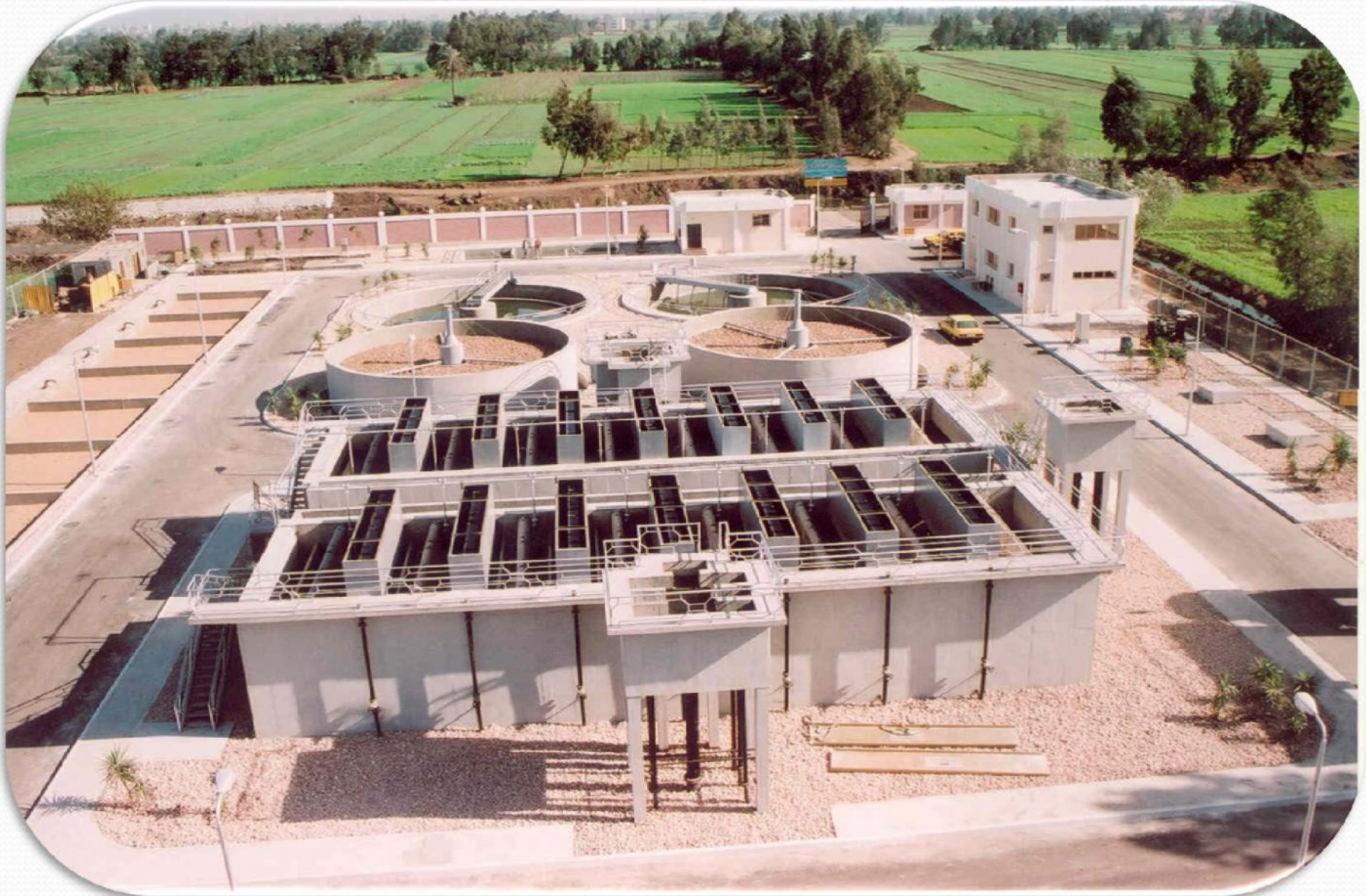


Waste water treatment training course



By / Ahmed Mohammed Hasham



About instructor:

- B.sc of chemistry –Alazhar university .
- Business administration diploma .
- MINI-MBA .
- Member of the Board scientists Egypt.
- Waste water treatment plants manager in rafhaa governorate – Saudi Arabia.
- Author of “waste water treatment principles”.
- Author of “ waste water examination – laboratory guide”.
- Delegate auditor president of water technologies and research magazine .
- Quality assistant manager in ME-VAC for veterinary vaccines.





What is the composition of wastewater?

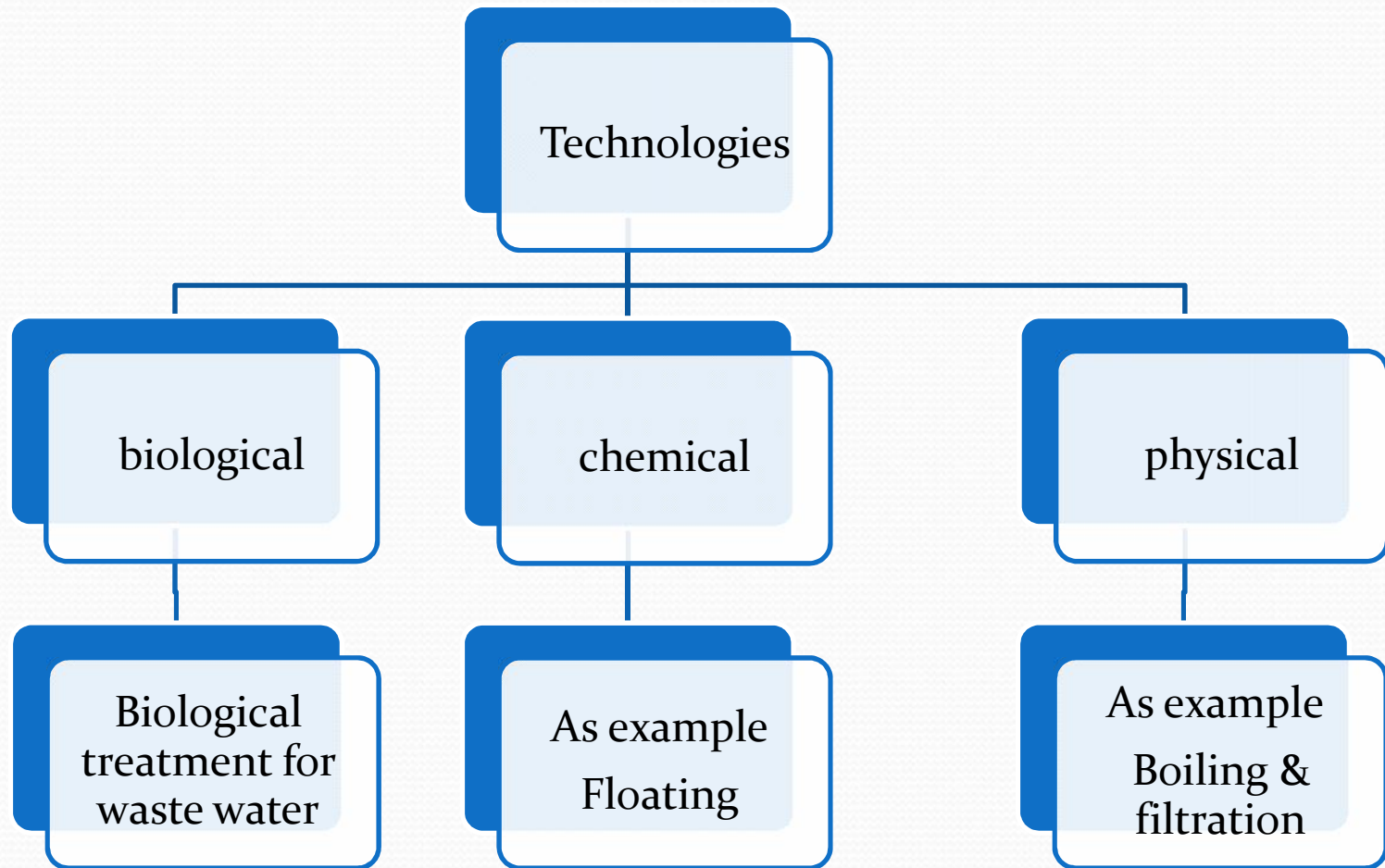
Municipal wastewater contains 99.9% water and 0.1% solids

Why we treat waste water ?

- 1- because it is a contamination source .
- 2- it is pathogenic.
- 3- to reuse in agriculture .
- 4- to reuse in fire fitting .
- 5- to reproduce the ground water .

And a lot of other reasons push us to treat waste water .

