**ANEAS WORKSHOP ON**

**Industrial Wastewater Treatment: Technologies and Solutions**

**Monday, 10 November 2014, Merida, Yucatan, Mexico**

# Challenges of Industrial Wastewater


Instructor:

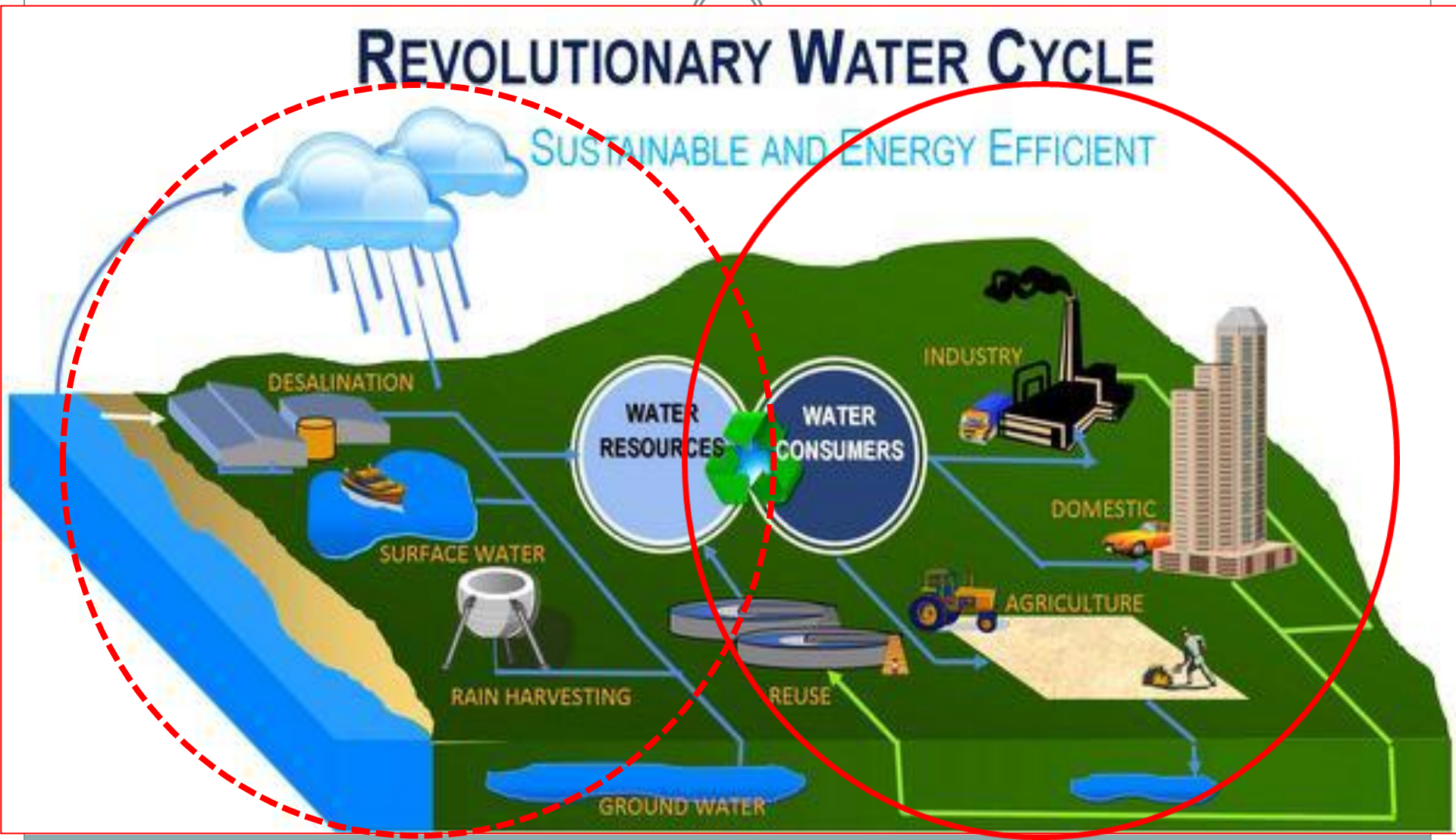
