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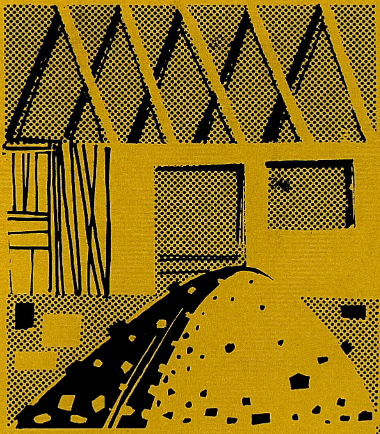

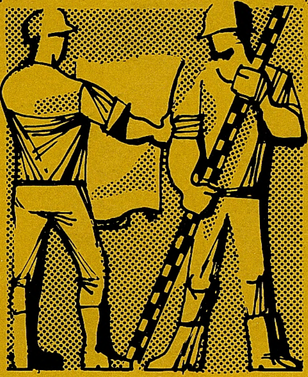

WASTE STABILIZATION POND

O & M GUIDE

August 1983

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WASTE STABILIZATION POND

O & M GUIDE

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Septembre 1983

WASTE STABILIZATION POND
O & M GUIDE

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1.0 INTRODUCTION

The purpose of this document is to provide guidelines for the operation and maintenance of waste stabilization ponds used as wastewater disposal systems in Indian communities and northern locations. Waste stabilization ponds are commonly known as lagoons.

This document is intended for use by wastewater treatment plant operators and maintenance supervisors.

Stabilization ponds are inexpensive, and straightforward in design, construction, operation and maintenance. If looked after properly they can provide efficient treatment of wastewater. There is no truth, however, to the widely held belief that little or no maintenance is required to produce a good quality effluent. If poorly operated and maintained, the pond soon produces a poor quality effluent and becomes a public nuisance, a health hazard to the population it is supposed to serve.

2.0 DEFINITIONS

Definitions are appended. Although not all the terms appear in this publication, they are frequently encountered in the literature on waste stabilization ponds.

3.0 RESPONSIBILITIES AND QUALITY STANDARDS

3.1 Responsibilities

The owner's responsibilities are as follows:

a. have a trained operator who is capable of operating and maintaining the installation;

b. supply the operator with all the necessary tools, materials and parts needed for proper plant operation and maintenance;

c. provide for proper instruction and orientation;

d. provide opportunities for plant personnel to increase their knowledge by participation at meetings and special training courses; and

e. obtain any permits required for operation of the plant from the appropriate regulatory agency.

The operator must:

a. operate the ponds efficiently and meet the effluent qualities stipulated by regulatory agencies;

b. maintain equipment, buildings, and grounds;

c. maintain a safe and healthy environment;

d. perform tests and make observations needed for the proper operation of the ponds;

e. properly interpret and apply laboratory tests and results;

f. notify the owner far enough in advance so that tools, parts and supplies will be available when needed;

g. keep the drainage course to the receiving stream clear of obstructions;

h. keep maintenance records; and

i. discharge when pond has the best quality effluent and will affect the receiving stream the least.

3.2 The Ideal Pond

These goals should be aimed for in a stabilization pond:

a. The primary cells should have a deep green sparkling colour which indicates high pH and DO.

b. Secondary or final cells should be high in DO and provide an effluent that will meet discharge limits.

c. The surface water in the pond should have wave action when wind is blowing. The absence of good wave action may indicate anaerobic conditions or an oily surface.

d. A good pond has no weeds growing in the water nor tall weeds on the bank to stop wave action.

e. Dikes are well seeded above the water line with grasses and kept mowed. This prevents soil erosion and insect problems.

f. Erosion of dikes is prevented at water's edge by the use of riprap, broken concrete rubble or a poured concrete erosion pad.

g. Inlet and outlet structures are clean. No floating debris, caked scum, or other trash that might produce odours or be unsightly is present.

h. Mechanical equipment is well maintained with the help of a written schedule and records are kept on lubrication and maintenance.

i. An available plant record should show weather data and basic test results such as pH, DO, BOD, SS, and chlorine residuals when chlorination is carried out.

