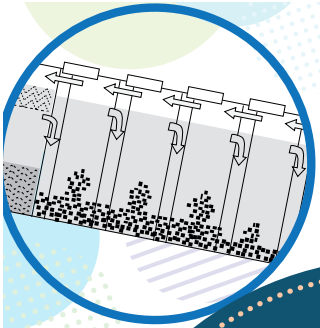
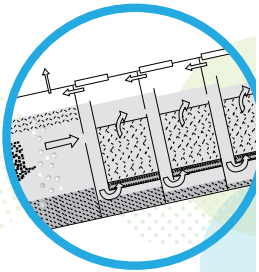
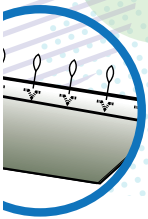
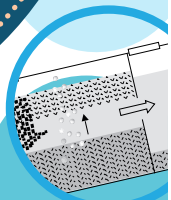




Handbook on

# Operation and Maintenance of Decentralized Wastewater Treatment System (DWWTs)





SCHOOL OF WATER AND WASTE
AAETI

**Prepared by School of Water and Waste, Centre for Science and Environment**

Handbook on

# Operation and Maintenance of Decentralized Wastewater Treatment System (DWWTs)

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**Prepared by School of Water and Waste,**
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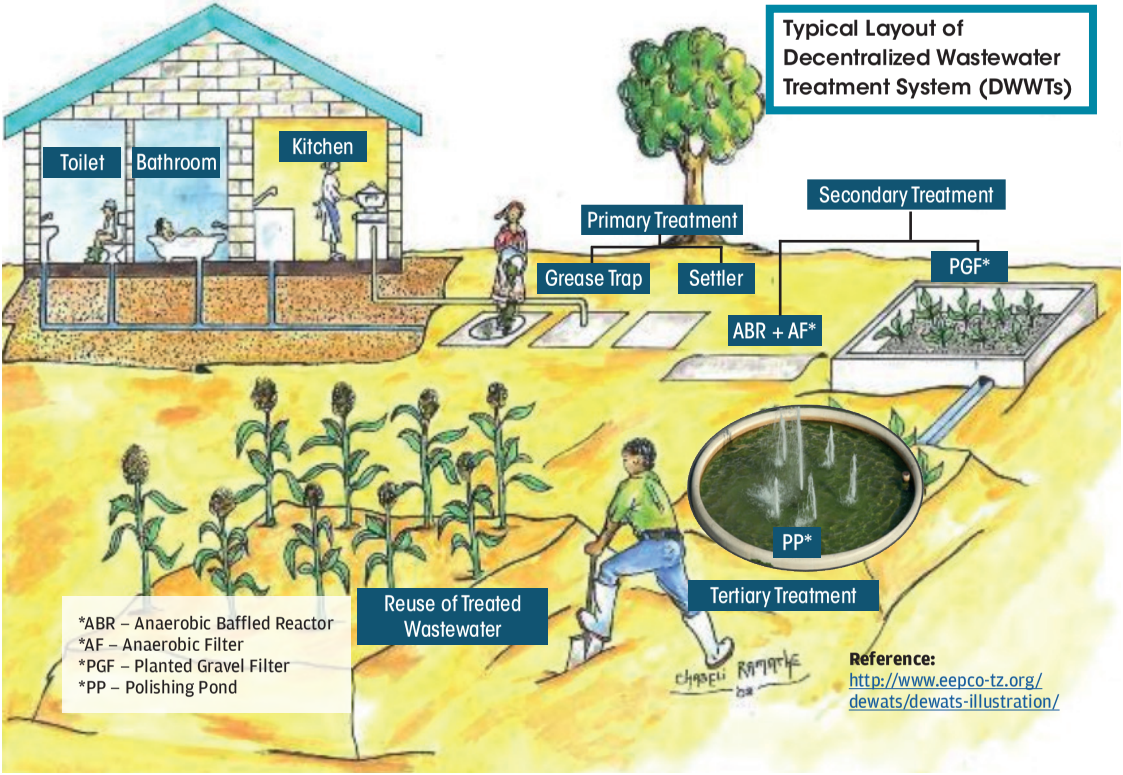
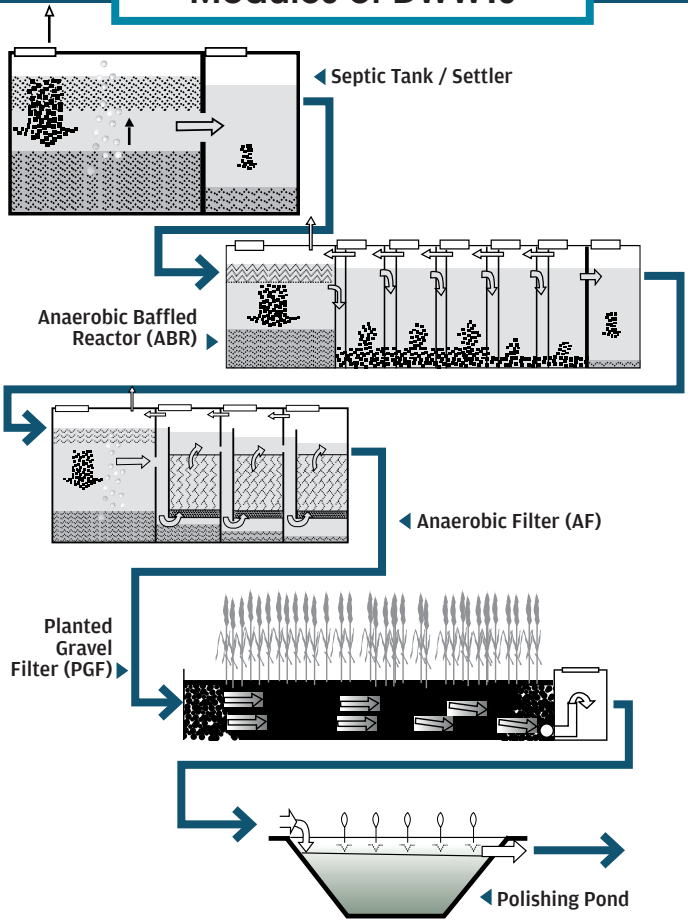

