

**Occupational Health and Safety Plan**

**Banka BioLoo Limited**

**FSTPs in Andhra Pradesh and  
Telangana**

# Chapter 1 – Introduction

## 1.0 Responsibility

Banka BioLoo Limited (BBL) is committed to provide a safe and healthy working environment to its employees, and comply with all regulations for the preservation of the environment of the territory it operates in, during the course of its operations. BBL is committed to prevent the wastage of natural resources, and minimize any hazardous impact of the development, production, use and disposal of any of its products and services on the ecological environment. BBL, as a responsible corporate citizen, considers its obligation to maintain highest standards of the environmental management and ensure, for all its employees, consultants, contractors and customers, a safe and healthy working environment, free from occupational injury and diseases.

## 2.0 OHS Committee

BBL have constituted an Occupational Health and Safety (OHS) Committee with the employees of the company as members, including its senior management. The OHS Committee will be responsible for ensuring a safe and healthy environment and will meet at regular intervals. For effective monitoring and observance of OHS, the Committee may form sub-committees. The OHS Committee shall, inter-alia, be responsible for:

Compliance with all legislative requirements pertaining to OHS as minimum standard and wherever appropriate, institute additional measures for OHS.

### 2.1 Responsibilities of OHS Committee

- Ensure exemplary performance in occupational health and safety
- Framing of guidelines for OHS in sync with this policy
- Review and revise guidelines for OHS, as required
- Dissemination of information regarding OHS amongst members, and promote awareness by organizing inter department, inter unit competitions and contests throughout the year.

# Chapter 2 - Activities at FSTP

## 3.0 Introduction

Faecal sludge treatment plants (FSTP) treat the sludge, evacuated from onsite containment systems, treating the liquid and solid in an eco-friendly and sustainable manner, thus protecting the surface water and ground water bodies from contamination.

## 3.1 Legislation and Regulatory Context

Presently, there is no single regulation for safe handling, transport and disposal of septage in India. There are many laws dealing with water, wastewater and sanitation services.

The legal context of the Faecal Sludge and Septage Management (FSSM) policy is guided by the following central laws and regulations:

1. Water (Prevention and Control of Pollution) Act, 1974
2. Environment (Protection) Act, 1986
3. National Sanitation Policy, 2008
4. Solid Waste Management Rules, 2016
5. Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013
6. National Building Code, 2005
7. Bureau of Indian Standards (BIS)

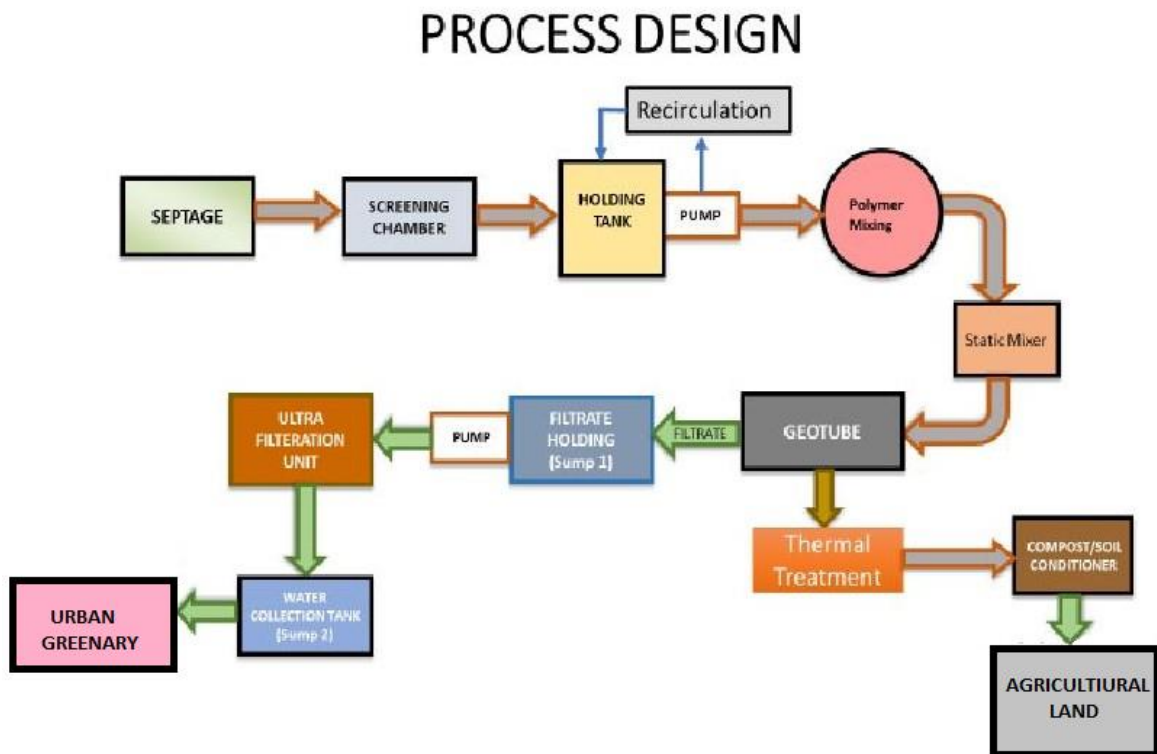
## 2.2 Steps for Faecal Sludge Treatment at FSTP

