

## **Wastewater Treatment**

### **Pre-use Water Treatment**

Before water is used by a municipality, it is generally filtered, flocculated, re-filtered, and disinfected.

#### **Filtration and Re-filtration**

Water is drawn through filters that contain gravel and sand of various diameters. At the end stage, carbon filters are used to remove the smallest particles and improve taste.

#### **Flocculation**

Aluminum sulfate may be added to water to bind small particles together so that they may be more easily filtered out.

#### **Disinfection**

Before entering the water supply system, water is frequently disinfected with chlorine, ozone, or ultraviolet light.

## **Wastewater Treatment**

### **Primary Treatment**

Primary treatment removes large particles through filtration, and then allows bacteria to partially digest carbon and nitrogen wastes in large settling tanks. However, this does not entirely degrade the carbon methane, or the ammonia/nitrogen into the atmosphere nitrogen, and pathogens or toxins may still exist in the water. Primary treatment is fundamentally a filtration and settling process.

### **Secondary Treatment**

Secondary treatment holds the waste for a longer time in conditions that are favorable to bacterial digestion of the carbon and nitrogen wastes. The carbon-rich sludge tends to settle in the initial pond and can be removed to be digested by anaerobic methane-producing bacteria. The methane has a pungent odor, but it can be burned off or used as an energy source to operate the treatment facility.

The nitrogen-rich solution is skimmed off and sprayed over high surface area substrate to promote aerobic, or oxygen-using, bacteria growth. These bacteria will add oxygen to the ammonia form of nitrogen and convert it to nitrate ions. The carbon and nitrogen-consuming bacteria can be easily filtered off before the waste is discharged. This solid waste is called sludge, and presents a major disposal problem for many metropolitan

areas. Also, the nitrates remain in the water and, if left untreated, will lead to decreasing the available dissolved oxygen in the water after being discharged.

Pathogens can be killed by exposing the effluent to chlorine, UV light, or ozone before discharge. Secondary treatment removes the greatest percentage of waste and pathogens, but it does not remove nutrient or toxic wastes.

### Tertiary Treatment

Tertiary treatment can involve many methods to remove nitrates, phosphates, and industrial pollutants. Nitrates and phosphates are fertilizers and can be removed by sprinkling the water on trees or fields, or running the water through marshes so the plants assimilate the nutrients. Exposing the water between electrically charged plates will remove charged particles. Reverse osmosis will remove all dissolved and undissolved particles, but it is very energy intensive.

Tertiary treatment may also involve specific chemical treatment to disinfect the water or remove toxic wastes, depending on the needs of a community, but this is very expensive.

