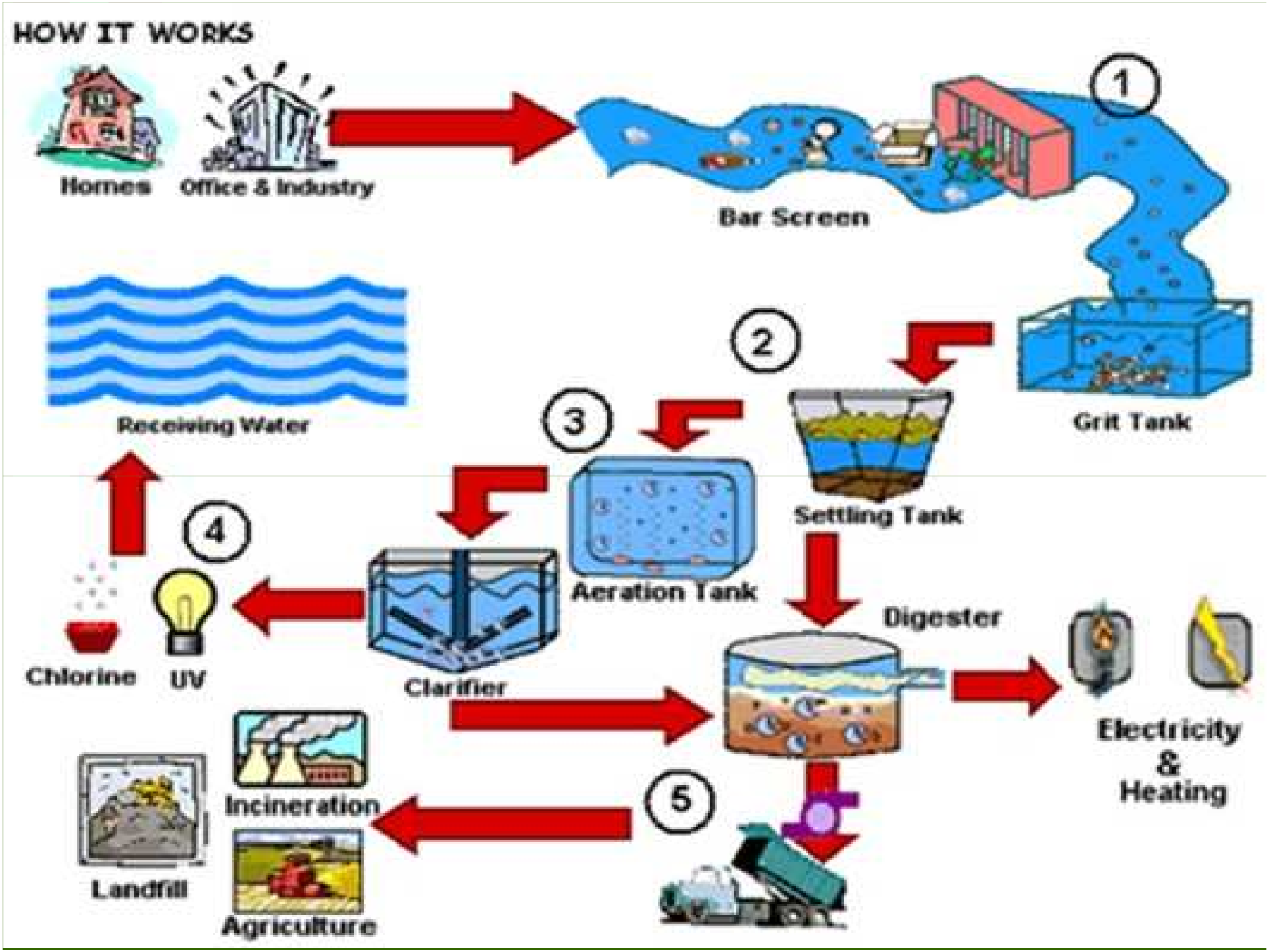
# *L-11*
# *Screen Chamber*

Environmental Engineering-II

Unit-II


HOW IT WORKS
Homes
Office & Industry
1
Bar Screen
Grit Tank
2
Settling Tank
3
Aeration Tank
Receiving Water
4
Chlorine
UV
Clarifier
Digester
Electricity
&
Heating
5
Incineration
Landfill
Agriculture

# *Screening,*

Definition:

- *Screening* is a unit operation that separates large floating materials in and/or on water (found in different sizes) from water and from entering water treatment/ Wastewater treatment facilities and mains.
- The unit involved is called a *screen*.

