

TRAINING OF TRAINERS PROGRAMME ON CAPACITY DEVELOPMENT OF ETP OPERATORS

Promotion of Sustainability in the Textile and Garment Industry in Asia - FABRIC



Day 2: Presentation 1

Physical Treatment systems



Contents

- Description of primary treatment
- Screening & grit removal
- Equalization & homogenization
- Post primary treatment

What is primary treatment?

- Primary treatment has physical and chemical components.
- many units including screening, grit removal, equalisation, chemical dosing, flocculation & solids separation.
- Primary treatment Screens remove solids harmful to pumps/aerators
- Equalisation ensures uniform quality of effluent for subsequent stages.
- Chemical coagulation removes suspended solids, reduces colour, precipitate heavy metals and a portion of organics.
- Primary treatment produces sludge equivalent to the suspended solids in the effluent & the chemicals dosed.

Efficiency of Primary Treatment

Screening	To remove the coarse and settleable solids to avoid clogging in the pumps, valves and pipelines
Grit removal	To remove the fine solids to avoid clogging in the pipelines
Flow metering	To maintain the process control, process monitoring and discharge reports
Flow equalization	To avoid shock loading in treatment, to homogenize effluent,
Chemical treatment	To remove the settleable organic and inorganic solids by sedimentation
Solids separation	To remove the settleable solids/ chemical sludge and thickening of sludge

What is primary treatment?



Efficiency of Primary Treatment



40% ETPs in BD is primary. 35% primary & secondary, 25% all-biological treatment.



Screens, equalisation, chemical dosing, primary settling, sludge dewatering and effluent filters.



mechanical screens are brush screens, drum screens in large ETPs. Manually cleaned screen is common.



Small ETPs has rectangular hopper bottom settling tanks & big units lamella clarifiers/circular clarifier.



Common chemicals ferrous sulphate, alum, lime and polyelectrolytes.