Activities being carried out at FSTPs for treatment of faecal sludge include:

- Intake of sludge through screening chamber and anaerobic tank
- Coagulation and flocculation
- Solid and liquid separation through Geotube
- Further drying and collection of the solid matter
- Liquid filtration of geo-filtrate effluent by sand filter
- Pressure sand filter

- Active carbon filter
- Disinfection by UV

The process design and description are explained by the below illustrated diagram:



All the steps in the FSTP Unit for treatment of Faecal Sludge mentioned above can be briefly discussed as follows:

#### A) Screening Chamber and Anaerobic Tank

The sludge input is screened, and the plastic, metal, rags are separated; and the sludge is collected into the anaerobic tank by gravity flow. In the anaerobic tank, the screened sludge is recirculated to make it a homogenous mixture.

#### B) Coagulation and flocculation

The homogenized sludge is pumped to a static mixer where in the polymer dosing is injected and flocculation of solids takes place. This flocculated liquid is pumped into Geotube.

### **C) Solid–Liquid Separation**

Geotube dewatering tubes are used for sludge dewatering projects of all sizes and there is good reason - simplicity and low cost. There are no belts, gears, or complicated mechanics. Geotube containers use an engineered textile that is designed for dewatering high moisture content sludge and sediment, one of the most effective treatment dewatering to provide a reduction of up to 85% to 90% in BOD.

Dewatering with Geotube technology is a three-step process:

#### **Filling**

The sludge is pumped into the Geotube. Environmentally-safe polymers are added to the sludge, which makes the solids bind together and water is separated. The Geotube container's unique fabric confines the fine grains of the material.

#### **Dewatering**

Clear effluent water simply drains out from the Geotube through the small pores in the specially engineered textile. This results in effective dewatering and efficient volume reduction of the contained materials. This volume reduction allows for the repeated filling of the Geotube. Over 99% of solids are captured, and clear filtrate is collected and recirculated through the system.

#### **Consolidation**

After the final cycle of filling and dewatering, the solids remain in the Geotube and continue to densify due to desiccation, as residual water vapor escapes through the fabric. Volume reduction can be as high as 90%. When full, the Geotube and contents are deposited at a landfill, remain on-site, or the solids are removed and land-applied when appropriate.

### **2.3 Disposal of Solid**

Solid is disposed of in the plant in the following ways:

1. Solid is contained in the Geotube and is sun dried for 6-8 weeks before being moved to the storage area.
2. No fly menace, with very low moisture content, the solid segregated can be disposed / used easily. The quality of the solid cake is as per the norms with no malodour.