4.0 STARTING A POND

4.1 Filling Primary Cell

The following procedure should be followed:

a. Fill primary cell(s) with fresh water (from a river or municipal system,) to the 60 cm level. (Spring or early summer is the best time to start to avoid low temperature and possible freezing).

b. Begin the addition of wastewater.

c. Keep pH above 7.5. See 9.0.

d. Check DO daily. See 9.0.

If started during warm weather:

a. Algal blooms will usually appear after 7 to 14 days.

b. A good biological community will be established in about 60 days. Colour will be a definite green, not blue or yellow-green.

This procedure tends to avoid odorous anaerobic conditions and weed growth during the start-up phase. If it is necessary to start in late fall or winter the level should be brought to 75 cm (28 in.) by filling with fresh water (from a river or municipal system) and there should be no discharge until late spring.

4.2 Filling Successive Ponds

The procedure is as follows:

a. Begin filling when the water level in the first pond reaches 1 metre.

b. Add fresh water to a depth of 60 cm (2 ft.).

c. Begin adding water from the previous pond using the following procedure:

(1) Use top draw-off to achieve good transfer. Do not draw off from a level below the bottom 45 cm (18 in.).

(2) Do not allow the water depth in the previous pond(s) to fall below 1 metre (3 ft.).

(3) Equalize water depths in all ponds. This should be done by one of the following methods:

(a). hold the discharge until all ponds are filled;

(b). if there is one, use effluent box with gates or valves to allow pumping of the effluent to any pond in the system; and

(c). continuously recycle the effluent to the ponds that need the water level raised.

d. Repeat the operation to equalize water depths using 15 cm (6 in.) increments until ponds are at their operating depth.

5.0 OPERATIONAL AND PREVENTIVE MAINTENANCE

5.1 Visual Survey

Every day, inspect around perimeters of ponds and make note of the following:

a. any buildup of scum on pond surface and discharge outlet boxes,

b. signs of burrowing animals,

c. anaerobic conditions - noted by odour and black colour,

d. water grown weeds,

e. evidence of dike erosion,

f. dike leakage,

g. fence damage, and

h. evidence of short circuiting.

Plan, schedule, and correct problems found (see 9.0).

5.2 Pretreatment

Clean inlet and screens, and properly dispose of trash.

Check inlet flowmeter and float well.

5.3 Mechanical Equipment

Check mechanical equipment and perform scheduled preventive maintenance on the following pieces of equipment according to the manufacturer's recommendations.

a. For pump stations:

(1) On a daily basis:

- remove debris,
- check pump operation, and
- log running time.

(2) On a weekly basis:

- run emergency generator, and
- clean floats, bubblers, or other control devices.

(3) Lubricate as necessary.

b. For comminuting devices:

(1) check cutters every week for condition of blades, and

(2) lubricate as necessary.

c. For aerators:

(1) log running time daily, and

(2) lubricate as necessary.

d. For chlorinators:

(1) check feed rate daily, and

(2) check chlorine residual, where chlorination is being carried out.

e. For flow measuring devices:

(1) check and clean floats, etc., daily, and

(2) have company representative verify accuracy every year.

f. For valves and gates:

(1) check daily to make sure they are set correctly, and

(2) open and close once a month to make sure they operate.

6.0 IMPROVING OPERATION

6.1 Flow Regulation

Flow regulation is one of the most helpful operational tools available to a lagoon operator. Without the flexibility of being able to move water around where it is needed the operator would be severely limited.

6.1.1 Single Cell Ponds

The only flexibility an operator has in a single cell pond is depth control. The water level may be varied according to the season or to control weeds and mosquitoes. This can only be done where ponds are discharged on a daily or weekly basis. It does not apply when discharging once or twice a year.

6.1.2 Multiple Cell Ponds

The operator may need to:

a. hold wastewater in the primary cell, especially during seasonal discharge operations;

b. move water from cell to cell to correct an oxygen deficiency problem;

c. isolate a cell that has turned anaerobic or to hold a toxic waste;

d. take advantage of both series and parallel operation to regulate loading; and

e. temporarily rest a cell for recovery.