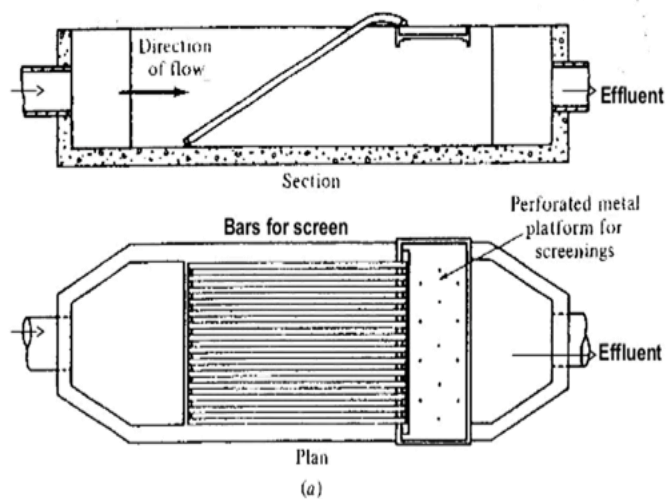


Theory of screening

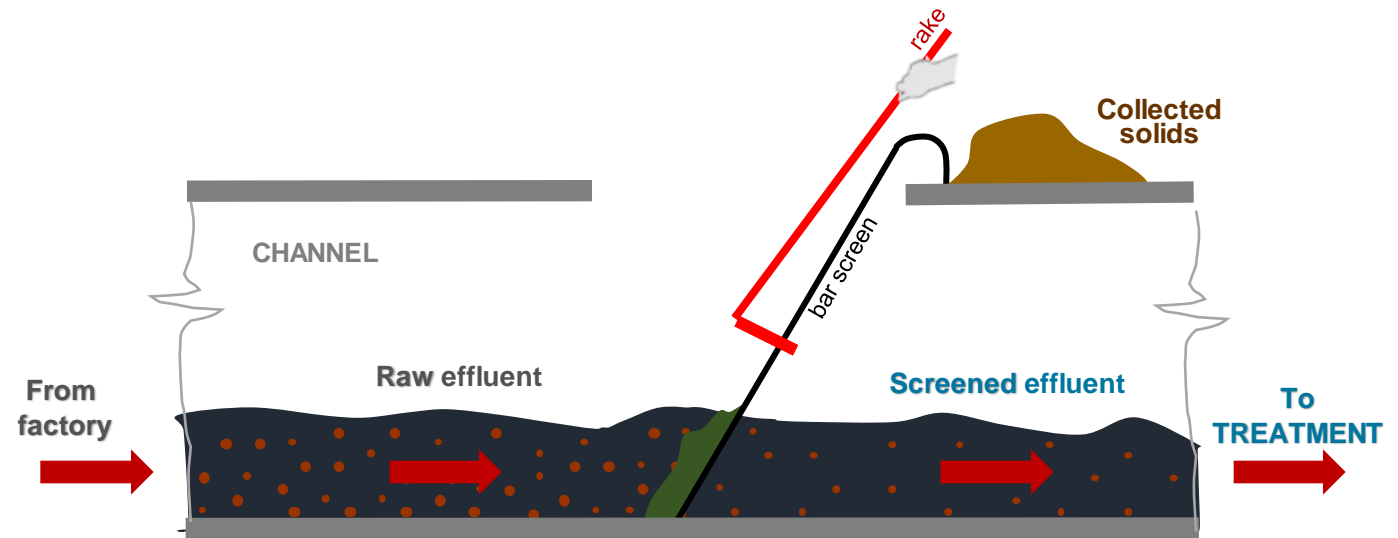


- Many view an effluent channel as dumping place of any waste.
- In screens, we get waste like fibres, yarns, gunny bags, plastic cups or packages.
- Screens are divided in two types: manually cleaned & mechanically cleaned.
- Manually cleaned screens: coarse (>25 mm), medium (10-25 mm) and fine (<10 mm).
- Objective: to separate coarse medium size solids, avoiding sedimentation in next stages

Manually cleaned screen



Manually cleaned bar screen



(image courtesy UNIDO)

Control of manually cleaned screening

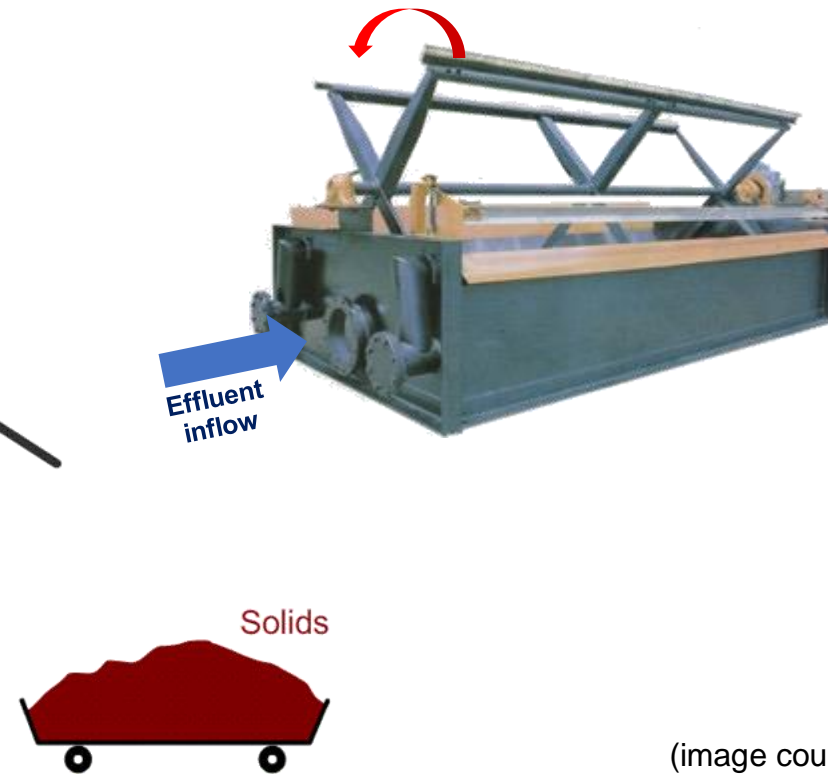
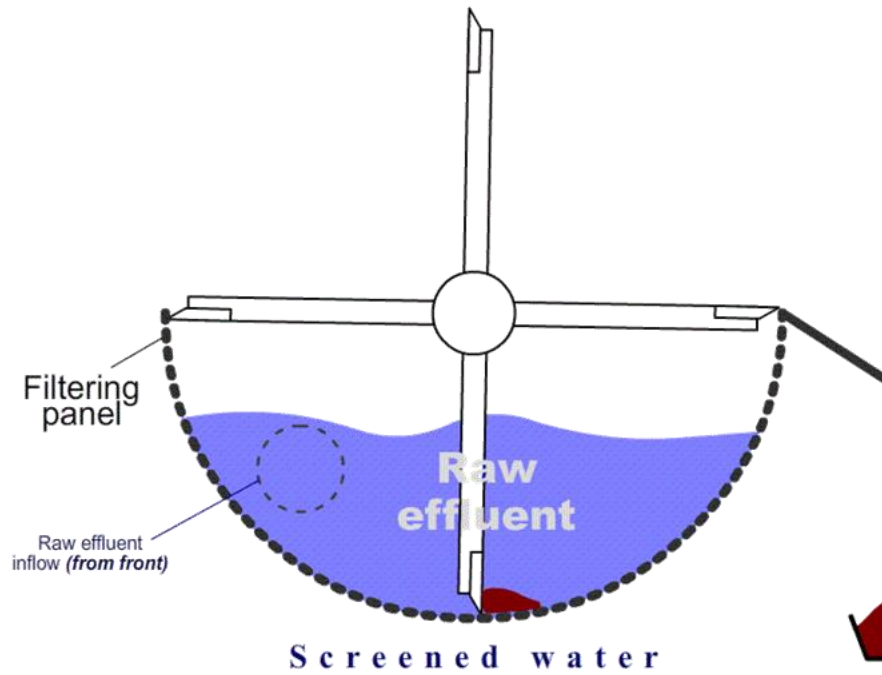


- Regular cleaning, once in a shift or more frequently if choking is more.
- Install screen as un-removable, cemented to wall
- Ensure no gaps between the wall and the screen.
- Inspect screens once in a week, ensure that no bars are missing or corroded away.
- Check spindle for any bend/missing teeth.
- Better make spindle in SS.
- Screenings laid on the draining platform to get dried.
- Prompt removal & proper disposal of dried screenings.