## *Objective of providing screens*

- Screens are provided to protect:

i. Pumps

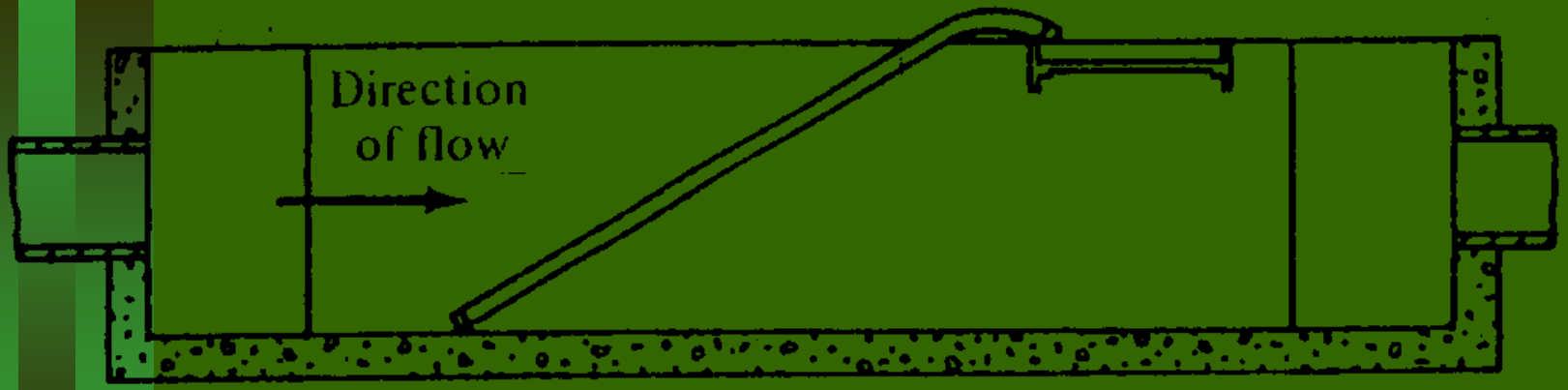
ii. Valves

iii. Pipe line and other appurtenances from damage or clogging by rags and other large objects