6.2 Baffles and Screens

Screens, often homemade, are used around pond surface outlets to keep wind-blown weed and surface trash from entering a pipe.

Baffles are quite commonly used for a variety of purposes:

a. To direct the flow of water, especially around inlets. These may consist of nothing more than pilings of 50 mm X 200 mm (2 in. x 8 in.) driven into the pond bottom.

b. To allow selection of depth for pond draw-off and to keep surface scum and trash from entering pond outlets.

c. To provide a stilling area ahead of a flow measuring device.

d. To reduce the force of a pump discharge.

7.0 POND CLEANING

If it becomes necessary to clean a pond, the operator should have access to a suction pump, a "mudcat" or other means of removing mud or sludge off the bottom. This is necessary to control pond bottom levels and localized deposit areas but this is seldom used unless grit or sand gets into the system. Advice should be obtained from the regulatory agency for disposal of bottom solids.

8.0 DISCHARGE CONTROL PROGRAM FOR SEASONAL DISCHARGE

8.1 Preparation

The following procedure should be observed:

a. Make a note of conditions in the stream which is to receive discharge.

b. Estimate duration of discharge and expected volume.

c. Obtain approval from your local regulatory agency.

d. Isolate cell to be discharged. If possible, allow to rest for at least 1 month.

e. Arrange sample analysis for DO, BOD, SS, pH, coliform and nutrients (if required).

f. Note and record turbidity, colour and any unusual conditions.

8.2 Discharge Procedures

The majority of waste stabilization ponds in Canada use seasonal discharge. Three or four weeks after ice break-up, the ponds generally return to normal operating conditions. The wastewater in the secondary cell is tested and results reported to the local authority. If effluent quality is suitable for discharging, the operator follows local authority guidelines on discharging.

The quality of the receiving waters is usually determined by the provincial or local municipal, authority, for example, the medical officer of health or the Environment Ministries.

When discharge approval is obtained the operator should proceed as follows:

a Begin the discharge program with the last cell in series.

b Draw off the discharge at a time when the discharge is acceptable. Stop the discharge when ponds are upset and when the depth of liquid in the pond reaches the minimum operating level.

c Follow testing procedures outlined by the local authority having jurisdiction. (See 8.0)

9.0 TROUBLESHOOTING FOR PONDS

9.1 Water Weed Control

9.1.1 Indicators/Observations

Water weeds are undesirable as:

a. they attract offensive animals like groundhogs and muskrats;

b. they cause short-circuiting problems;

c. they stop wave action allowing scum to collect which produces a breeding site for mosquitoes and a still area where odours can develop;

d. they stop sunlight penetration and prevent wind action thus reducing the oxygen in the pond; and

e. root penetration causes leaks in the pond seal.

9.1.2 Probable Cause

- Poor circulation and maintenance and insufficient water depth.

9.1.3 Solutions

Suggested methods of weed control:

a. Pull weeds by hand if new growth.

b. Mow weeds with a sickle bar mower.

c. Lower water level to expose weeds, then burn with gas burner.

d. Allow the surface to freeze at a low water level, raise the water level and the floating ice will pull the weeds as it rises. The best results are obtained when weeds are young as large clumps of roots will leave holes in the pond bottom.

e. Increase water depth to above the tops of the weeds.

f. Use riprap. Caution: If weeds get started in the riprap they will be difficult to remove, but can be sprayed with an acceptable herbicide.

g. To control duckweed, use rakes or push a board with a boat, then physically remove duckweed from pond.

9.2.0 Control of Burrowing Animals

9.2.1 Indicators/Observations

- Rodents such as groundhogs dig holes or tunnels into dikes. Muskrats dig partially submerged tunnels into dikes. If the water level is raised, they will burrow further and may weaken the dike.

9.2.2 Probable Cause

- Bank conditions that attract animals
- High population in area adjacent to ponds.

9.2.3 Solutions

Suggested methods of control:

a. Remove food supply such as cattails and burr reed from ponds and adjacent areas.

b. Raise and lower the water level 15 cm to 20 cm several times over a few weeks. Muskrats prefer a partially submerged tunnel and will extend it upwards if the water level is raised. If the water level is lowered sufficiently they may abandon the tunnel entirely.

