Process and Technologies of Treatment & Pre-treatment for Municipal & Industrial Wastewater

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Expected Objectives of this presentation

- Enable participants to explain what wastewater is and why it should be collected, treated and reuse.
- Enable participants to assess their community’s current and future wastewater needs and implement strategies plan to meet them.
Why Collect, Treat and Reuse of Wastewater

- To prevent the spread of disease
- To protect water resources
- To insure adequate water supplies
How to start wastewater project

- Prepare proposals
  - Important: the request shall come from the beneficiary or the end user or inform them and consider their feedback
- Seek for fund
- Prepare to operate and maintain the system
Oslo agreement obligation regarding water and wastewater projects

• the West Bank land areas are designated as one of three different categories:
  – Area A: under full control of the Palestinian National Authority.
  – Area B: civil administration is controlled by the Palestinian Authority while security is controlled by the Israeli’s.
  – Area C: under full control of the Israeli’s.
Oslo agreement obligation regarding water and wastewater projects

• Permits
  – First: JWC shall approved or disapprove all the project all over the West Bank
  – Then: in area C, the construction permit shall be issued only by the Israeli’s Civil Administration.
Main requirements for success project

• Permitting
• Land acquisition
• Consultant cost
• Construction cost
• O&M cost
Seeking for fund

- Prepare proposals
- Prepare answers
- Approach all the available donors
- Propose stages for implementation
- Long term plan and clear vision shall be present
- Ask for integrated system: collection, treatment and reuse
Sources of Municipal wastewater

- Domestic wastewater:
  - kitchen, bathroom, laundry, commercial, institutional
- Industrial wastewater:
  - factories
- Storm water
Domestic Wastewater Characteristics

- **General:**
  - Grey color
  - Musty odor
  - 99.9% water
  - 0.1% solids
    - 30% Suspended
    - 70% dissolved
- **Chemically:** Organic, inorganic and gases
- **Biologically:** microorganisms (Fecal Coliform)
Main Wastewater parameters measured

- BOD
- COD
- TSS
- TDS
- Temp
- Kjeldahl Nitrogen (N)
- Total phosphorus (P)
- FC/100 ml
Overview of wastewater treatment plants

- **Type**
  - Full treatment
  - Pre-treatment

- **Location**
  - Centralized
  - Decentralized

- **Cost**
  - Conventional with high technology
  - Low cost
## Wastewater Management Technologies – Treatment plants

<table>
<thead>
<tr>
<th>Technology</th>
<th>Capital Cost</th>
<th>O&amp;M cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activated sludge</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Trickling filter</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Lagoons</td>
<td>Low to medium</td>
<td>Low</td>
</tr>
<tr>
<td>Constructed wetland</td>
<td>Low to medium</td>
<td>Low</td>
</tr>
<tr>
<td>Anaerobic treatment</td>
<td>Medium</td>
<td>Low to medium</td>
</tr>
</tbody>
</table>
TYPICAL WASTEWATER TREATMENT FACILITY

PRIMARY TREATMENT
FROM DRAINS, SEWERS
BAR SCREENS
SCUM REMOVAL
SETTLING TANK
SLUDGE
GRIT REMOVAL

SECONDARY TREATMENT
AERATION SEDIMENTATION
ACTIVATED SLUDGE
TRICKLING FILTER
SEDIMENTATION
TREATMENT PONDS/LAGOONS*

SLUDGE TREATMENT
DEWATERING
ANAEROBIC DIGESTION
THICKENING
USE OR DISPOSAL
HEAT
CENTRIFUGE
GRAVITY

ADVANCED TREATMENT
NITROGEN REMOVAL
PHOSPHORUS REMOVAL
FILTER
DISINFECTION

STREAM/CREEK/RIVER

* PONDS/LAGOONS ARE DREDGED OUT ONLY WHEN SYSTEMS FAIL.
Requirement of wastewater Solution

- Fulfill the effluent criteria in the permit
- Operation and management must be within the capabilities of the community
- It must be economical to build, operate and maintain

LOW RUNNING COST
Municipalities are trying to control wastewater quality

- The governarates work with the municipalities against all the vacuum tracks who empty their tracks in nearby wadis
- The municipalities encourage the vacuum tracks and free of charge to empty their trucks in the treatment plant
- There are laws to force the factory to do pre-treatment
- It is forbidden to connect storm water to wastewater system
## Industrial sources and pollutants