What are the type of mechanical screens used in textile ETPs of Bangladesh?



Self cleaning brush screen

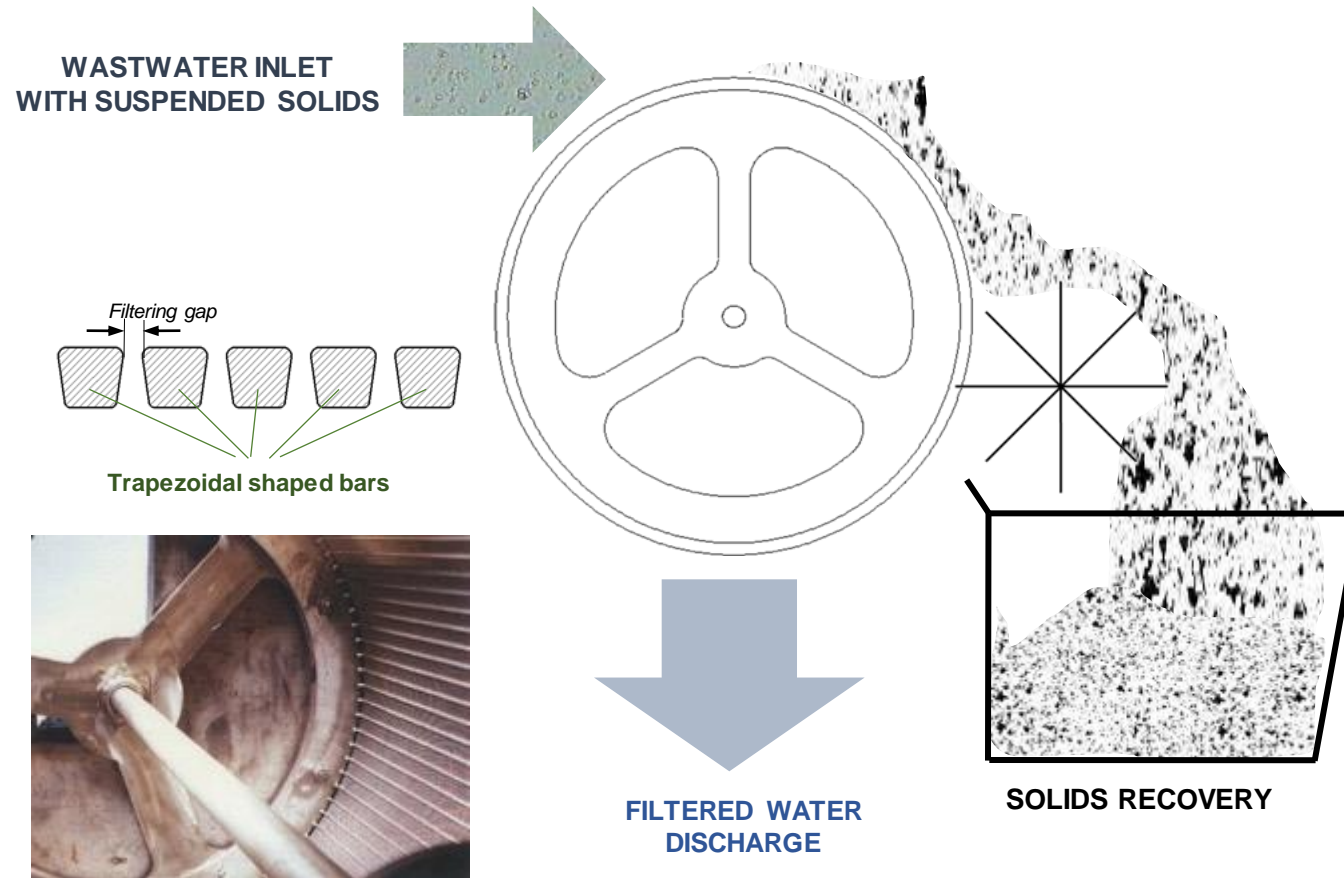


(image courtesy UNIDO)

