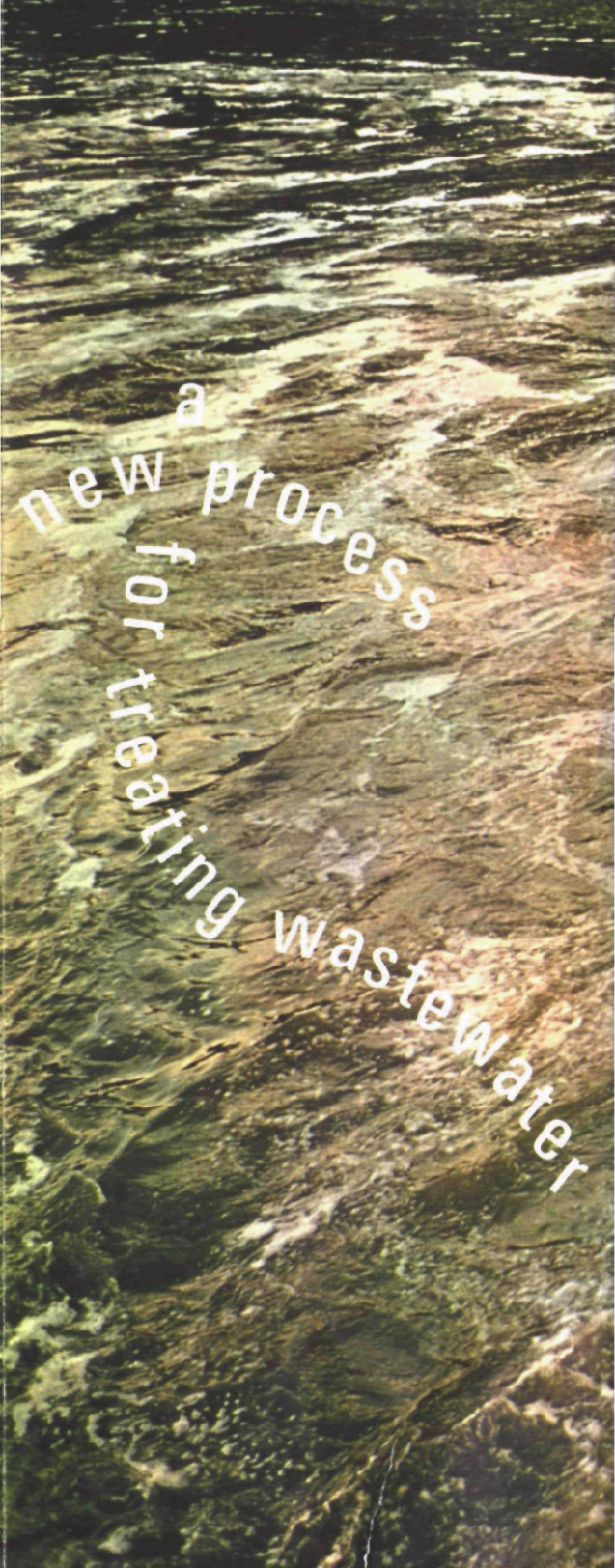

a
new process
for treating wastewater

WHAT IS OXYGEN AERATION?