Water treatment technologies





Must to know

- Hydraulic load
- Hydraulic profile
- Organic load
- Water Hammering system
- Odor control system
- Sludge
- Septic tanks
- Biological treatment
- Auto sampler
- BOD – COD – TSS -TCF – FCF



Parameter affecting choice of treatment units:

- 1- nature of raw water – and its quantity .
- 2- properties of waste water inlet to treatment .
- 3- the requested quality for the final water .
- 4- the cost of plant .
- 5- the area which received the final water.
- 6- the place of treatment station and lifting pump stations.



Average Composition of Domestic Wastewater mg/l (ppm)

Composition	Explanation	Range (ppm)
TS	Total Solids	700-1000
TDS	Total Dissolved Solids	400-700
TSS	Total Suspended Solids	180-300
BOD	Biological Oxygen Demand	240-420
COD	Chemical Oxygen Demand	550-700
N	Nitrogen	40-50
P	Phosphorus	10-15
Grease	-----	90-110

Odor control system



Water Hammering system



Septic Tanks

Septic Tanks

- * Bacteria in sewage degrade organic matter
- * Tank buried in ground to treat sewage from an individual home
- * Wastewater flows into tank

DESIGN OF RAW (LOW) LIFT PUMP STATION

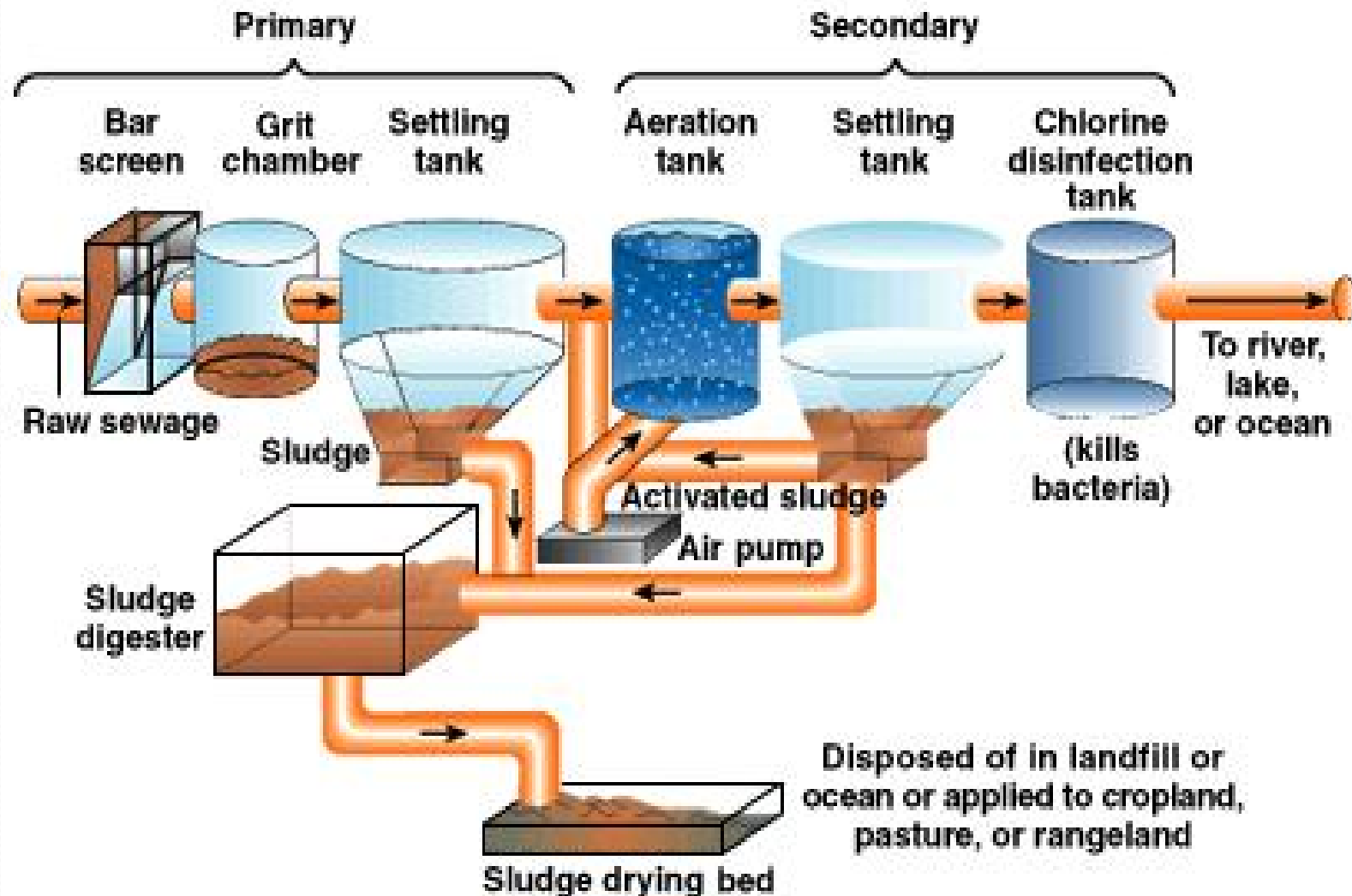
Total number of pumps = working + standby

Standby pumps = 50% to 150% working pumps

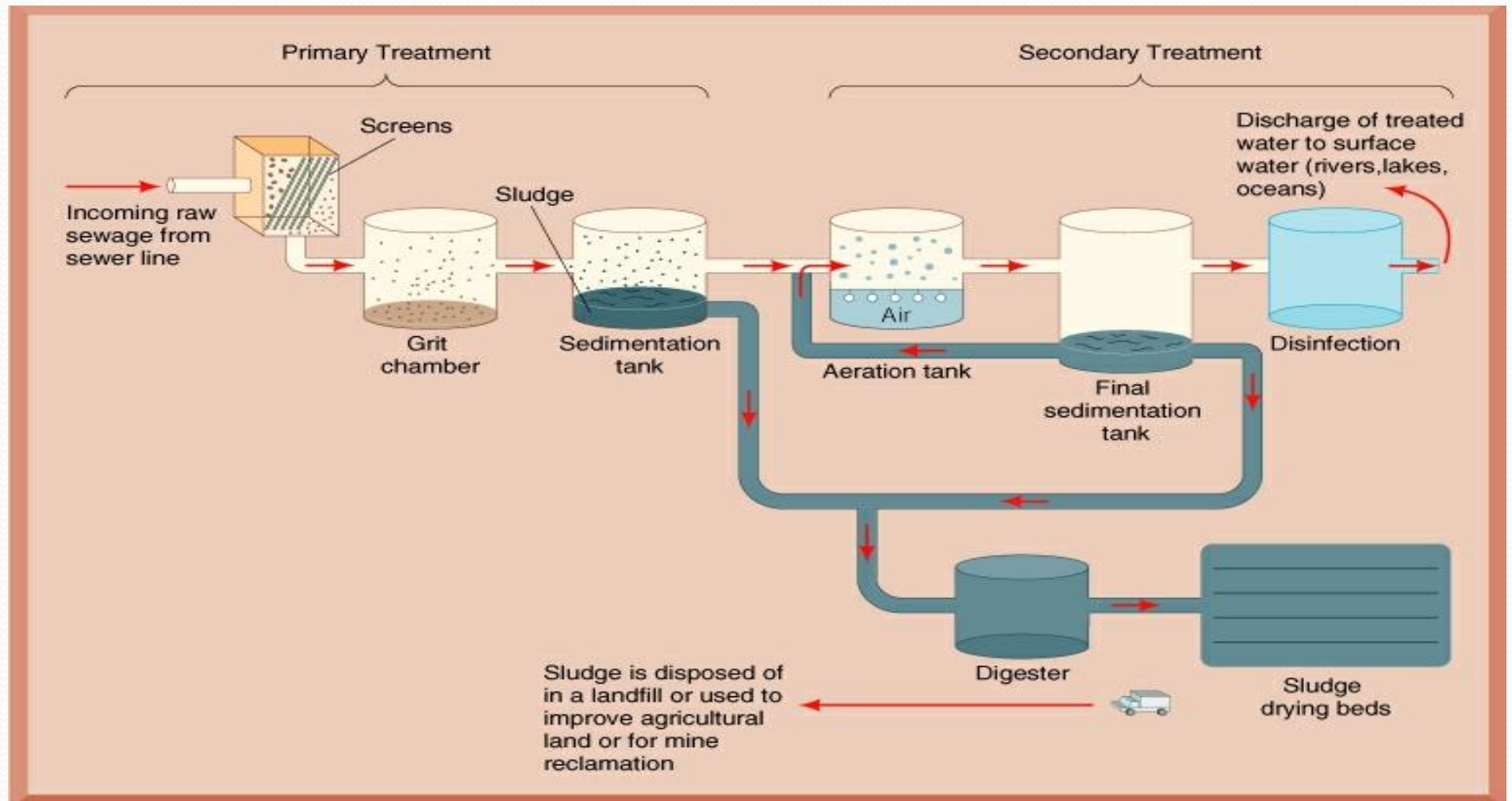
Working pumps ≥ 2



The Wastewater Treatment Process



Are you visit STP before?