Prof. Avner Adin

Adin Holdings, Israel

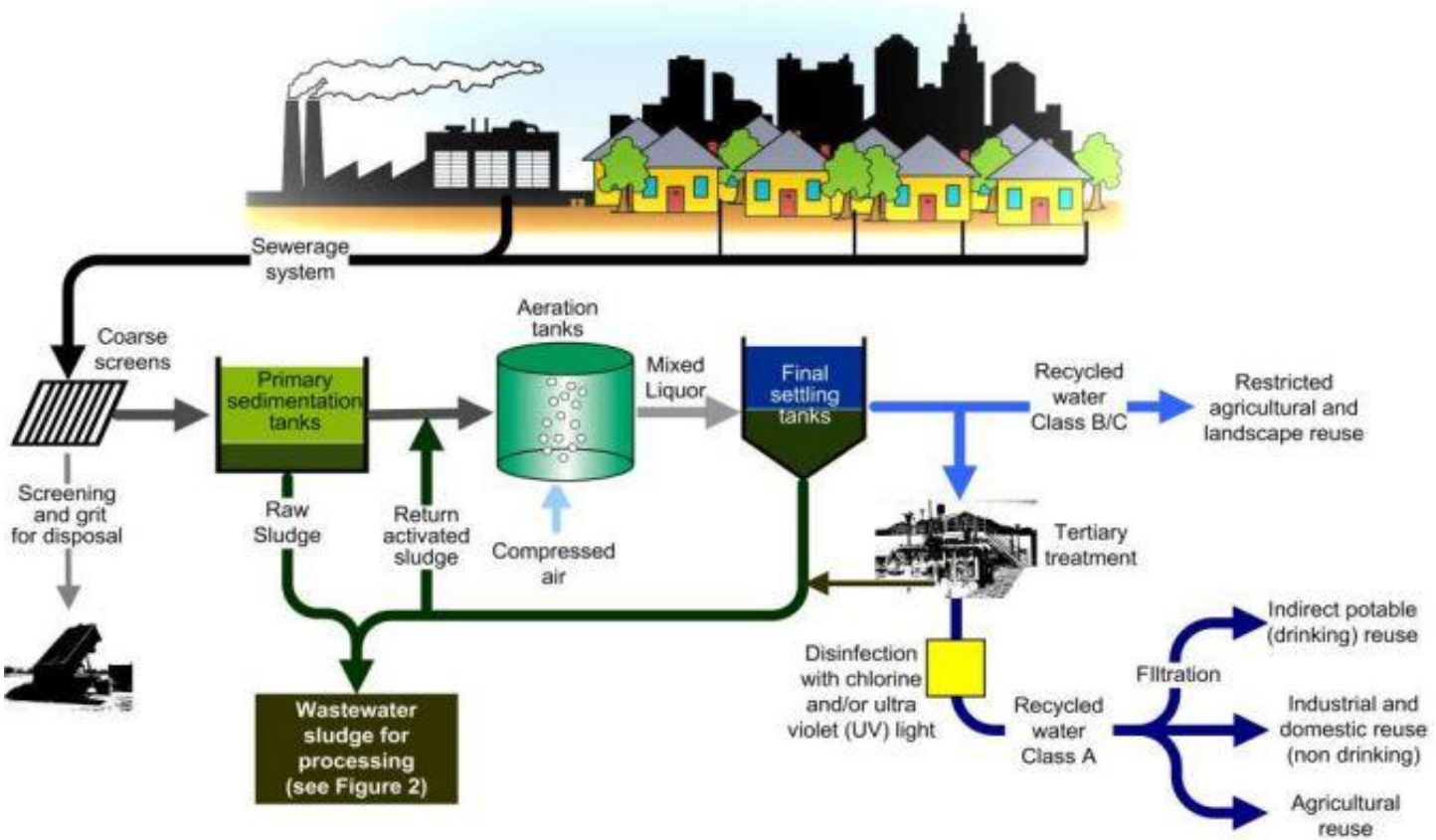
# Outline

- Challenges of industrial wastewater
- Overview of pretreatment technologies and solutions
- Toluca industry - Rio Lerma case study

