WASTE WATER TREATMENT IN PETROLEUM REFINERIES

- Petroleum industry, have had considerable role in generation and release of waste materials into the environment.

- A variety of waste products are produced in refineries in gaseous, liquid and solid phases, which must be treated and disposed in an environmentally friendly manner.

- Production, refining and conversion of crude oil to useful chemicals are associated with direct or indirect release of waste materials and pollutants into the environment.
- Water consumption in oil refineries is huge and so is the wastewater generation.

- Crude oil contains small amount of water soluble compounds, but Water and hydrocarbons are basically immiscible which makes wastewater treatment operations a challenge.
- Oil refineries are under immense pressure to comply with the new rules and regulations related to environment protection and operation safety
- Despite regular generation of wastes, there are inevitable release of pollutants in refineries due to malfunctioning of the units, pump leakage, erosion, corrosion, pipeline failure, etc.

- These contaminants are highly mobile and can easily travel distances by different mechanisms through air, soil and underground water.
- Contamination may be in the form of free phase product (e.g. liquid or vapor), dissolved products, or emulsified phase.
- On the other hand physical, chemical properties of water and soil will be affected, which results in shifting ecological equilibrium in damaged areas.

Ultimate fate of refinery wastes

- **The primary processes determining the fate of waste materials in an oil refinery may be summarized as:**
  - **Dispersion in air and water**
  - **Dissolution in water**
  - **Emulsification**
  - **Sedimentation**
  - **Adsorption/absorption**
  - **Spreading**
- **The waste materials may undergo some of these processes simultaneously.**

