="checkbox"/>
Third step: Create a notification of malfunction by recording it in inspection report.	<input type="checkbox"/>
Fourth step: Inform supervisor and receive confirmation for repair or replacement	<input type="checkbox"/>
Fifth step: Check warranty of the equipment, check availability of equipment in stock, carry out discussion with plant manager for replacement or repair of equipment	<input type="checkbox"/>
Sixth step: Release an order notice with permission of plant manager or in charge person.	<input type="checkbox"/>
Seventh step: once the equipment is replaced, document the relevant details.	<input type="checkbox"/>

4.3.4 Do's and don'ts

Do's		Don'ts
<p>1</p> <p>Do inform the plant manager before taking any decision</p> 	<p>2</p> <p>Do keep record of all the activities</p> 	<p>1</p> <p>Do not accept any damaged equipment (shipment) from the vendor</p> 

4.4 Preparing a report on repair and maintenance activities

You must ensure that all required repair and maintenance work is documented using the form given below. This form will be used to detail out the repair and maintenance activity carried out for a particular equipment. The completed form must be given to plant manager or in charge and kept in safety. Through these reports the repair and maintenance procedures done on equipment can be monitored.

Repair and maintenance Report			
FSTP Technician name:		Maintenance date:	
Equipment type:		Location:	
Type of maintenance activity		Status:	Problems identified
Routine	<input type="checkbox"/>		Noise <input type="checkbox"/>
Breakdown	<input type="checkbox"/>		Odor <input type="checkbox"/>
Service	<input type="checkbox"/>		Vibration <input type="checkbox"/>
Last maintenanc date:			Leakage <input type="checkbox"/>
Problem description:			Blockage <input type="checkbox"/>
			Crack <input type="checkbox"/>
			Others <input type="checkbox"/>
Routine maintenance activity description:			
Breakdown maintenance activity description:			
Service maintenance activity description:			
Status after repair and maintenance:			
Name of plant manager:			
Signature of plant manager:			
Date:			

Table 10: Sample Repair and maintenance Report

4.5 Ensuring the cleanliness of the equipment

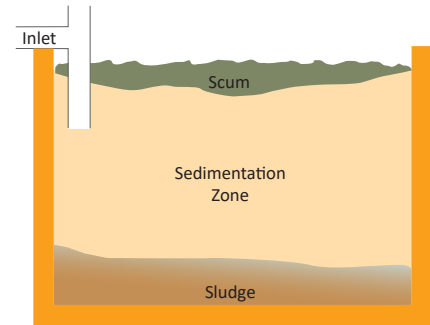
Cleaning the equipment is important because if your equipment is in dirty condition, it might eventually lead to damage and malfunction in the plant. Following a regular maintenance and cleanliness routine for equipment have a number of benefits. For example, it extends the life of the equipment, increases productivity and efficiency of treatment, saves you from the risk of hurting yourself etc.

4.5.1 Cleaning Activities to be taken up

Maintain a cleaning schedule based on the key points mentioned below to avoid making mistakes related to the frequency of cleaning i.e. failure to clean the plant machineries on time will lead to costly repairs and cleaning the plant machineries too frequently is a wastage of time and money

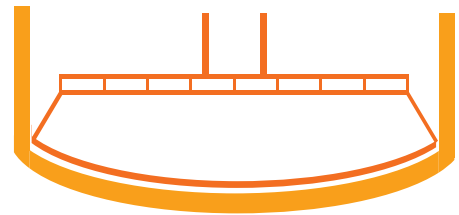
1. Measure scum and settled sludge:

(Free Encyclopedia of Building & Environmental Inspection, Testing, Diagnosis, Repair, n.d.) A floating scum layer on top of treatment modules and settled sludge on the bottom of treatment module are key factors that determine the retention time. The scum layer comprises of oil and grease particles which are harmful for the treatment process. Settled sludge comprises of dissolved solids which are dense enough for settling at the bottom of the tank.

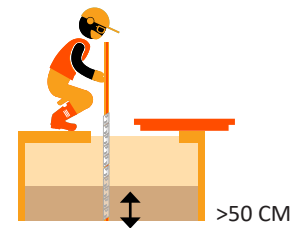
**2. Scum removal mechanism:**

You should clean the plant machinery if the scum layer has thickened to the point where it can overflow into the next treatment module.

- Remove the scum either manually or using a mechanical rake as shown in figure
- Dispose the collected scum along with municipal solid waste in a landfill or a trench can be made and filled with the collected scum and then covered with mud or soil.

**3. Settled sludge removal mechanism:**

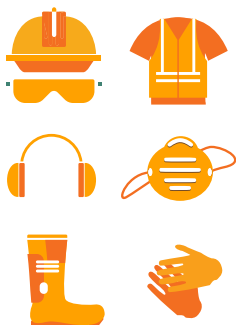
As mentioned in Types and description of treatment units/ technologies; use a glass tube sludge sampler for measuring the height of settled sludge from the bottom of treatment module. If the height is more than 50cm, call for a desludging truck operator.

**4. Check the growth of grass or weed:**

Remove either manually or using a garden scissor or fork

**4.5.2 Dos and don'ts****Do's****1**

Do wear protective gears while cleaning

**2**

Do keep the cleaning tools and detergents at a designated, clean and dry place

**3**

Do wash your hands thoroughly after any cleaning activity



Do carefully handle the trash and collect it in trash collection bucket only



Do record the information of desludging truck operator in logbook



Do's

Do not mishandle any tool or equipment



4.6 Handling the repair and maintenance (R&M) tools

Tools can pose a safety risk if they are misplaced or improperly handled by workers. Thus, as the FSTP technician you must instill the importance of safe handling of repair and maintenance tools in the workers. An example of inadequate maintenance of tools is given in the figure below.



General habits: Certain rules of handling are not specific to the type of tool and thus can be applied to anything that is used on duty.

- Keep an **inventory of tools** which is basically a list of the entire collection of tools, spare parts, essential consumables that you have in the FSTP with relevant information as shown in **Table 11 Sample format for maintaining inventory of tools** and designate an area for tool storage.
- Clean and store the equipment correctly after every use. Make cleaning and storing the tools in the right place, a part of safe handling procedure.
- Remove any liquids that may have been contaminated.
- Apply a thin layer of oil (motor oil) on metal tools to avoid rust
- In case of rusting, remove the rust with a sand paper or wire brush
- Use a hand-held file to sharpen tools such as shovels, scissors, axes and trowels
- Keep power tools and electrical tools unplugged and disconnected when not in use

Inventory of tools					
Name	Quantity	Price	Date of procurement	Current status	Place of storage

Table 11 Sample format for maintaining inventory of tools

4.6.1 Dos and Don'ts

Do's

1

Read the maintenance/ cleaning/ repair instructions in the User Manual provided by the manufacture before performing the maintenance work on any equipment.



2

Do handle sharp tools carefully



3

Do carry tools in a tool box or in a tool pouch



4

Do check the tools for any damage before use



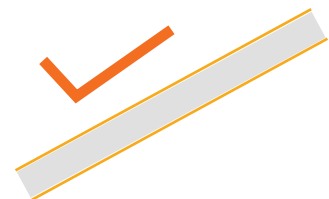
5

Do wear your PPE (personal protective equipment)



6

Use the right tool for the right job



Don'ts

1

Do not put sharp and pointed tools in your pocket unless it has a cover



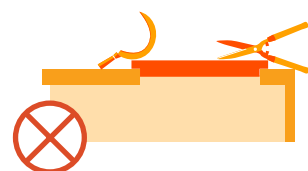
2

Do not put away tools unless it's ready for the next day's use.



3

Do not leave tools lying around when not in use



4

Do not toss a tool to your co-worker



4.7 Exercise

1. Name two inspection activities
2. List the steps for a cleaning pump
3. Name any four types of maintenance activity
4. What are the steps for replacing screen in screen chamber?
5. What is an inventory for tool?
6. Which of the following is not the duty of the FSTP technician?
 - Option A: Order new equipment
 - Option B: fill inspection report
 - Option C: clean equipment

True or False

1. Apply grease on tools to avoid rusting
2. Store each tool at its own place
3. Screen chamber requires replacement of screens after 6 months
4. Purchase replacement equipment on your own
5. Do not wear protective equipment while doing maintenance work
6. It is the responsibility of plant manager to fill the repair and maintenance report

4.8 Summary

This chapter gives you information on the following list

1. List of plant equipment and the issues that arise if they are not properly maintained.
2. The methods of solving issues
3. Importance of documenting the repair and maintenance activity
4. Method of reporting repair and maintenance activity
5. Correct steps of inspection work
6. Correct steps for handling of repair and maintenance tools

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Chapter 5: Maintain personal health & safety in FSSM

- 5.1 Major hazards at the plant
- 5.2 Personal protective equipment which are to be used while working
- 5.3 Health and safety practices at the FSTP
- 5.4 Electric safety measures
- 5.5 Confined spaces safety
- 5.6 Protection against falling and drowning hazards
- 5.7 Chemical and material storage safety
- 5.8 Sampling safety
- 5.9 Managing movement of vehicles within the plant
- 5.10 Medication
- 5.11 Contingency measures in case of emergencies within the plant
- 5.12 Natural hazard
- 5.13 Visit plan
- 5.14 Emergency situation involving the visitors
- 5.15 Questions frequently asked by visitor



Chapter 5: Maintain personal health & safety in FSSM

Unit Objectives: At the end of this unit, you will be able to:

- Identify violation of workplace safety policies
- Identify the location of first aid materials
- Administer first-aid
- Identify personal safety hazards or work site hazards
- Identify the personal protective equipment
- Demonstrate safety drill
- Demonstrate safe and accepted practices for personal protection
- Use insect repellent at unhygienic places
- Identify sign boards/caution such as “Work in progress” or “Danger” to avoid accidents

5.1 Major hazards at the plant

The following is the list of major hazards in an FSTP and how to avoid them.

Hazards

1. Biological hazard

A large number of coliform groups, various kinds of pathogen, and egg parasites exist in the faecal sludge. These pathogens can cause a number of diseases such as jaundice, worm infestation, infection, typhoid etc.



2. Chemical hazards

A number of chemicals are used in the FSTP for treatment, laboratory analysis and housekeeping. Direct contact with these chemicals can cause burns, itching, lung problems (if inhaled) and other damages.



3. Physical hazards

There are a number of potential physical hazards in an FSTP. These are:

A. Confined spaces

A space that is enclosed and has limited access, such as tanks, dry wells, pump rooms, maintenance holes etc. These places which have limited exit in terms of number of exit points, size of exit points etc.; are not designed for continuous occupancy and may have a hazardous atmosphere. Hence there is a possibility of engulfment, suffocation or a worker getting trapped through converging walls or a sloped floor, or any other factors causing a serious safety or health hazard.

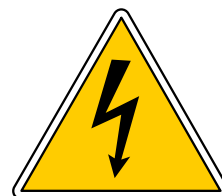


B. Spillages from trucks**C. Leakages from treatment modules**

This can cause threat by means of contamination of the surrounding soil and water (in case of liquid leakages) and unpleasant odour and even fire accidents (in case of gaseous leakages)

**D. Electrical hazards**

A number of pumps, motors and other electrically powered devices (filters, press, mechanised treatment units) are used in an FSTP. Besides these, a number of equipments are used for the purpose of offices, housekeeping etc. Mishandling and malfunction in these equipments can lead to fatal electric shocks, burns and other injuries.

**E. Falling:**

The presence of tanks, ponds and a number of other treatment systems in which water is present, creates a risk of falling, slippages and drowning.

**F. Falling of objects:**

Areas where things are stacked up such as material storage rooms create spaces where objects can fall on top of a person.

**G. Fires**

Faecal sludge is anaerobically digested and can generate methane which is an inflammable gas. Similarly, fires can light from electric equipments and chemicals

**H. Natural hazards**

FSTPs are not very prone to natural hazards because they are usually constructed by keeping in mind the natural disasters to which the location of the FSTP is prone to. Still, it is a good practice to discuss the usual natural disasters that the region is prone to and how the FSTP O&M technicians should conduct themselves if they are within or around the premises. These include floods, storms and earthquakes.



Source: (Faecal Sludge Management: Systems Approach for Implementation and Operation, 2014)

5.2 Personal protective equipment which are to be used while working at FSTP

Wearing personal protective equipments (PPEs) is the first and foremost requirement while working at an FSTP, especially while handling sludge & wastewater, chemicals, plant equipments, any sharp tools and engaging in housekeeping activity. However, desk activities such as writing a report, entering logbook don't require PPE. Most of the risks and damages at the plant can be avoided by wearing personal protective equipment. These equipments provide protection against head injuries (eg. helmets), protection from contamination by avoiding direct contact; burns, abrasion and electric shock. The equipments include the following:

List of personal protective equipment

1. Helmet

Helmets to provide head protection in the event of a fall, slippage and falling objects.

To be worn by everyone at the FSTP at all places where there is a danger of falling, slippages, objects falling over head, near large tanks and uneven surface.



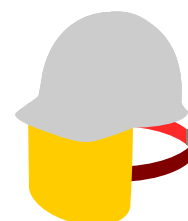
2. Safety glasses or goggles for eye protection

To be worn by operation & maintenance technician, plant workers, labourers and other staff while working with the plant machineries, tools and equipments which can throw up sparks, dust or micro-particles



3. Face shields to protect against chemical or dust

To be worn by operation & maintenance technician, plant workers, labourers and other staff while working with the plant machineries, tools and equipments which can throw up sparks, dust or micro-particles



4. Gloves

Gloves (made from rubber or latex) for hand protection from transmitting infections, pathogens, burns and abrasion

To be worn by everyone working around the plant machineries and equipments at the FSTP



5. Electric Safety Gloves

Gloves for protection against electric shocks. To be worn by operation & maintenance technician, plant workers and other staff while working on highly energised electric equipments or repairing electric equipments.



6. Respirators, dust masks or self-contained breathing apparatus

for protection from inhaling dust, fumes etc,

While masks or respirators are to be used while regular operations, self-contained breathing apparatus are to be used for special tasks such as entering a unit such as maintenance holes, wet well, dry well etc., where air is highly contaminated and there are high chances of



suffocation and inhaling dangerous fumes. To be worn by operation & maintenance technician, plant workers, labourers and other staff while working with the plant machineries, tools and equipments which can throw up sparks, dust, micro-particles, fumes, other dangerous gases especially if entering any treatment unit.

7. Gum boots

For protection of foot from burns, abrasion. To be worn by operation & maintenance technician and plant workers while working in areas with high level of contamination such as sludge drying beds, large tanks, spillages, maintenance holes, broken tools and other areas with risk of contamination through feet.



7. Plant Uniform

Separate plant uniform to be worn at the plant to avoid contamination and damage to regular clothes. To be worn by operation & maintenance technician and plant workers while working with the plant machineries, tools and equipments.