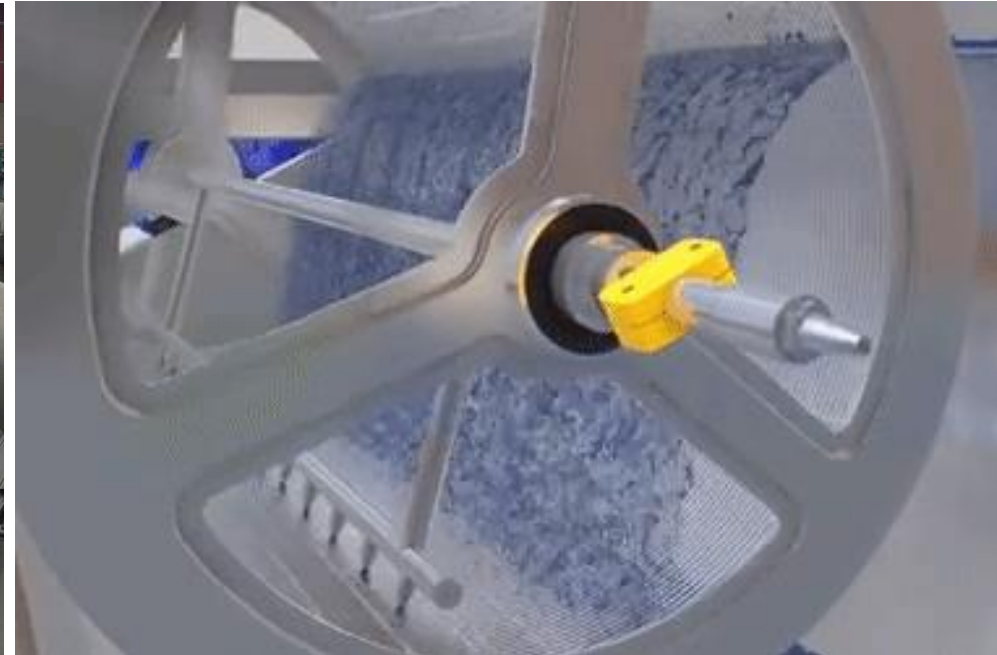
Brush screen



Rotary Drum screen



Mechanical drum screens



Mechanical screens



Mechanically cleaned bar screen



- Three popular type of mechanically cleaned screens.
- First one resembles manually cleaned screen, but has mechanical comb
- Second type is the brush screen.
- Third popular type is the drum screen
- Screens need a drying platform for the screenings to get dry
- Irrespective of the type of screen, water jet cleaning arrangements are common

Mechanical bar screen operation



Control of mechanical screening



- Ensure smooth rotation of blades without any jerks and noise.
- Inspect rake teeth on mechanically cleaned screens once a week for breakage & bending
- Ensure no gaps between wall & screen.
- Drum & brush screen ensure continuous spray of cleaning water.
- Place removed screenings in draining tray / platform, ensure perforations not clogged.
- The solids removed from screens must be disposed of regularly.

Do's & Don'ts in screening



Do's

- Always ensure screen regularly cleaned and chamber not flooded.
- Always inspect the screen rake and ensure no teeth are missing
- Always place removed screenings in drainage platform.
- Always keep mechanism of screen in good condition.
- Do periodical oiling & greasing with recommended SAE grades
- Always flush & clean the mechanical screen surface once in a week with water jet, even if built in washer present.
- Always clean and make sure brush in the screen not entangled with fiber or thread.

Do's & Don'ts in screening



Don'ts

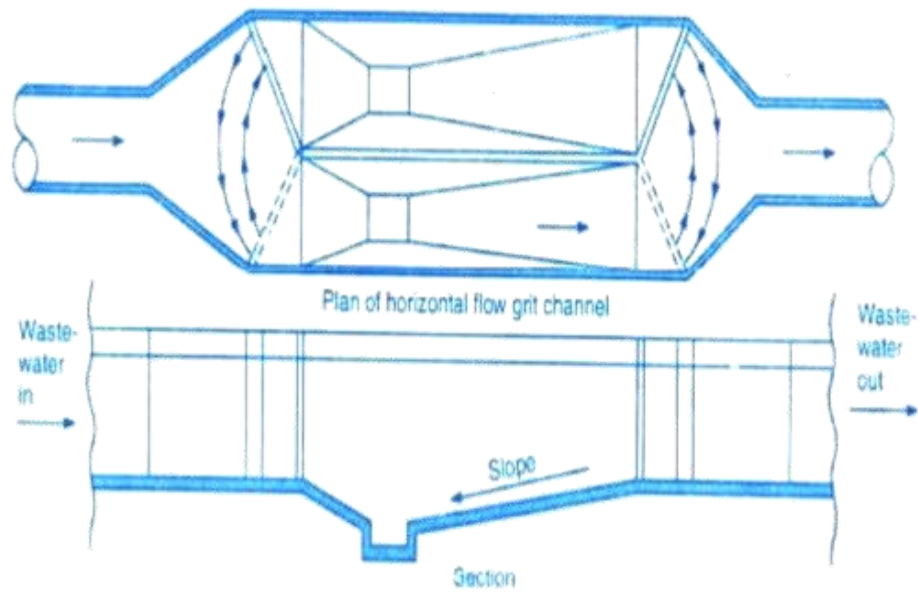
- Never remove the screen for cleaning.
- Never get into the screen chamber for cleaning. It might have high concentration of H₂S gas.
- Never handle the screenings with bare hands. If needed use gloves.
- Never run screen with excessive screenings and when jerks or noise noticed. Stop and clean/repair.
- Never allow screen motor to get heated and ensure it consumes allowed amperage only all the time.
- Never put your hand into cleaning platform when the screen is operating.