3. The dried sludge is pulverized to small particles, and packed for usage in soil conditioning and used as manure for agricultural purpose with high nitrogen, phosphorus and potassium (NPK) value.

Inactivation of helminth ova can be achieved in sewage / sludge treatment where the temperature is increased over 40 °C or moisture is reduced to less than 5%. Best results can be obtained when both these conditions are combined for an extended period of time.

#### **2.4 Liquid Filtration of Effluent by Sand Filter**

1. Filtration combines with sand and carbon filter with UV
2. Low cost
3. High quality of effluent
4. No chemicals used

#### **2.5 Pressure Sand Filter**

The pressure sand filter offers filtration up to 30 microns. The filter consists of a non-corrosive vessel that can withstand pressure up to 6.5 kg/cm<sup>2</sup>, multi-graded sand filtration media for filtration, internal distribution system to distribute the water evenly inside the vessel for proper filtration, multi-port valve (MPV) for easier operation along with back wash and rinse facilities, a stand to hold the MPV in position and pressure gauges to know the position of the sand filter. The filter is designed for 15m<sup>3</sup> per day internal flow for proper filtration.

#### **2.6 Active Carbon Filter (ACF)**

The system is required to be fed with no chlorine water. The activated carbon filter is incorporated in the system to ensure the same. It also ensures that the water is colourless, odourless and contains no dissolved gases.

The filter consists of a non-corrosive vessel that can withstand pressure up to 6.5 kg/cm<sup>2</sup>, multi-graded sand and activated carbon filtration media for filtration, internal distribution system to distribute the water evenly inside the vessel for proper filtration, multi-port valve (MPV) for easier operation, along with back wash and rinse facilities, a stand to hold the MPV in position and pressure gauges to know the position of the activated carbon filter.

The filter is designed for 14m/s internal flow for proper filtration.

## **2.7 UltraViolet**

Ultraviolet (UV) works by exposing and striking microorganisms (such as cryptosporidium, giardia lamblia and more), which disrupt their DNA, disabling the ability to replicate. No chemical is added to the water except energy.

The sterilized microorganisms are not removed from the water after passing the UV light, meaning, a filtration system must be in-place to remove dissolved organics, inorganics and or particulates from the water.

UV is ultraviolet radiation, an energy band within the electromagnetic energy spectrum. Its wavelength is between that of visible light and x-rays and it has been found to be an effective method for destroying germs in a water supply.

UV destroys germs by causing a molecular change in their DNA make-up that prevents them from multiplying, and destroys the ability to spread disease. When germs cannot multiply, they are considered dead.

## Chapter 3 – Possible Hazards in FSTP

Risk is a probability that damage to life, health and / or the environment. Risk will occur as a result of the hazard. Hazard is an inherent property of a substance, agent, and source of energy or situation having potential of causing undesirable consequences. The following two methods of hazard identification have been employed in the study:

- Identification of major hazards based on Manufacture, Storage, and Import of Hazardous Chemicals Rules, 1989 Government of India, as amended till date.
- Primary Hazard Analysis

The following are the various hazards considered during different phases of the FSTP project i.e. construction and operation phase.

**3.1 Natural Hazards:** natural hazards such as flooding, earthquake, lightening, etc. may be possible and may cause danger to surrounding environment. These hazards can be further elaborated as follows:

**3.2 Earthquake Hazards:** In situations where the site comes under earthquake-prone zone based on seismic characteristics of the site it will be required to protect the plant from earthquakes. In this case we have to refer to Annexure A - Natural Hazards Safety Earthquakes.

**3.3 Flood Hazards:** In situations where it is required to protect the plant from floods, we have to refer to Annexure B - Natural Hazards Safety Floods.