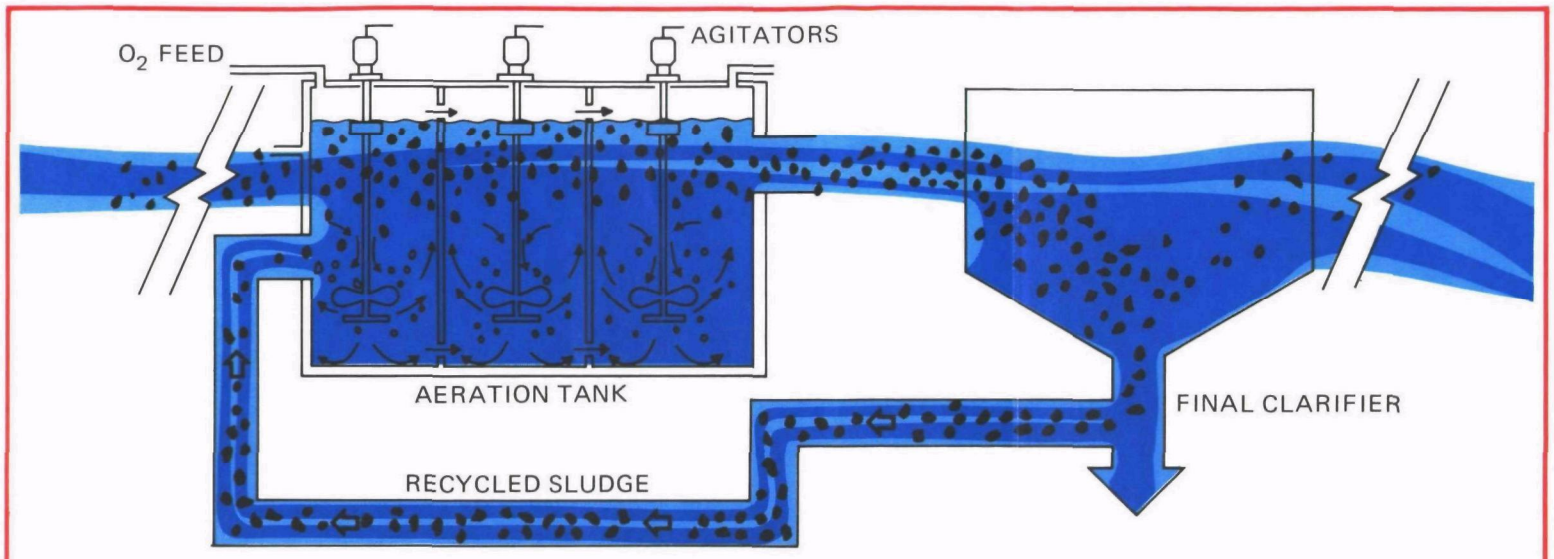
One common, or conventional, method of treating wastewater is the activated sludge process. This process—as all biological treatment processes—functions by contacting wastewater with bacteria able to break down organic material and thereby reduce the amount of pollutants in the wastewater. The bacteria utilized in the activated sludge process to perform this operation are contained in the material settled out of a wastewater stream after oxygen is introduced into the system. This mass of settled solids, called activated sludge, is then mixed with the wastewater being treated. Introduction of oxygen into the system, and mixing of the activated sludge with the wastewater both occur in the same tank, as can be seen from the accompanying schematic diagram.

Historically, this required oxygen has been provided by the introduction of atmospheric air into the treatment system. Oxygen gas, however, possesses certain characteristics which can make its use, in lieu of atmospheric air, advantageous. One of these is the high partial pressure of pure oxygen. Since air contains only about 21 percent oxygen, the use of pure oxygen instead of air in that portion of the treatment system needing oxygen increases the oxygenation capacity by a factor of nearly five. As a result, smaller aeration tanks can be used to treat the same amount of wastewater. This utilization of pure oxygen rather than atmospheric air to provide the oxygen required in treating sewage is oxygen aeration.

WHAT ARE THE APPLICATIONS OF OXYGEN AERATION?

Oxygen aeration can be used for the construction of new facilities and for upgrading the capacity and performance of existing overloaded secondary treatment facilities. Several applications include:

1. Upgrading of existing overloaded activated sludge plants by conversion from air aeration to oxygen aeration.
2. Upgrading of existing trickling filter plants by adding oxygen aeration as a second stage biological step in the treatment system.
3. New plant construction, both with and without primary sedimentation.



SCHEMATIC DIAGRAM OF MULTI-STAGE OXYGENATION SYSTEM

WHAT ARE THE ADVANTAGES OF OXYGEN AERATION?

Potential benefits, depending on the specific installation and application, include:

1. Improved reliability of treatment performance
2. Reduced waste sludge production
3. Increased plant organic loading capacity
4. Improved resistance to toxic substances
5. More effective odor control
6. Reduced power requirements
7. Higher dissolved oxygen content in the treated effluent

Generally speaking, there is also an economic advantage over conventional aeration methods for plants with capacities greater than 5 million gallons a day. In the smaller capacity plants, the major advantages involve greater acceptance of unusually strong loads and greater treatment process reliability.

WHAT'S INVOLVED?

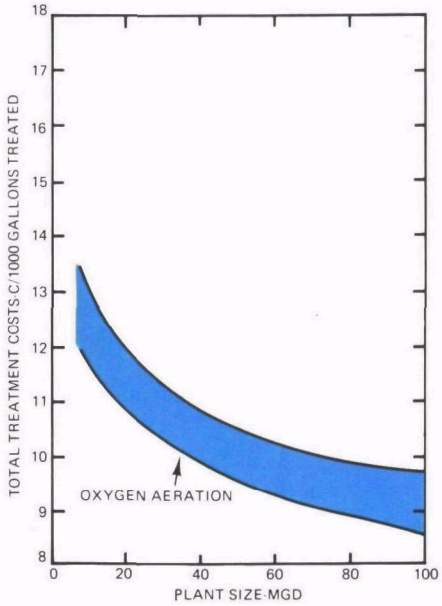
This schematic diagram depicts the equipment involved and operation of a typical multi-stage oxygenation system. Basic differences between this system and a conventional air aeration system are the tank covers and compressor units.

High purity oxygen (90-100%) enters the first stage of the system and flows concurrently with the wastewater being treated through the oxygenation basin. Pressure under the tank covers is essentially atmospheric and sufficient to maintain control and prevent back mixing from stage to stage. This allows for efficient oxygen utilization at low power requirements. Mixing within each stage can be accomplished either with surface aerators or with a submerged rotating sparge system (shown).