Typical Layout of Decentralized Wastewater Treatment System (DWWTs)
Toilet
Bathroom
Kitchen
Primary Treatment
Secondary Treatment
Grease Trap
Settler
PGF*
ABR + AF*
PP*
Tertiary Treatment
Reuse of Treated Wastewater
*ABR – Anaerobic Baffled Reactor
*AF – Anaerobic Filter
*PGF – Planted Gravel Filter
*PP – Polishing Pond
Reference:
http://www.eepco-tz.org/dewats/dewats-illustration/

# Sectional View of Different Modules of DWWTs



# Purpose of the handbook

- To provide a concise and complete understanding about maintenance issues and their remedies, which arise in day to day operation and maintenance of DWWT system.
- To provide an insight about the safety measures to be adopted during COVID-19
- To be used as a handy user guide as well as monitoring tool

## Target Group

This handbook is intended to be used by the DWWTs operator, supervisor, maintenance in-charge, monitoring in-charge, caretaker of the DWWTs, gardener, implementer, resident welfare associations (RWAs) etc.

# Need for Operation and Maintenance

Proper operation and maintenance of a DWWT system ensures smooth functioning and expected performance of the system throughout the design period.

**Operational Activities:** Activities to fulfill objectives of the treatment and to check performance of the different modules of the DWWT system.

**Maintenance Activities:** Activities that ensure the smooth functioning of different treatment modules based on regular inspections.

» DWWT system operated and maintained efficiently has the potential to be productive and sustainable economically, environmentally and socially.

# Frequently Asked Questions (FAQs)

**Is DWWTs environmentally and economically viable?**
Yes, DWWTs are designed to maximize the reliance on natural processes and its O&M does not require external energy and can be done by semi skilled labour.

**What will happen if we completely empty the baffled reactor during desludging process?**
If we completely empty the baffled reactor during the desludging process then all the necessary micro-organisms required for the biological decomposition of organic matter will be removed and the reactor will require addition of fresh cow dung/ existing septic tank waste for the re-commissioning/innoculation purpose.

**How to control foul smell/odour in treated wastewater?**
Improper aeration leads to the foul smell and odour in the treated wastewater. To control this, avoid to store the treated wastewater for more than two days. Also ensure that there is no hindrance in subsurface flow of wastewater in PGF bed.

# Regular Operational and Maintenance Instructions

» Make sure to adopt necessary precautions and wear all the required PPEs (Mask, Hand Gloves, Safety Jacket, Gum Boots etc.) while performing the regular operational and maintenance activities.