<table>
<thead>
<tr>
<th>Source</th>
<th>Industry/Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid</td>
<td>Acetate rayon, beet root manufact., mines, <strong>textiles</strong> manufact.</td>
</tr>
<tr>
<td>Acids Chem</td>
<td>Manuf., mines, <strong>textiles</strong> manufact.</td>
</tr>
<tr>
<td>Alkalies scouring</td>
<td>Cotton and straw kiering, wool</td>
</tr>
<tr>
<td>Ammonia manufacture</td>
<td>Gas and coke and chem.</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Sheep dipping</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Plating</td>
</tr>
<tr>
<td>Chromium anodizing</td>
<td>Plating, chrome tanning, alum</td>
</tr>
<tr>
<td>Citric acid processing</td>
<td>Soft drinks and citrus fruit</td>
</tr>
<tr>
<td>Copper</td>
<td>Copper plating, copper pickling</td>
</tr>
</tbody>
</table>
Industrial sources and pollutants

- Cyanides  Gas manufacture, plating, metal cleaning
- Fats, oils, grease Wool scouring, laundries, textile industry
- Fluorides  Scrubbing of flue gases, glass etching
- Formaldehyde Synthetic resins and penicillin manufact.
- Free chlorine  Laundries, paper mills, textile bleaching
- Hydrocarbons Petrochemical and rubber factories
- Mercaptans Oil refining, pulp mills
- Nickel Plating
- Nitrocompounds Explosives and chemical works
Industrial sources and pollutants

- Organic acids  Distilleries and fermentation plants
- Phenols  Gas and coke manufact., chem. plants
- Starch  Food processing, **textile** industries
- Sugars  Dairies, breweries, sweet industry
- Sulfides  **Textile** industry, tanneries, gas manufact.
- Sulfites  Pulp processing, viscose film manufact.
- Tannic acid  Tanning, sawmills
- Tartaric acid  Dyeing, wine, leather, chem. manufacture
- Zinc  Galvanizing zinc plating, rubber process.
Pre-treatment definition

- Treatment of wastewater before discharging it to the local wastewater treatment facility
Objectives of the Pretreatment

- Reducing the amount of pollutants,
- Eliminating pollutants, or
- Altering the nature of pollutant properties
- Reduce the capital cost and the running cost of the public wastewater treatment plant
Factories that affect the amount of pretreatment

- Fee based on the amount and types of pollutants discharged (pay as you pollute).
- Pollutant or pollutants to be removed.
- Site constraints, such as space availability for equipment.
- Amount and variation of wastewater flow and pollutant concentration, both hour to-hour basis and seasonal
Why do not industries applies pre-treatment

- In-complete of rules and regulation
- Absent of authority
- The economical and social situation of the society
Types of Pretreatment Unit Operations

- **Biological Processes** - Processes where living microbial organisms are used
- **Chemical Processes** - An example is heavy metal precipitation by pH adjustment.
- **Physical Processes** - Examples are reverse osmosis, and filtration.
- **Thermal Processes**
specific types of unit operations used in wastewater pretreatment systems

- Aerobic or Anaerobic Pretreatment
- Disinfection
- Clarification
- Simple Filtration
- Membrane Filtration
- Reverse Osmosis (RO)
- Ion Exchange
- Dissolved Air Flotation (DAF)
- Adsorption
- Chemical Precipitation/Redox Reactions
- Neutralization
Example of heavy metal removals

- Most heavy metals will precipitate at higher pH levels.
- Hexavalent chromium, is very soluble in wastewater and must be chemically reduced at lower pH levels to the trivalent form.
- Thus, the need for two different pH conditions for the chromium reduction and precipitation steps.
- Then, third tank is needed for final neutralization before discharge.
My advice: Prevention better than care

- Each factory has its own case
- Re-arrangement for manufacturing process
- Recycling for used water inside the factory
- Recycling of the heavy metal inside the factory
Typical Pretreatment Processes for Selected Industries

○ Textiles:
  ● **Polluants**: BOD, TSS, alkalinity
  ● **Pretreatment Process**: Neutralization, chemical precipitation, biological treatment

○ Leather goods
  ● Polluants: BOD, TSS, Chromium
  ● Pretreatment Process: Sedimentation, biological treatment

○ Laundry:
  ● Polluants: Alkalinity, BOD, turbidity
  ● Pretreatment Process: Screening, chemical precipitation, adsorption
Separate pre-treatment in each factory
Separate full treatment for industrial zone
What do municipalities need

- Detailed industrial survey studies
- Full cooperation of factories owners
- Complete rules and regulations, in addition to authorities to apply that.
- Municipal wastewater treatment plant
Reuse of treated wastewater
El Bireh treated WW after few Kms
Reuse of treated wastewater

- Store the treated wastewater and mixing it with spring water like Wadi Al-Qilt and Wadi Al-Bathan
- Use wadi Al-Zumar as a reservoir to store treated wastewater and storm water as will
FINALLY

- Remember that you have to work with your neighbor to solve any sanitation issue for clean and safe environment
- Remember to think twice before you take a decision regarding sewage issue

Thanks
I WISH YOU
GOOD LUCK
Questions  ???