7. Safety Harness

Harness for entering maintenance holes and other treatment modules below ground. To be worn while entering the maintenance holes



5.2.1 Using personal protective equipment (PPE)

Correct method of putting personal protective equipment (PPE) is essential to be maintain hygiene and be comfortable wearing the PPE. 5.2.1.1 and 5.2.1.2 detail out all the steps to be followed while putting on and removing PPE.

5.2.1.1 Putting on personal protective equipment

Sequence of putting on personal protective equipment

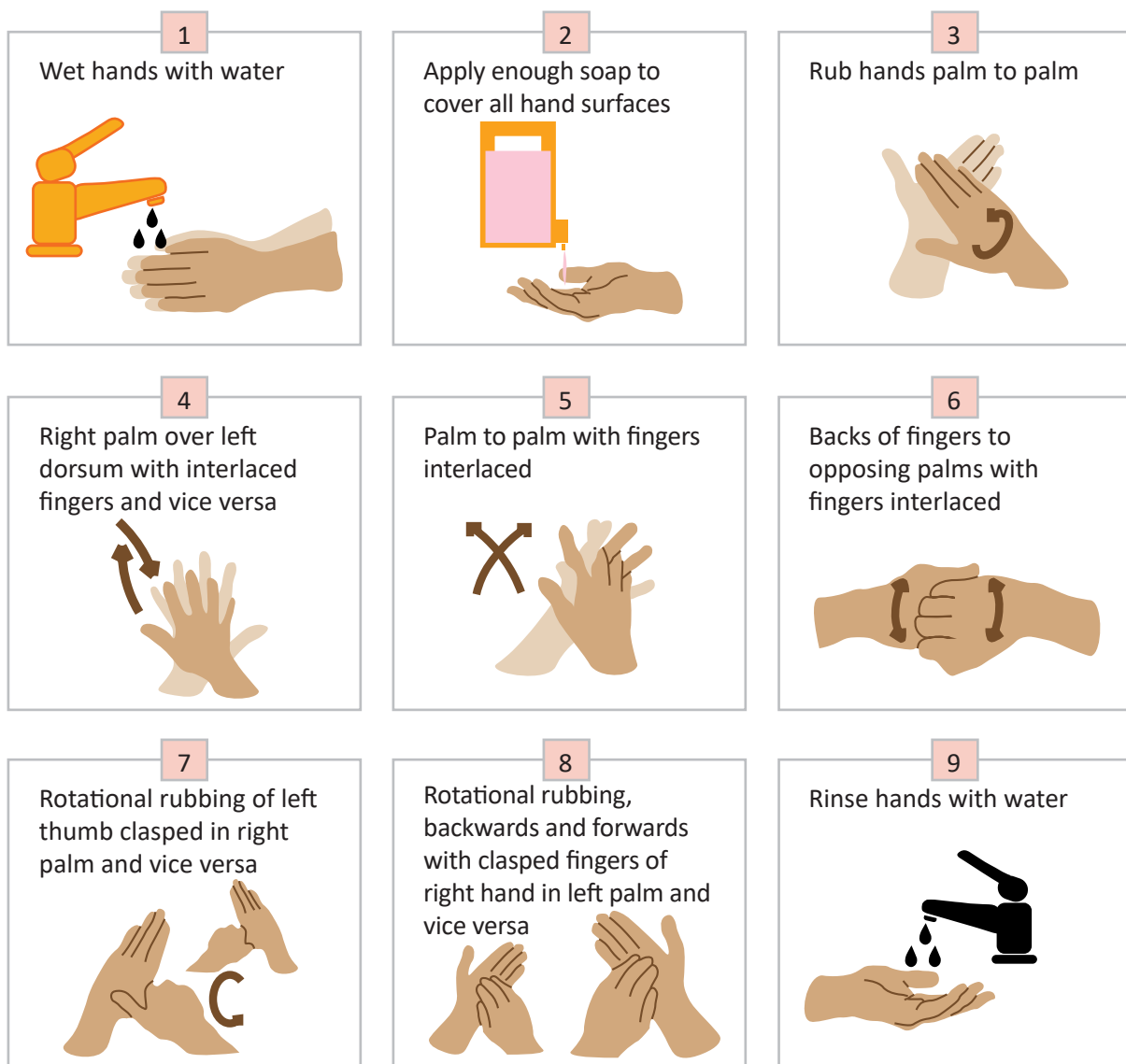
1. Perform hand hygiene
2. Put on the uniform
3. Put on the gum boots
4. Perform hand hygiene
5. Mask, respirator or self-contained breathing apparatus
6. Put on the goggles, face shield
7. Helmet
8. Perform hand hygiene
9. Gloves
10. Harness, if needed

Table 12: Sequence of putting on PPE

Source: (Faecal Sludge Management: Systems Approach for Implementation and Operation, 2014)

Perform hand hygiene

1. Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap.
2. Lather your hands by rubbing them together with the soap. Be sure to lather the backs of your hands, between your fingers, and under your nails.
3. Scrub your hands for at least 20 seconds.
4. Rinse your hands well under clean, running water.
5. Dry your hands using a clean towel or air dry them.
6. Source: (Centre for Disease Control and Prevention)
7. Duration of the procedure: 40 to 60 seconds



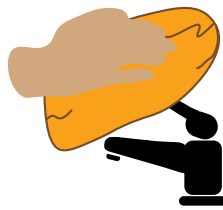
10

Dry hands thoroughly with a single use towel



11

Use the towel to turn off the faucet



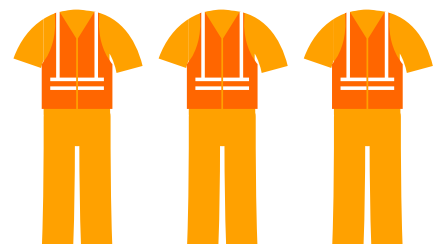
12

Your hands are now safe



Wear uniform

- Wear the uniform as any other clothing, but it should be well fitted with no loose ends and comfortable.
- There should be at least 3 to 4 pairs of uniform. Wash each pair after each use.



Wear gum boots

- Wear gumboots as any other footwear, but it should be well fitted and comfortable.

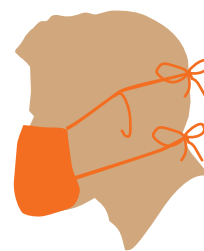


Perform hand hygiene (refer to Perform hand hygiene, page 72-73)

Wear mask, respirator and self-contained breathing apparatus

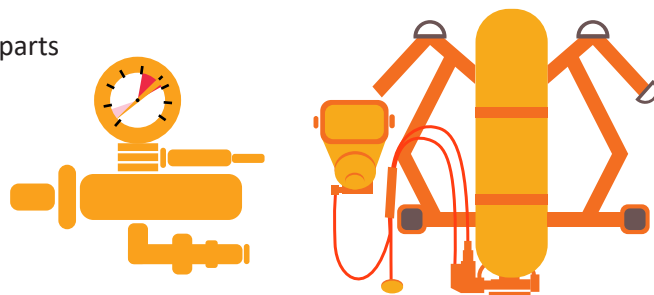
Mask or respirator

- Secure ties or elastic bands at middle of head and neck
- Fit flexible band to nose bridge
- Fit closely and tightly to face and below chin
- Fit-check respirator

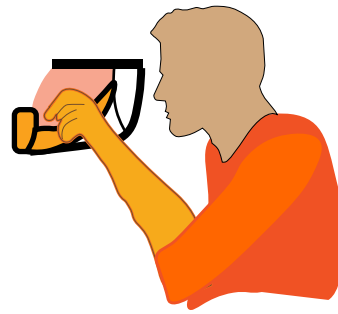


Self-contained breathing apparatus (SCBA)

- Check if the bottle is full
- Check for leakages in hose and other parts



- Check for tightness of the face mask and the whistles
 - With demand valve still closed, try to hold the face mask on your face with hands and without using the straps
 - If you are able to hold the face mask, it means face mask is able to hold the vacuum you created and is airtight.
 - Activate the demand valve. Once demand valve is activated and air pressure is released and reaches the alarm level, whistle should sound.
- Two ways of wearing SCBA
 - Over the head: hold the back plate with both hands and lift the SCBA over your head
 - Coat: hold one strap closer to the back plate and wear the SCBA like wearing a coat. After the SCBA is on the back, lean forward and pull the straps.
- Wear the mask and open the cylinder valve before entering the maintenance holes, wet well etc.



Put goggles or face shield

- Place over the eyes and face and adjust to fit.



Wear helmet

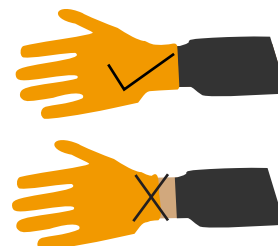
- Place the helmet over your head and adjust to fit.



Perform hand hygiene (Perform hand hygiene, page 72-73)

Wear gloves

- Wear the gloves on both the hands. They should extend to cover wrist of the uniform and should be tightly fitted.



Wear a harness

- Hold the harness by the rear D-ring and shake it to allow the straps to fall into place
- Place your arms through the shoulder straps, ensuring the webbing remains untwisted
- Ensure the D-ring is in the middle of the back between the shoulder blades. Adjust shoulder straps so the sub-pelvic strap sits under the buttocks.
- Pull each thigh strap through the legs and fasten the buckles. Adjust the tension or release the slack as necessary
- Connect the chest strap and adjust so that the shoulder straps are centred on the shoulder and tighten
- Once all straps are buckled, tighten them so that the harness fits comfortably and does not pinch or restrict movement.



5.2.1.2 Removing personal protective equipment

Sequence of removing personal protective equipment

1. Remove the harness (if any)	
2. Remove gum boots	
3. Remove gloves	
4. Perform hand hygiene	
5. Remove helmet	
6. Remove goggles or face shield	
7. Remove safety uniform	
8. Remove mask or respirator	Remove the SCBA (Self-contained breathing apparatus) is before removing the uniform
9. Perform hand hygiene	

Table 13: Sequence of removing PPE

Move to a safe area away from hazardous areas such as sludge drying bed, maintenance hole opening, slippery surfaces etc. Keep trash can and disinfectants nearby.

Remove safety harness

Unbuckle the harness and remove your arms followed by your legs one by one. Put the harness away for cleaning.

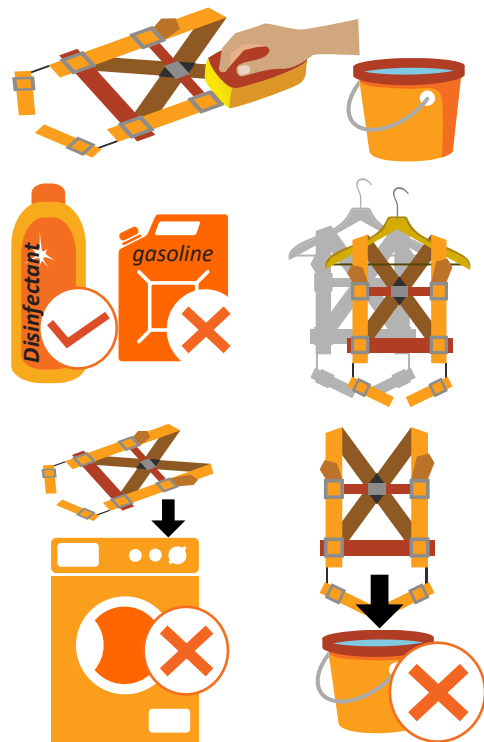
- It is best to begin with cleaning the harness on a flat surface, leaving open to visible inspection.
- Using a moist sponge, wipe down the harness to remove excess dirt and dust.
- Mix a cleaning solution using laundry detergent or dish soap. DO NOT use any cleansers that contain chlorine, bleach, or abrasives.



- Dip your sponge into the solution and thoroughly scrub each portion of the harness until a thick lather form.
- Using a sponge dipped in CLEAR water, wipe down the harness to remove the suds and soap residue.
- Let the safety harness dry in room temperature air. DO NOT use a mechanical heat dryer or expose the harness to long periods of sun-drying.
- When cleaning multiple harnesses, store each in a separate, dry compartment. Hang them in such a way that they are not crushed, worn, or creased.
- Never use gasoline or other 'drying solvents' to clean harnesses.

And the two most important cautions:

- Dampen but DO NOT SOAK the harness. The excessive expansion of the fibres by soaking (and the contraction by drying) can compromise the fabric's effectiveness and shorten the harness's life.
- NEVER put a harness in the dryer. Excessive heat and tumbling can (and will) damage the harness.



Remove safety boots

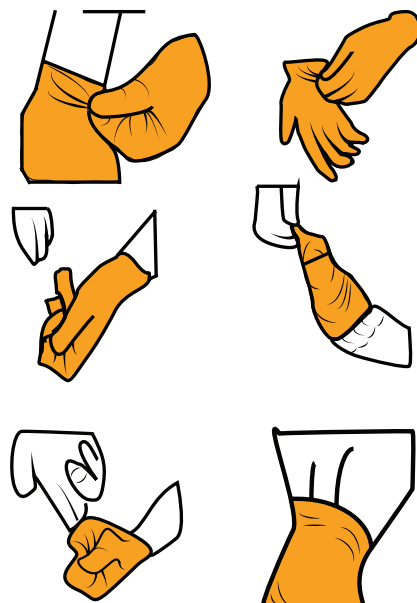
If wearing rubber boots, remove them while gloves still on your hands. Place the boots in a container with disinfectant.



Remove gloves

1. Pinch and hold the outside of the glove near the wrist area.
2. Peel downwards, away from the wrist, turning the glove inside out.
3. Pull the glove away until it is removed from the hand and hold the inside-out glove with the gloved hand.
4. With your un-gloved hand, slide your finger/s under the wrist of the remaining glove, taking care not to touch the outside of the glove.
5. Again, peel downwards, away from the wrist, turning the glove inside out.
6. Continue to pull the glove down and over the inside-out glove being held in your gloved hand.

This will ensure that both gloves are inside out, one glove enveloped inside the other, with no contaminant on the bare hands. Dispose the gloves in the waste container. The urban local body should collect the waste from the waste container daily.



Perform hand hygiene

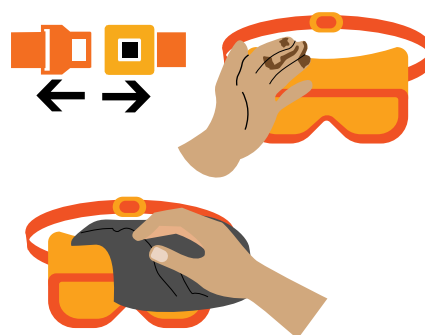
Refer to the beginning of **Perform hand hygiene**, page 72-73

Remove helmet

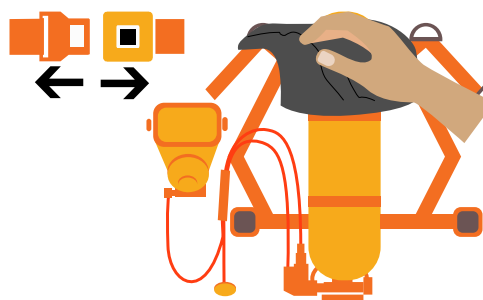
- Unbuckle the helmet.
- Avoid contact with the outer surface of the helmet.
- Wipe the surface with a cloth soaked in disinfectant followed by a dry cloth or as per the manufacturer's instructions

**Remove goggles or face shield**

- Remove goggles or face shield from back by lifting head band or the ear pieces.
- Avoid contact with the front of the goggle or face shield.
- Wipe the surface with a cloth soaked in disinfectant followed by a dry cloth or as per the manufacturer's instructions.