» During maintenance, the system should not be closed completely, make sure that activities are carried out in phased manner.

**1**

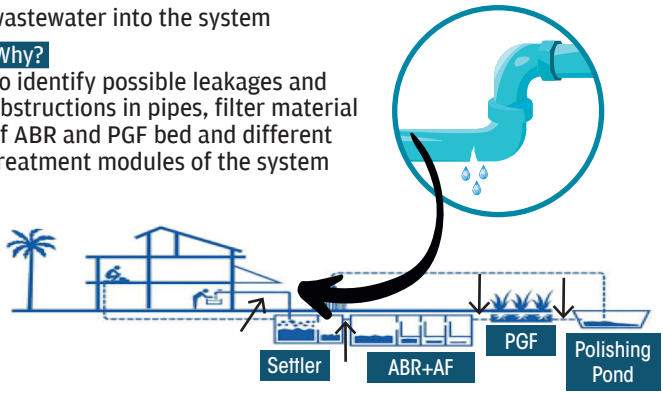
## Check for free wastewater flow

**When?**

In case of overflow or no flow of wastewater into the system

**Why?**

To identify possible leakages and obstructions in pipes, filter material of ABR and PGF bed and different treatment modules of the system




↘Leakages/obstructions to be checked in pipes from source to primary treatment unit and within inter-module pipes

## 2

# Removal of oil and grease from Grease Trap

**When?**

Regular cleaning (twice or thrice a week) depending on the quantum of oil and grease generated also in case of overflow, backflow or foul smell

**Why?**

To avoid clogging and interruption in further biological treatment

- For small grease traps, the waste could be removed manually by scooping it into watertight plastic bags and disposed of together with other kitchen refuse.
- For large grease traps, one installed in restaurants and food processing factories should employ reputable collectors to collect the grease trap waste for proper disposal through incineration or land filling. Land filling should be done at-least 30 feet away from any water tank or bore well to avoid contamination.
- Scum can be collected at one place and industries can be explored were it can be reused such as soap and biodiesel.
- Oil can be filtered out from scum and used for burning purposes.

**Reference:**
https://www.thomasville-nc.gov/Home/ShowDocument?id=102

http://hrfog.com/Content/EducationalMaterial/Grease-Trap-Cleaning-Guide.pdf

## 3
# Removal of scum layer from Settler

**When?**

Once in fortnight or in case of excess scum / foul smell

**Why?**

To avoid clogging and interruption in further biological treatment

**De-scumming**

- Removal of hard scum layer with spades
- Soft scum removal by sieving
- Feeding into biogas digesters to increase gas production

**Reference:**

https://www.researchgate.net/publication/283713518_Operational_measures_to_cope_with_FOGscum_in_DEWATS_plants

https://sswm.info/sites/default/files/reference_attachments/BORDA%202008%20Decentralized%20Wastewater%20Treatment%20System%20-DEWATS%20Manjuyod%20Public%20Market.pdf

## 4

## Desludging of the sludge accumulated at the bottom of Settler and Anaerobic Baffled Reactor (ABR)

**When?**

Regular desludging once in 2-3 years or in case of excess solids, BOD or COD at the outlet of ABR

During desludging, chambers should not be emptied completely otherwise it will require re-commissioning of the system.

**Why?**

To ensure efficient treatment and avoid clogging. Longer intervals between two successive desludging will compact the sludge accumulated in the bottom and will cause difficulties during the removal process.

**Reference:**

https://sswm.info/sites/default/files/reference_attachments/BORDA%202008%20Decentralized%20Wastewater%20Treatment%20System%20-DEWATS%20Manjuyod%20Public%20Market.pdf

## 5

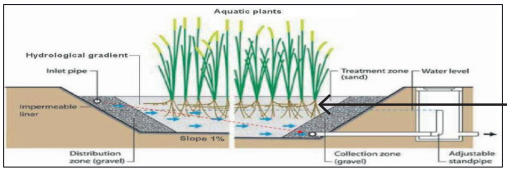
## Check for minimum required water level in Planted Gravel Filter (PGF) Bed

**When?**

In case of overflow, no plant growth or prevalence of mosquitoes in abundance around PGF etc

**Why?**

To avoid overflow, mosquito breeding and death of plants




Min Required Water Level

## 6

## Removal of weed and dead leaf litter from PGF

**When?**

Once a week or in case of excess weed or litter observed on the surface

**Why?**

To avoid clogging and formation of algae in filter media and to maximize efficiency. Also, it will ensure the flow of oxygen and ultraviolet rays of the sun to enter the gravel filter.