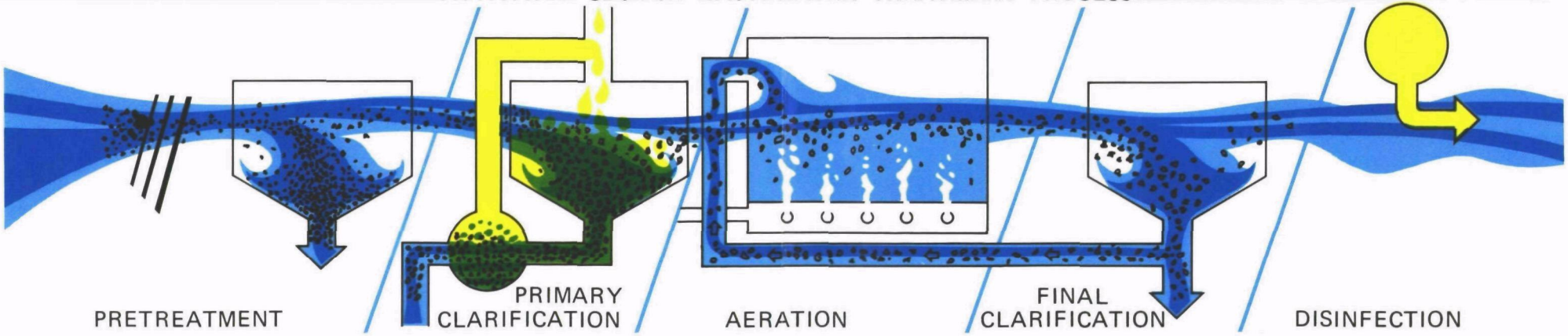
The selection of the number of stages and the type of mixing device are variables that depend on waste characteristics, plant size, land availability, treatment requirements and other similar considerations.

HOW MUCH DOES IT COST?

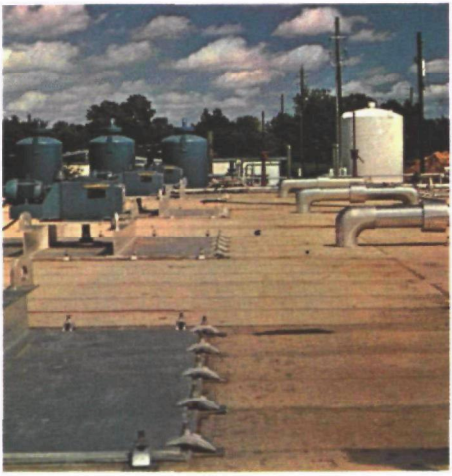
The chart below depicts representative total treatment cost ranges for oxygen aeration activated sludge plants. The costs shown are for construction of new treatment facilities and include operation, maintenance and capital amortization (5½%-25 years) costs for primary treatment, secondary treatment, and sludge handling and disposal facilities.



ACTIVATED SLUDGE WASTEWATER TREATMENT PROCESS



A new wastewater treatment process has been developed which utilizes oxygen-enriched air or pure oxygen. This process is termed oxygen aeration or, more simply, oxygenation. The potential of oxygen aeration has resulted in an extremely rapid acceptance by consulting engineers, municipalities, and industries. The first full-scale application of the oxygen aeration process to the treatment of municipal wastewater occurred in 1969 under a demonstration contract from the U.S. Environmental Protection Agency's forerunner, the Federal Water Pollution Control Administration. In this demonstration project, a total of 1.25 million gallons per day of sewage was treated. Today, just three years later, over 35 full-scale municipal wastewater treatment plants which will utilize the oxygen aeration process are in various stages of design and construction. The total amount of sewage to be treated by these plants exceeds 1.5 billion gallons a day.



WHO IS USING OXYGEN AERATION?

Below is a partial listing of full-scale municipal wastewater treatment plants currently using or planning to use oxygen aeration.

Location	Size (Million Gallons/Day)
Detroit, Michigan	300
Middlesex County, N.J.	120
East Bay MUD, Calif.	120
Louisville, Ky.	105
Miami, Fla.	55
Hollywood, Fla.	36
Danville, Va.	24
Euclid, Ohio	22
Newtown Creek, N.Y.C.	20
Decatur, Ill.	18
Fayetteville, N.C.	16
Salem, Oregon	16
New Rochelle, N.Y.	14
Fairfax County, Va.	12
Jacksonville, Fla.	10
Speedway, Ind.	10
Morganton, N.C.	8
Deer Park, Texas	6
Baltimore, Md.	5

WHERE CAN I GET MORE INFORMATION?

Contact your consulting engineering firm or write to:

Technology Transfer
Environmental Protection Agency
Washington, D.C. 20460

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