If the problem persists, check with local game commission officer for approved methods of removal, such as live trapping, etc.

9.3 Dike Vegetation Control

9.3.1 Indicators/Observations

- High weed growth, brush, trees and other vegetation provide nesting places for animals, can cause weakening of the dike and presents an unsightly appearance. They also reduce wind action on the pond.

9.3.2 Probable Cause

- Poor maintenance

9.3.3 Solutions

Suggested methods of control:

a. Periodic mowing is the best method.

b. Sow dikes with a mixture of fescue and blue grass on the shore and short native grass elsewhere. Select a grass that will form a good sod and bind the soil. This will prevent undesirable weed growth.

c. Spray with approved weed chemicals. Note: Be sure to check with authorities. Some do not allow the use of chemicals. Others require that chemicals be bio-degradable. Examples of some herbicides that can be used are:

(1) Dow Dalapon for cattails,

(2) Dow Silvex for willows and emergent weeds,

(3) Ortho Endo-thal for suspended weeds,

(4) Copper sulphate for filamentous algae, and

(5) Simazine for weeds.

9.4 Scum Control

9.4.1 Indicators/Observations

Scum control is necessary to prevent odours and to eliminate breeding spots for mosquitoes. In addition, sizeable floating rafts reduce sunlight.

9.4.2 Probable Cause

Scum formation may be caused by:

a. the turning over of the pond bottom causing sludge to float to the surface;

b. poor circulation and wind action; or

c. large amounts of grease and oil in the influent.

9.4.3 Solutions

Break up scum formations using rakes, a portable pump to get a water jet, or motor boats. Broken scum usually sinks.

Any remaining scum should be skimmed and disposed of by burial or hauled to a sanitary landfill site with approval of the local regulatory agency.

9.5 Odour Control

9.5.1 Indicators/Observations

Odours are a general nuisance to the public.

9.5.2 Probable Cause

The odours are generally the result of over-loading, long periods of cloudy weather, poor pond circulation, industrial wastes or ice melt.

9.5.3 Solutions

The problem can usually be cured by the following methods:

a. Use parallel feeding to primary cells to reduce loading.

b. Apply chemicals such as sodium nitrate, Dibrom or Micro-Aid to introduce oxygen. Application rate: 5-15 percent of sodium nitrate per kilogram of BOD on a kilogram for kilogram basis or 90 kg sodium nitrate per 4500 m^3 (200 lbs. per million gallons). See literature for commercial products. Repeat at a reduced rate on succeeding days. Or use 112 kg sodium nitrate per hectare (100 lb. per acre) for the first day, then 56 kg per hectare per day (50 lb. per acre) thereafter if odours persist. Apply in the wake of a motor boat.

c. Install supplementary aeration such as floating aerators, caged aerators, or diffused aeration to provide mixing and oxygen. Daily trips over the lagoon area in a motor boat also help. Note: stirring the pond may cause odours to be even worse for a short time.

d. Recirculate pond effluent to the pond influent to provide additional oxygen and to distribute the solids concentration. Recirculate effluent on a 1 to 6 ratio to the influent.

e. Eliminate septic or high-strength industrial wastes.

9.6 Blue-green Algae Control

9.6.1 Indicators/Observations

- Low pH (less than 6.5) and dissolved oxygen (less than 1 mg/L). Foul odours develop when algae die.

9.6.2 Probable Cause

- Blue-green algae is an indication of incomplete treatment, overloading and/or poor nutrient balance.

9.6.3 Solutions

Apply 3 applications of a solution of copper sulphate.

a. If the total alkalinity is above 50 mg/L apply 4.5 kg of copper sulphate per 4 500 m^3 (10 lb. per million gallons).

b. If alkalinity is below 50 mg/L reduce the amount of copper sulphate to 2.3 kg per 4 500 m^3 (5 lb. per million gallons).

Break up algal blooms with a motor boat or a portable pump and hose. Motor boat engines should be air cooled as algae may plug up water cooled ones.