Common treatment steps

- 1-Pre-treatment
- 2- Preliminary treatment
- 3-Primary treatment
- 4-Secondary treatment
- 5-Sludge (bio solids) disposal

1-Pre-treatment

- The first protection line to the pumps and sewerage water pipe network as example the screen in your home which keep large size away and not allowed to large size particle to enter to the pipe .
- Also as the oil trap in the restaurants.



2 - Primary treatment

- typical materials that are removed during primary treatment include
 - fats, oils, and greases (aka FOG)
 - sand, gravels and rocks (aka grit)
 - Larger settle able solids including human waste, and
 - floating materials



Methods used in primary treatment

- ❖ Sand catcher
 - ❖ Remove sand and grit
 - ❖ Control wastewater velocity
 - ❖ Sand grit and stone settle
 - ❖ Keep suspended organic matter in water
 - ❖ Damage equipments in the remaining treatment stage
- ❖ Landfill

Primary Sedimentation Tank

- Remove grease, oil
- Fecal solid settle, floating material rise to the surface
- Produce a homologous liquid for later biological treatment
- Fecal sludge are pumped to sludge treatment plant





Purpose of Primary Sedimentation Tank

- Removal of 40 to 60 % of SS
- Removal of 25 to 35 % of BOD
- Removal of Oil and Grease



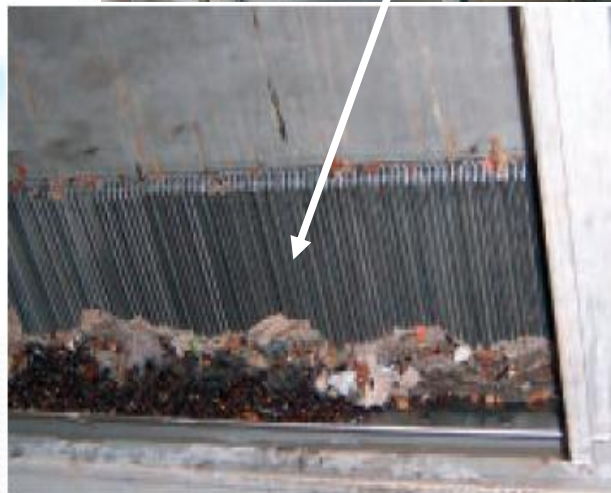
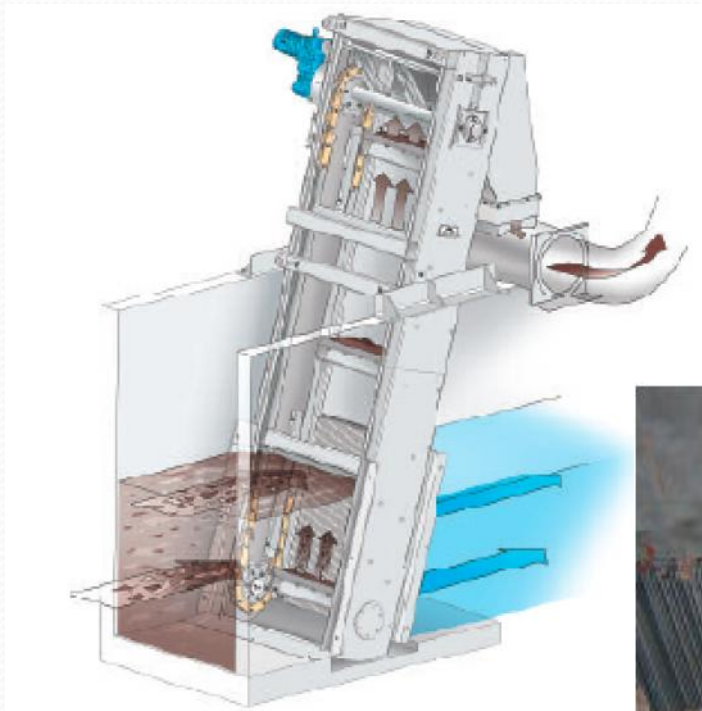
Mechanical treatment

2-Preliminary treatment

- The second protection which protect pumps in pumping station ; protect the mechanical equipment's and treatment unit as mechanical screen.
- Grit Chamber
 - removes rocks, gravel, broken glass, etc.
- Mesh Screen
 - removes diapers, combs, towels, plastic bags, syringes, etc.