Preliminary Treatment: Grit Removal



- Not very common in Bangladesh.
- Removes grit/sand/broken glass/gravel etc.
- Main objective : protect mechanical equipment such as pumps, aerators etc. from abrasion.
- Grit settles faster than organic solids, higher specific gravity (>2.0), dia > 0.2 mm
- Gravity sedimentation in channels/chambers.
- Modified units include aerated grit removers.
- The horizontal flow velocities maintained below 0.3m/s.

Principle of grit removal

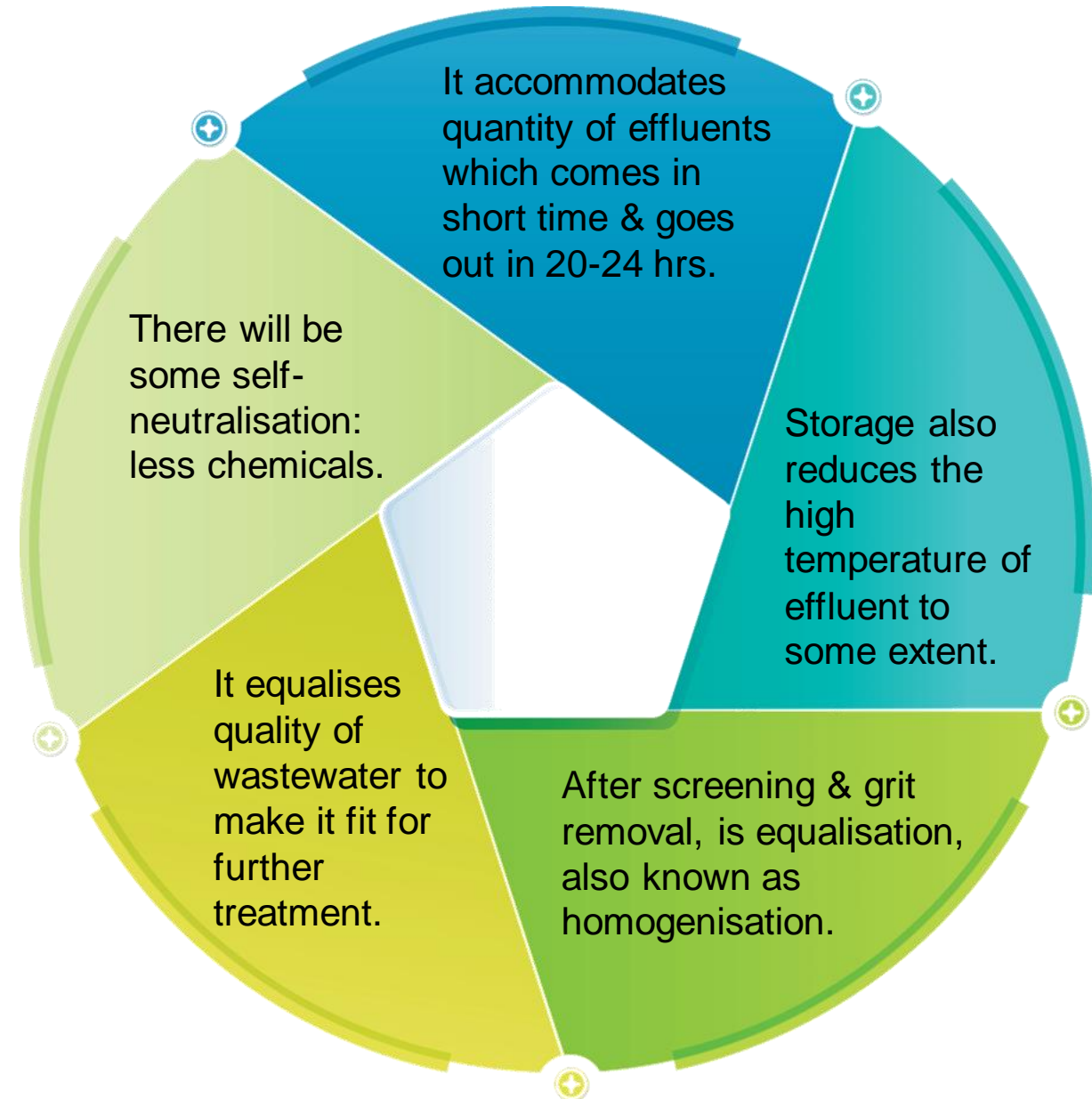


What are the type of mechanical screens used in textile ETPs of Bangladesh?



Equalization Tank

In short, equalisation is to equalize flow, minimize temperature and homogenise the wastewater



Equalisation tank types

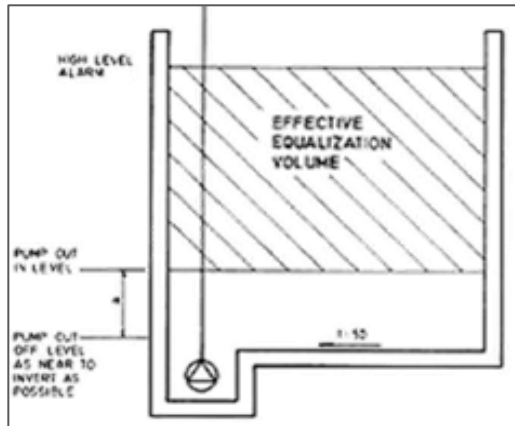


Circular equalization tank



Rectangular equalization tank

Description of equalization tank



- Normal retention time 16 -24 hours. It can be circular or rectangular in shape.
- Mostly tanks are kept below ground level. Where inflow level of screens & grit chamber is too low, a pumping well is given
- In diffused aeration, there are main air headers & lateral headers.
- Liftable air header & diffusers are preferred : can change/ clean diffusers without emptying the tank.
- In some equalisation, aeration is supplemented by submersible mixers