NOTE: In sensitive areas the local regulatory authority may not approve the use of copper sulphate since in concentrations greater than 1 mg/L it is toxic to certain organisms and fish.

9.7 Insect Control

9.7.1 Indicators/Observation

Insects present in area, and larvae or insects present in pond water.

9.7.2 Probable Cause

Poor circulation and maintenance.

9.7.3 Solutions

To control mosquitoes:

a. Keep pond clear of weeds and allow wave action on bank to prevent mosquitoes from hatching.

b. Keep pond free from scum.

c. Stock pond with Gambusia (Mosquito Fish).

d. Spray with larvacide as a last resort. Check with the local regulatory agency for approved chemicals. Some that have been used are Dursban, Naled Fenthion and Abate.

To control midges:

a. Stock pond with Gambusia.

b. Spray with approved insecticide. Fenthion, Abate and Sursban have been used.

9.8 Correcting A Low Dissolved Oxygen (DO)

9.8.1 Indicators/Observations

A low, continued downward trend in DO indicates anaerobic conditions and causes unpleasant odours. The daytime DO should not drop below 3.0 mg/L during warm months.

9.8.2 Probable Cause

Poor light penetration, low detention time, high BOD loading or toxic industrial wastes.

9.8.3 Solutions

Suggested methods of control:

a. Remove weeds such as duckweed.

b. Add supplemental aeration (surface aerators, diffusers and/or daily operation of a motor boat).

c. Apply sodium nitrate.

d. Determine if overload is due to industrial source. If so, eliminate it.

9.9 Correcting Overloading

9.9.1. Indicators/Observations

Incomplete treatment of waste.

Overloading problems can be detected by offensive odours and a yellow-green or grey colour. Lab tests showing low pH, DO, and excessive BOD loading per unit area may also indicate overloading.

9.9.2 Probable Cause

Industrial waste, poor design, new construction (service area expansion), inadequate treatment and weather conditions.

9.9.3 Solutions

Suggested methods of control:

a. bypass the cell and let it rest;
b. use parallel operation;
c. apply recirculation of pond effluent;
d. look for possible short-circuiting; or
e. install supplementary aeration equipment.

9.10 Correcting A Decreasing Trend In pH

9.10.1 Indicators/Observations

The pH controls the environment for algae types, for example, the green chlorella needs a pH from 8.0 to 8.4. The pH should be on the alkaline side, preferably about 8.0 to 8.4.

Both pH and DO will vary through the day with the lowest reading at sunrise and the highest reading in late afternoon. Therefore, measure the pH at the same time each day and plot on a graph.

If the pH decreases, the green algae will die causing a drop in DO.

9.10.2 Probable Cause

A decrease in pH is most often caused by overloading or long periods of adverse weather.

9.10.3 Solutions

Suggested methods of control:

a. bypass the cell and let it rest;

b. use parallel operation;

c. apply recirculation of pond effluent;

d. check for possible short-circuiting; and

e. look for possible toxic or external causes of algae die-off and correct at source.

9.11 Correcting Short-Circuiting

9.11.1 Indicators/Observations

Odour problems, anaerobic conditions, and low DO and pH in some parts of the pond. Differences of 100 percent to 200 percent may indicate short-circuiting.

Check DO and pH at several locations in the pond. Record the readings on a map of the pond. The areas with low pH and DO become evident. These areas are not receiving good circulation.

9.11.2 Probable Cause

Poor wind action due to trees or poor arrangement of inlet and outlet locations. May also be due to shape of pond, weed growth or irregular bottom.

9.11.3 Solutions

Suggested methods of control:

a. Cut trees and growth at least 150 m away from the pond if they are in the direction of the prevailing wind.

b. Install baffling around inlet location to improve distribution.

c. Add recirculation to improve mixing.

d. Provide new inlet-outlet locations, including multiple inlets.

e. Clean out weeds.

f. Fill in irregular bottoms.

9.12.0 Correcting Anaerobic Conditions

9.12.1 Indicators/Observations

Anaerobic conditions are indicated by unpleasant odours, the presence of filamentous bacteria, a yellowish-green or grey colour and a placid surface.