Automatically cleaned trash rack



Sieve

Slotted sieve
 $\geq 0.5 \text{ mm}$

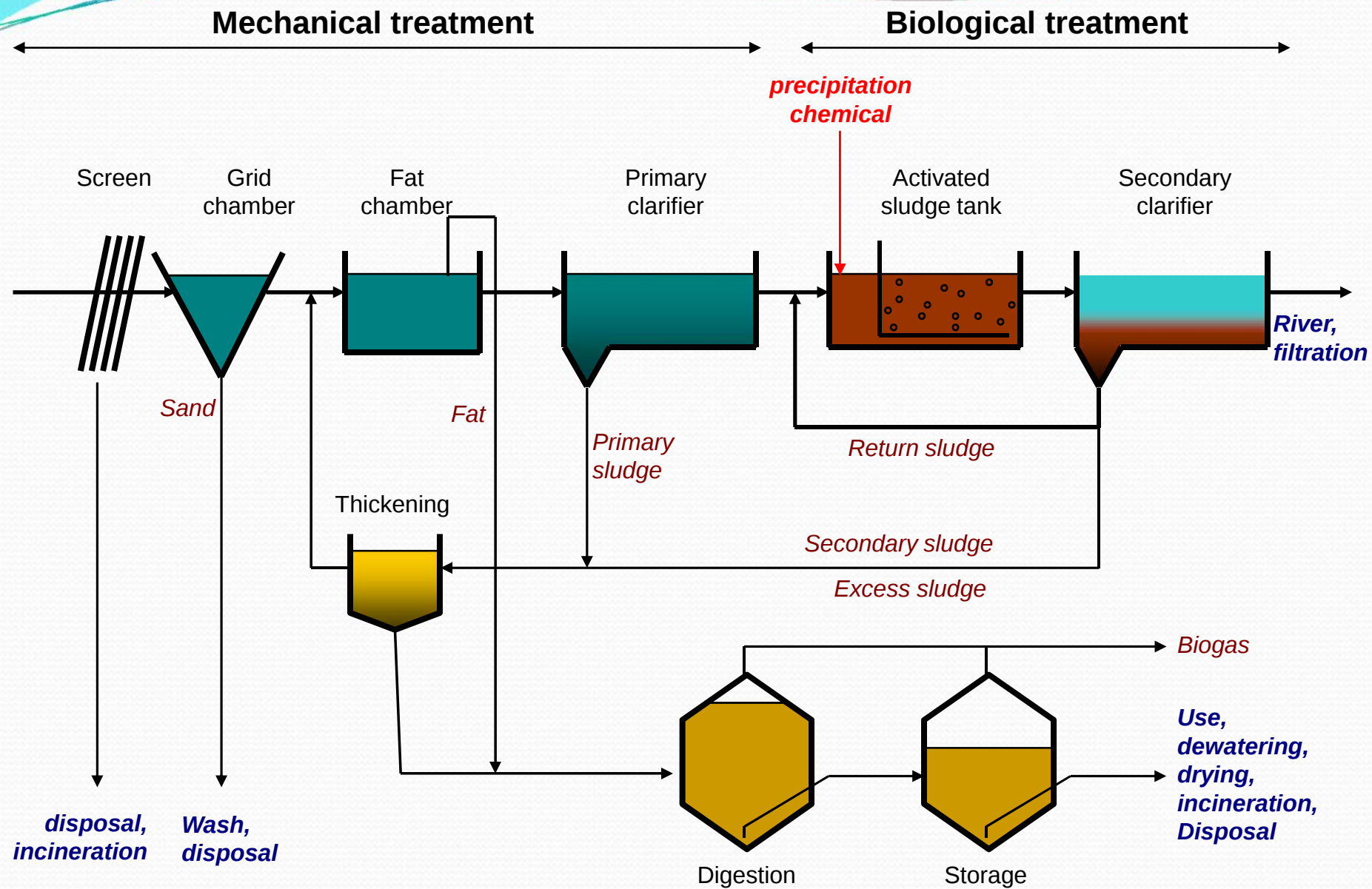


Perforated tin
 $\geq 3 \text{ mm}$

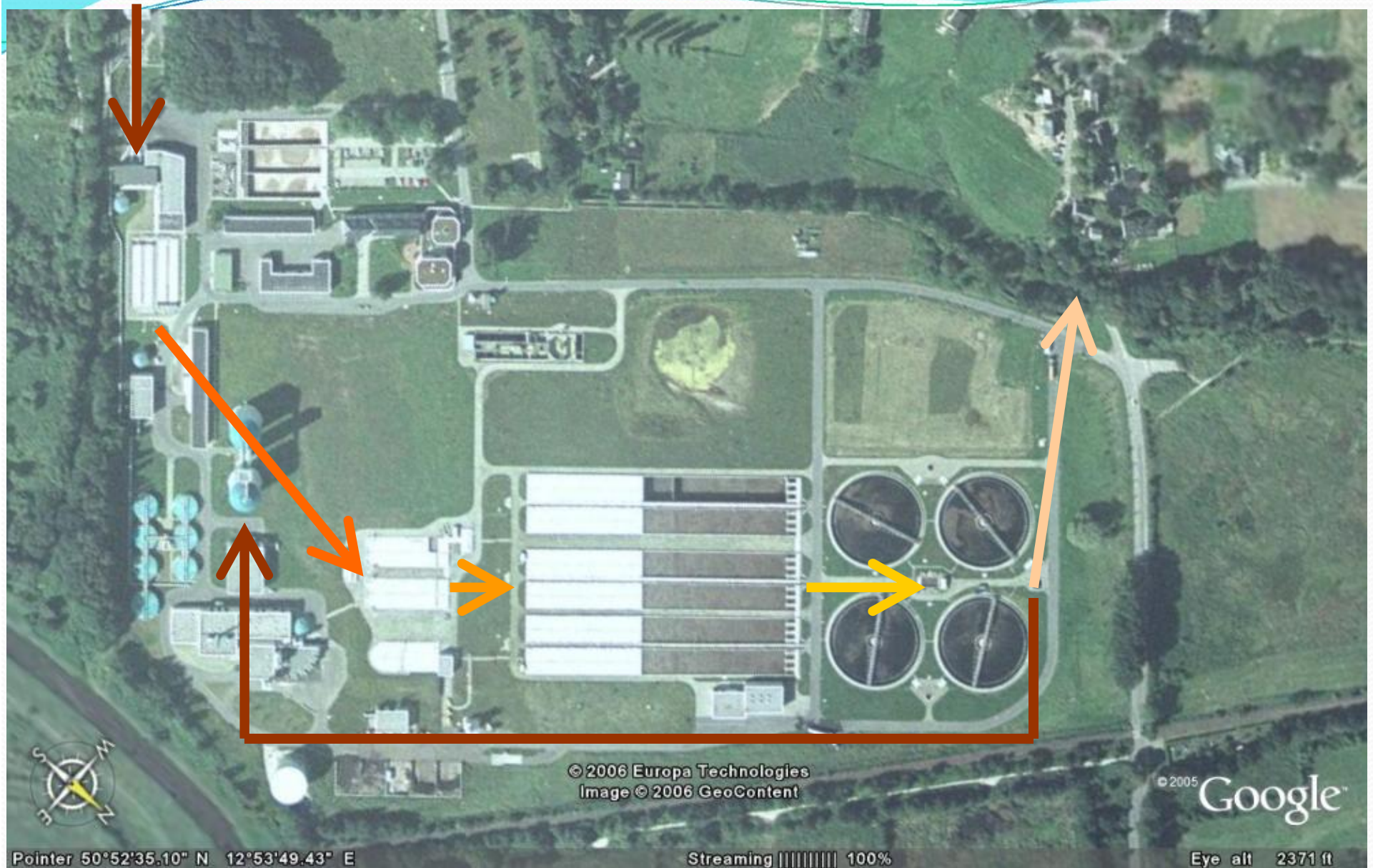




Layout of a WWTP



Example: WWTP Chemnitz-Heinersdorf





Biological treatment



3- Secondary treatment

- Degrade biological content (dissolved organic matter) of the sewage
 - Ex: human waste, food waste, soaps, detergent
- Added bacteria and protozoa into sewage
- 3 different approaches
 - Fixed film system
 - Suspended film system
 - Lagoon system

5- physical components of activated sludge process

- aeration tank
 - oxygen is introduced into the system





Aeration tank

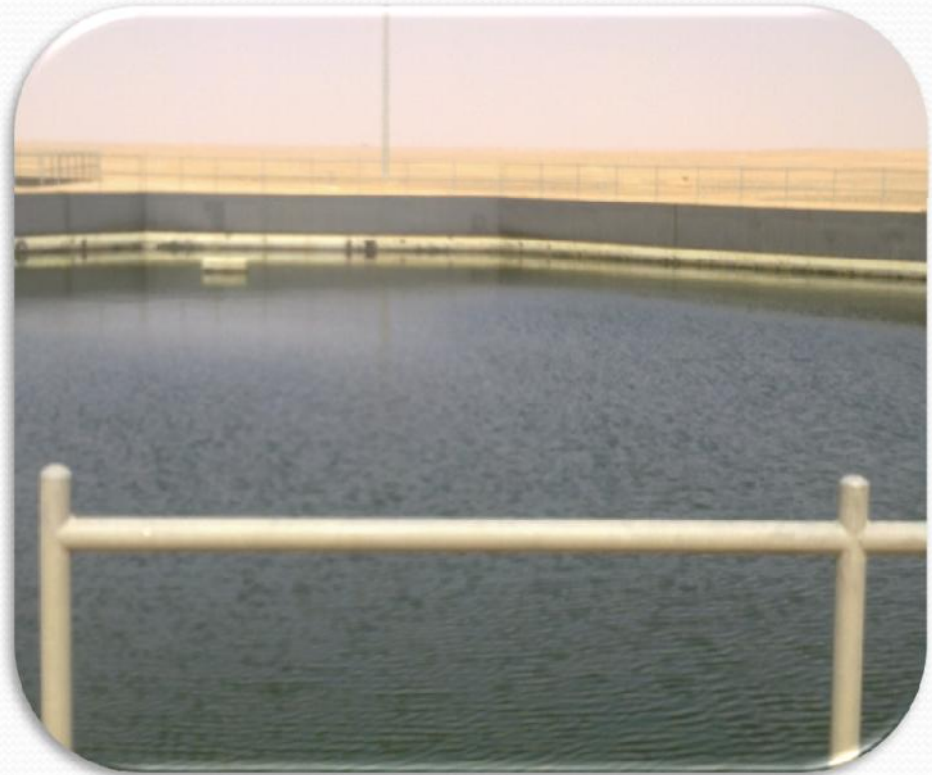


Compressed Air Pipe

- aeration source
 - ensure that adequate oxygen is fed into the tank
 - provided pure oxygen or compressed air



- secondary clarifiers
 - solids separate from the surrounding wastewater



- **Lagoon Systems**

- hold the waste-water for several months
- natural degradation of sewage





What can effluent use for?

- discharged into a stream, river, bay, lagoon or wetland
- used for the irrigation of a golf course, green way or park
- If it's sufficiently clean, it can be used for groundwater recharge

Advanced Treatment

- Nitrogen removal
 - Ammonia (NH_3) $\rightarrow$ nitrite (NO_2^-) $\rightarrow$ nitrate (NO_3^-)
- Phosphorous removal
 - Precipitation with iron or aluminum salt