# New water cycle of XXI century



# Combined treatment of domestic and industrial wastewater



# Industrial wastewater characteristics

| ***Industry*** | ***pH*** | ***TSS mg/l*** | ***BOD mg/l*** | ***COD Mg/l*** | ***Miscellaneous constituents*** | ***Pollutional aspects*** |
|---|---|---|---|---|---|---|
| **Pulp and paper (Kraft process)** | **6.9-9.8** | **600-2300** | **150-420** | **700-100** | **Mercaplants, sulphides, lignin** | **Large volume, high pH, SS, colour and toxicity** |
| | | | | | | |
| **Straw board** | **7.5-12.9** | **3000** | **2000** | **5000** | **-** | **High pH ,SS and BOD** |
| **Tannery** | **9.5** | **3200** | **7000** | **-** | **Chromium 15-20 mg/l** | **High BOD, SS, Cr and colour** |
| | | | | | | |
| **Cotton textiles** | **8.0-11.0** | **30-50** | **200-600** | **-** | **Detergents, dyes, chromium 3mg/l** | **Alkali, BOD, dyes and varying chemical quality** |
| **Distillery** | **4.3** | **4000** | **20000** | **65000** | **Oil and grease** | **High BOD , SS ,grease and ready putrescibility and low pH** |
| **Steel mill** | | **-** | **630** | **-** | **Grease, oil and tar NH,N** | **Highly toxic due to phenols cyanides and ammonia** |
| **Coke ovens** | **-** | | | | **1000 mg/l, phenols 1300 mg/l ONS** | |
| **Steel(finished)** | **-** | **310** | **280** | **-** | **Phenol 97.5 mg/l NH,N 440mg/l** | |
| **Refinery** | **-** | **-** | **200** | | **Sulfides, 180 mg/l-30 mg/l** | **Mineral oil and phenols** |
| **Fertilizers Ammonia and urea** | **8.0** | **3700** | **30** | **330** | **NHON 510 mg/l arsenic** | **Toxic due to free ammonia and promotes eutrophication** |
| **Dairy** | **8.0** | **690** | **816** | **1340** | **Oil and grease ready putrescibility** | **High BOD, SS. grease And** |

# PRINCIPLES OF INDUSTRIAL WASTEWATER TREATMENT

## Classification of wastewater

1. Wastewater for process and wash
2. Wastewater for cooling
3. Sanitary wastewater

## Waste minimization

Is achieved through good housekeeping (using water economically)

- Volume reduction
- Strength reduction

## •Volume reduction

- •Conservation and re-use of wastewater
- •Changing production to decrease waste
- •Elimination of batch discharge

1. To increase frequency of discharge to lessen the magnitude of batch discharge

2. To retain the batch discharge in basins and allowing it to flow uniformly and continuously

## •Strength reduction

- •Equipment modification
- •Process and raw materials change
- •Equalization of wastewater
- •Segregation of wastewater
- •Recovery of by-products