Aeration in Equalization Tank

Most equalisation tanks has aeration. It has three purposes

- To keep good mixing, ensuring homogenisation,
- To prevent anaerobic conditions, bad smell etc.
- To reduce the temperature to some extent.

Most common aeration system in BD is diffused aeration.

- About 80% of equalisation tank mixing is by submerged aeration: diffusers or perforated pipes.

Unlike aeration tanks, fixed aerators mounted on platforms are not suitable

- Level of the tank goes up and down

Main handicap of diffused aeration is choking of diffusers

- Floating aerator, jet aeration, aerators, aspirators
- Small ETPs : perforated pipes.

Other aerators are less common. They include

- Floating aerator, jet aeration, aerators, aspirators
- Small ETPs : perforated pipes.

Aeration in equalization tank



Equalization tank with jet aeration



Diffusers in equalization tank

Equalization Tank pumps



After equalisation, effluent is pumped to: either primary treatment or biological treatment.



Equalised effluent pump can be submersible, centrifugal or others like Archimedean screw



Equalisation pumping is continuous. The Eq.T inlet is in 8-10 hrs. But outlet is 16 hours to 24 hours a day.

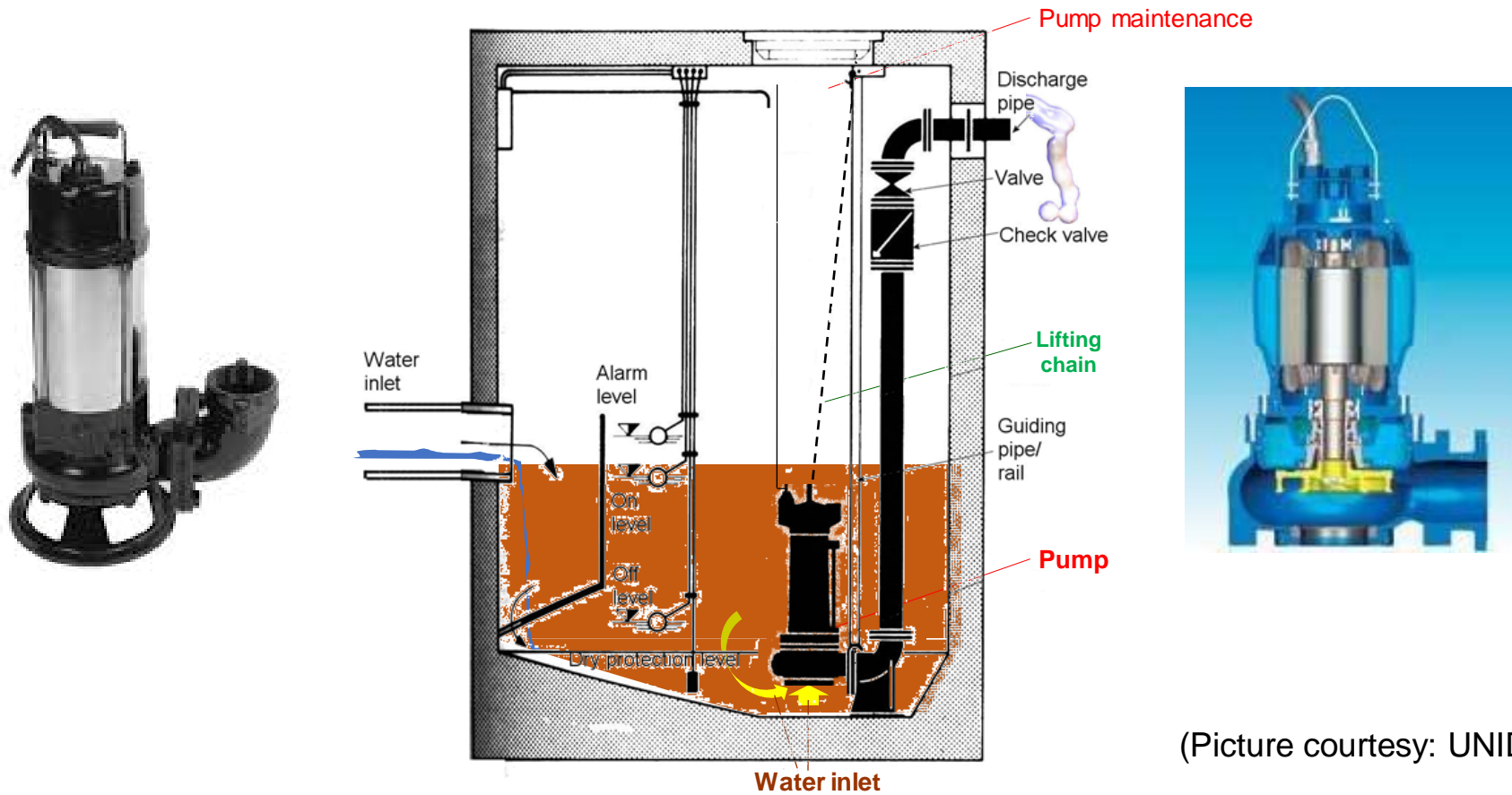


Usually, a set of pumps are installed with level sensor: some times to operate alternately