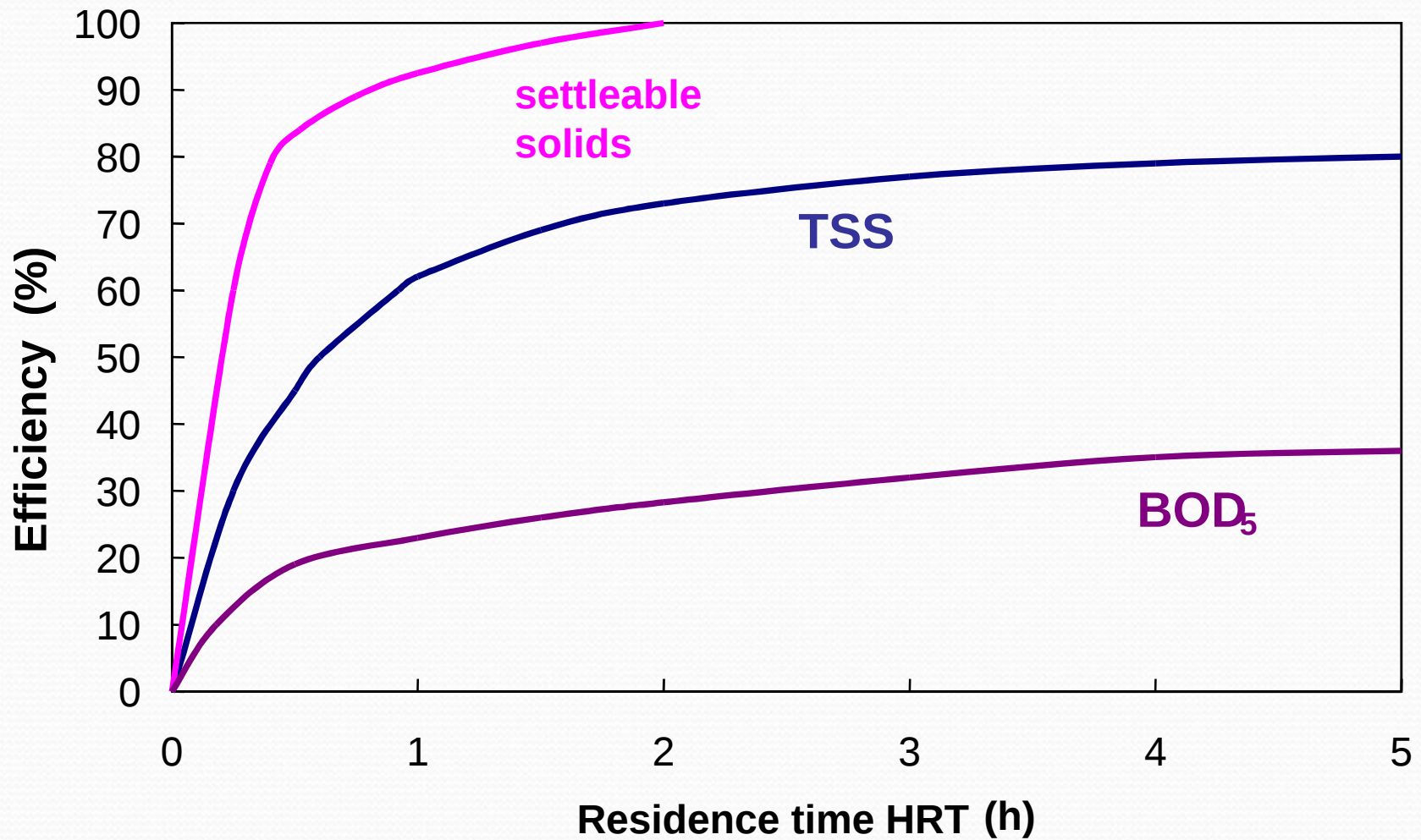


Sludge treatment

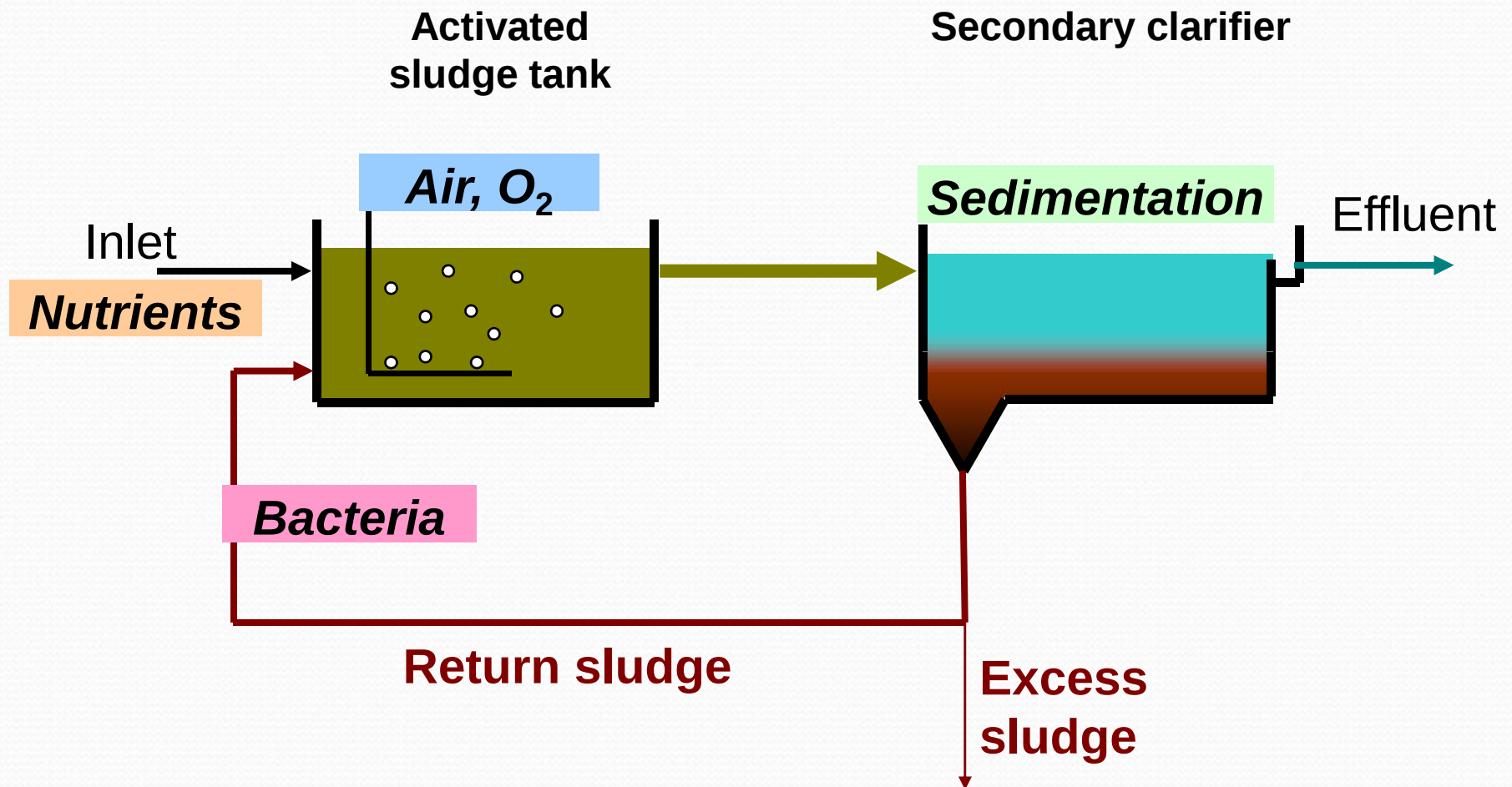
- Primary sludge usually have strong odors
- Secondary sludge have high concentration of microorganism
- Goals of treatments are:
 - Reduce odors
 - Remove water reduce volume
 - Decompose organic matter

- 
- Untreated sludge are about 97 percent water
 - Settling can reduce about 92 to 96 percent of water
 - dried sludge is called a sludge cake