# Physical & Chemical Treatment

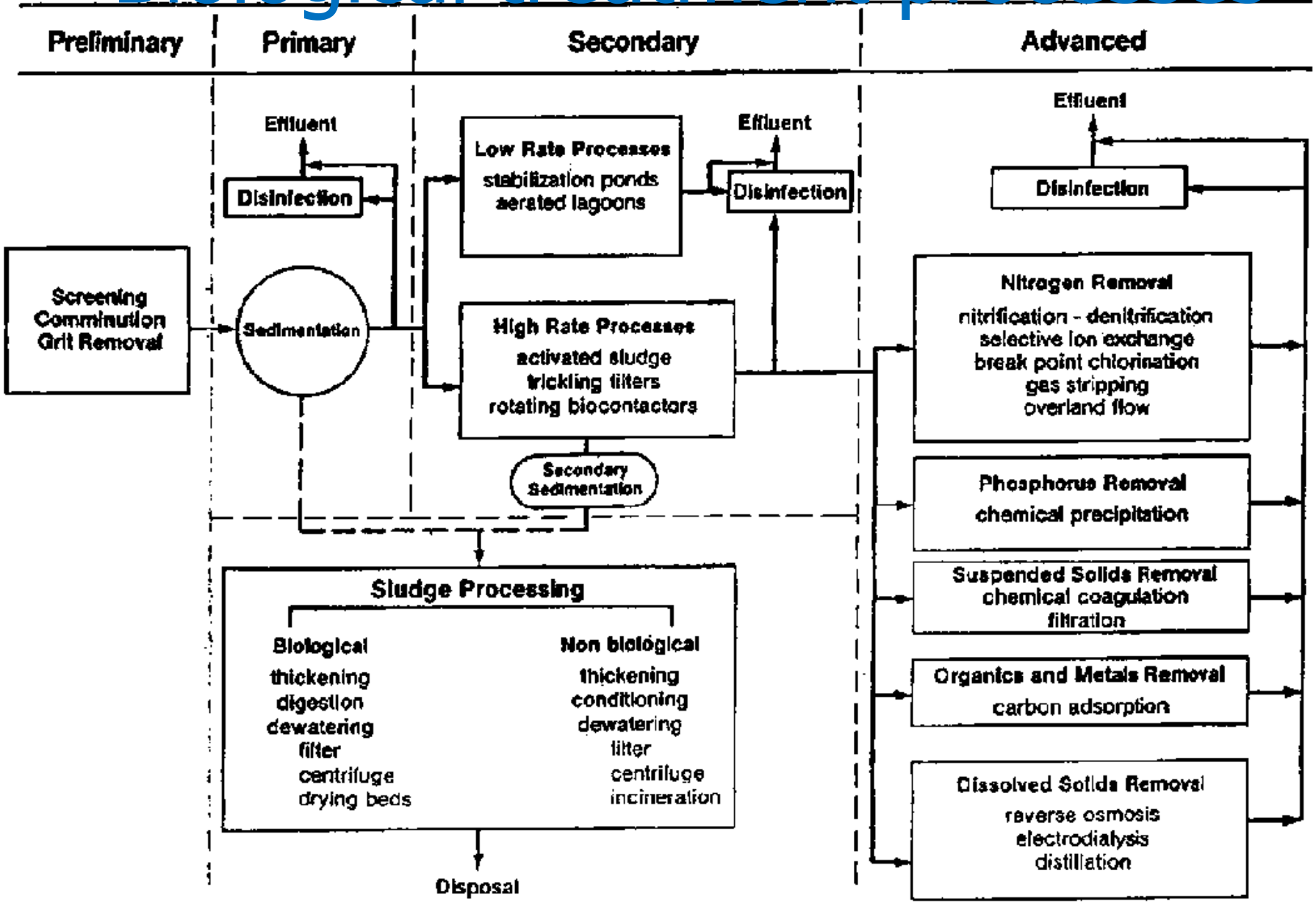
## Preliminary

- Screening - Rotary drums
- Grinding, cutting, shredding
- Grit chambers, grease traps
- Pre - Aeration
- Plain / Primary sedimentation