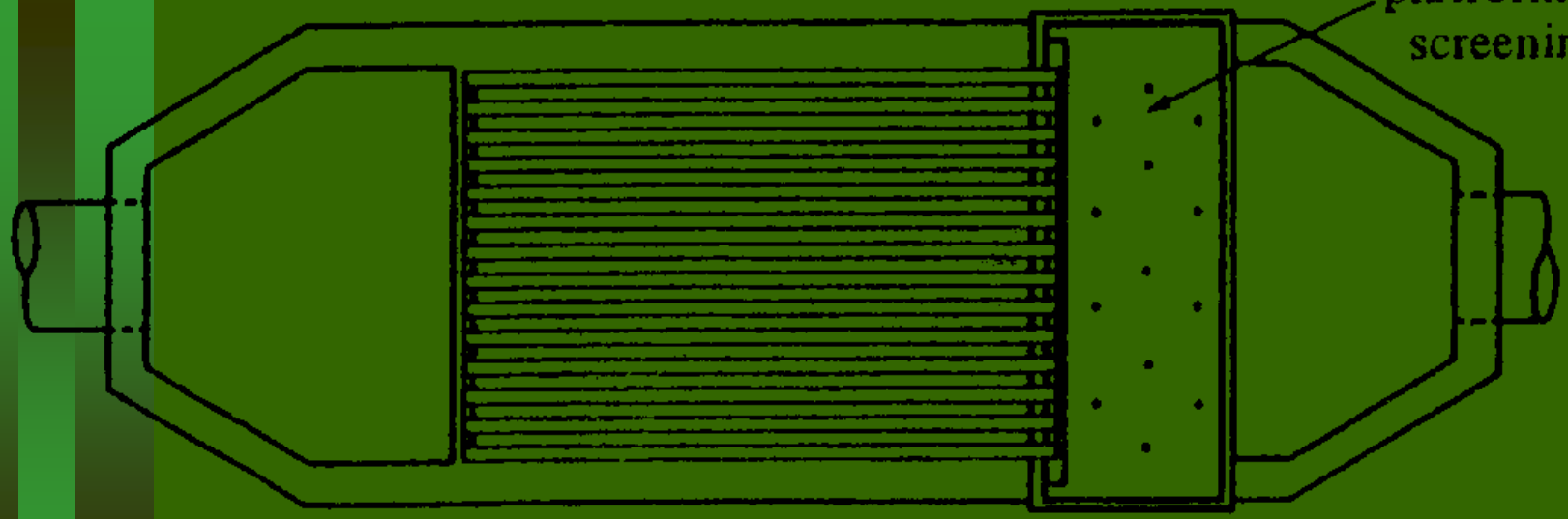
# *Bar Screen*

## *Vendor-Provided Equipment*

- Purpose: to remove large objects (sticks, cans, etc) which may cause flow obstructions.
- Depending on the size of the plant, bar screens are either hand or mechanically cleaned.
- Hand cleaned: used primarily at small plants.




Section



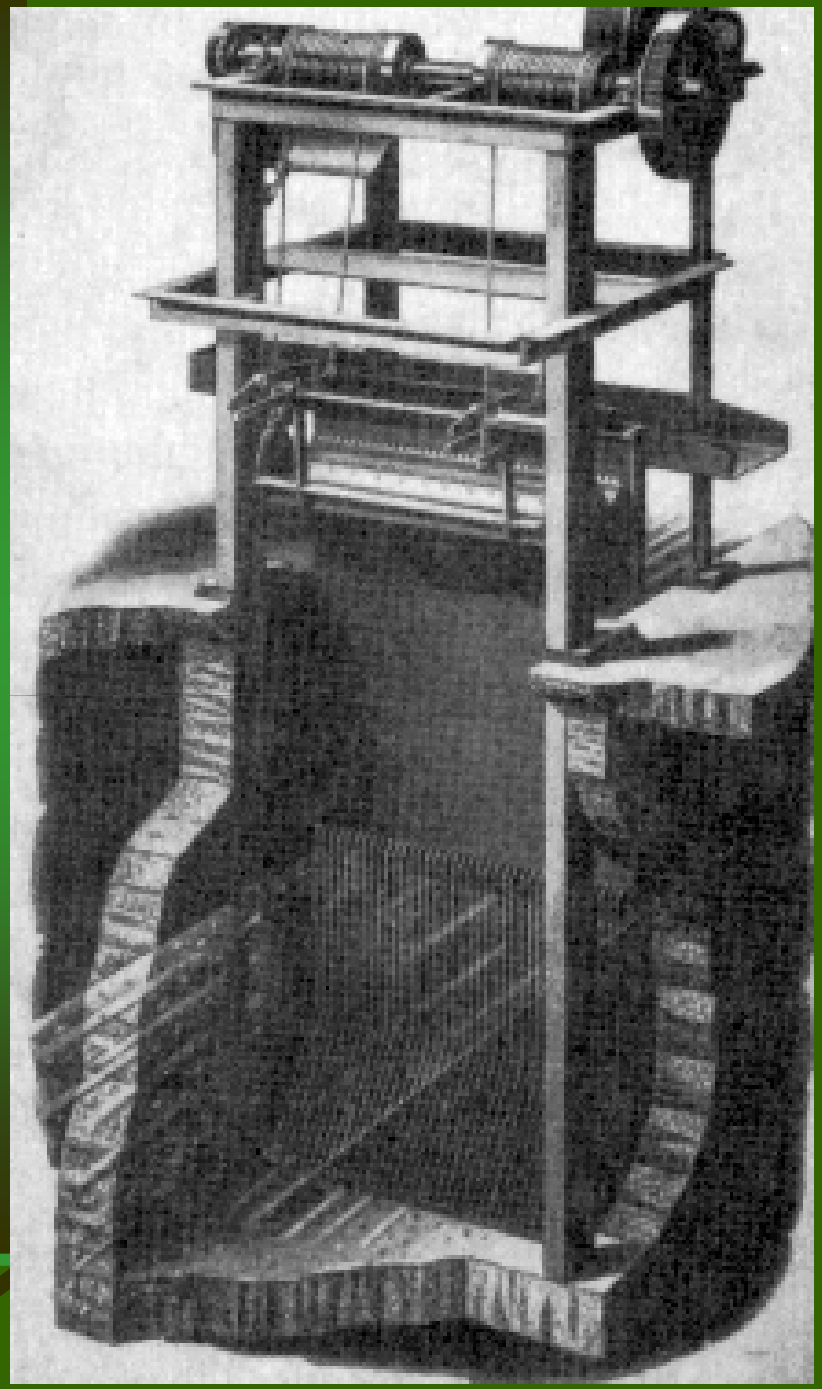

Plan

(*a*)

# *Bar Screen*

## *Mechanically Cleaned*

- More frequently used because labor and overflowing are greatly reduced.
- A by-pass channel with a hand cleaned bar screen must also be provided. A second mechanically cleaned bar screen can also be provided.
- The purpose of the by-pass channel is to provide treatment in case of a mechanical failure.
- Screens are either front or back cleaned.