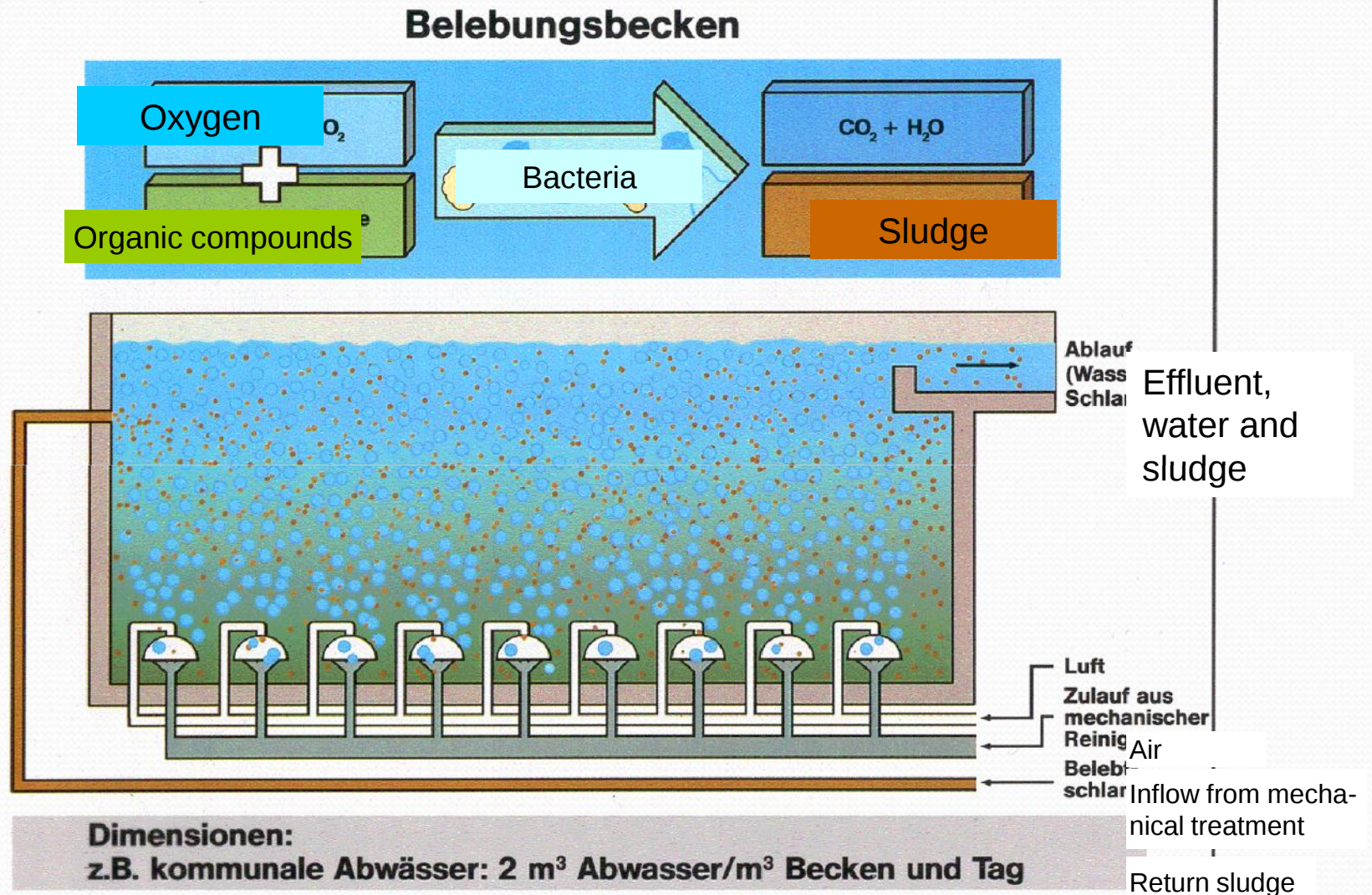
Efficiency of primary clarifier



Activated sludge system



Aeration in an activated sludge tank



Dimension:

communal wastewater treatment 2 m^3 wastewater per m^3 reactor volume and day

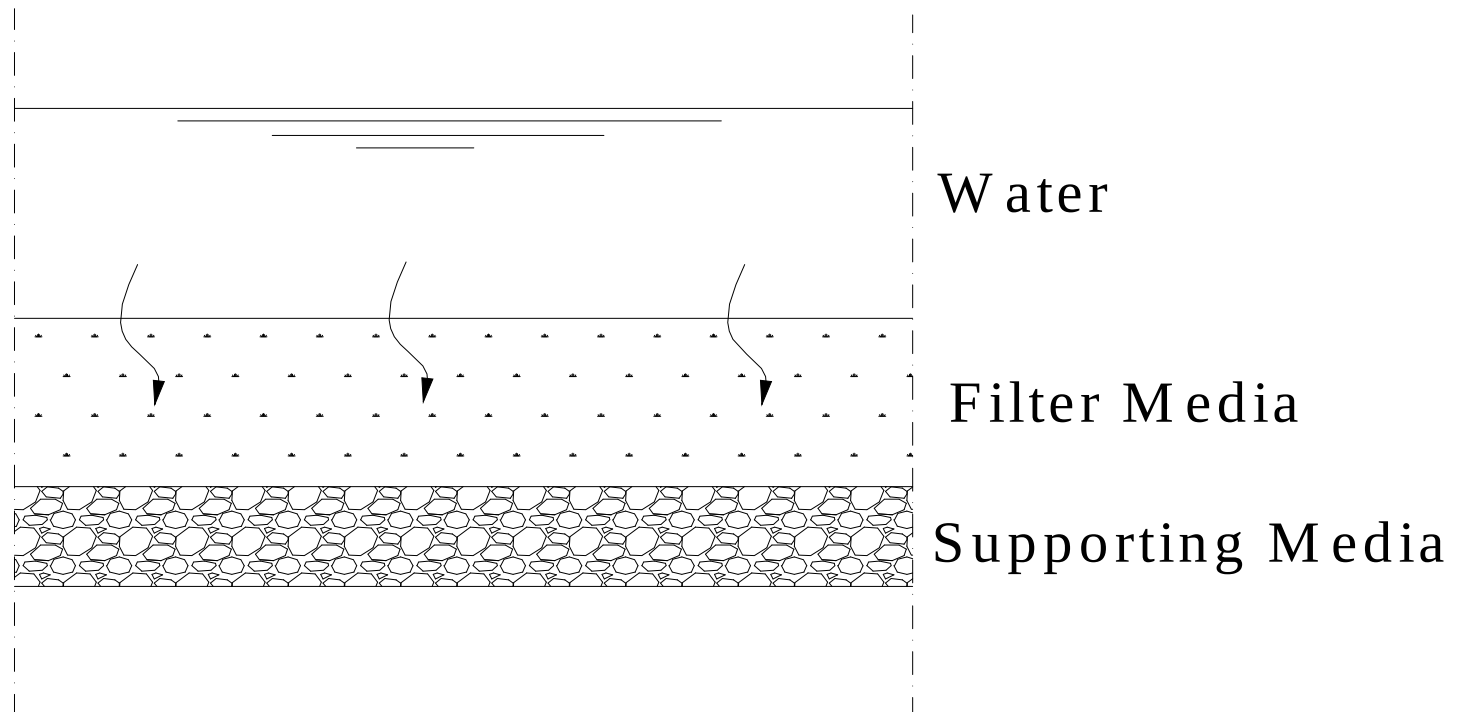


5-tertiary treatment

- Clarifiers
- Sand filters

THEORY OF FILTRATION

Filtration theory depends on passing water through a porous material that removes the undesirable impurities from it.





Number of layers in filter bed

Single media

Dual media

Multi-media

Direction of flow

Down flow

Up flow

Horizontal flow

Characteristic of flow

Gravity flow

Pressure flow



Treatment stages – Tertiary treatment

- remove disease-causing organisms from wastewater
- 2 different disinfection process
 - Chlorination
 - UV light radiation



Disinfection:
specification of chemical used as disinfection agent :

Chlorination systems :

- 1-solid state .
- 2-liquid state.
- 3-gas state .

UV system

Problems which happen to gas systems.

Chlorination

- Most common
- Advantages: low cost & effective
- Disadvantages: chlorine residue could be harmful to environment