↘Dead leaf litter to be removed manually by using an appropriate tool (garden rake, fish net and sieve). Weed should be removed by extracting the roots also.

## 7

## Harvesting of plants in PGF

**When?**

Once a month or, in case of excess growth of plants or observe dead leaves in PGF

**Why?**

To remove dead leaves and allow proper natural reactions such as photosynthesis

## 8

## Replacement / Re-installation of filter media in PGF

**When?**

Once in 4-5 years or in case of clogging of filter media

**Why?**

To avoid any hindrance to the flow of wastewater and to maintain the efficiency of the treatment

## 9

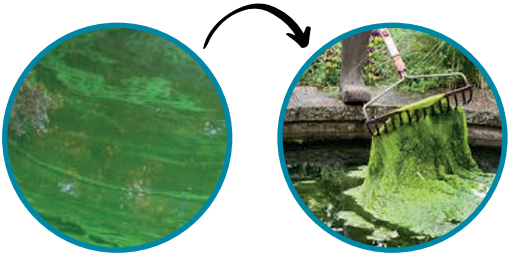
## Check for algal bloom and froth formation in Polishing Pond

**When?**

In case of froth/bubbles or greenish appearance on the surface

**Why?**

To get clearer and better quality of treated wastewater for reuse



↘Excess algae from polishing pond should be removed manually using a fish net.

## 10

## Testing of treated wastewater

**When?**

In regular interval of 3-6 months or in case of inefficient treatment

**Why?**

To check the performance of the system and to maintain the quality of treated wastewater

**Sample Testing:** Sample testing should be done by authorized / NABL accredited laboratory with enlisted parameters - pH, TSS, TDS, BOD, COD, Total Ammonical Nitrogen, TKN, Total Phosphates, Faecal Coliform, Total Coliform.

Sampling Points: Settler Inlet; ABR Inlet; PGF Inlet; PGF Outlet; Collection Tank/ Polishing Pond

- Individual taking the sample should have adequate knowledge of the preparation and handling of the sample. The monitoring in charge should be aware of the necessary things like checklist, sampling tools, guidelines and method of collection and transportation of the wastewater samples. Sampling procedure can be found in attached reference link.

**Reference:**

https://www.cseindia.org/scoping-paper-development-and-validation-8338

## 11

## Ensure regular reuse of treated wastewater from collection tank or polishing pond

**When?**

Regular reuse of treated wastewater everyday or once in two days

**Why?**

To minimize the growth of algal bloom, foul smell and also to avoid overflow/backflow of treated water in collection tank/polishing pond

## Recommended norms of treated wastewater quality for different reuse options by CPHEEO

| Parameter | Toilet Flushing | Fire Protection | Vehicle Exterior Washing |
|---|---|---|---|
| Turbidity (NTU) | <2 | <2 | <2 |
| SS | Nil | Nil | Nil |
| TDS | | | |
| pH | | | |
| Temp. (˚C) | | | |
| Oil and Grease | 10 | Nil | Nil |
| Minimum Residual Chlorine | 1 | 1 | 1 |
| Total Kjeldal Nitrogen | 10 | 10 | 10 |
| BOD | 10 | 10 | 10 |
| COD | AA | AA | AA |
| Dissolved Phosphorus | 1 | 1 | 1 |
| Nitrate | 10 | 10 | 10 |
| Faecal Coliform/ 100 ml | Nil | Nil | Nil |
| Helminthic eggs/ litre | AA | AA | AA |
| Colour | Colourless | Colourless | Colourless |
| Odour | | | |

Note: All units in mg/l unless specified; AA - as arising when other parameters are satisfied;
A tolerance of plus 5% is allowable when yearly average values are considered.

| Non-contact Impound-ments | Horticulture, Golf Courses | Non-edible Crops | Edible Crops | |
|---|---|---|---|---|
| | | | Raw | Cooked |
| <2 | <2 | AA | <2 | AA |
| nil | nil | 30 | Nil | 30 |
| 2100 | | | | |
| 6.5 to 8.3 | | | | |
| Ambient | | | | |
| nil | 10 | 10 | nil | nil |
| 0.5 | 1 | nil | nil | nil |
| 10 | 10 | 10 | 10 | 10 |
| 10 | 10 | 20 | 10 | 20 |
| AA | AA | 30 | AA | 30 |
| 1 | 2 | 5 | 2 | 5 |
| 5 | 10 | 10 | 10 | 10 |
| nil | nil | 230 | nil | 230 |
| AA | AA | <1 | <1 | <1 |
| Colourless | Colourless | AA | Colourless | Colourless |
| Aseptic (Not septic and no foul odour) | | | | |