### 3.4 Hazards from Lightening

To protect the facility from lightening, the following measures need to be taken:

- Make sure that building is grounded
- Every conductive path such as water, gas, sewer, structural steel, electrical etc. that enters the building is bonded at the perimeter to the ground system
- Provision of an isolation protection through insulating barrier to electrical conduction

### 3.5 Accidental Hazards

Different accident hazards associated with FSTP construction and operation activities are:



- Fire hazards
- Electrical hazards
- Slips, trips, and falls at work, and
- Biological hazards

### **3.6 Fire Hazards**

Accidental fires due to electrical short circuit represent minor hazards. Special precautions are taken for electrical fitting and appliances uses. Sources of ignition for fire hazards are direct flames, heat radiation, and electric spark.

#### **Safety Measures for Fire Hazards**

- Matches, cigarettes, etc. are prohibited
- Soldering, welding or cutting torches be used after taking necessary precautions
- Being an FSTP, plenty of water is available; in case of fire, treated water reservoir can be used for emergency operation

### **3.7 Electrical Hazards**

Poor electrical installations and faulty electrical appliances can lead to fires which may cause death or injury to workers. Hazards involved with electrical network are:

- Contact with live parts causing shock and burns
- Faulty wiring, which could cause fires

#### **Safety Measures for Electrical Hazards**

- Ensure safety of electrical installations and their maintenance
- Provision of safe and suitable equipment
- Provision of safety device(s)
- Carry out preventive maintenance

### **3.8 Slips, Trips and Falls at Work**

Slips and trips are the most common cause of fatal injuries as well as non-fatal major injuries. The hazards related to slips and trips at work can be reduced through good housekeeping as well as health and safety arrangements.

### **Safety Measures for Slips, Trips and Falls at Work**

The risk associated with slip and trip hazards can be reduced by avoiding spillages in workplace, especially on uneven floors, and trailing cables, and by maintaining good housekeeping. However, for further reduction in the slips and trips, following measures be followed:

- Safety railing / grills, and safety stairs be provided
- Safety operating procedure be followed for chemical handling, and doing regular maintenance work

### **3.9 Biological Hazards**

The workers in the FSTP Unit are prone to biological hazards through handling and possible contact with fecal matter at the facility.

#### **Safety Measures for Biological Hazards (Infection and Illness)**

- Employees are helped to understand the risks through proper instructions, training and supervision at the FSTPs
- Workers' exposure to fecal matter at the plants is eliminated by wearing the correct personal protective equipment (PPE) such as gloves, goggles, face shield, while handling the fecal sludge at the plant (at any point of time there is no direct contact with the sludge)
- The workers dealing with the fecal sludge at the treatment plant wash hands properly with clean water and anti-bacterial soap before and after eating at the plant
- The workers handling the fecal matter at the plant are instructed not to touch their nose, mouth, eyes, or ears with their hands unless they have washed their hands properly with clean water and anti-bacterial soap after handling the fecal matter at the plant as most of the time people get these diseases when they have germs on their hands and they touch their mouth, nose or eyes

- The workers in the plant wear waterproof gloves while cleaning the pumps or screens and while handling septage, sludge, or grit
- Adequate welfare and sanitation facilities as well as first-aid measures are provided in the plant
- Separate eating facilities to avoid food poisoning through cross contamination is provided in the treatment plant for workers
- Separate changing room is provided within the FSTP premises for workers to change clothes on a daily basis after the end of each shift
- Effective vaccination is administered to all the operators working in the plant in two doses per annum. These vaccinations are provided to the operators in the plant in order is to get rid of hepatitis, typhoid and dengue
- Complete health check is done twice a year for every operator in the plant
- Records of health data for all operators are maintained in files in every year in the plant

**3.10 Chemical Hazards:** Sources of chemical hazards can be exposure to chemicals and toxic effects of chemicals. As far as exposure to chemicals is concerned, there is no direct contact with any chemical in the plant as the chemicals used in the treatment process are all handled by mechanical devices for mixing purposes instead of manual handling. However, in case of a situation arising at the plant where manual handling is required, workers will handle it by wearing appropriate PPE such as gloves. The four main exposure routes where chemicals enter the body are through inhalation (breathing), absorption (skin or eye), ingestion (swallowing, eating) and accidental.