Chlorine Storages

Chlorination system



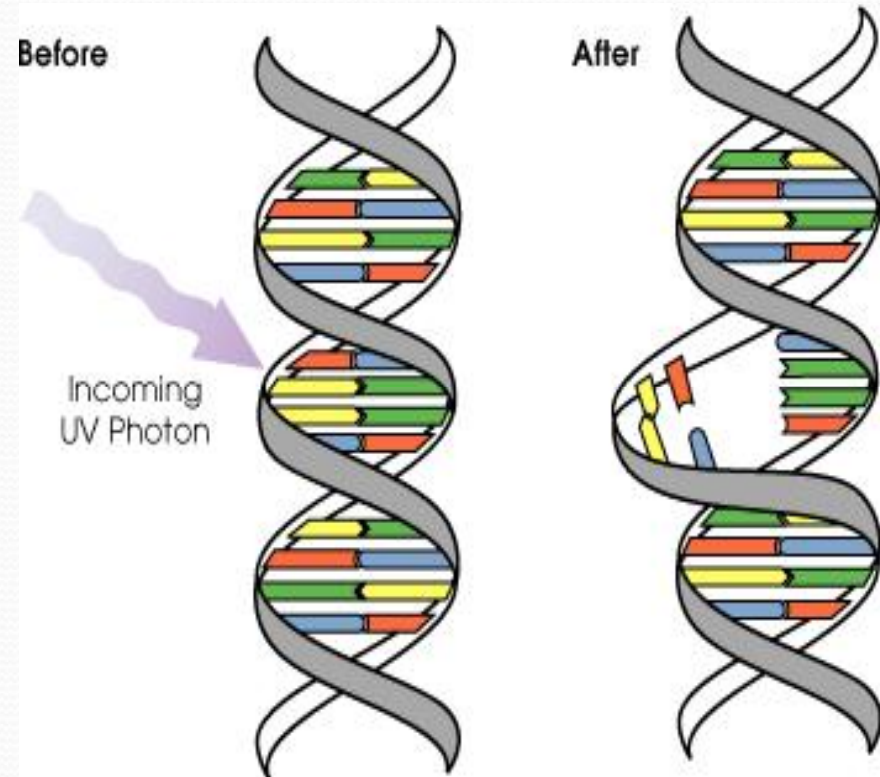


Chlorination Tanks

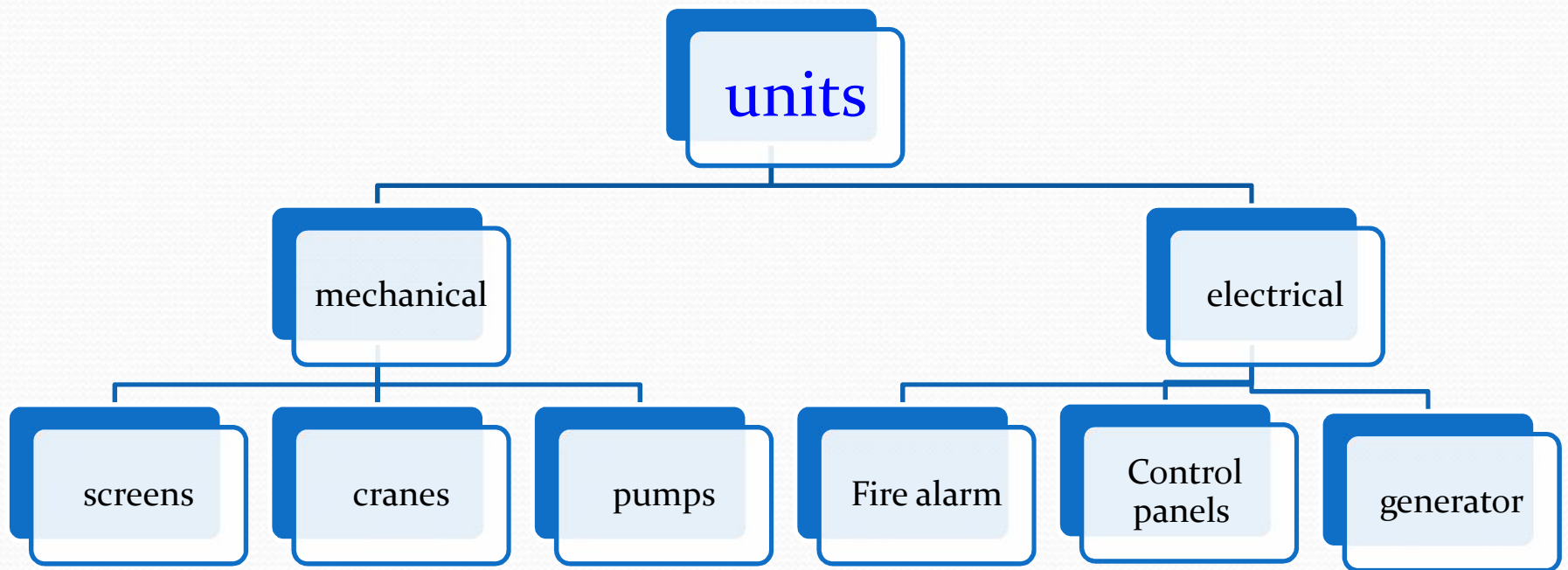


UV light radiation

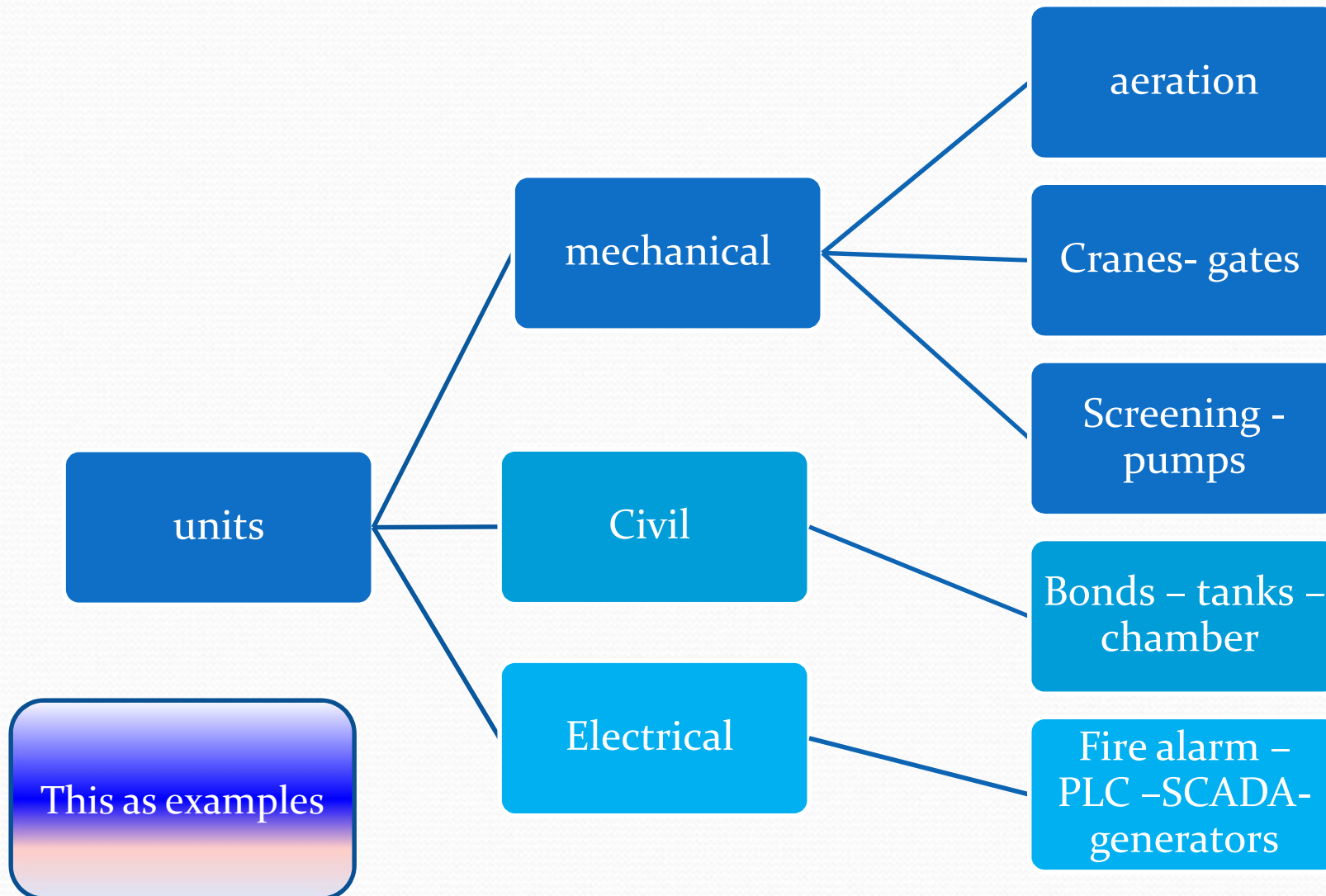
- Damage the genetic structure of bacteria, viruses and other pathogens.
- Advantages: no chemicals are used
- Disadvantages: high maintenance of the UV-lamp