**Remove SCBA (self-contained breathing apparatus)**

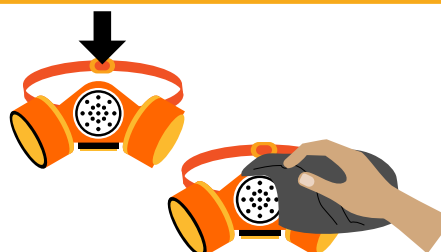
- Remove the mask from the back while avoiding contact with the front surface.
- Unbuckle the SCBA.
- Wipe the surface with a cloth soaked in disinfectant followed by a dry cloth or as per the manufacturer's instructions.

**Remove uniform**

- Remove the uniform by rolling it inside out in order to avoid contact with the outside surface.
- The uniform should then be sent for washing.

**Remove mask and respirator**

- Remove the mask from the back while avoiding contact with the front surface.
- Dispose it off if it is meant for single use.
- In case it is recyclable, disinfect by wiping the with a cloth soaked in disinfectant followed by a dry cloth or as per the manufacturer's instructions.

**Perform hand hygiene**

Refer : 5.2.1.1 - **Perform hand hygiene**, Pg 72-73

5.2.2 Do's and Don'ts

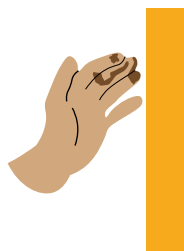
1

Keep hands away from mouth and face



2

Limit surfaces touched



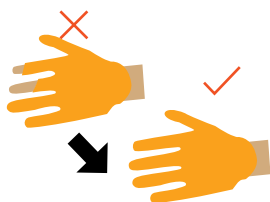
3

Avoid touching surfaces such as door knobs, stationary, mobiles while working to limit chances of contamination.



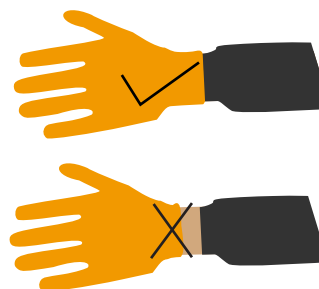
4

Change personal protective equipment immediately if damaged.



5

Ensure rubber gloves are long enough to extend well above the wrist, leaving no gap between the glove and coat or shirt sleeve



6

Perform hand hygiene whenever contamination is suspected while putting on and removing personal protective equipment and in case of damage of gloves



5.3 Health and safety practices at the FSTP

A number of personal hygiene practices should be maintained by you, the FSTP operation & maintenance technician, to avoid any occupation related diseases.

Do's

1

Use appropriate Personal Protective Equipment (PPE) to avoid contamination and stay safe from physical hazards at the plant. Refer **List of Personal Protective Equipment**, page 70-71



2

Follow procedures for using PPE. Refer **Putting on personal protective equipment**, page 71-75

3

Perform hand hygiene prior to wearing and removing PPE and eating



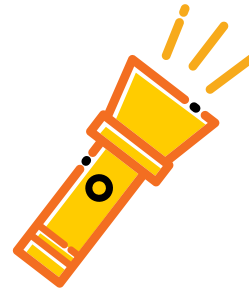
4

Take a shower after working at the FSTP, if possible.



5

When additional light is required while working on the treatment plant premises, use a battery powered flashlight, or an approved properly guarded electrical extension light.



Don't's

1

Do not use an open flame light such as a match, torch, or cigarette lighter.



2

Do not eat or drink in areas where FS is treated and stored, and areas where chemicals are stored to avoid faecal-oral contamination



3

Do not drink alcohol or smoke while at the FSTP to remain alert



4

Do not smoke while at the FSTP to avoid fires.



5

Do not enter the offices and lounges wearing dirty clothes.



6

Do not wear sandals or open toe shoes in the treatment plant premises to avoid injuries to the feet.



5.4 Electric safety measures

Electric safety measures refer to all the measures to be taken while performing operation and maintenance activities on powered devices. According to the Occupational Safety & Health Administration, United States of America, the following are the key things to be kept in mind while working with electricity:

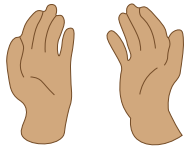
1. Always be cautious while working with electricity
2. Never operate electrical equipment while you are standing in water or if you have wet hands.
3. Overhead wires: Assume that all overhead wires are energized at very high voltages. Never assume that a wire is safe to touch even if it appears to be insulated. Never touch a fallen overhead power line. Call the electric utility company to report fallen electrical lines.
4. Never repair electrical cords or equipment unless qualified and authorized.
5. Have a qualified electrician inspect electrical equipment that has got wet or are malfunctioning before energizing it

5.4.1 Do's and Don'ts while working with electric equipments

Do's

1

Keep hands dry while working on electricity



2

Switch off the machine while performing repair and maintenance activities



3

Use electric safety gloves while working on highly energised electric machineries and equipments



4

Wear shoes while working with electrical equipments



Don'ts

1

Do not work with wet hands and feet



5.5 Confined spaces safety

A confined space is defined as any place in an FSTP that is enclosed and has limited access, such as tanks, dry wells, pump rooms. According to OSHA Guidelines, any space that meets the following three criteria is designated as a confined space:

- Is large enough for a worker to enter it;
- Has limited means of entry or exit; and
- Is not designed for continuous occupancy.

A space may also be a permit-required confined space if it has a hazardous atmosphere, the potential for engulfment or suffocation, a layout that might trap a worker through converging walls or a sloped floor, or any other serious safety or health hazard. (OSHA Fact Sheet: Confined Spaces in Construction: Sewer Systems)

According to the Faecal Sludge Management: Systems for Approach for Implementation and Operation, confined spaces are potentially hazardous as the breathable atmosphere may become compromised, either by depletion of oxygen or the presence of chemical gasses, such as chlorine or hydrogen sulphide. In order to prevent confined space accidents, a “Confined Space Entry Permit” programme is followed at FSTPs. When maintenance is required inside these areas, certain procedures can be defined in order to protect the worker. These typically include the following:

- a confined space entry permit is prepared by the worker and signed by the supervisor;
- prior to entry, the atmosphere is tested with an oxygen meter or, in the case of maintenance holes, with a hydrogen sulphide meter; and
- the work is conducted using the buddy system, with one person entering the confined space secured with a harness attached to a safety rope, and one person located outside of the confined space ready to provide assistance if needed. When the work is completed, the permit is returned to the supervisor for signature indicating the completion of the task.

5.5.1 Checklist for confined spaces

Take permission from the plant manager before entering the confined space ☐

If confined space is a maintenance holes, or any space that is below ground level or has inadequate ventilation, it can contain deadly gases. Prior to entering any confined space clean the confined space off sludge and keep the cover slab on for a minimum of 1 hour. ☐

Wear personal protective equipment ☐

Keep a co-worker located outside for rescue and support ☐

5.6 Protection against falling and drowning hazards

FSTPs that utilise lagoons or waste stabilisation ponds, or even large reactor tanks need to have a drowning prevention programme in place that provides safety equipment, signage and training:

1. Plants with large tanks and lagoon cells often have boats from which O&M tasks are accomplished. In these situations,
2. workers must make use of floatation devices, work in pairs, and be trained in proper procedures to
3. minimise the hazard of drowning. At all FSTPs, measures should be taken to avoid slip hazards such as
4. preventing the spillage of FS, as well as ensuring that maintenance holes are closed in order to avoid falls.
5. Place "Work in progress" sign board at places where any maintenance work is going on so as to indicate to other to be careful while around that place



Source: (Faecal Sludge Management: Systems Approach for Implementation and Operation, 2014)

5.7 Chemical and material storage safety

Chemical and material safety refers to the safety measures which need to be undertaken for the safety of the workers and the plant. A Material Safety Data Sheet (MSDS), a document that contains information on the potential hazardous materials present at a site, should be made available and the required safety measures should be followed accordingly. The following are the measures to be taken up:

Chemical storage

Store the chemicals away from heat and direct sunlight



Reduce the amount of chemicals stored by buying in limited quantities. Also, clear old stock by means of use, replacement & safe disposal.



Store the chemicals in a segregated way based on considerations such as temperature, ignition control, ventilation, type and identification. Proper segregation is necessary to prevent incompatible materials from inadvertently coming into contact. A physical barrier and/or distance is effective for proper segregation.



All chemical storage areas and cabinets should be inspected at least annually and any unwanted or expired chemicals should be removed.



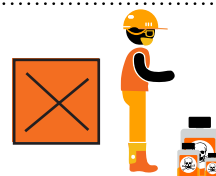
Flammable materials should be stored in an approved, dedicated flammable materials storage cabinet or storage room if the volume exceeds 37 litres. Keep cabinet doors closed



Chemicals should be stored no higher than eye level and never on the top shelf of a storage unit. Do not overcrowd shelves. Each shelf should have an anti-roll lip.



Avoid storing chemicals on the floor (even temporarily) or extending into traffic aisles.



Liquids should be stored in unbreakable or double-contained packaging, or the storage cabinet should have the capacity to hold the contents if the container breaks.



Chemical storage

Volatile or highly odorous chemical shall be stored in a ventilated cabinet. Chemical fume hoods shall not be used for storage as containers block proper air flow in the hood and reduce available work space. Chemical fume hoods are chimney-like structures in a place where chemicals are used. They contain vapors, dusts, gases, and fumes generated within the hood, and remove them as air flows into the hood and then out via the laboratory exhaust system.



All chemicals should be labelled and dated upon receipt in the lab and on opening.



Chemicals stored in explosion-proof refrigerators or cold rooms shall be sealed and labelled with the name of the person who stored the material in addition to all other required hazard warnings.



Look for unusual conditions in chemical storage areas, such as:

- Improper storage of chemicals
- Leaking or deteriorating containers
- Spilled chemicals
- Temperature extremes (too hot or cold in storage area)
- Lack of or low lighting levels
- Blocked exits or aisles
- Doors blocked open, lack of security
- Trash accumulation
- Open lights or matches
- Fire equipment blocked, broken or missing
- Lack of information or warning signs ("Flammable liquids", "Acids", "Corrosives", "Poisons", etc.)



Source: (Chemical Storage Guidelines from The CDC)

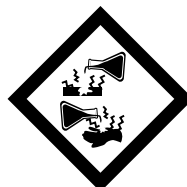
Harmful Chemicals



Flammable



Toxic



Corrosive



Harmful Irritant



Dangerous for Environment



Health Hazard



Compressed Gas



Oxidising

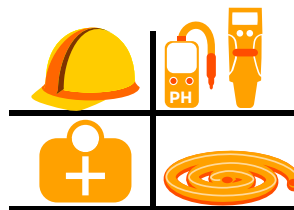


Explosive



Material safety

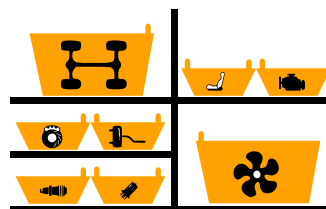
Materials and supplies used at a plant site should be stored in a neat and orderly manner to prevent them from falling off the shelves.



Junk parts removed from the treatment module should be disposed off in a proper manner



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 the of equipment on which the spare part is to be used.



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.



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.

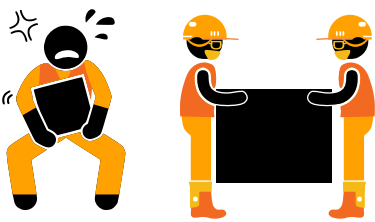


Do not allow accumulation of oily rags and papers as they can spontaneously combust.



Material storage

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 assistance or wait until assistance is available. When carrying objects near treatment modules take extra care to avoid falling in the tanks or dropping objects into the tanks.



Use carbon dioxide or halon compressed gas extinguishers to control fires.



(Operation and Maintenance Manual FSTP, Devanahalli)

5.8 Sampling safety

Outmost care should be taken while sampling faecal sludge and transporting the samples to laboratory. This includes the following precautions:

Do's

1

Wear personal protective equipment

2

Handle samples with care to avoid spillage

3

Perform hand hygiene in case of contact with the faecal sludge

4

Clean up the sampling area after use

5

Clean sampling equipments after use

6

Tightly close the lid of the sample bottles to avoid leakage

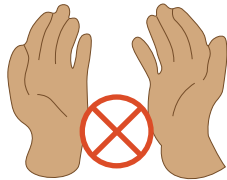
7

Store samples in ice box.
Transport the samples in the same ice box.

Dont's

1

Do not touch with bare hands and foot



5.9 Managing movement of vehicles within the plant

Managing movement of vehicles within the plant is essential to avoid accidents. This includes managing the movement of:

- Desludging trucks
- Vehicles of the staff and visitors
- Any other vehicles

Checklist for vehicle movement within the plant

Desludging trucks coming to the plant for disposal or cleaning should move only on their pre-defined route within the plant



Vehicles of staff and visitors should be parked in designated parking area



Other vehicles coming to the plant for maintenance purpose should follow the route for desludging trucks.



All the personnel on the vehicle should wear gloves



5.10 Medication

Faecal sludge being a bio-hazardous material can affect your health. Besides this a number of chemicals are used to treat the FS, direct exposure to which can affect your health. Similarly, fall and accidents in FSTPs are things to be watched out for. Some of the common sickness, experienced by people working at FSTP are:

- Stomach infection
- Diarrhea
- Jaundice
- Typhoid
- Worm infestation
- Falls
- Cuts
- Burns
- Bleeding
- Fractures
- Electric shocks

5.10.1 Precautions to be undertaken

The following precautions can help in avoiding serious health hazards while working at the FSTP:

Wear personal protective equipment



Perform hand hygiene



Always be alert at work



Take vaccination: Ask your employer to provide vaccines against:

- hepatitis A= 2 doses at least 6 months apart
- typhoid= One dose provides protection. It should be given at least 2 weeks before travel to allow the vaccine to work. A booster dose is needed every 2 years for people who remain at risk.



Deworming tablet: once in every 6 months



Tetanus injection: to be taken following an injury. It is not required only if the last dose of the primary series, or of subsequent booster injections, was given less than 5 years ago for dirty wounds or less than 10 years ago for clean wounds



Source: Centre for Disease Prevention

5.10.2 First Aid

First aid is the initial assistance provided to any person suffering a sudden illness or injury, care provided to preserve life, prevent the condition from worsening, or to promote recovery. Since FSTPs are usually located in the periphery of the city, first aid should be available on the FSTP campus at all times to deal with any medical emergency situation till professional medical help comes. Creating A first aid kit is the first step towards being prepared to give first aid.