The workplace must implement effective safety procedures for protection against chemical hazards agreed jointly by employer and workers through, and Banka BioLoo does that:

- Regular inspection of chemicals with standard checklists for particular chemicals and chemical processes
- Investigations of workers' complaint, if any
- Use of accident and sick records
- Regular survey of workers' health
- Regular environmental and medical monitoring
- Assessment of government inspectors and consultants report, if available

- Investigation of cause of accident and its prevention, development of workplace chemical register
- Development of safe working procedures
- Reduction of workers exposed to hazards and duration and frequency of exposure
- Use of personal protective equipment
- Environmental and biological monitoring

**3.11 Workplace Hazards:** Workplace hazards include ergonomical and psychological hazards that are common in many workplaces nowadays. These hazards can take place due to stress levels during work. Workplace hazards can be implemented for the FSTPs. More details about these hazards and how it can be mitigated is available in Annexure C - Workplace Hazards Safety.

## **Chapter 4 - General Preventive Measures**

### **4.1 Personal Protective Equipment**

The workers are provided necessary personal protective equipment, depending upon the type and nature of work they are handling. They are provided secure and clean place to store the personal protective equipment (PPE) given to them.

A list of personal protective equipment for safety purpose includes:

- Face shields / goggles / safety glasses
- Gloves
- Rubber / gum boots
- Protective clothing / apron
- Respirators
- Dust masks / nose masks
- Helmets

### **4.2 Training**

The workers are trained properly for appropriate use of personal protective equipment provided to them. They are also trained for, when to use which kind of PPE and the right method to use. The workers are informed periodically about health risks they potentially face at the work place and safety measures to be taken.

### **4.3 First Aid During Emergencies**

General principles to be employed during designing of first-aid program for this facility are:

- There is at least one worker in every shift, who has received approved first aid training. He is offered follow-up and refresher courses periodically to update his knowledge.
- All workers should have knowledge of technique of cardiopulmonary resuscitation (CPR) and appropriate use of it.
- Emergency showers and eye-baths are situated close to the site of any potentially hazardous work process.

- First aid box is provided and workers are trained in emergency first aid procedures for any accident or chemical exposure.
- Telephone number, in case for medical assistance and ambulances, is prominently displayed in the work place and a telephone must be available for use in case of emergency.
- There is an emergency response plan (ERP), in which individuals are assigned to perform certain tasks.

#### **4.4 Health Surveillance**

Health surveillance or medical monitoring consists of periodic health examination of a worker by a doctor, nurse, or health worker in order to detect any health effects of chemicals. Medical monitoring is useful for assessing the effectiveness of measures implemented to control chemical exposure. Health surveillance also includes blood and urine testing in addition to general health.

OHS Committee will assign a doctor, who will treat the occupational injury to the workers and monitor impact on the workers of the FSTP facility.

#### **4.5 Safety Signages**

To ensure the health and safety of workers and visitors, there is provision of safety signs and signals in and around plant premises. Mark and provide sign boards for hazardous areas, such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage must be in accordance with international standards, and be well known to and easily understood by workers, visitors, and the general public as appropriate.

#### **4.6 Alarm System**

An effective alarm system will direct the operator's attention towards the plant conditions requiring timely assessment or action. Alarm system will do:

- Alert, inform and guide the operators, allowing them to diagnose problems and keep the process within its safe envelope
- Prevent unnecessary emergency shutdown
- Only present the operator with useful and relevant alarms
- Allow enough time for the operator to respond

- Use prioritization to highlight the critical alarms

#### **4.7 Permit to Work System**

A permit-to-work system is a formal written system used to control certain types of work that are potentially hazardous. A permit-to-work is a document that specifies the work to be done and the precautions to be taken. It forms an essential part of safe systems of work for many maintenance activities. It allows working to start only after safe procedures have been defined and provides a clear record that all foreseeable hazards have been considered, and necessary precautionary measures ensured.

