

## CHAPTER 1

### GENERAL

1-1. Purpose and scope. This manual prescribes general information and design criteria for guidance in the planning and design of domestic wastewater treatment plants at Army mobilization facilities.

1-2. Overall design considerations. Wastewater treatment plant design will be as simple as is commensurate with the required degree of treatment. Plants will be capable of treating normal laundry wastes together with sanitary wastewater. Some types of industrial waste may be admitted to wastewater treatment plants. These include cooling tower discharge, boiler blowdown, vehicle washrack wastewater, swimming pool filter discharges, and aircraft wash wastes using biodegradable detergents. Pretreatment will be provided when conditions require it. In design for expansion of existing plants constituting new construction, criteria contained herein regarding flows and wastewater characteristics may be modified to conform to existing plant performance data if the plant has been in operation long enough to have established accurate data. Package treatment plants offer many advantages and will be considered for all feasible applications.

1-3. Definitions. The following definitions apply to this manual.

a. Auto-oxidation. Utilization of the endogenous phase of biological metabolism for the complete stabilization of organic wastes.

b. Biochemical oxygen demand (BOD). The quantity of oxygen used in the biochemical oxidation of organic matter in a specified time, at a specified temperature, and under specified conditions. It is not related to the oxygen requirements in chemical combustion, being determined entirely by the availability of the material as biological food and by the amount of oxygen utilized by the microorganisms during oxidation. Unless otherwise stated, BOD refers to the biochemical oxygen demand in 5 days at 20 degrees C.

c. Biological oxidation. The process whereby living organisms in the presence of oxygen convert the organic matter contained in wastewater into a more stable form.

d. Biological treatment. Biological treatment systems are "living" systems which rely on mixed biological cultures to break down waste organics and remove organic matter from solution.

e. Chemical oxygen demand (COD). The oxygen equivalent of that portion of organic matter susceptible to oxidation by a strong chemical oxidant.

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f. Chlorine demand. The difference between the amount of chlorine added to the wastewater and the amount of residual chlorine remaining at the end of a specific contact time. The chlorine demand for given water varies with the amount of chlorine applied, time of contact, temperature, pH, and the nature and amount of impurities in the water.

g. Combined sewer system. A transport system which carries both sanitary wastewater and storm or surface water runoff.

h. Effluent. Any wastewater or liquid flow (raw, partially or completely treated) leaving a treatment process unit or operation.

i. Endogenous respiration. An auto-oxidation of cellular material, which takes place in the absence of assimilable organic material, to furnish energy required for the replacement of protoplasm.

j. Filterable solids. The quantity of material which passes through the filter paper when a quantity of water, sewage, or other liquid is filtered through an asbestos filter in a Gooch crucible.

k. Food to microorganism ratio. An aeration tank loading design parameter. Food may be expressed in pounds of suspended solids, COD, or BOD added per day to the aeration tank, and microorganisms may be expressed as mixed liquor suspended solids (MLSS) or mixed liquor volatile suspended solids (MLVSS) in the aeration tank.

l. Hydraulic surface loading. The flow (volume per unit time) applied to a unit of surface area, applicable to trickling filter and filtration processes.

m. Influent. Wastewater or other liquid--raw or partially treated--flowing into a reservoir, basin, treatment process, or treatment plant.

n. Mixed liquor. A mixture of activated sludge and wastewater undergoing biological treatment in the aeration tank.

o. Mixed-liquor volatile suspended solids. The concentration of volatile suspended solids in an aeration basin. It is commonly assumed to equal the biological solids concentration in the basin.

p. Organic loading. Pounds of BOD applied per day to a biological reactor. Can also be related to reactor surface area or volume.

q. Oxygen uptake rate. The amount of oxygen being utilized by an activated sludge system during a specific time period.

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r. Screening. A physical process preceding primary treatment. Its function is to protect subsequent treatment units and to minimize operational problems.

s. Primary treatment. Any physical or chemical treatment for the removal of settleable and floatable materials.

t. Raw sludge. Settled sludge directly removed from sedimentation tanks before decomposition has progressed. Frequently referred to as undigested sludge.

u. Recirculation rate. The rate of return (given in percent) of part of the effluent from a treatment process to the head end of that process.

v. Secondary treatment. Any treatment process capable of producing an effluent containing a BOD and suspended solids (SS) concentration no greater than 30 mg/l each.

w. Sanitary sewer. A sewer intended to carry domestic wastewater from homes, businesses, and industries.

x. Storm sewer. Storm water runoff collected and transported in a separate system of pipes.

y. Sludge age. In the activated sludge process, a measure of the length of time a particle of suspended solids has been undergoing aeration, expressed in days. It is usually computed by dividing the weight of the suspended solids in the aeration tank by the daily addition of new suspended solids having their origin in the raw waste.

z. Sludge density index. A term used in the expression of settling characteristics of activated sludge;  $100/\text{sludge volume index}$ .

aa. Sludge volume index (SVI). A numerical expression of the settling characteristics of activated sludge. The ratio of the volume in milliliters of sludge settled from a 1,000-ml sample in 30 minutes to the concentration of mixed liquor in milligrams per liter multiplied by 1,000.

ab. Surface settling rate. One of the criteria for the design of settling tanks and gravity sludge thickeners, expressed in gallons per day per square feet of surface area in the tank.

ac. Suspended solids. Solids that either float on the surface of (or in suspension in) water, wastewater, or other liquids, and which are removable by laboratory filtering.

ad. Total oxygen demand (TOD). An instrumental method that is used to measure the organic content of water, wastewater, or other liquids.

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In the test, organic substances and, to a minor extent, inorganic substances are converted to stable end products in a platinum-catalyzed combustion chamber. The total oxygen demand is determined by monitoring the oxygen content present in the nitrogen carrier gas.

ae. Volatile solids. The amount of solid material present in the solid fraction of wastewater or sludge that is combustible at 550 degrees C.

af. Wasted sludge. The portion of settled solids from the final clarifier removed from the wastewater treatment processes to the solids handling facilities for ultimate disposal.