List the number of the nearby hospitals and emergency medical services



Anti-bacterial soap



Anti-bacterial wipes in case of heavy bleeding



Disinfection solution/ lotions/ powders: to be used to disinfect cuts and abrasion



Cotton: rolls and balls: for applying anti-septic lotions, medicine; to stop bleeding and to dress the wounds



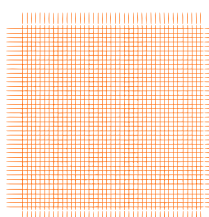
Tweezer: can be used to remove debris such as glass, dirt, or splinters from a wound.



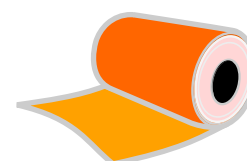
Adhesive bandages in different sizes



Sterile gauze pads



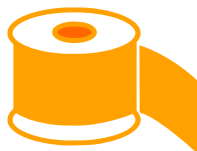
Bandage: in case of larger cuts



Safety Pins: can be used to hold and secure wraps and bandages



Adhesive Tape: used for holding a bandage or other dressing onto a wound.



Scissors: in order to cut the bandage



Anti-septic cream/ ointment: to be applied on minor cuts, burns, grazes, scalds



Crepe Bandages: to be used in case of a sprain in joints



Oral Rehydration Solution: to be used in case someone is feeling dehydrated or having diarrhoea



Thermometer: to test temperature of the person



- Keep the first aid kit in a clean, cool and dry place.
- Keep the first aid kit in an easily accessible location and everyone in the plant should know it.
- Some items, such as solutions, may have use-by dates. Check regularly and replace when necessary.
- If an item is used from the first aid kit, promptly replace it

5.10.3 Administering first aid for different kinds of situation

5.10.3.1 Diarrhoea

Diarrhoea is the most common illness among sanitation workers. This is mainly due to accidental ingestion of pathogens.

Prevention: Wearing gloves while working and taking de-worming tablets can help prevent diarrhoea.

The following are the steps to be taken to provide first aid for diarrhoea:

Make sure the person drinks more fluids than they are losing through diarrhoea. Give the person Oral Rehydration Solution regularly to replace the fluid.



Have the person rest as needed and avoid strenuous exercise. Send the person to residence, if possible. Ask the person to continue drinking fluids and ORS.



Medical advice should be sought if symptoms do not improve in 48 hours.



Call the doctor immediately if any of the following symptoms are there:

- Severe abdominal or rectal pain
- Blood in stool
- Black, tarry stools
- High fever (greater than 101.3 F)
- Signs of dehydration such as:
 - Moderate dehydration
 - Thirst
 - Dry or sticky mouth
 - Not peeing very much
 - Dark yellow pee
 - Dry, cool skin
 - Headache
 - Muscle cramps
 - Signs of severe dehydration include:
 - Not peeing or having very dark yellow pee
 - Very dry skin
 - Feeling dizzy
 - Rapid heartbeat
 - Rapid breathing
 - Sunken eyes
 - Sleepiness, lack of energy, confusion or irritability
 - Fainting



Source: (WebMD, 2017)

In case you are the one suffering, take the above measures as applicable and call for help if needed.

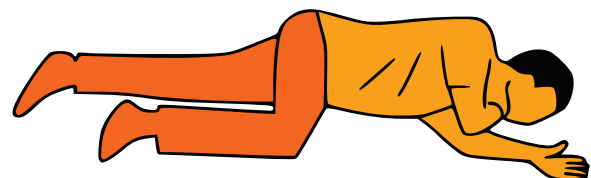
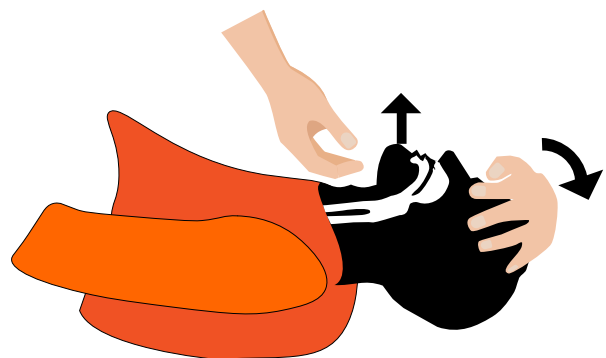
5.10.3.2 What should be done if someone is not breathing and heart beat has stopped?

You may find a person not breathing and their heart beat stopped under a number of circumstances:

- Head injury
- Heavy bleeding
- Heat stroke
- Burns
- Electric shock

The person should receive immediate medical attention. Call the nearest hospital to send an ambulance. Meanwhile, the person should be given first aid, which is as follows:

- Take the person to a safe space away from dust and debris.
- Tap the person's shoulder and shout to see if the person can hear you.
- Call the nearest hospital for an ambulance. In case you are not able to make the call, ask someone to do so.
- Loosen any tight clothing, if possible.
- First, open a person's airway to check if they are breathing (don't begin CPR if a patient is breathing normally).
- Check Airway
 - Clear any obstruction in the airway :The most common cause of airway obstruction is the tongue. To keep the airway open, perform the head-tilt, chin-lift. Place one hand on the victim's forehead and put the fingers of your other hand under the bony part of the chin. Press down on the forehead and lift out the chin so that the mouth is slightly open. If you suspect a spinal injury, do not press down on the forehead nor tilt the head back. Perform a chin lift only. The victim may start to breathe after you open the airway.
- If the victim is breathing, and no spine injury is suspected, place in the Recovery Position (on his/her side (preferably left) extending the lower arm above the head).
- If an obstruction to the airway is visible in the back of the mouth and the victim is unconscious, remove the object with your index finger. (Gloves should be worn.)
- Never place your fingers in the mouth of a conscious or semiconscious individual. If the victim is conscious, give first aid for Choking (Handal, n.d.)



CPR: Cardiopulmonary Resuscitation

Do hands-only CPR (Cardiopulmonary Resuscitation) to help circulation and get oxygen into the body.

1

Call 108/Ambulance or ask someone else to



2

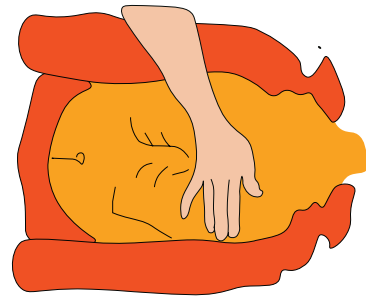
Kneel besides victims chest. Loosen clothing if practical.



3

Position your hand

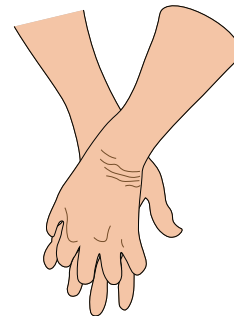
Make sure the patient is lying on their back on a firm surface. Kneel beside the patient and place the heel of your hand on the centre of the chest.



4

Interlock fingers.

Keeping your arms straight, cover the first hand with the heel of your other hand and interlock the fingers of both hands together. Keep your fingers raised so they do not touch the patient's chest or rib cage.



5

Give chest compressions

Lean forward so that your shoulders are directly over the patient's chest and press down on the chest about two inches. Release the pressure, but not your hands, and let the chest come back up. Repeat to give 30 compressions at a rate of 100 compressions per minute. Continue until patient starts breathing normally or medical help has arrived or you are exhausted giving CPR.



5.10.3.3 Choking

Choking occurs when a foreign object lodges in the throat or windpipe, blocking the flow of air. In adults, a piece of food often is the culprit. Since choking cuts off oxygen to the brain, give first aid as quickly as possible.

Prevention: Wearing mask while at work can help protect against choking to some extent.

The universal sign for choking is hands clutched to the throat. If the person doesn't give the signal, look for these indications:

- Inability to talk
- Difficulty breathing or noisy breathing
- Squeaky sounds when trying to breathe
- Cough, which may either be weak or forceful
- Skin, lips and nails turning blue or dusky
- Skin that is flushed, then turns pale or bluish in colour
- Loss of consciousness

If the person is able to cough forcefully, the person should keep coughing. If the person is choking and can't talk, cry or laugh forcefully, the American Red Cross recommends a "five-and-five" approach to delivering first aid:

Give 5 back blows

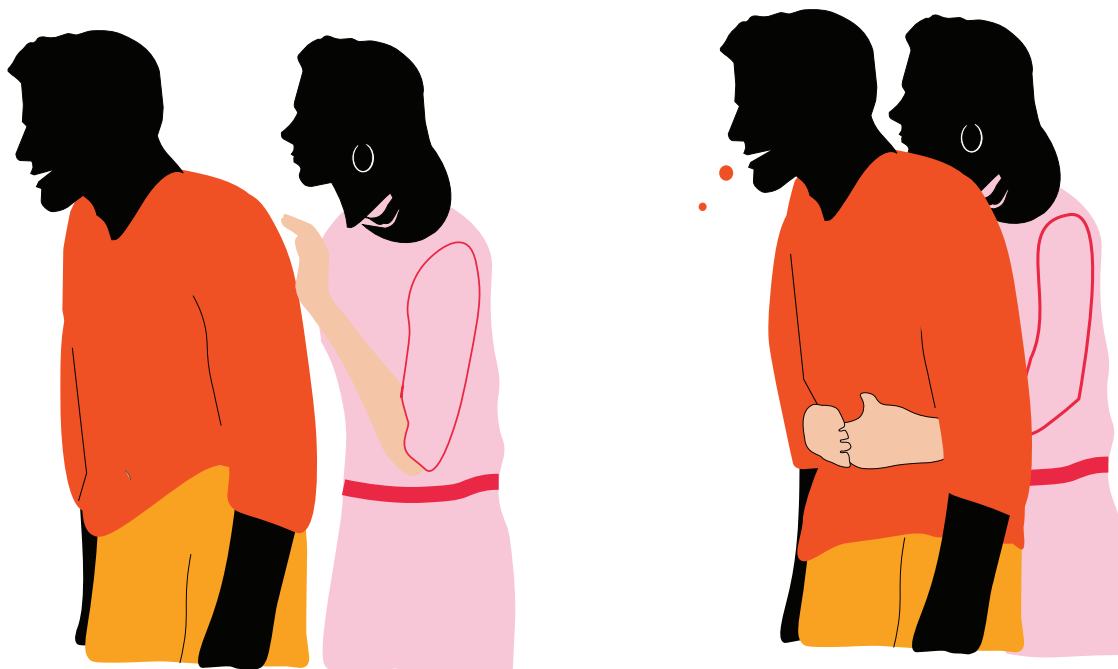
Stand to the side and just behind a choking adult. Place one arm across the person's chest for support. Bend the person over at the waist so that the upper body is parallel with the ground. Deliver five separate back blows between the person's shoulder blades with the heel of your hand.

Give 5 abdominal thrusts

Perform five abdominal thrusts (also known as the Heimlich manoeuvre).

Alternate

Alternate between 5 blows and 5 thrusts until the blockage is dislodged.



To perform abdominal thrusts (Heimlich manoeuvre) on someone else:

The American Heart Association doesn't teach the back-blow technique, only the abdominal thrust procedures. It's OK not to use back blows if you haven't learned the technique. Both approaches are acceptable. To perform abdominal thrusts (Heimlich manoeuvre) on someone else:

- Stand behind the person. Place one foot slightly in front of the other for balance. Wrap your arms around the waist. Tip the person forward slightly. If a child is choking, kneel down behind the child.
- Make a fist with one hand. Position it slightly above the person's navel.
- Grasp the fist with the other hand. Press hard into the abdomen with a quick, upward thrust — as if trying to lift the person up.
- Perform between six and 10 abdominal thrusts until the blockage is dislodged.

If you're the only rescuer, perform back blows and abdominal thrusts before calling your local emergency number for help. If another person is available, have that person call for help while you perform first aid. If the person becomes unconscious, perform standard cardiopulmonary resuscitation (CPR) with chest compressions and rescue breaths.



If you are the one who is choking then perform the abdominal thrusts on yourself as follows:

Abdominal thrusts (Heimlich manoeuvre) on yourself: First, if you're alone and choking, call your local hospital immediately. Then, although you'll be unable to effectively deliver back blows to yourself, you can still perform abdominal thrusts to dislodge the item.

- Place a fist slightly above your navel.
- Grasp your fist with the other hand and bend over a hard surface — a countertop or chair will do.
- Shove your fist inward and upward.



To clear the airway of a pregnant woman or obese person:

- Position your hands a little bit higher than with a normal Heimlich manoeuvre, at the base of the breastbone, just above the joining of the lowest ribs.
- Proceed as with the Heimlich manoeuvre, pressing hard into the chest, with a quick thrust.
- Repeat until the food or other blockage is dislodged. If the person becomes unconscious, follow the next steps.



To clear the airway of an unconscious person:

- Lower the person on his or her back onto the floor, arms to the side.
- Clear the airway. If a blockage is visible at the back of the throat or high in the throat, reach a finger into the mouth and sweep out the cause of the blockage. Wear gloves. Don't try a finger sweep if you can't see the object. Be careful not to push the food or object deeper into the airway.
- Begin CPR if the object remains lodged and the person doesn't respond after you take the above measures. The chest compressions used in CPR may dislodge the object. Remember to recheck the mouth periodically. Refer **CPR: Cardiopulmonary Resuscitation, Page 92** (Mayo Clinic, 2017)

5.10.3.4 Heat stroke

Staff working at the FSTP work in open environment for long hours. In Indian conditions, where summer are very hot for most part of the country, there is a possibility of heat strokes. Symptoms of heat stroke:

- Core temperature is greater than 40 °C or 104 °F
- Dizziness
- Throbbing heart
- Red, hot and dry skin
- Muscle cramps or weakness
- Rapid, shallow breathing
- Unconsciousness
- Lack of sweating despite of heat
- Seizures
- Nausea and vomiting
- Behavioural changes such as confusion, disorientation or staggering

Take the following steps to provide first aid for heat stroke:

Heat stroke is a medical emergency and can be fatal if immediate medical care is not provided. Call the nearest hospital for ambulance or rush the person to the hospital

Meanwhile, take the following steps to provide first aid by the time the person gets medical help:

- Lower Body Temperature While Waiting for Emergency Services to Arrive

Get the person into air conditioning if possible or out of the sun and into the shade.

- Spray the person with cool water, or apply cold wet clothes or ice packs to the armpits, neck, and groin. Fan air across the person to increase cooling. These methods help cool the person more quickly.
- Do not give the person anything to drink if the person is not alert or is vomiting.
- Treat Symptoms
 - If the person experiences seizures, keep him or her safe from injury.
 - If the person vomits, turn the person on his or her side to keep the airway open.

In case you are the one suffering, take the above measures and call for help.



5.10.3.5 Minor cuts

Workers at FSTP can get injured and bleed under a number of circumstances such as:

- Handling broken items such as glass, metals etc
- Tripping over or falling down

Take the following measures to provide first aid for the following:

Wash your hands thoroughly before touching the wound. Wear a pair of gloves.