## 12
## Ensure to cover all the access covers of the system

**When?**
While not performing any operational and maintenance activities

**Why?**
To ensure proper treatment and avoid any untoward incident

## 13
## Maintain a log-book / Register

**When?**
Regularly based on frequency of operation and maintenance activities

**Why?**
To track all the operations and maintenance activities (mentioned from point 1 to 11). It will help in smooth run of the system

**Reference:**
https://drive.google.com/file/d/1o2HXB1S6BsFpJRNQT1WeV-rT7Q_qrJrd/view?usp=sharing

# In view of the COVID-19 (or any WASH related pandemic) following precautions need to be adopted for smooth operations of DWWTs as well as for the safety of sanitation workers

Over and above the regular O&M instructions

## 1

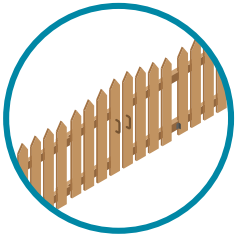
## Visitor's entry to be controlled within the plant's premises

**Why?**

To ensure physical distancing and health safety

**Benefit?**

It will help in reducing the risk of infection through any object or human contact



2

## Use Personal Protective Equipments such as Mask, Gloves, Gum Boots, Goggles/ Face Shield, Full Sleeve Clothes etc during operational and maintenance activities of the system

**Why?**
To avoid exposure to wastewater

**Benefit?**
It will help preventing the transmission of infection through nose, eyes, mouth etc while handling the wastewater

3

## Avoid watering the plants by sprinkler method

**Why?**
There might be chances of infection through aerosols

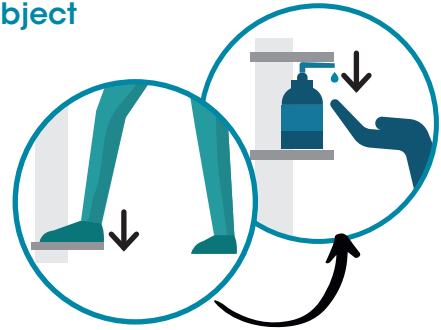
**Benefit?**
It will help in minimizing the risk of infection through aerosols

## 4

## Sanitize your hands properly, before and after touching any object

**Why?**
The logbook or any other object may be touched by some infected person

**Benefit?**
It will minimize the risk of spread of virus



↘It is recommended to use sensor based or foot pedal sanitizer dispenser to avoid the spread of COVID-19 through the contaminated bottle because by touching the sanitization bottle one can unknowingly leave the virus on the bottle and it may transmit to other person who comes in contact with it.

**Reference:**
https://www.csir.res.in/csir-products-for-covid-19

https://drdo.gov.in/sites/default/files/whats_new_document/Technical_document_Contactless_Sanitizer_Dispenser.pdf

## 5

## In case of cold or flue symptoms, consult a doctor and avoid visiting the DWWT site

**Why?**
Doctor will suggest you the correct measures to avoid any severe illness

**Benefit?**
It will ensure health safety and avoid the spread of infection to others at the site

6

## Use bandage and wear water proof gloves in case of any cut or wound

**Why?**

To prevent the contact of cut or wound with the wastewater

**Benefit?**

It will help in reducing the risk of infection through bloodstream

7

## Use lime powder as a disinfectant in case of spillage or leakage of wastewater at site

**Why?**

To prevent human contact with infected wastewater

**Benefit?**

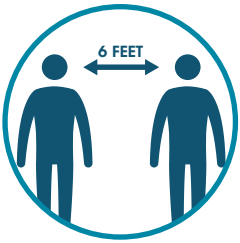
It will help in reducing the risk of spread of the infection through spillage or leakage of wastewater

## 8

## Maintain a minimum safe distance of at least 6 feet (as per new norms) with your colleagues at site

**Why?**
To ensure physical distancing

**Benefit?**
It will help in reducing the risk of spread of the virus through human contact




➘As per new social distancing norms CDC recommends to stay at least 6 feet (about 2 arms length) from other people.