It is needed when maintenance work can only be carried out if normal safeguards are dropped or when new hazards are introduced by the work. e.g. entry to the underground tank. The system should include the following points:

- Clear identification of person authorized for particular types of jobs
- Clear identification of responsibility of person specifying necessary precautions
- Clarity about its design to allow for use in unusual circumstances
- Does the person issuing permit have sufficient knowledge concerning the hazards and precautions associated with the work?
- Does the permit clearly identify the work to be done and hazards associated with it?
- Is there a detailed work method statement for complicated tasks?
- Does the system require the removal of hazards and, where this is not reasonably practicable, effective control?
- Does the permit contain clear rules about how the job should be controlled or abandoned in the case of an emergency?

The permit-to-work will help communication between everyone involved in the particular task / job. Separate permit forms must be designed for different tasks, so that sufficient emphasis can be given to the particular hazards present and required precautionary measures.

#### **4.8 Housekeeping**

A clean and tidy work place must be maintained at all times. Particular attention shall be given to:

- Ensure work place area floors are of sound construction suited to the process, kept free of all obstructions and are cleaned regularly
- No more than a day's or a shift's supply of materials be kept at the work area
- Put all waste (off cuts, process waste, excess packaging material etc) into the appropriate and labelled bins
- Empty all bins at the end of each shift or as soon as full, whichever is earlier. The two types of bins shall remain separate throughout the disposal stage, be emptied into separate transport bins and be disposed of appropriately, by licensed carriers.
- Thoroughly clean all working areas at the end of each shift
- Ensuring that there is clear access to exits, fire extinguishers and fire-fighting equipment at all times
- Ensuring that there is good air space around stored materials and components
- Inspect concealed spaces and keep clear of wastes
- Maintaining lights in good condition

#### **4.9 Safety Showers**

Safety showers and eye washing facilities must be provided in close proximity to the work place where chemicals are handled and used. If contamination occurs, irrigate the eyes and/or wash the contaminated area for at least 20 minutes under the shower. Remove contaminated clothing in the shower and wash underlying skin. In the case of peroxide contact, the eye should be flushed continuously until medical treatment is available.

Where it is not practicable to provide an eye wash facility, portable eye wash bottles must be provided. Care must be taken to ensure they are protected from contamination such as dust and that the solution is changed at the interval recommended by the supplier.

#### **4.10 Personal Protection**



Stringent use of the use of personal protection equipment (PPE) such as head gear, caps or helmets, dust mask, gloves, face shield, safety glasses, respirators, gumboot, aprons, goggles etc. would be put into practice. However, it will be the responsibility of the members to use the safety gadgets while on duty. The workers must be trained properly for appropriate use of personal protective equipment provided to them. They must also be trained for when to use, which kind of PPE and right method to use it.

### **Safety Measures**

In conjunction with the work practices specified in Storage & Handling of Hazardous Materials & Personal Protection the following steps to be followed:

- Eye and skin protection must be worn when working with chemicals
- Clean up all spills immediately
- Frequent hand washing is essential especially prior to meal breaks
- Recommended to use hot running water and soap
- Work clothing must be changed daily at the end of each shift
- In addition, smoking, eating, drinking and storing food in FSTP work areas must be forbidden

#### **4.11 First Aid During Emergencies**

First aid boxes must be provided in all work areas and workers trained in emergency first aid procedures for any accident or chemical exposure. Emergency showers and eye-baths will be situated close to the site of any potentially hazardous work processes. All workers should have knowledge of technique of cardiopulmonary resuscitation (CPR) and appropriate use of it. Telephone number in case for medical assistance and ambulances to be prominently displayed in the work place and a telephone must be available for use in case of emergency.