Stop the Bleeding: Apply direct pressure on the area



Clean and Protect :Clean the area with warm water and gentle anti-septic soap. Apply an anti-septic ointment to reduce chance of infection. Put a new adhesive bandage on the area.



Call a health care provider if

- The cut is deep or over a joint
- You cannot get the cut or laceration clean
- The injury is a deep puncture wound or the person has not had a recent (within the last 5 to 10 years) tetanus shot or booster
- The cut is from a human or animal bite

(WedMD , 2018)

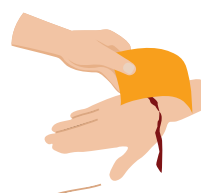


In case you are the one suffering, take the above measures as applicable and call for help if needed. If the bleeding is heavy, refer to the next section.

5.10.3.6 Heavy bleeding

Take the following measure to provide first aid for heavy bleeding:

- Wash your hands thoroughly before touching the wound. Wear a pair of gloves.
- Clean the wound with a gauze pad or cloth in saline solution or tap water, or use an alcohol-free wipe, and gently dab or wipe the skin with it
- gently pat the area dry using a clean towel or pad of tissues, but nothing fluffy such as a cotton wool ball – strands of material can get stuck to the wound
- apply a sterile dressing, such as non-adhesive pad with a bandage, or a plaster – use a waterproof dressing if available



- if blood soaks through the dressing, leave it in place and add another dressing, and continue to apply pressure on the wound to stop or slow down the flow of the blood.



Do's for heavy bleeding

1

Reassure victim that help is on the way.



2

Be calm.



3

Call emergency as soon as possible or take the patient to the hospital



4

Call ambulance immediately



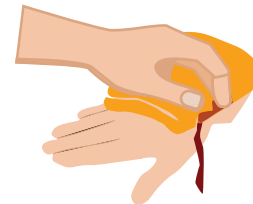
5

Check victim's status regularly



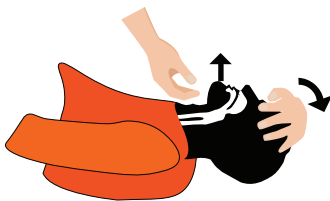
6

Use direct pressure to stop bleeding



7

Check to see if victim's airways are clear



8

If no pulse or respiration, start CPR



9

To prevent transmission of disease, use latex gloves



10

Raise head if bleeding in upper body areas



11

Raise feet if bleeding in lower body areas



Don'ts for heavy bleeding

1

Don't move the patient if not required



2

Always suspect "spinal injury" (and don't move the victim)



3

Don't set fractures and breaks (simply immobilize the victim)



4

Use "direct" pressure to stop bleeding



5

Don't remove items imbedded in the eye



6

Don't use burn ointments



Source: (National Health Portal, India, 2019)

In case you are the one suffering, take the above measures and call for help.

5.10.3.7 Abdominal wound

In case the wound is caused by tripping over a sharp object with stomach down or some form of deliberate or accidental injury to the abdomen, the patient must be taken to the hospital immediately. However, on the way to the hospital, the following first aid measures must be taken:

- Keep the patient flat on his back.
- Give nothing by mouth.
- Maintain warmth.
- If intestines protrude from the wound, do not attempt to touch or replace them.
- Apply sterile dressing and binder on the wound.
- Provide immediate transportation to the hospital.
- (Ministry of Labour & Employment, n.d.)

In case you are the one suffering, call the nearest hospital for help immediately.



5.10.3.8 Head injury

Head injuries usually happen if a person falls or trips from a height or hits a hard, blunt or sharp object with their head. This can be prevented by wearing a helmet while working on the treatment plant machineries.

Most head trauma involves injuries that are minor and don't require specialized attention or hospitalization. However, even minor injuries may cause persistent chronic symptoms, such as headaches or difficulty in concentrating.

Call local emergency number or take the person to the hospital if any of the following signs or symptoms are apparent, because they may indicate a more serious head injury.

Symptoms of head injury:

- Head or facial bleeding
- Bleeding or fluid leakage from the nose or ears
- Headache
- Change in level of consciousness for more than a few seconds
- Black-and-blue discoloration below the eyes or behind the ears
- Cessation of breathing
- Confusion
- Loss of balance
- Weakness or an inability to use an arm or leg
- Unequal pupil size
- Slurred speech
- Seizures

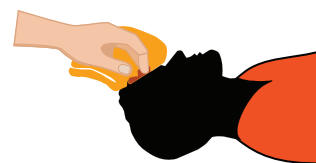


Until medical help is reached, take the following steps:

Keep the person still: Until medical help arrives, keep the injured person lying down and quiet, with the head and shoulders slightly elevated. Don't move the person unless necessary, and avoid moving the person's neck. If the person is wearing a helmet, don't remove it.



Stop any bleeding: Apply firm pressure to the wound with sterile gauze or a clean cloth. But don't apply direct pressure to the wound if you suspect a skull fracture.



Watch for changes in breathing and alertness: If the person shows no signs of circulation — no breathing, coughing or movement — begin CPR. (Mayo Clinic, 2018)



In case you are the one suffering, call the nearest hospital for help immediately.

5.10.3.9 Burns

Do's

1

Call an ambulance for any serious burns.



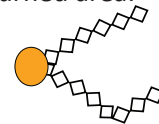
2

Apply CPR if the person is not breathing normally.



3

Try to remove clothes and jewellery (from the area that has been burned) only if it is not sticking to the burned area.



4

Hold the burned area under gently running water, for about 10 minutes to half an hour.



5

To prevent corneal damage (in the case of chemical burns to the eyes), immediately but gently wash the eyes with water or a saline solution.



6

For second degree burns (affecting outer and inner surfaces of the skin) on the limbs – elevate the limbs higher than the heart.



7

To reduce shock as well as loss of body heat, place clean, dry, non-fluffy cloths lightly over the burn.



8

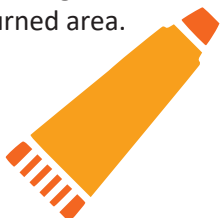
Cover the person with a cool, wet, lint-free cloth, while waiting for an ambulance or when transporting the person to hospital.



Do's

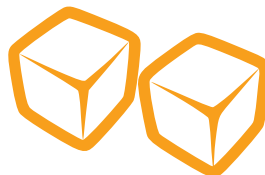
1

Do not apply lotions, butter, grease or oil to burned area.



2

Do not use ice, as it may cause frostbite.



3

Do not remove any piece of clothing or any other thing stuck to the burnt area but remove clothing and other items around the burnt area.



4

Do not put plaster on the burnt area.

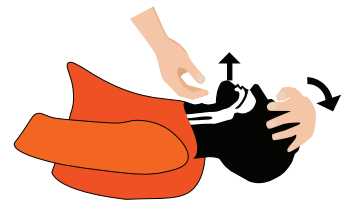


(National Health Portal, India, 2019)

In case you are the one suffering, take the above measures as applicable and call for help if needed.

5.10.3.4 Heat stroke

Tilt the head backwards: This is done to avoid tongue to fall backwards and block the airway. Tilting the head backwards and pulling the tongue forward will help to clear the airways.



If you suspect a back or neck injury, it is still advisable to tilt the head slightly in order to help the patient breathe. The priority is to keep the patient breathing. Try to keep their spine in a straight line when turning them. If possible, get someone's else to help to turn them.



If someone is feeling faint, advise them to lie down on their back and raise their legs to improve blood flow to the brain. Fainting is caused by a temporary reduction in the flow of blood to the brain and can result in a brief loss of consciousness. A person who has fainted should quickly regain consciousness. If they don't, treat them as an unconscious person.



Give hands-only CPR.



(National Health Portal, India, 2019)

5.10.3.9 Burns

Symptoms of nose-bleeding

- Bleeding from either or both nostrils
- Sometimes bleeding from ears/ mouth too.

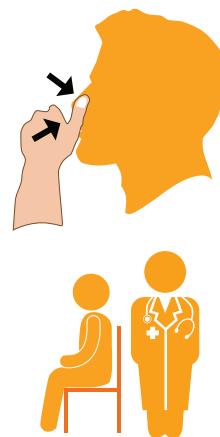
Q. What are the causes of nose bleeding

- Dryness
- Blowing nose with force
- Use of medications, like aspirin
- Nose picking
- Pushing objects into nose
- Injuries / blow to the nose
- Infections of the nose
- Atherosclerosis
- Blood-clotting disorders



Q. How to manage nose bleeding?

- One should not panic and should make the patient sit in upright position with his head slightly forward.
- With thumb and index finger, one should apply pressure on soft part of nostrils below the nose bridge.
- Continue applying pressure until the bleeding stops.
- Ask the patient to breathe through the mouth while nostrils are pinched
- Loosen the tight clothing around the neck
- After 10 minutes, release the pressure on the nostrils and check to see if the bleeding has stopped
- If bleeding persists, seek medical aid



Note: Ask the patient not to sniff or blow their nose for at least 15 minutes

In case you are the one suffering, take the above measures as applicable and call for help (preferably the nearest hospital) immediately

5.10.3.12 Poisoning

There are chances of poisoning in an FSTP if person deliberately or accidentally swallows, inhales or comes in direct contact with the chemicals present in the FS or used in treatment or analysis of FS. Rush the person to the nearest hospital or call the ambulance, whichever is earlier.

Meanwhile professional medical help is reached, the following needs to be done:

- Swallowed poison. Remove anything remaining in the person's mouth. If the chemical is identified, follow the instructions written on the bottle for accidental poisoning.
- Poison on the skin. Remove any contaminated clothing using gloves. Rinse the skin for 15 to 20 minutes in a shower or with a hose.



- Poison in the eye. Gently flush the eye with cool or lukewarm water for at least 15 minutes or until help arrives.
- Inhaled poison. Get the person into fresh air as soon as possible.
- If the person vomits, turn his or her head to the side to prevent choking.
- Begin CPR if the person shows no signs of life, such as moving, breathing or coughing.
- Have somebody gather the bottles, packages or containers with labels, and any other information about the poison to give to the ambulance team.

In case you are the one suffering, take the above measures as applicable and call for help (preferably the nearest hospital) immediately



5.10.3.13 Snake bite

- Keep the victim calm, restrict movement.
- Assure the victim and do not let him panic. When under panic, it will enhance heart rate and would circulate the venom faster in the body.
- Remove any rings or constricting items; the affected area may swell.
- Stop lymphatic spread of venom - bandage firmly, splint and immobilise. The limb, which has been affected by the bite, should be immobilized with splint. Victim to keep the hand as close to the level of the heart as possible - this reduces the flow of venom to major areas. A compression bandage (as firm as you would put on a sprained ankle) should cover the entire limb with the splint. The wrapping should start from the digits and extend till armpit in case of hands and groin in case of bite to the leg.
- A snakebite victim is under tremendous psychological stress. It is necessary to keep the patient warm. However, no alcohol/hot beverages should be given.
- The patient should not be allowed to exert himself in any manner. Do not allow the victim to eat or to drink water in order to keep metabolism at low rate. No water No food is the golden rule.
- DO NOT COVER THE BITE AREA AND PUNCTURE OR CUT MARKS. The wound should be gently cleaned with antiseptic.
- Try to aspirate the venom out of the puncture marks with standard suction devices. It has been identified that a suction more than 270 mmHg can initiate the flow from the puncture marks. Suction instruments often are included in commercial snakebite kits. But the suction should be applied within 5 minutes of the bite.
- The only remedy for venomous snakebite is the anti-venom serum, which is available at most government hospitals and public health centres. Some private nursing homes have also started stocking it and treat snakebite cases. (Auroville, 2014)



First- Aid treatment protocol

First-aid currently recommended may be remembered by mnemonic

“ CARRY NO R.I.G.H.T”

CARRY

Do not let victim to walk even for short distance. Transport by conveyance, especially when bite is in legs



NO

NO- Tourniquet.
NO- Cutting.
NO- Electrotherapy.
NO- Pressure immobilisation, nitric oxide donor (nitrogenic ointment/nitrate spray)

R.I.G.H.T.

R.

Reassure patient, since 70% of all snake bites are from non-venomous species. Only 50% of bites by venomous type of snakes actually envenomate (poison with venom) victims.



I.

Immobilise limb in a fashion similar to a fractured limb, in case of bites on the limb. A bandage or cloth is used to hold the splints. Do not apply pressure and ensure that blood supply is not blocked. Compression in the form of tight ligatures does not work and may be dangerous even.



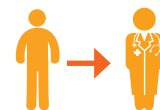
G.H.

Get to Hospital immediately.



T.

Tell any systemic symptoms that manifest on way to hospital.



(National Health Portal, India, 2019)

In case you are the one suffering, take the above measures as applicable and call for help (preferably the nearest hospital) immediately

5.10.3.14 Fractures

Symptoms of a broken bone

- Pain and bleeding
- Swelling
- Bruising or discoloured skin around the affected area



- The patient is unable to put weight on the injured area
- The patient cannot move the affected area

(National Health Potral, India, 2015)

First-aid care for a broken bone

- Stop any bleeding: Elevate and apply pressure to the wound using a sterile bandage, a clean cloth, or a clean piece of clothing. Refer to **Heavy bleeding (page 96-97)**
- Immobilize the injured area: If you suspect they've broken a bone in their neck or back, help them stay as still as possible. If you suspect they've broken a bone in one of their limbs, immobilize the area using a splint or sling.
- Apply something cold to the area: Wrap an ice pack or bag of ice cubes in a piece of cloth and apply it to the injured area for up to 10 minutes at a time.
- Treat them for shock: Help them get into a comfortable position, encourage them to rest, and reassure them. Cover them with a blanket or clothing to keep them warm.
- Get professional help: Call the nearest hospital or clinic or help them get to the emergency department for professional care.
- If the person doesn't appear to be breathing, is unconscious, or both, medical help and begin CPR.



5.10.3.15 Electric Shock

The danger from an electrical shock depends on the type of current, how high the voltage is, how the current travelled through the body, the person's overall health and how quickly the person is treated. Seek immediate medical help if the patient is showing the following symptoms:

- Severe burns
- Confusion
- Difficulty breathing
- Heart rhythm problems (arrhythmias)
- Cardiac arrest
- Muscle pain and contractions
- Seizures
- Loss of consciousness



Do's and Don't

Don't touch the injured person if he or she is still in contact with the electrical current.



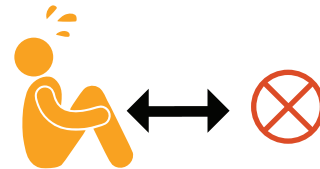
Turn off the source of electricity, if possible. If not, move the source away from you and the person, using a dry, nonconducting object made of cardboard, plastic or wood.



Call your nearest hospital or local emergency number or take the person there.



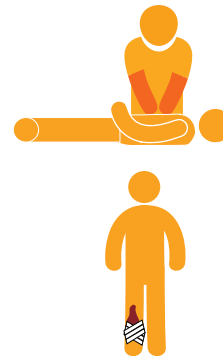
Don't move a person with an electrical injury unless he or she is in immediate danger.