# *Bar Screen*

# *Classification of Screens*

| Point of Comparison | Coarse screen | Medium screen | Fine screen |
|---|---|---|---|
| Angle of Inclination | @ $45^0$ | $30^0$ to $60^0$ | $30^0$ to $60^0$ |
| Openings | 50 mm or more | 6-40 mm | 1.5 to 3 mm |
| Cleaning | Mechanically or manually cleaned | | |

| | | | |
|---|---|---|---|
| Disposal of screenings | By Burial or dumping or incineration | | |
| Screenings collection | 6 lit of solids/ mLd | 30 to 90 lit solids/mLd | 20% of SS from sewage |
| Frequency of clogging | less | moderate | Often or more |

# ***Velocity***

- The velocity of flow ahead of and through the screen varies and affects its operation.
- The lower the velocity through the screen, the greater is the amount of screenings that would be removed from sewage.
- However, the lower the velocity, the greater would be the amount of solids deposited in the channel.

- Hence, the design velocity should be such as to permit 100% removal of material of certain size without undue depositions.
- Velocities of ***0.6 to 1.2 m/s through the open area for the peak flows*** have been used satisfactorily.
- Further, the velocity at low flows in the approach channel should ***not be less than 0.3 m/s*** to avoid deposition of solids.

# ***Head loss***

- Head loss varies with the quantity and nature of screenings allowed to accumulate between cleanings.
- The head loss created by a clean screen may be calculated by considering the flow and the effective areas of screen openings, the latter being the sum of the vertical projections of the openings.

- The head loss through clean flat bar screens is calculated from the following formula:
- $$h = 0.0729 (V^2 - v^2)$$
- where, h = head loss in m
- V = velocity through the screen in m/s
- v = velocity before the screen in m/s

- Another formula often used to determine the head loss through a bar rack is Kirschmer's equation:
- **$h = \beta(W/b)^{4/3} h_v \sin\theta$**
- where h = head loss,m

- $\beta$ = bar shape factor (2.42 for sharp edge rectangular bar, 1.83 for rectangular bar with semicircle upstream, 1.79 for circular bar and 1.67 for rectangular bar with both u/s and d/s face as semicircular).
- W = maximum width of bar u/s of flow, m
- b = minimum clear spacing between bars, m
- $h_v$ = velocity head of flow approaching rack, m = $V^2/2g$
- $\theta$ = angle of inclination of rack with horizontal

# *Number of bars in screen chamber*

**[clear spacing x (n+1)] +[size of bar x n] =B**

Where,

N= number of bars

B= width of screen chamber or channel

Clear spacing and size of bars is expressed in m

## *Other formulae used*

- Gross area

**$A_g = A_{net}$ x (c/c spacing/ clear spacing)**

- Velocity of flow above screen

**v = Velocity through the screen (V) x (clear spacing/c/c spacing)**

# ***Disposal of Screenings***

- **Screenings is the waste materials collected from screens.** Screenings should be properly disposed.
- Various methods of screening disposal were used such as:
  - **burning,**
  - **burying,**
  - **digestion,**
  - **dumping into large bodies of water,**
  - **and shredding and returning it to wastewater collection or treatment system.**

- Inland burying is efficient in small treatment plants, while burning is best for medium and large treatment plants.
- Other methods cause problems and may need subsequent treatment.
- Digestion is used for large systems and in combination with the treatment of the organic portion of municipal solid waste.

# *A Must Visit Site*

- http://techalive.mtu.edu/meec/module21/title.htm

# ***Video: Mechanical bar screen***

# *Objective Questions*

1. Screens can not remove _____.(Paper/plastic/tree leaves/silt)
2. Design of screens mainly depends upon _____.
3. Suggest suitable type of screen for 80-100 mm sized floating particles. _____

# *Theory Questions*

Q1. Draw a general flow sheet of Domestic Wastewater treatment plant and write function of each and every unit.

Q2. Write short note on

i. Types of screen

ii. Design of screen chamber

iii. Disposal of screenings

Q3. Draw a neat sketch of screen chamber.