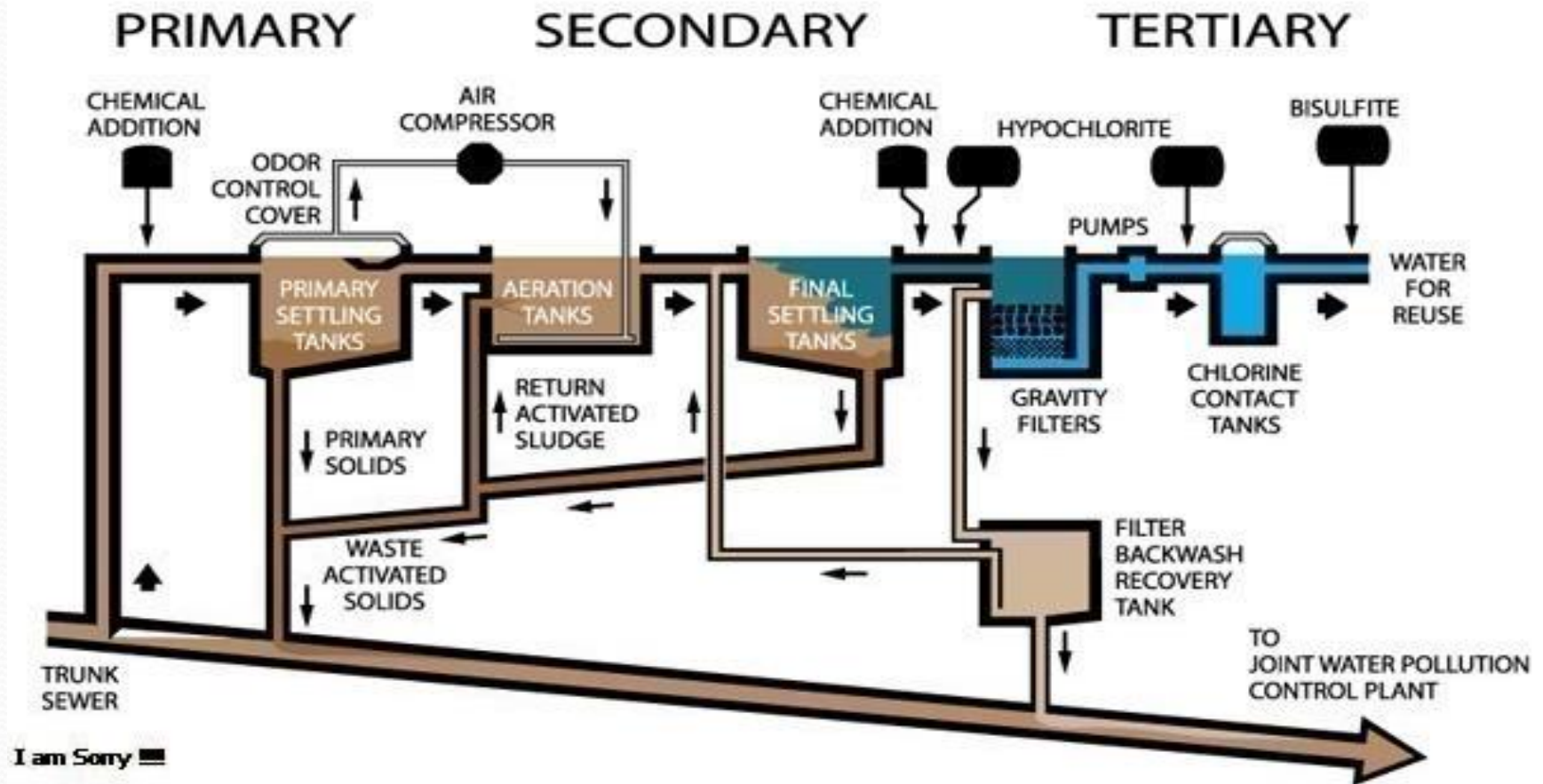
Lifting pump station units



Treatment station units



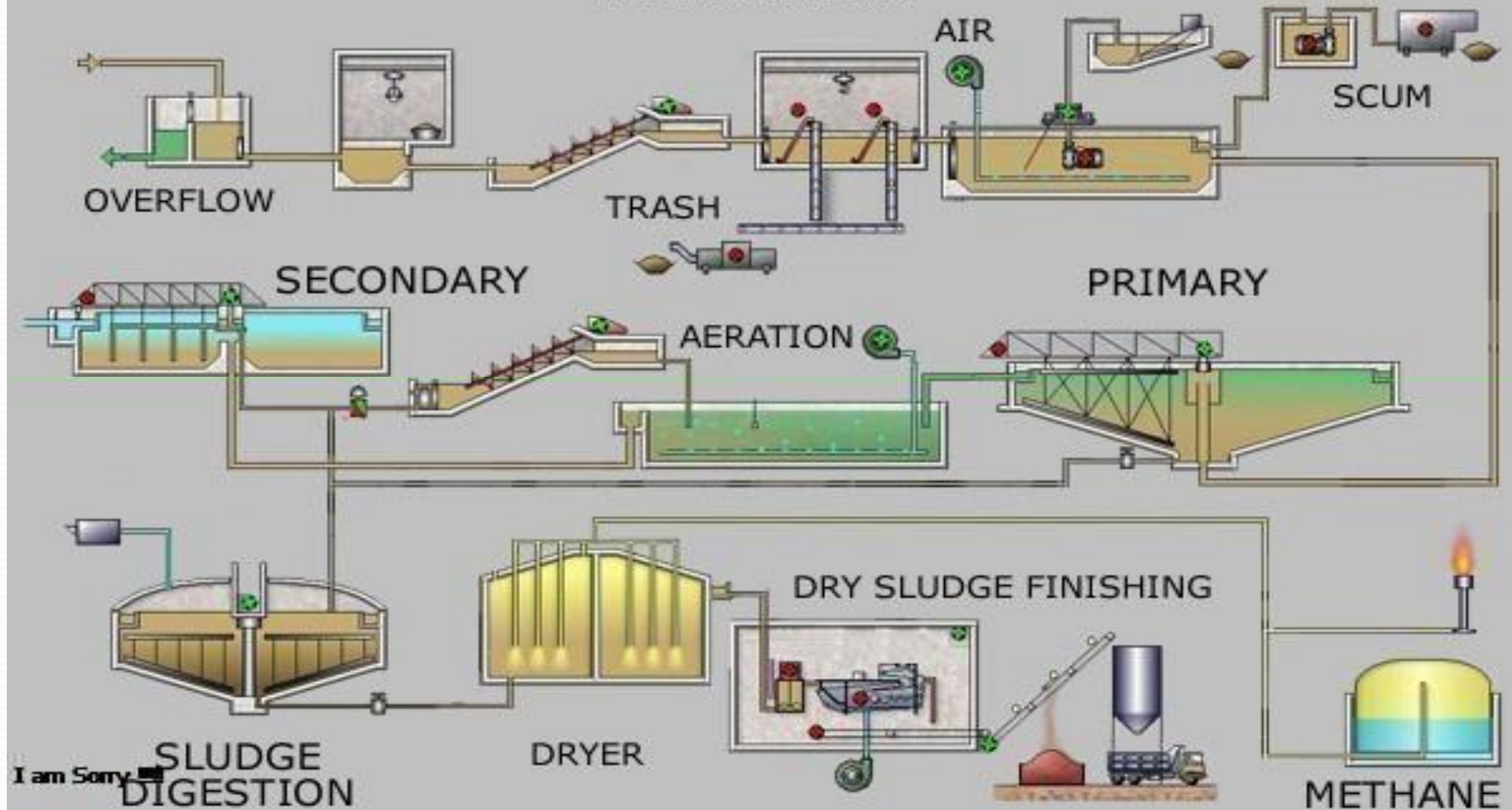
finally



SUMMARY OF LOADING AND OPERATIONAL PARAMETERS FOR AERATION PROCESSES

Process	BOD Loading (gm BOD/m ³ /d)	F/M ratio (gm BOD/d/gm MLSS)	RT (hrs)	%Return Sludge	% BOD efficiency
Extended Aeration	150 - 500	0.05 - 0.2	20 - 30	100	85 - 95
Conventional	450 - 600	0.2 - 0.5	0.6 - 7.5	30	90 - 95
Step Aeration	500 - 800	0.2 - 0.5	5.0 - 7.0	50	85 - 95
Contact Stabilization	500 - 800	0.2 - 0.5	6.0 - 9.0	100	85 - 90
High Rate	1300 - 1500	0.5 - 1.0	2.5 - 3.5	100	80 - 85
High Purity Oxygen	1900 - 2000	0.6 - 1.5	1.0 - 3.0	50	90 - 95

PRETREATMENT



DEVICES



AUTO SAMPLER



CONTROLLER



إعادة استخدام مياه الصرف الصحي في الزراعة

رقم المجموعة	درجة المعالجة	النباتات المسموح بزراعتها	الاحتياطات البيئية والصحية	طرق الري	نوع التربة
الأولى	مياه صرف صحي	الأشجار الخشبية والنخيل	عمل سياج حول المزارع. عدم التلامس مع المياه مباشرة مع عدم دخول غير العاملين للمزارع. اتخاذ الإجراءات الصحية اللازمة للحماية من الإصابة بالكائنات الممرضة والعلاج.	بالخطوط	خفيفة القوام
الثانية	معالجة ابتدائية	القطن - الكتان - الزهور	مثل المجموعة السابقة	بالخطوط ، النقاطات مع استخدام المرشحات	خفيفة القوام
الثالثة	معالجة ثانوية	محاصيل الأعلاف والحبوب المجففة المحاصيل والفواكه القشرية. الخضراوات التي تطهى. الفواكه المصنعة بالحرارة.	يمكن تربية الماشية غير المدرّة للبن أو المنتجة للحوم. يجب طهى الطعام قبل تناوله	بالخطوط - بالتنقيط	خفيفة متوسطة القوام
الرابعة	معالجة متقدمة	النباتات التي تؤكل نيئة. النباتات القشرية. جميع المحاصيل والبساتين. الأعلاف والمراعى الخضراء	لا توجد	جميع الطرق ماعدا الرش	جميع أنواع التربة