Take these actions immediately while waiting for medical help:

- Begin CPR if the person shows no signs of circulation, such as breathing, coughing or movement.
- Try to prevent the injured person from becoming chilled.
- Apply a bandage. Cover any burned areas with a sterile gauze bandage, if available, or a clean cloth. Don't use a blanket or towel, because loose fibres can stick to the burns.

(Mayo Clinic, 2018)



5.10.4 Handling a medical emergency

A sudden onset of medical condition characterised 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 or any bodily organ or part.

Steps to be followed while administering first aid during a medical emergency

Keep the victim lying down. Examine the victim- look for serious bleeding



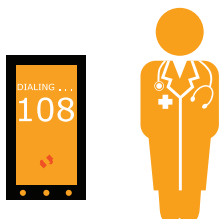
Lack of breathing and poisoning.



Keep the victim warm.



Send someone to call a physician or ambulance.



Remain calm. Do not be rushed into moving the victim unless absolutely necessary.



Never give an unconscious victim anything to eat or drink.



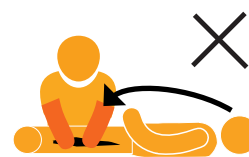
If there is a crowd, keep it away from the victim.



Ensure the victim is comfortable.



Don't allow the victim see his injury.



Give CPR, if required.



Source: (Operation and Maintenance Manual FSTP, Devanahalli)

5.11 Contingency measures in case of emergencies within the plant

Given the number of hazardous materials at the FSTP, a contingency plan should be prepared beforehand to handle such situation. Broadly the emergency measures at the FSTP can be divided into operational emergencies, fire emergency, security emergency and medical emergency. Medical emergency has already been elaborated in unit **Handling a medical emergency**. This unit focuses on operational emergencies, fire emergencies and theft or vandalism.

General steps to be taken in order to be able to handle any emergency at the FSTP:

- Prepare a list of emergency contact numbers.
 - Number of the police station in whose jurisdiction the FSTP falls
 - Number of the nearest hospital
 - Number of the fire brigade under whose jurisdiction the FSTP falls.
- This contact list should be posted at multiple locations around the plant and should be easily visible from all the staff and visitors.

For all FSTPs, but especially those in remote areas, first aid materials, supplies and equipment must be provided. A typical emergency procedure consists of the following actions:

Call your nearest hospital or local emergency number or take the person there.



Contacting the appropriate emergency personnel: this can be a fire fighter in case of a fire and an ambulance in case of a medical emergency.



Contacting the plant manager if not already on site; and providing support to affected personnel until emergency personnel arrives and takes control of the emergency situation.



Emergencies must be documented on an emergency report form that is then sent to management for investigation. All emergencies must also be fully detailed in the operators log book.

5.11.1 Operational emergencies

5.11.1.1 In case of spillage from the truck

Cause: Failure of outlet valve of desludging vehicle or wrong operation of outlet valve of the desludging vehicle.

How could this happen?

- Damage of the desludging vehicle's outlet valve during feeding into the receiving station
- Desludging vehicle outlet valve stuck in open position during feeding into the receiving station
- Spillage from the hose pipe used for feeding of faecal sludge into the receiving station

Emergency response measures to be taken:

- Desludging vehicle driver should close the outlet valve according to their standard operation.
- To clean the spilled sludge, pour soil over the sludge and let it dry for at least 2 hours and then clean it with water



5.11.1.2 In case of spillage from the valves

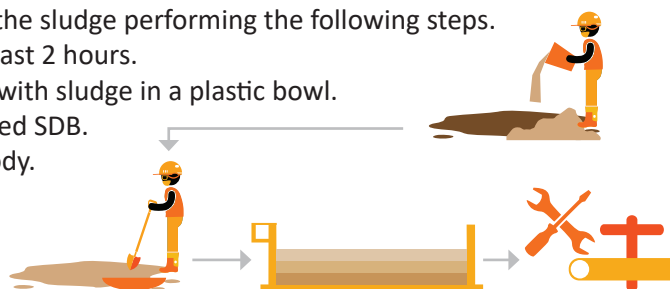
Cause: Failure of valve due to blockages or wrong operation of valves.

How could this happen?

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

Emergency response measures to be taken:

- If sludge has spilled near the valve, clean the sludge performing the following steps.
- Pour soil over the sludge. Leave it for at least 2 hours.
- Using the shovel collect all the soil mixed with sludge in a plastic bowl.
- Dispose this sludge in the Sludge Drying bed SDB.
- Report the problem to the Urban Local Body.
- Repair or replace the valve if necessary.



5.11.1.3 Overflow from any treatment modules

Cause: The module outlet or the inlet of the next downstream module is clogged.

How could this happen?

- 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 measures to be taken:

- Stop the flow into the module immediately if any.
- Clear the blockage in the pipes by inserting an iron bar or as instructed by the manufacturer of the treatment module and force pump water.
- 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 or as instructed by the designer of the treatment module and collect the debris from the inlet of downstream module. If debris cannot be moved from its place, immediately report it to the plant manager
- Check for damage/crushing of pipe. If found, immediately report it to the plant manager.
- Repair or replace the valve if necessary.



5.11.1.4 Gas leakage

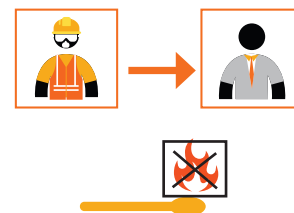
How could this happen?

This can happen due to external physical damage to a pipe or a treatment module



Emergency response measures to be taken:

- Locate where the smell is coming from;
- If damage is found, inform the plant manager
- Do not light any flammable objects near the area of gas leakage.



5.11.2 Fire emergency

Due to the number of chemicals and the flammable nature of the methane present in faecal sludge, fire is a real hazard at the FSTP. The following are the measures which should be taken in the event of a fire.

Learn the cause:

It is crucial to learn that there are four classes of fires (A, B, C, D) depending on the source of fire. Fires can be set off by different factors: chemical, physical, mechanical or electrical. They can occur because of facilities or equipment, or unground electrical connections (wiring), accumulation, storage and improper handling of combustible materials, tank or fuel spillage and for each of these kinds of fires.

Fire extinguishers

Different substances are used to extinguish fire depending on the source of origin. The equipments containing these substances are called EXTINGUISHERS. Fire extinguishers should be located in an area which is visible and easily accessible. It is portable and can be easily transferred to the site of incipient fire.

Remember

When fire is past its incipient stage, it is usually too big to fight with fire extinguisher and in that case safe evacuation is the best strategy.

Classification of fire and extinguishing agent

Type of Fire
Class A



Source of origin
Fires involving solid combustible materials of organic nature such as wood, paper, rubber, plastics, etc, where the cooling effect of water is essential for extinction of fires

Extinguishing agent : Water, foam, ABC dry power and halocarbons.



Type of Fire
Class B



Source of origin
Fires involving flammable liquids or liquefiable solids or the like where a blanketing effect is essential.

Extinguishing agent : Foam, dry powder, clean agent and carbon dioxide extinguishers.



Type of Fire
Class C



Source of origin
Fires involving flammable gases under pressure including liquefied gases, where it is necessary to inhibit the burning gas at fast rate with an inert gas, powder or vaporising liquid for extinguishment.

Extinguishing agent : Dry powder, clean agent and carbon dioxide extinguishers.



Type of Fire
Class D



Source of origin
Fires involving combustible metals, such as magnesium, aluminium, zinc, sodium, potassium, etc, when the burning metals are reactive to water and water containing agents and in certain cases carbon dioxide, halogenated hydrocarbons and ordinary dry powders. These fires require special media and techniques to extinguish.

Extinguishing agent : Extinguishers with special dry powder for metal fires.



Type of Fire
Electrical Fire



Source of origin
Where energized electrical equipment is involved in a fire, non-conductivity of the extinguishing media is of utmost importance

Extinguishing agent : Extinguishers expelling dry powder, carbon dioxide (without metal horn) or clean agent should be used. Once the electrical equipment is de-energized, extinguishers suitable for the class of the fire risk involved can be used safely.



Type of Fire
Sensitive items

Source of origin
Equipment sensitive to dirt,
contamination or whose control
systems are likely to be affected
are categorised as sensitive items.

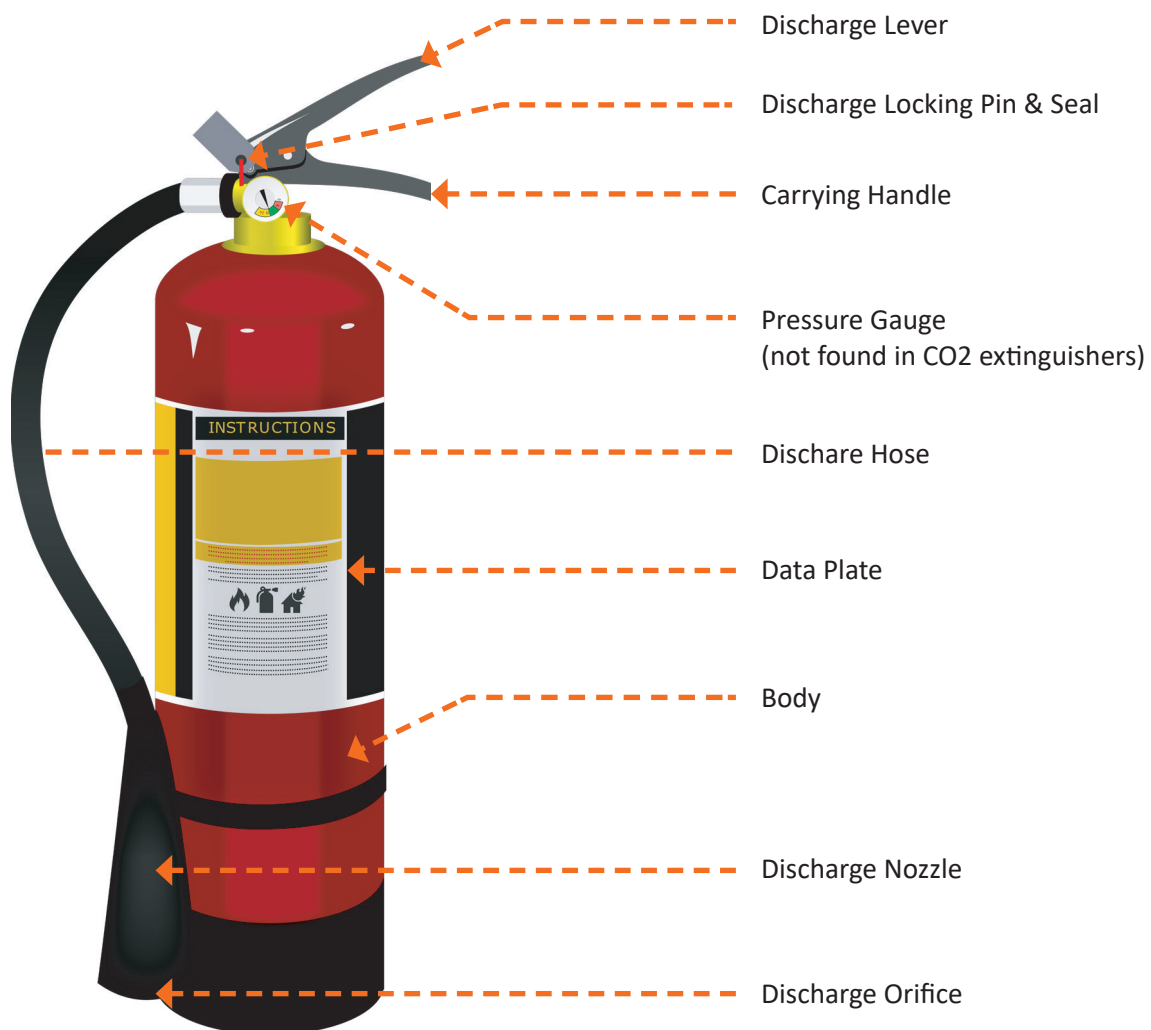
(Bureau of Indian Standards, 2010)

Extinguishing agent : carbon dioxide or clean agent type
extinguishers



Anatomy of a fire-extinguishers

The following first illustrates different parts of a fire extinguisher.



Using fire extinguisher

The steps to use a fire extinguisher is summed up using the acronym

" PASS "

P

A

S

S

PULL

Pull the pin of the fire extinguisher.

**AIM**

Aim the nozzle at the base of the fire. Do not hit the top of the flame.

**SQUEEZES**

Squeeze the trigger. In a controlled manner, squeeze the trigger of the extinguisher to release the agent.

**WEEP**

Sweep from side to side. Sweep the nozzle of the extinguisher from side to side until the fire is put out. Keep aiming at the base while you do so. Most extinguishers will give you about 10-20 seconds of discharge time.



Slowly walk backwards, away from the fire. Even if the fire appears to be extinguished, don't turn your back on it. There might be unseen hot spots or hidden fires that can ignite into a large flame at any moment. You should be cautious about it. Once a fire extinguisher has been used, it must be recharged or replaced even if the entire contents were not used.

Do's and don'ts

Keep only limited people around the place of fire while extinguishing the fire. Ask the rest of the people to evacuate calmly.



Keep the fire extinguishers in places away from any corrosive fluids.



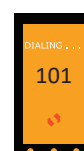
Preventive measures

- To identify the chemical properties of the products being stored
- Do not overload electric lines.
- Switch off electronic equipments when not in use
- Avoid connecting more than one appliance in each outlet.
- Redistribute equipment or install additional circuits.
- No smoking in the plant.
- Do not throw matches or any other lighted things indiscriminately. Extinguish them completely and then dispose them.
- Do not place oily rags around electric plugs, treatment modules or any other flammable items.
- Report the presence of gas or fuel leaks or flammable liquid spills.
- Identify fire exits and nearby phones to call external support groups.
- Adapt specific sites for fuel supply and storage.
- Place fire extinguishers according to the combustible material and in the appropriate places to provide emergency care.



Action in case of emergency

- Immediately warn the plant manager
- Remove people to a secure site
- If the threat is not controlled, get help from the Firefighters
- Ensure that all staff are in the safe meeting place
- After inspecting the fire investigation to proceed Start immediate evacuation, with the support of the brigade.
- Remove people at least at a distance of 10 m.
- Try to find out the source of fire and use the appropriate fire extinguisher to control the fire, if possible. If the outbreak of fire is not controlled immediately notify the firefighters.
- Help those who are injured, give first aid and take the person to the nearest hospital or call the emergency number of the hospital for sending an ambulance.

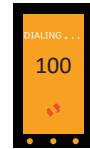


(General Guidelines on Occupational Health and Safety: Emergency and contingency plan, n.d.)