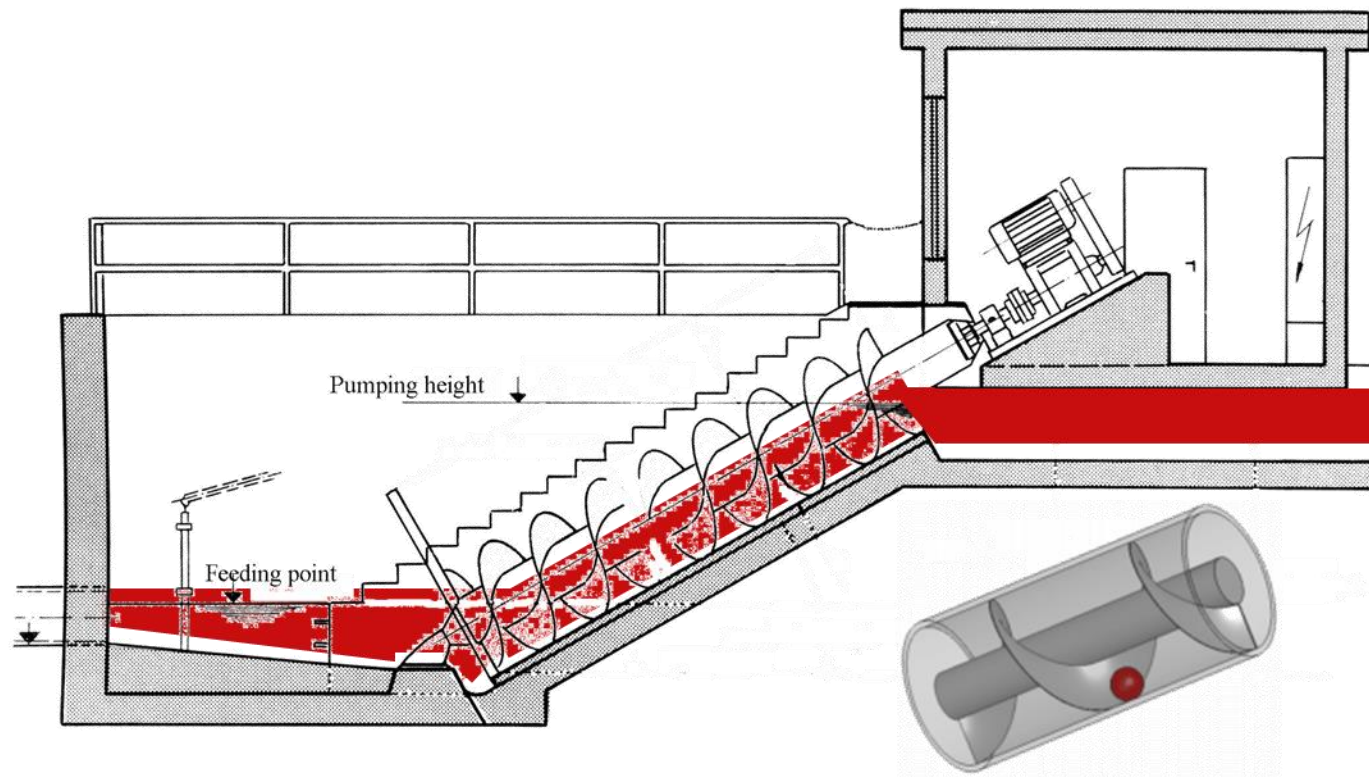


The operator should ensure rotational operation of pumps including standby pumps

Submersible Pump Arrangement



Submersible Pump Arrangement



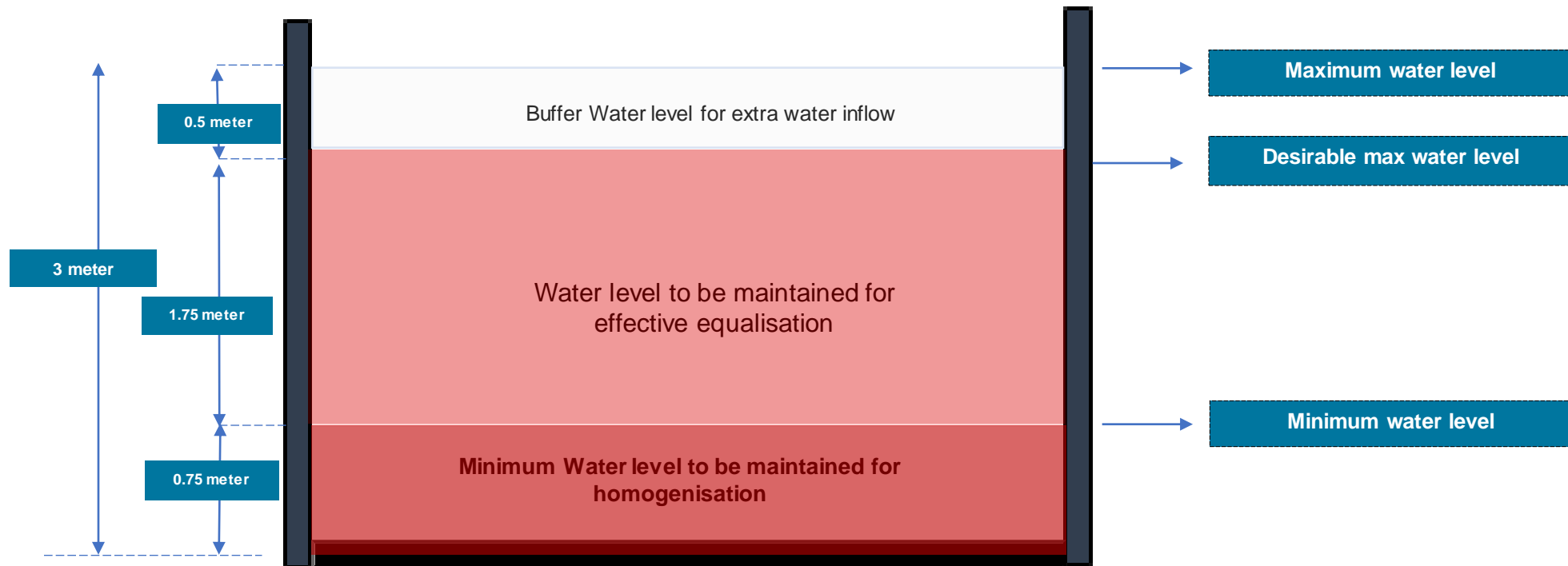
(Picture courtesy: UNIDO)

Control of equalization



- Where two equalisation tanks or a tank with two compartments, operate alternatively.
- Keep Inlet and outlet points of the equalisation tanks distant to prevent channelling.
- Ensure no settlement of sludge, especially in the corners. Adjust position of floating aerator
- Pumping lines from the equalisation tank should extend till bottom of the tank. Take safety precautions.
- **Maintenance of level** is most important operation control

Equalisation tank levels



Do's & Don'ts in equalisation



Do's

- Always empty the tank completely every once in 3 days. Try to flush out the sediments
- Always check amperage of blowers and compare with standard.
- Always spray water to arrest any undue generation of foam
- Always set level controller to ensure desired levels specified.
- Always check aeration pattern. Look for any coarse bubble in any region (torn/loose diffusers)
- Always clean diffusers once in three months with citric acid.

Do's & Don'ts in screening



Don'ts

- Never run blowers if any jerks, vibrations or noise.
- Never add any coagulant chemicals to equalization tank: result in settling of sludge, damage diffusers.
- Never take samples from tank. Take it from the pumping line.
- Never stop the mixing/aeration for more than 2 wo hours.
- Never attempt to manually clean the tank without all PPEs.
- Never handle sludge with bare hands. If needed, use gloves.

pH control of Equalized effluent



- Biological treatment need neutral pH in influent.