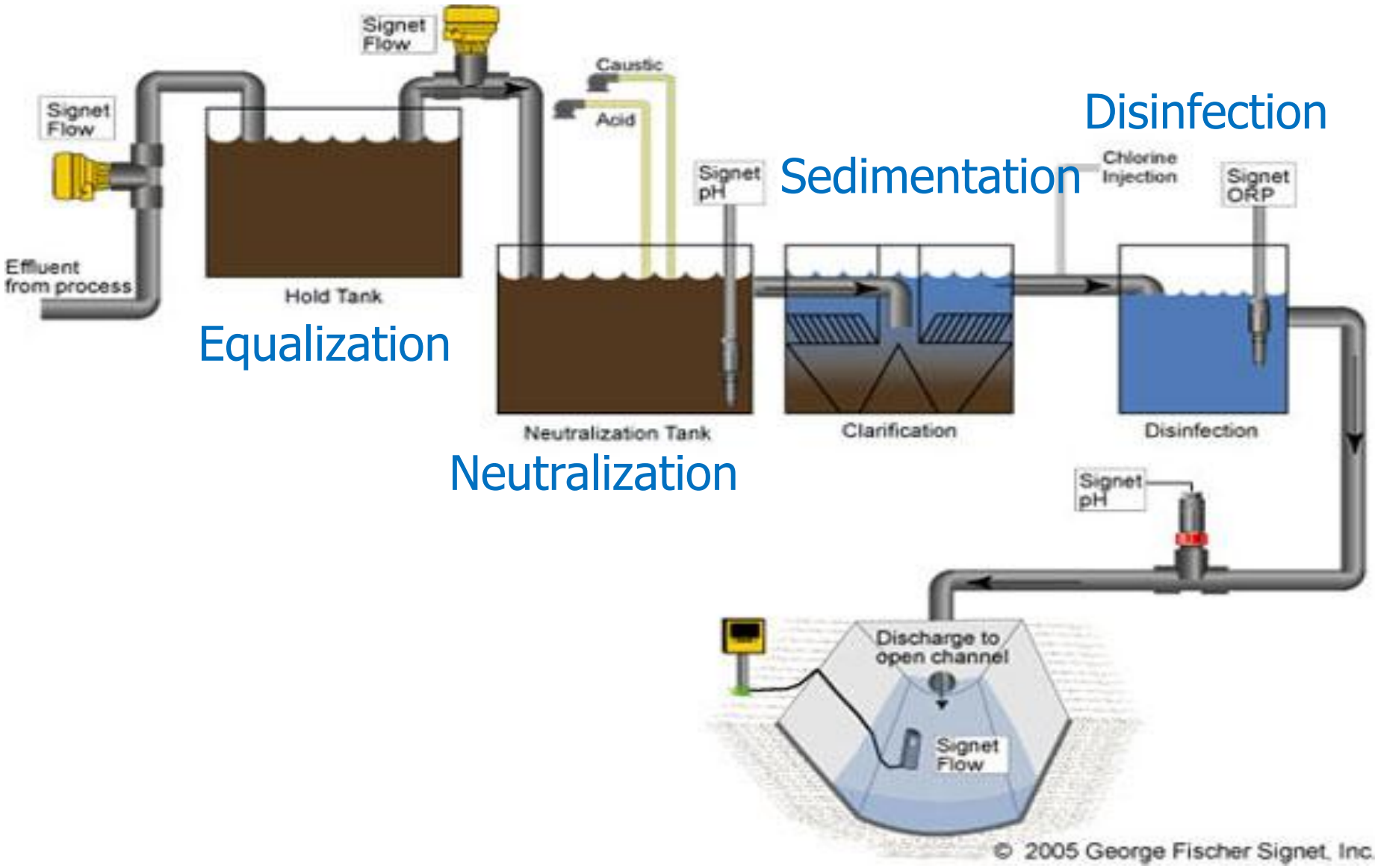
## Chemical

- Neutralization
- Chemical Coagulation
- Dissolved air floatation
- Chemical Precipitation
- Oxidation and reduction of wastes

# Biological treatment processes



# Basic industrial wastewater treatment



# Stream segregation

- Forbiden to dispose to municipal sewage system, e.g. blow-down from cooling systems
- Direct recycling of cooling water, e.g. bottles washing
- Process water after treatment, e.g. paper mill, readymix concrete, carwash
- Intended for by-products recovery, e.g. beer - yeast, wool - lanolin, metals
- For separate  treatments, e.g. detergents, metal finishing (Cr, CN)
- Specific materials for distruction and disposal

# Equalization

Definition: Storage and mixing of wates for a pre-determined time in order to enable emission of contaminants in constant discharge or constant mass.

Why:

1. Reduces pick flows
2. Enables more economic design of the treatment plant
3. Minimizes concentrations of materials that harm the biological treatment process or others
4. Rapid mixing 0of “strong” wastes in a large volume of very weak wastes enables mass equalization without flow equalization

# Neutralization

Purpose – Neutralize wastewater of too high or too low pH. The problem is harder in a sudden drop to a stream.
Methods :

- Mixing streams of different pHs in the factory of two adjacent ones, e.g. of a factory for construction materials (lime and magnesium hydroxide) and of a chemical plant (acids). Sometimes equalization tanks are needed to enable residence timing and flows adjustments.
- To acid wastes – add limestone, lime slurry, soda caustic (NaOH)
- To alkali wastes - add $CO_2$, $H_2SO_4$, other acids

# Process of industrial wastewater treatment analysis

# Case study: Rio Lerma, Mexico


- Lerma River
- Origin lagoons near Almoloya del Río, Mexican Plateau
- Mouth Lake Chapala (→Río Grande de Santiago→Pacific Ocean)
- Basin countries Mexico
- Length 750 km (466 mi), without Río Grande de Santiago