**Reference:**
https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html

## 9

## Used equipments and reusable PPEs to be sanitized or fumigated properly before storing

**Why?**
Used equipments may get contaminated with the virus and also it may cause the spread of the disease

**Benefit?**
After sanitization these equipments/reusable PPEs can be used again without any risk of infection

## 10

## Dispose off masks and gloves in designated bin, In case of reusable PPE, wash with warm water and sun dry


**Why?**

Throwing masks here and there may infect others

**Benefit?**

It will provide safe disposal of used masks and gloves and also will be helpful in reducing the risk of infection

- Collect used mask (including three layer mask, N95 mask etc.), head cover/cap, shoe-cover, disposable linen Gown, non-plastic or semi-plastic coverall in Yellow bags
- Collect used PPEs such as goggles, face-shield, splash proof apron, Plastic Coverall, Hazmet suit, nitrile gloves into Red bag

↘It is advisable to keep the used PPEs in a designated bag for at-least 72 hours before its disposal to avoid contamination

**Reference:**

https://cpcb.nic.in/openpdffile.php?id=TGFOZXNORmlsZS8yOTdfMTU5MjE0NzcwMF9tZWRpYXBob3RvMzA3NDgucGRm

## 11

## Wash used PPEs and clothes using 0.05% chlorine solution and sun dry

**Why?**

To control the infection from virus and avoid mixing of used clothes /PPEs with other clothes

**Benefit?**

It will help preventing the mixing of infected clothes and will reduce the risk of spread of the virus infection

**Reference:**

https://www.cdc.gov/healthywater/global/sanitation/workers_handlingwaste.html

## 12

## Wash your hands frequently with soap

**Why?**

Germs/viruses from unwashed hands can be transferred to other objects and then transferred to another person's hands

**Benefit?**

Frequent hand washing will helps prevent respiratory infections

↘As per WHOs recent guideline, proper hand-washing requires at-least 40-60 seconds instead of 20 seconds. Hand-rub to be used for at-least 20-30 seconds to kill the germs/viruses. Earlier it was suggested to wash hands at least for 20 seconds.

**Reference:**

https://www.who.int/gpsc/5may/Hand_Hygiene_Why_How_and_When_Brochure.pdf

https://globalhandwashing.org/wp-content/uploads/2020/04/UNHCR-Technical-WASH-Guidance-for-COVID-19-Preparedness-and-Response-UNHCR-2020.pdf

## 13

## Do not eat and drink at the DWWTs site

**Why?**

Germs, bacteria and viruses present in wastewater may contaminate the food and it can be the reason for several diseases

**Benefit?**

It will help safeguarding health and also prevent the risk of food poisoning

**Reference:**

https://d3n8a8pro7vhmx.cloudfront.net/cupebcvotes2014/pages/1551/attachments/original/1457451862/Wastewater_Treatment_Plant_-_CUPE_Occupational_Health_and_Safety_Bulletin.pdf?1457451862

## 14

## Do not smoke and spit at the DWWTs site

**Why?**

Smoking should be prohibited to prevent the incidence of fire through flammable gases produced during treatment process. Also abstrain from spit at the site as it could be a carrier for infection

**Benefit?**

It will ensure health safety of both workers and visitors. Also it will help in reducing the risk of transmission of the infection

**Reference:**

https://www.who.int/news-room/detail/11-05-2020-who-statement-tobacco-use-and-covid-19

https://d3n8a8pro7vhmx.cloudfront.net/cupebcvotes2014/pages/1551/attachments/original/1457451862/Wastewater_Treatment_Plant_-_CUPE_Occupational_Health_and_Safety_Bulletin.pdf?1457451862

## 15

## Routinely consult a doctor and as per recommendations, ensure to take vitamin supplements and vaccinations of Polio, typhoid fever, hepatitis A, hepatitis B etc.

**Why?**

To protect one's health from infectious diseases and prevent invading of viruses/bacteria

**Benefit?**

It will help strengthening the immune system

**Reference:**

https://www.cdc.gov/healthywater/global/sanitation/workers_handlingwaste.html

We are grateful to the Bill and Melinda Gates Foundation (BMGF) for their support to School of Water & Waste, AAETI (a unit of CSE).


# Centre for Science and Environment

## Be Alert, Be Safe!

https://www.cseindia.org/page/school-waterwaste
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