5.11.3 Security emergency: Theft or vandalism

Theft or vandalism of equipments and tools from the plant should be dealt as a security threat. Take the following steps in such event:

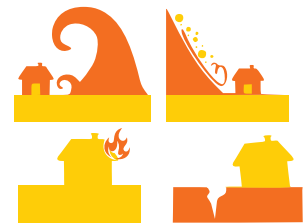
- Do not touch or move anything at the scene
- If you are not certain that the intruder has left the scene, leave.
- If people are around in the FSTP, raise an alarm
- Notify the police or call 100
- Report:
 - Location
 - Nature of the event
 - Your name and the number you are calling from
- Request immediate assistance
- Take action: Follow the instructions of the police personnel. If you are witnessing the crime, move to a safe location and call the police. Provided it is safe to do so, take a picture or record a video



(Yale University, n.d.)

5.12 Natural hazard

Natural hazard are natural processes and therefore, human control over it is limited to preventing/ minimizing the damage to life and property. Usually FSTPs are constructed as per the standard norms, hence, the chances for damage to life and property is minimal. However, it is good to keep a watch in the deterioration of the FSTP over time and take measures to address them. At the same time, it is possible that the FSTP can be affected if the intensity of the natural hazard reaches unprecedented levels, something for which the FSTP was not constructed. Under such condition, it is essential to know the things to be done during and after the occurrence of such an event.



5.12.1 Thunderstorm

Preparedness against thunderstorm:

Look for indication of structural weakness of the FSTP such as cracks and get them repaired



Seal any leakages.



Repair any gas leakages or defective electrical wiring.



Remove dead or rotting trees and branches that could fall and cause injury or damage during a severe thunderstorm.



Regularly view the weather forecast.



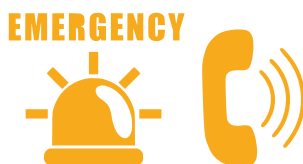
Shutdown the FSTP and leave for home, if possible.



Look for early warning of thunderstorm such as vivid and frequent lightening.



Keep the emergency numbers (such as hospitals, fire brigade etc. ready)



Prepare an emergency kit with first aid, dry food items, mineral water, torch, batteries and sturdy ropes, in case of an event of thunderstorm. Periodically check the expiry date of the articles in this kit.

In case thunderstorm is forecasted, postpone outdoor activities. Keep mobile phones, laptops any other chargeable items charged.



If at the FSTP during a thunderstorm:

- Stay indoors. Get inside the office of the FSTP.
- Secure all the doors, ventilation and windows.
- Unplug any electronic equipments: both plant machineries and office equipments.
- Avoid contact with corded phones and devices including those plugged for recharging.
- Avoid contact with electrical equipment or cords. Unplug appliances and other electrical items such as computers and turn off air conditioners. Power surges from lightning can cause serious damage.
- Avoid contact with plumbing. Do not wash your hands, do not take a shower, do not wash dishes, and do not do laundry. Plumbing and bathroom fixtures can conduct electricity.
- Stay away from windows and doors, and stay off porches.
- Do not lie on concrete floors and do not lean against concrete walls.
- Avoid natural lightning rods such as a tall, isolated tree in an open area.
- If in a vehicle, safely park and stay in the vehicle until the strong winds subsides. Avoid touching metal or other surfaces that can conduct electricity in and outside the vehicle.



If at the FSTP after a thunderstorm:

- Check if someone has been injured.
 - If yes, give appropriate first aid and take the person to the hospital
- Stay away from storm-damaged areas to keep from putting yourself at risk from the effects of severe thunderstorms.
- Stay away from drowned power lines and report them immediately.
- Report the damages to your plant manager



(National Disaster Management Authority , 2018)

5.12 Natural hazard

Preparedness for flood:

Look for indication of structural weakness of the FSTP such as cracks and get them repaired



Seal any leakages.



Repair any gas leakages or defective electrical wiring.



Keep the emergency numbers (such as hospitals, fire brigade etc. ready)

EMERGENCY



Regularly view the weather forecast. If possible, shutdown the FSTP and leave for home



Prepare an emergency kit with first aid, dry food items, mineral water, torch, batteries and sturdy ropes, in case of an event of flood. Periodically check the expiry date of the articles in this kit.



Prepare a list of areas with higher elevation in the vicinity where you can move during flood.



Keep mobile phones, laptops any other chargeable items charged.



If at the FSTP during a flood:

- Secure all the doors, ventilation and windows of the FSTP office.
- Unplug any electronic equipments: both plant machineries and office equipments.
- Evacuate calmly and move to higher secure areas.
- Do not walk through moving water. Six inches of moving water can make you fall. If you have to walk in water, walk where the water is not moving. Use a stick to check the firmness of the ground in front of you.
- Do not drive or ride a bike into flooded areas. If floodwaters rise around your car, abandon the car and move to higher ground if you can do so safely. You and the vehicle can be quickly swept away.

**If at the FSTP after flood**

- Check if someone has been injured.
 - If yes, give appropriate first aid and take the person to the hospital
- Stay away from drowned power lines and report them immediately.
- Report the damages to your plant manager



(National Disaster Management Authority, India)

5.12.3 Earthquakes

Preparedness against earthquakes

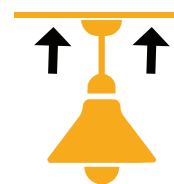
Look for indication of structural weakness of the FSTP such as cracks and get them repaired



Seal any leakages.



Anchor overhead lighting fixtures to the ceiling.



Fasten shelves securely to walls.



Place heavy objects in the lower shelves and lighter objects in the upper shelves.



Store breakable items like glass, chemicals in close but ventilated cabinets with latches.



Secure geysers, gas cylinders, huge chemical containers and flammable items to the floor or ceiling.



Keep the emergency numbers (such as hospitals, fire brigade etc. ready)

EMERGENCY



Regularly view any warnings against earthquakes in your area.



If possible, shutdown the FSTP and leave for home.



Identify safe places indoors and outdoors:

Inside:

- Under strong table
- Against an inside wall
- Away from places where glass can shatter or heavy furniture can fall.

In open, away from any collapsible structures such as buildings, trees, electric lines, telephone lines, poles, flyovers, bridges

Prepare an emergency kit with first aid, dry food items, mineral water, torch, batteries and sturdy ropes, in case of an event of flood. Periodically check the expiry date of the articles in this kit.



Look for indication of structural weakness of the FSTP such as cracks and get them repaired



If at the FSTP during an earthquake:

- Shutdown all electrical equipments in the FSTP and in this office.
- If indoors:
 - DROP to the ground; take COVER by getting under a sturdy table or other piece of furniture; and HOLD ON until the shaking stops. If there is no a table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building.
 - Protect yourself by staying under the lintel of an inner door, in the corner of a room, under a table
 - Stay away from glass, windows, outside doors and walls, and anything that could fall, (such as lighting fixtures or furniture).
 - Move outside only if you are sure that the doorway is strong and it is safe to go outside.



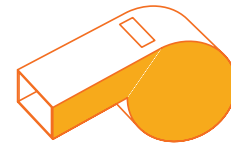
- If outdoors:

- Do not move from where you are. However, move away from buildings, trees, streetlights, and utility wires.
- If you are in open space, stay there until the shaking stops. The greatest danger exists directly outside buildings; at exits; and alongside exterior walls. Most earthquake-related casualties result from collapsing walls, flying glass, and falling objects.



- If trapped under debris:

- Do not light a match.
- Do not move about or kick up dust.
- Cover your mouth with a handkerchief or clothing.
- Tap on a pipe or wall so rescuers can locate you. Use a whistle if one is available. Shout only as a last resort. Shouting can cause you to inhale dangerous amounts of dust.



- If in a moving vehicle

- Stop as quickly as safety permits and stay in the vehicle. Avoid stopping near or under buildings, trees, overpasses, and utility wires.
- Proceed cautiously once the earthquake has stopped. Avoid roads, bridges, or ramps that might have been damaged by the earthquake.



- If at the FSTP after an earthquake:

- Check if someone has been injured.
 - If yes, give appropriate first aid and take the person to the hospital
- Report the damages to your plant manager



(National Disaster Management Authority, India)

5.13 Visit plan

Since faecal sludge treatment plant (FSTP) is a unique and emerging solution in sanitation space, they usually attract a lot of visitors who come there for the purpose of learning, monitoring and evaluation. These visits should be planned out well so that they do not hinder the normal operations of the plant; ensure smooth learning process for the visitor and help in fulfilling the objectives of the visit. The first step towards this is creating a visit plan which should include the following:

- Time of visit
- Number of visitors
- Profile of the visitors:
 - Who are coming?
 - What are their objectives of visiting the plant?
- Classroom session for the visitors giving them the background to the plant
 - Discuss with the plant manager about it
- Visiting all the module in the treatment plant
 - Discuss with the plant manager about it
- Question and answer session
- Arrangement of refreshments keeping in mind the time of the day, budget and food preferences of the visitors.
- Distributing PR (public relations) materials such as brochure, leaflets etc.
 - Kinds of PR materials to be distributed
 - Number of PR materials to be distributed
- Creating a visitors' kit with PR materials, safety gear (gloves and helmet, if needed) and pen/pencil and note pads

5.13.1 Communication with the visitors

The visitors come from a variety of background. Hence, the following points have to be kept in mind while communicating with them:

- Take into account the profile of the visitors
- Use simple language that is easily understood
- Be polite
- Be attentive to their queries
- Inform the visitors about the places where they can go and where they shouldn't go.
 - Visitors are not to be permitted to confined spaces and material and chemical storage areas without prior approval from the plant manager.
- Do not share sensitive information without prior approval of the plant manager

5.13.2 Emergency situation involving the visitors

As discussed, there are a number of hazards in the FSTP. Refer to Major hazards at the plant. The presence of these hazards, create possibility of injury to the visitors. Refer to relevant sub-sections under section **5.10.3 Administering first aid for different kinds of situation, page 89-106; and 5.10.4 Handling medical emergency, page 106-107**, to deal with any medical emergency involving the visitors. In other case such as fire or theft, follow the procedure mentioned in **Contingency measures in case of emergencies page 107-115** within the plant. Besides this, any emergency involving the visitors should be informed to the plant manager.

5.13.3 Questions frequently asked by visitor

The following are the questions visitors usually ask and you, as the FSTP operator should have the knowledge of these things:

1. What is the technology of the FSTP?
2. What is the capacity of the treatment plant?
3. When was the FSTP established?
4. What is the approximate amount of electricity consumed at the FSTP monthly?
5. How much is the amount of chemicals used at the FSTP monthly/ yearly?
6. How many people are working at the FSTP?
7. What is the approximate monthly/ yearly expenditure of the FSTP?
8. How much did it cost to establish the FSTP?
9. On an average, how much faecal sludge is received per day?
10. Where do the rejects from the FSTP go?
11. How much is earned from the sale of by-products (end products) per month

5.14 Exercise

1. What are the two-personal protective equipments to be worn in case of entering a maintenance hole?
2. What are the types of emergencies in an FSTP?
3. What are the types of fire extinguishers?
4. What is CARRY NO R.I.G.H.T'?

True or False

- | | |
|--|--|
| 1. ORS is to be given to a person suffering from diarrhoea | |
| 2. Wet hands can be used while handling electric equipments | |
| 3. Emergency numbers should be only available to the FSTP O&M Technician | |
| 4. A deep wound should be washed with water | |

5.15 Summary

This Chapter detailed out the various hazards in an FSTP and the resultant emergency situations. It also detailed out the preventive measures and contingency measures to handle such situations.

[illegible]



Chapter 6 : Working effectively with co-workers

- 6.1 Reporting structure
- 6.2 Work ethics and etiquettes
- 6.3 Drug free workplace rules
- 6.4 Information and data security rules
- 6.5 Risk management at workplace rules
- 6.6 Diversity and inclusion at workplace rules
- 6.7 Facilitating the co-workers at FSTP while field visit or any investigations
- 6.8 Working effectively with co-workers
- 6.9 Exercise
- 6.10 Summary

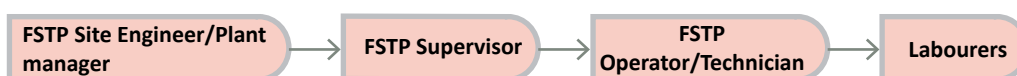


Chapter 6 Working effectively with co-workers

Unit Objectives: At the end of this unit, you will be able to:

- Identify ways to assist colleagues positively to maximize effectiveness and efficiency in carrying out tasks
- Discuss importance of work culture
- Demonstrate appropriate communication etiquette and dressing at work place
- Demonstrate responsible and disciplined behaviours at the workplace
- Identify ways to put up grievances and problems to appropriate authority
- Demonstrate collaboration and group participation to achieve common goals

6.1 Reporting structure



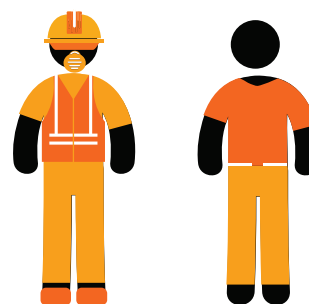
6.2 Work ethics and etiquettes

You must understand that your behaviour serves as an example for other workers of FSTP. Your work ethic and etiquettes will set standards for how FSTP workers are expected to behave.

In addition to the professional duties, you shall:

1. Protect treatment plant infrastructure and the environment

- Properly and consciously operate and maintain the treatment plant
- Follow safe operating procedures
- Report to higher authority (plant manager/supervisor) of any violations of plant machineries and/or workers immediately
- Protect and wisely use resources and funds allocated for operation and maintenance of the treatment facility
- Strive to maintain the aesthetics of the treatment plant



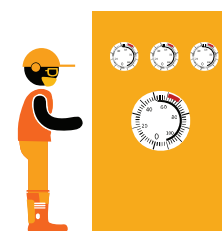
2. Health and Welfare of the employees

- Always consider personal safety, the safety of fellow workers and any other person or visitor present within the FSTP boundary
- Communicate with each other and share experiences to promote the expansion of knowledge and valuable information



3. Properly and accurately fill record books and/or make reports

- Be truthful in data representation
- Acknowledge errors and do not distort any fact or incident



4. Avoid unprofessional activities

- Always be honest and truthful
- Always be on time
- Always respect your co-workers and managers. Do not intimidate and/or bully other workers
- Always use professional language in reports and in professional meetings
- Avoid the use of cell phones on duty unless it is an emergency
- Accept personal responsibility for your actions and do not criticise others untruthfully
- Do not wear inappropriate clothing to work
- Do not use loud, offensive or abusive language



6.3 Drug free workplace rules

A drug free workspace policy is required to protect any employee who may be working under the influence of alcohol or drugs from injuring himself or another employee. It can also help in avoiding other negative impacts of being under the influence of alcohol or drug such as absenteeism, lower productivity, unethical behaviour etc.

A drug-free workspace policy includes the following points (Ellen Aldridge, 2008)

- It is prohibited for the FSTP employees to possess, sell, consume, or be under the influence of alcoholic beverages or illegal drug while in the office and during working hours outside the office.
- It is not permitted for the FSTP employees to smoke in the FSTP premises, with the exception of the allocated smoking area
- Any FSTP employee who is under the influence of over-the-counter or prescription pills that may affect the safety of others and the ability to safely perform the job must inform the plant supervisor before starting or resuming work.
- Disciplinary action in the form of verbal warning, written warning, suspension or termination will be taken (depending on the gravity of the situation) against anyone who violates the rules.