9.12.2 Probable Cause

Overloading, short circuiting, poor operation or toxic influents.

9.12.3 Solutions

Suggested methods of control:

a. Change from a series to a parallel operation to divide load. Helpful if conditions exist at a certain time each year and are not persistent.

b. Add supplemental aeration if pond is continuously overloaded.

c. Add recirculation (temporary-use portable pumps) to provide oxygen and mixing.

d. Eliminate sources of toxic discharges.

9.13 Correcting High BOD in the Effluent

9.13.1 Indicators/Observations

High BOD concentrations that are in violation of regulatory agency permit requirements. Visible dead algae.

9.13.2 Probable Cause

Short detention times, poor inlet and outlet placement, high organic or hydraulic loads and possible toxic compounds.

9.13.3 Solutions

Suggested methods of control:

a. Check collection system for sewage dumping from septic tank pump-out vehicles and eliminate.

b. Use portable pumps to recirculate the water.

c. Add new inlet and outlet locations.

d. Reduce loads due to industrial sources if above design level.

e. Prevent toxic influent.

9.14 Correcting Problems in Aerated Ponds

9.14.1 Indicators/Observations

Fluctuating DO, fine pin floc in final cell effluent, frothing and foaming, ice interfering with operation.

9.14.2 Probable Cause

Shock loading, overaeration, industrial wastes, floating ice.

9.14.3 Solutions

Solutions are as follows:

a. Control aeration system by using time clock to allow operation during high load periods, monitor DO to set up schedule for even operation.

b. Vary operation of aeration system to obtain solids that flocculate or "clump" together in the secondary cell but are not torn apart by execessive aeration.

c. Locate industrial wastes that may cause foaming or frothing and eliminate or pretreat wastes. Examples are slaughter house, milk or some vegetable wastes.

d. Operate units continuously during cold weather to prevent freezing damage. If freezing cannot be prevented, remove completely.

9.15 Correcting Problems In Anaerobic Ponds

9.15.1 Indicators/Observation

Odours
Hydrogen sulphide, (rotten egg) odours or other disagreeable conditions are due to sludge in a septic condition.

Low pH
A pH below 6.5, accompanied by odours, is the result of acid bacteria working in the anaerobic condition.

9.15.2 Probable Cause

A lack of cover (surface sludge blanket) over the surface and an insufficient load to have complete activity will eventually form a scum blanket.

Problems will also develop if acid formers work faster than methane formers in an acid condition.

9.15.3 Solutions

Use straw cast over the surface or polystrene planks as a temporary cover until a good surface sludge blanket has formed.

The pH can be raised by adding a lime slurry of 45 kg (100 lb.) of hydrated lime to 480 kg (200 litres/50 gallons) of water at a dosage rate of .45 kg (1 lb.) of lime for every 45 000 litres (10 000 gallons) in the pond. The slurry should be mixed while being added. The best place to put the lime in is at the entrance to the lagoon so that it is well mixed as it enters the pond.

10.0 REFERENCES

United States Environmental Protection Agency. 1977. Operations Manual, Stabilization Ponds.

Water Pollution Control Federation. 1976. Operation of Wastewater Treatment Plants - Manual of Practice No. 11 Washington, D.C. US.

APPENDIX

Terms Commonly Used in Literature on Waste Stabilization Ponds (Lagoons)

ACRE-FOOT - A volume term referring to that amount of liquid 1 acre in area and 1 ft. deep. (Metric equivalent is 1233.482 m^3).

AERATED POND - A wastewater treatment pond in which mechanical or diffused-air aeration is used to supplement the oxygen supply.

AEROBIC - A condition characterized by the presence of free dissolved oxygen in the aquatic environment.

AEROBIC BACTERIA - Bacteria that require free dissolved oxygen for growth.

AEROBIC STABILIZATION - The stabilization of organic matter by bacteria in the presence of dissolved oxygen.

ALGAE - Primitive one or many-celled plants, usually aquatic, that produce their food by photosynthesis.

ALGICIDE - Any substance or chemical applied to kill or control algal growth.