- If pH is acidic, pH adjustment done by an alkali like caustic soda or soda ash.
- Mostly pH is alkaline and adjustment done with Hydrochloric acid or Sulphuric acid
- In small plants, acid dosing done from a chemical barrel. Large ETPs have dosing pump with variable speed control.
- In some cases, automatic pH control done using an online pH meter coupled with PID control of dosing valves.
- A lab study is a must to decide on the quantity of acid to be dosed.

Cooling of Equalised effluent



- Textile dyeing effluent is hot.
- Biological treatment need ambient temperature effluent.
- Normally biological treatment efficiency increases with temperature (thermophilic micro-organisms).
- However, if temperature goes above 40-42°C, microbes may die.
- Hence, most biological ETPs have a cooling system at inlet of aeration.

Conclusion



- Preliminary treatment need to work well for efficient ETP.
- Screening removes particles that clog pumps and piping.
- Usual scheme: manual screen & mechanical screen.
- Grit remover remove sand like particles in effluent to protect mechanical equipment from abrasion wear.

Conclusion



- Equalisation is important to ensure homogenisation of effluent quality to make further treatment easier.
- To prevent anaerobic condition & settling, an aeration-cum-mixing system is used in equalisation.
- Depending on ETP type, pH neutralisation and cooling system is installed before aeration system.

**Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH**

Registered offices
Bonn and Eschborn

Friedrich-Ebert-Allee 32 + 36
53113 Bonn, Germany
T +49 228 44 60 - 0
F +49 228 44 60 - 17 66

Dag-Hammarskjöld-Weg 1 - 5
65760 Eschborn, Germany
T +49 61 96 79 - 0
F +49 61 96 79 - 11 15

E info@giz.de
I www.giz.de