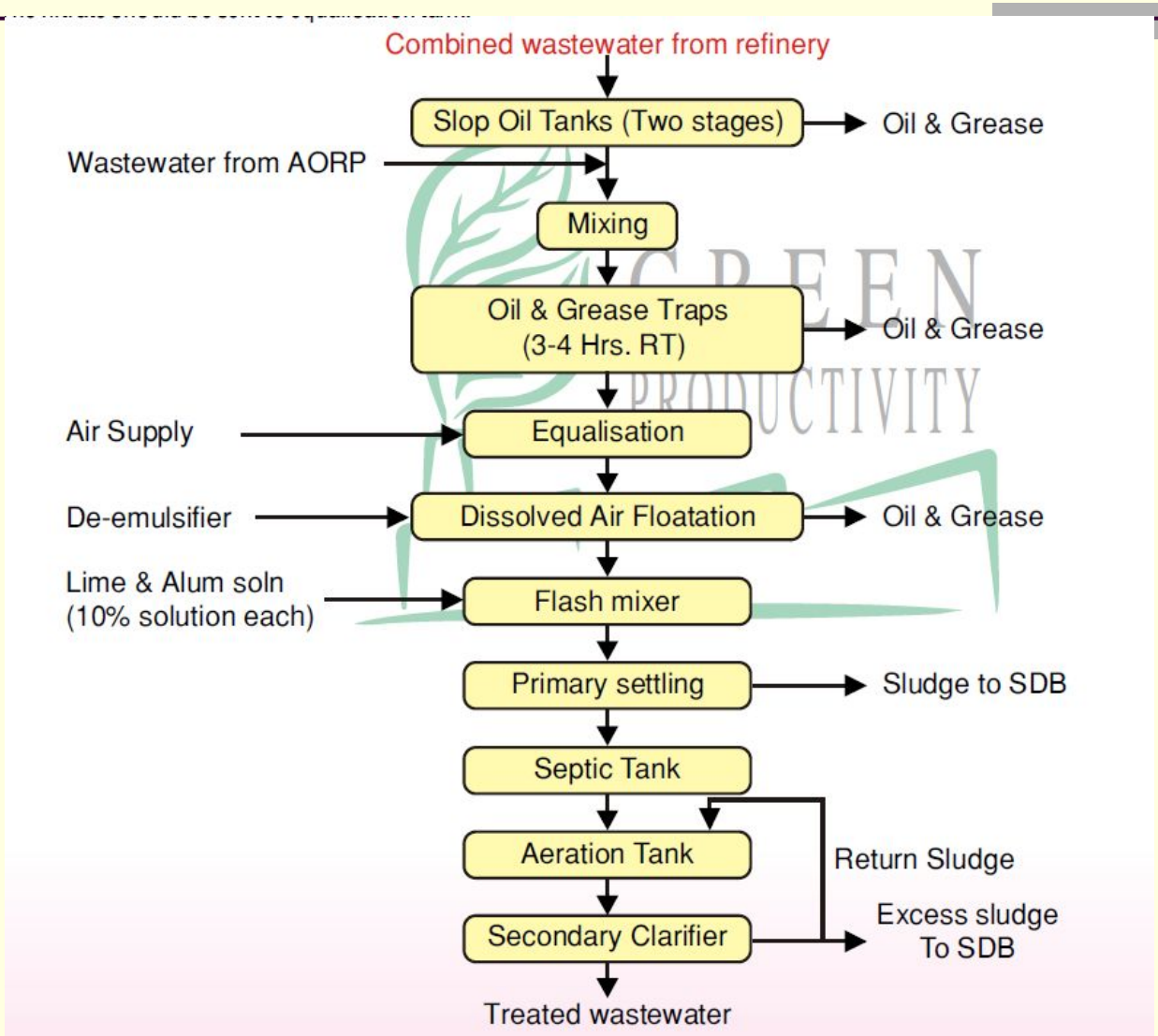
Wastewater treatment

- Waste waters from petroleum refining consist of cooling water, process water, storm water, and sanitary sewage water.
- A large portion of water used in petroleum refining is used for cooling (may contain hydrocarbons due to leakage).
- Process wastewater is usually highly contaminated depending on the process.
- Storm water (i.e., surface water runoff) is intermittent and will contain constituents from spills to the surface, leaks in the equipment and any materials that may have collected in drains.
- Runoff surface water also includes water coming from crude and product storage tank roof drains.

Wastewater treatment

- Waste waters are treated in onsite wastewater treatment facilities and then discharged to publicly owned treatment works (POTWs) or discharged to surfaces waters under National Pollution Discharge Elimination System (NPDES) permits.
- It is essential not to mix wastewaters from different processes as it may complicate the treatment process, unless they have similar properties.
- Petroleum refineries typically utilize primary and secondary wastewater treatment.
- Wastewater treatment plants are a significant source of refinery air emissions and solid wastes.

WASTE WATER TREATMENT SCHEME



OIL SKIMMERS

- Pieces of equipment that remove oil floating on the surface of a fluid. In general, oil skimmers work because they are made of materials to which oil is more likely to stick than the fluid it is floating on.

- Pre-treating the fluid with oil skimmers reduces the overall cost of cleaning the liquid.

- All designs depend on the laws of gravity and on surface tension in order to function. The six primary types of oil skimmers are belt, disk, drum or barrel style, mop, large tube or mini tube, and floating suction oil skimmers.

EQUALIZATION TANKS

- They are provided (i) to balance fluctuating flows or concentrations, (ii) to assist self neutralization, or (iii) to even out the effect of a periodic "slug" discharge from a batch process.
- **Types of Equalization Tanks**
- Flow through type - useful in assisting self neutralization. A flow through type tank once filled, gives output equal to input.
- Intermittent flow type- Flow balancing and self-neutralization are both achieved by using two tanks, intermittently one after another.
- Variable inflow/constant discharge type- When flows are large an equalization tank of such a size may have to be provided that ***inflow can be variable while outflow is at a constant rate***

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TRICKLING FILTERS

- Also called trickle filter, trickling biofilter, biological filter and biological trickling filter roughing filters, intermittent filters, packed media bed filters, alternative septic systems, percolating filters, attached growth processes, and fixed film processes.
- Consists of a fixed bed of rocks, lava, coke, gravel, slag, polyurethane foam,peat moss, ceramic, or plastic media over which sewage flows downward and causes a layer of microbial slime (biofilm) to grow, covering the bed of media.
- Aerobic conditions are maintained by splashing, diffusion, and either by forced air flowing through the bed or natural convection of air if the filter medium is porous.

AERATION TANK

- An aeration tank is a place where a liquid is held in order to increase the amount of air within it.
- There are two main methods of aerating liquid: forcing air through the liquid or forcing liquid through the air.
- The water is mixed with biological agents and then aerated. The increased oxygen promotes the growth of the beneficial biological material. That material will consume unwanted waste products held in the water. The beneficial material will grow due to the increased oxygen and food, which makes it easier to filter from the clean water.

LAGOONS

- Sometimes refineries have lagoons or final polishing ponds.
- **Types of aerated lagoons or basins**
- Suspension mixed lagoons, where there is sufficient energy provided by the aeration equipment to keep the sludge in suspension. [4]
- Faculative lagoons, where there is insufficient energy provided by the aeration equipment to keep the sludge in suspension and solids settle to the lagoon floor. The biodegradable solids in the settled sludge then degrade anaerobically.

MINIMUM NATIONAL STANDARDS

- The treated water should have the maximum limits of the following
- BOD (Biological Oxygen Demand) - 25 mg/l (30 day average)

  - 45 mg/l (7 day average)

- TSS (Total Suspended Solids) -30 mg/l (30 day average)

  - 45 mg/l (7 day average)

- pH shall remain between 6.0 and 9.0
- In addition, there shall be no visible solids and/or visible oil or greases in the discharge.

THANK YOU