ANAEROBIC BACTERIA - Bacteria which grow in the absence of free dissolved oxygen and must obtain their oxygen by chemically breaking down organic compounds which contain combined oxygen.

ANAEROBIC DECOMPOSITION - The breakdown of complex organic matter by bacteria in the absence of dissolved oxygen.

AQUATIC VEGETATION - Vegetation that grows in or near water.

BACTERIA - A group of microscopic organisms lacking chlorophyll and using organic nutrients as a food source.

BIOCHEMICAL OXYGEN DEMAND (BOD) - This is a common measurement of the amount of oxygen required to stabilize wastewater.

COLIFORM GROUP - A group of bacteria that inhabit the intestinal tract of man and warm blooded animals and may be found in plants, soil and air, and the aquatic environment.

DISSOLVED OXYGEN (DO) - Dissolved molecular oxygen usually expressed in mg/L, ppm or percent saturation.

DIURNAL - Having a daily cycle.

EFFLUENT - A liquid flowing out of a chamber, treatment unit or basin.

FACULTATIVE BACTERIA - Those bacteria that can adapt to aerobic or anaerobic conditions. They can utilize dissolved or combined oxygen (oxygen bound in a compound by a chemical action).

FUNGI - Simple or complex organisms without chlorophyll. The simpler forms are one-celled; higher forms have branched filaments and complicated life cycles. Examples are molds, yeasts and mushrooms.

GRAB SAMPLE - A single sample not necessarily taken at a set time or flow.

HYDRAULIC LOADING - The volume of flow per day per unit area.

INFLUENT - That liquid entering a process unit or operation.

INORGANIC MATTER - Chemical substances of mineral origin.

MILLI - An expression used to indicate 1/1000 of a standard unit of weight, length or capacity (metric system).

millilitre (ml) - 1/1000 litre (L)
milligram (mg) - 1/1000 gram (g)
millimetre (mm) - 1/1000 metre (m)

MILLIGRAMS PER LITRE (mg/L) - A unit of concentration on weight/volume basis. Equivalent to ppm when speaking of water or wastewater.

ORGANIC LOADING - The number of pounds of BOD added to treatment unit per day.

OXYGEN AVAILABLE - That part of the oxygen available for aerobic stabilization of organic matter. Includes dissolved oxygen and that available in nitrites or nitrates, peroxides, ozone and certain other forms of oxygen.

OXYGEN DEPLETION - The loss of dissolved oxygen from water or wastewater due to biological, chemical or physical action.

pH - Expresses the intensity of acidity or alkalinity of a liquid.

PHOTOSYNTHESIS - A process in which chlorophyll-containing plants produce living material from carbon dioxide, water and inorganic salts, with sunlight as the catalyst. Oxygen is produced in this process.

POPULATION EQUIVALENT - The calculated population which would normally contribute the same amount of biochemical oxygen demand as the wastewater. A common base is 0.09 kg, of 5-day BOD per capita per day.

SETTLEABLE SOLIDS - Those solids which will settle out when a sample of sewage is allowed to stand quietly for one hour.

SHORT-CIRCUITING - The hydraulic conditions in a tank, chamber or basin where the flow is quicker than normal.

SLUDGE BANKS - The accumulation of solids including silt, mineral, organic and cell mass material that is produced in an aquatic system.

STABILIZATION - The process of reducing a material, using biological and/or chemical means, to a form that does not readily decompose.

STANDARD METHODS - Methods of analysis prescribed by joint action of the American Public Health Association (APHA), American Water Works Association (AWWA) and Water Pollution Control Federation (WPCF).

SUPERSATURATION - The situation in which water holds more oxygen at a specified temperature than normally required for saturation.

SUSPENDED SOLIDS (SS) - The concentration of insoluble materials suspended or dispersed in waste or used water. Generally expressed in mg/L on a dry weight basis. Usually determined by filtration methods.

TOTAL SOLIDS - Refers to the solids contained in dissolved and suspended form in water. Determined on weighing after drying at 103°C.

VOLATILE SOLIDS - The quantity of solids in water that represent a loss in weight upon ignition at 550°C.