It is your responsibility to ensure that the above-mentioned policy is adhered to. If any worker is found to be consuming alcohol/drug or smoking outside the allocated space, they should be stopped immediately and the plant supervisor or manager should be made aware of this breach of policy.

6.4 Information and data security rules

Every organization has an obligation to keep certain information confidential and the kind of information which needs to be shared with the public.

Following are the information of confidential report which can be shared only after getting permission from plant manager

Reports on Lab results



FSTP Employee details
(name, contact details,
performance reviews,
pay scale, health related
information etc.)



Reports on operating
expenses and revenue
generation

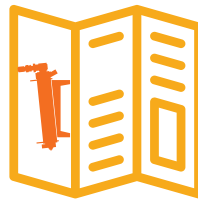


Following promotional materials or PR materials can be shared with public

Brochures and flyers
giving the overview of
treatment plant



Brochures to describe the
treatment technology of
the treatment plant



Written policy documents
of the treatment plant



Advertorials as news
stories and reviews on
newspaper



Reports on Operation and
maintenance activities



E-newsletter to keep the
public informed on the
amount of FS treated,
population served etc.



6.5 Risk management at workplace rules

Anything that disrupts the workspace, impacts on the productivity of workers or poses a threat to other employees is called a risk and it needs addressing. Following table describes the type of risk and respective risk management rules to be followed:

Type of risk	Risk management rules
Health and Safety	Covered in Chapter 5 and Chapter 6
Interpersonal conflict	<ol style="list-style-type: none"> 1. Be open to negotiation, 2. Never show favouritism, 3. Be humble of your capabilities and invite contribution from others 4. Have an open discussion with your colleague and brainstorm suggestions and solutions to solve the conflict
Communication issues	<ol style="list-style-type: none"> 1. Conduct a private meeting and try to identify the cause of the issue, it can be hesitation, ego, unapproachability, confusion in the reporting structure etc. 2. Find a common solution
Harassment	<ol style="list-style-type: none"> 1. Allow the workers to express themselves clearly 2. Find out whether the employee's allegations are true or not 3. Take necessary action after discussion with plant authority
Discrimination	<ol style="list-style-type: none"> 1. Follow the rules mentioned in Diversity and inclusion, 6.6 Pg 129 at workplace rules to be followed
Pay discrepancies	<ol style="list-style-type: none"> 1. Firstly, there should not be any discrepancies in pay based on class, colour or creed 2. The pay scale should be based only on qualification and the job description
Workspace theft	<ol style="list-style-type: none"> 1. Be sure to keep your workspace clean and organization 2. Keep valuable personal items in lockers 3. Keep an inventory of plant equipment 4. Do not let unauthorized person to enter the FSTP 5. Do not let unauthorized entry into store rooms without prior permission 6. Install CCTV in store rooms and other areas where FSTP supplies are kept

Table 14 Risk management at work place

6.6 Diversity and inclusion at workplace rules

FSTPs can be national and international workspaces with employees who come from a wide variety of backgrounds. Diversity typically includes, but is not limited to, differences in race, gender, sexual orientation, gender identity or expression, political and religious affiliation, socioeconomic background, cultural background, geographic location, physical disabilities and abilities, relationship status, veteran status, and age (Diversity and Inclusion, n.d.).

As the FSTP technician, you are closely involved with the superiors and your subordinates, thus, you can play an important role in delivering workspace inclusion by being vocal about the benefits of working with people from diverse background, and make others believe that workspace inclusion can drive stronger better performance and results.

The following diagram shows the key elements of a diverse and inclusive workspace which must be considered to mitigate risks which can arise out of working with co-workers from diverse backgrounds

Refer **Risk management at workplace rules**, increase productivity and for the betterment of the FSTP.



Figure 13 Four Key elements of Diversity and Inclusion

Source: Deloitte Insights

- Employees should be treated equitably and with respect, participation without favouritism is the key.
- Every employee should feel valued, they should believe their individuality is respected by others and at the same time should feel connected with the team
- Every employee should feel safe to speak up and be open without feeling judged or embarrassed
- When employees are confident with themselves, they feel empowered and give their best in the job which helps them grow along.

General points to be kept in mind:

- Do use a common language understood by all while speaking to a group
- Do speak to everyone with respect in the workspace, interact with all co-workers without discrimination
- Do not bully or make anyone feel inferior or left out
- Do have open discussions and involve everyone
- If possible, conduct informal get-togethers, celebrate festivals. It will help in engaging every employee, improving the organization culture and making the employees feel appreciated.

6.7 Facilitating the co-workers at FSTP while field visit or any investigations

Before the site/field visit ensure that you have the following:

- The list of visitors with respective contact details
- Purpose of visit and the agenda
- Time of arrival
- Duly signed permission letter for a guided field visit

During the site visit, you are expected to

- Welcome everyone and review the agenda with everyone
- Distribute PPE (gloves and masks) to the visitors and instruct them to return it once the visit is over
- Introduce the staff and their job description
- Introduce the FSTP and give an overview of the technology
- Guide the group of visitors or investigators to each treatment unit one by one
 - Introduction of the list of equipment in the FSTP
 - Function of each equipment
 - Daily operational activity of each equipment and briefly explain the challenges, risks and mitigation procedures
- Address the queries clearly and appropriately
- Post the site visit
 - Make a note of the number of visitors and the organizations represented.
 - Conduct a short meeting with plant manager, supervisor and your co-workers to review the visit and identify areas of improvement.

6.8 Working effectively with co-workers

Since you will be working mostly in teams it is very important to develop good habits to work effectively with co-workers. Following characteristics are required to work effectively with co-workers:

- Be honest and straight-forward
- Do share the load equally and assist others if required
- Treat others with respect and dignity
- Be an active listener and speak with discretion when communicating with your colleagues
- Acknowledge the contribution of your team members

6.8.1 Assisting co-workers in performing the tasks

- Show your staff and colleagues that you support them in their tasks in order to promote productivity and a healthy working environment.
- Every new employee should be trained properly before the commencement of work.
- Conduct periodic reviews on our co-workers work and assist wherever required.

6.8.2 Communicating and behaving with the co-workers while working in the group

When you're working with a team, make sure to gather everyone's opinion and best ideas. It is also important to use their time and energy efficiently. Following are the points to be considered:

- Always be humble and open to suggestions
- Communicate your views openly using the correct language with respect
- Allow people to share alternative ideas
- Always explain your decision and give reasons behind your choice
- If you're the leader, delegate tasks as per a person's capability and area of expertise and briefly explain what needs to be done and why.

6.8.3 Work with the co-workers to achieve the common goals

The FSTP will perform better when all the employees cooperate with each other and work effectively as a team. It signifies that everyone is working towards a common goal and in doing so they are sharing their own expertise and skills while cooperating with each other. Also, workers will be more engaged, effective and active in their work when they know how their contribution is helping in achieving common organizational goals.

6.8.4 How to express the grievances and problems to the appropriate authority?

Define grievances

Grievances is basically a feeling of resentment which can be against a supervisor, co-worker, machine, equipment, about the environment, against workload etc. A large number of work stoppages, strikes can be a result of faulty handling of grievances. The cost of grievances can be very high in terms of loss of time, poor work, damage to plant machineries due to neglect, conflict and so on (Chaudhary, 2005). Thus, it is your responsibility and duty to address grievances and problems at the FSTP, thus, you must equip yourself with the knowledge and skill required to handle grievances without being biased. There can be certain situations where the plant manager or supervisor needs to be involved

Grievances can be individual or group. In case of an individual grievance, it is not required to involve higher authorities, a one-on-one conversation and discussion of the problem can help in solving the issue. It does not need to be very formal and elaborate. In case of group grievances, they can make a formal written expression of the grievance and it should be brought to the attention of the plant manager and supervisor.

Following is the general outline of a typical grievance process

- Express your problem with your immediate supervisor either verbally or in writing
- Your supervisor can deal with the grievance/problem on his own or pass it on to the higher authority
- Conduct a formal meeting between the staff and plant authority where everyone can present their side, discuss and resolve the issue
- Gather information and relevant data, investigate the situation
- Take a final decision after reviewing with seniors keeping in mind the benefit of the treatment facility

Expressing grievances is a skill. You can keep the following points in your mind when you want to make any such kind of conversation:

- Use positive language while reporting a complaint to your senior
- Remain assertive when under pressure
- Ask questions calmly. Do not intimidate or interrogate.
- Aim to achieve a win/win outcome for both the parties
- Honour the commitments and promises made to resolve the issues

6.9 Exercise

- What are the four key elements of inclusive workspace?
- What is grievance?
- Should you ask for suggestions before taking a decision? (yes/no)

True or false

- Laborer reports directly to plant manager (True/False)
- Smoking is allowed in the FSTP when not in duty (True/False)
- PR materials can be shared with public (True/False)
- Do not inform anyone if you feel discriminated (True/False)

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6.10 Summary

This unit covers the importance and the correct way of working effectively with co-workers, importance of diversity and inclusion in an organization, best practices for a diverse and inclusive work culture, procedure for risk mitigation and addressing grievances.

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Annexure 1: Qualification Pack

Sample Manifest form

General Details	
1. Date	
2. Time of arrival at plant	
3. Property type (mark ü)	Household Industry Institution Commercial Wastewater treatment plant
4. Volume of Sludge	5. Reason for desludging
Details of Owner	
1. Name	
2. Property No.	
3. Address	
4. Ward No.	
5. Contact No.	
6. No of people in house/Institute	
Geographical data	
Type of soil in the area:	Ground water table in the locality in ft:
Route and time details	
Meter reading at	Time taken for
1. Starting location:	1. Traveling to location
2. Desludging location:	2. Opening pit:
3. FSTP:	3. Desludging:
	4. Traveling to FSTP:
Containment system details	
1. Age of sludge collected:	2. Is the containment system plastered on the inside? (Yes/No):
3. Type of containment system (mark ü)	4. If rings, No. of rings:
Single pit	Ring height:
Twin pit	Ring diameter:
Septic tank	
5. Type of construction (mark ü)	6. If not rings, Length:
Ring	Breadth:
Stone masonry	Depth:
Concrete structure	
7. Is vent pipe available? (Yes/No):	8. Volume of water added:
9. Length of pipe used in ft.:	10. Location of pit:
Cesspool vehicle details	
1. Vehicle Name:	2. Vehicle Driver name:
3. Vehicle plate number:	4. Driver Contact Number:
Driver's signature	FSTP Operator's Signature

Sample format for Quality testing report

Quality report				
FS sample:		Date:		Time:
Contaminant	Unit	Value	Range detected	Violation to standards (Yes/No)

Sample format for Operational expenditure and revenue report

Operation expenditure and revenue generation report				
Month	Expenses	Revenue	Net profit/loss	Remarks

Sample format for Operational & Maintenance reports

Daily O&M activities report								
FS details:								
Date	Volume of FS arrived	Source of FS			Sample taken (yes/no)			
Treatment unit operation								
Name of treatment unit	Volume of FS	Retention time	Date of valve operation	State of valve (half open/full open)	Volume of liquid discharged	Rate of flow	Volume of sludge remaining	Observations

Answer Key

Chapter 3

1. Sludge height sampler
2. Garden scissor, Sickle (any one)
3. pH, Electrical Conductivity, Sludge volume index and Temperature
4. Dashboard, Manifest details, desludging vehicle details, rejected loads details, on-site parameters of FS, weather conditions record, treatment unit operations, flow of liquid from one treatment unit to next treatment unit, sludge height reduction in drying beds, details of desludging treatment units, revenue generation details (any two)
5. Gloves, Masks, Goggles,

TRUE OR FALSE

- a. False
- b. False
- c. True
- d. False
- e. False
- f. True
- g. False
- h. True
- i. False

Chapter 4

1. Inspect inlet and outlets of treatment modules, free flow of water in distribution pipes, percolation collection pipes and vent pipes, Inspect the condition of tools and equipment, Inspect the condition of safety equipment and repair and replace as needed, Inspect the cleanliness of the plant, check if there is growth of grass/weed in an around treatment units, check if garbage bins are routinely emptied, check cleanliness of toilets and wash areas, Inspect if there is accumulation of scum in treatment unit, Inspect the treatment efficiency by checking sample reports weekly, Inspect all the light fixtures in FSTP: lighting in operator's room, FSTP premises lighting etc. (any two)
2. Remove all wiring and clean the pump
 - Check pump volute for any damage
 - Check for any clogged debris and clean as required
 - Follow the guidelines provided by the vendor for operating the pump
3. Cleaning and replacement of screen chamber, cleaning of filter media, cleaning and replacement of pumps, checking and replacement of wastewater pipes, backwashing of sand and carbon filter, cleaning of maintenance tools and equipment, checking and replacement of PPE, Replacement of wheel chocks, control panels, cleaning of treatment units (any four)
4. Unscrew the screens
 - Wash the screen using fresh water
 - Paint the screens with anticorrosive paints/ Replace with new ones as per drawings
 - Fix back the screens in the same position
 - Close the maintenance holes with covers
 - If screen plate is highly corroded, replace is entire plate with new one
5. A list of the entire collection of tools, spare parts, essential consumables that you have in the FSTP with relevant information such as name, quantity, price, date of procurement, current status, place of storage
6. Option A: order new equipment

Chapter 5

1. Safety harness and Self-Contained Breathing Apparatus
2. Operational emergency, fire emergency, medical emergency and security emergency
3. Class A, Class B, Class C and Class D
4. "CARRY NO R.I.G.H.T" stands for the first aid procedure in case of snake bite.
 CARRY: Do not let victim to walk even for short distance. Transport by conveyance, especially when bite is in legs.
 NO:
 NO- Tourniquet.
 NO- Cutting.
 NO- Electrotherapy.
 NO- Pressure immobilisation, nitric oxide donor (nitroglyceric ointment/nitrate spray)
 R.I.G.H.T stands for reassure, immobilise limb
 R: Reassure patient, since 70% of all snake bites are from non-venomous species. Only 50% of bites by venomous type of snakes actually envenomate (poison with venom) victims.
 I: Immobilise limb in a fashion similar to a fractured limb, in case of bites on the limb. A bandage or cloth is used to hold the splints. Do not apply pressure and ensure that blood supply is not blocked. Compression in the form of tight ligatures does not work and may be dangerous even. Carry the person. Do not allow any movement whatsoever.
 GH: Get to Hospital immediately.
 T: Tell any systemic symptoms that manifest on way to hospital.

TRUE OR FALSE

- a. True
- b. False
- c. False
- d. False

Chapter 6

1. Fairness and respect, Valued and belonging, Safe and Open, Empowered and growing
2. Grievances is basically a feeling of resentment (complaint) which can be against a supervisor, co-worker, machine, equipment, about the environment, against workload etc.
3. Yes, always consider opinions/suggestions of your co-workers before taking the final call.

TRUE OR FALSE

- a. False
- b. False
- c. True
- d. False

Notes

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Notes





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