#### **4.12 Safe Working Practices**

##### **4.12.1 Storage and Handling of Hazardous Materials**

Provide areas for storage of clean and contaminated equipment and personal effects are segregated and separate from eating facilities, and have facilities readily available for decontamination of workers. Monitor stored bio solids prior to application to assure that the bio solids are properly stabilized and that unacceptable re-growth or cross-

contamination from sub-standard material has not occurred. The workers at the site are provided with secure and clean place to store their PPE given to them.

#### **4.13 Waste Disposal**

All waste generated on site will be solid and liquid waste. The liquid effluent will be filtered further in the ultra-filtration unit of the plant, and can be reused for gardening in the FSTP premises or for agricultural purposes. The solid output from the Geotube, after drying in the sunlight for 6-8 weeks, will be sterilized in the microwave for pathogens and microorganisms such as bacteria elimination, and is sent for pulverization.

The pulverized component is packed in 25 kg bags and is supplied to farmers or sold in the market or used for further agricultural purposes as organic compost.

Excess chemicals left over at the end of the job are removed from site.

## **Annexure A – Natural Hazards Safety Earthquakes**

### **Safety from Earthquakes**

Earthquake may cause damage to the site and may result in fatal injuries to workers. Some of the possible preventive measures to be taken before, during and after earthquake are:

#### **Before an Earthquake**

- All the structural design work of treatment units will be carried out considering the safety factor based on seismicity of the area.
- There will be an earthquake operation plan (EOP) including evacuation map, emergency telephone list, and emergency assembly point (EAP).
- Storing laboratory chemicals on lipped shelves to prevent falling
- Inspecting work areas periodically to maintain awareness and to identify situations that may need correction
- Keeping large and heavy objects stored on low levels of shelves and cabinets
- Conducting periodic earthquake drills
- Preparing for earthquake in advance by taking basic first aid training
- Keeping earthquake survival kit and first aid kit readily available in hand
- Bolting down gas and chemical appliances of the laboratory properly
- Conducting calm discussions with co-workers about earthquakes and other possible disasters
- Teaching co-workers how to turn off water, chemicals, gas, and electricity pipelines and main switch valves

#### **During an Earthquake**

- Everybody should stay calm and think through consequences before taking any action
- Staying away from windows, and mirrors

- Avoid running outside until shaking stops
- Moving to an open space area, away from the possible hazards

#### **After an Earthquake**

- If earthquake is severe, go to EAP
- If uncertain about any potential hazard in building / work place, do not enter, raise alarm, seek help of co-workers
- Review fire hazards, structural damage, and water leakages
- Shut off electrical power at the control box if there is any damage to wiring and piping
- Avoiding usage of lighters, candles, or electrical equipment

## **Annexure B – Natural Hazards Safety Floods**

### **6.10.2 Safety from Floods**

In case of any unexpected circumstance such as catchment runoff, the plant will have high plinth level and internal storm water drain to avoid flooding within the premises.

## **Annexure C – Workplace Hazards Safety**

### **Ergonomical and Psychological Hazards**

These hazards can take place due to stress levels during work. Some of the problems, which may lead to stress are: boring job, repetitive tasks, too little or too much work to do, too little time, too little training for the job, selecting right person to fit into the task, poor relationship with others, bullying, racial harassment, inflexible work schedules, poor physical working conditions, lack of communication and consultation, lack of support for individuals to develop their skills, lack of control over work activities, negative work culture.

### **Mitigating Measures**

- Clarity in defined objectives and responsibilities of an individual linked to business objectives, selection of appropriate person for the assigned tasks prioritizing the jobs.
- Training the individuals based on inter-personal skills and increasing the scope of work for the trained.
- Increase the variety of tasks by rearranging people between the jobs in order not to get bored with the single task working in group to improve the performance setting up of an effective system.
- To prevent and stop harassments working in shifts, to ensure flexible working hours, provision for regular health check-ups.
- Provision for adequate control measures opportunity to contribute individual ideas in planning and organizing the jobs.
- Introducing clear business objectives, good communications and employee involvement, particularly during period of change, an individual should be honest and respect others, support the individuals to develop their skills.