

# **of Wastewater Treatment Facilities**

OCTOBER 1977



**Office of Water Program Operations  
Municipal Operations Branch  
U.S. Environmental Protection Agency  
Washington, D.C. 20460**

SECRET AGENCY

## INTRODUCTION

The Operations and Maintenance documents described on the following pages were prepared under sponsorship of the Environmental Protection Agency's Municipal Operations Branch, Office of Water Program Operations. The information was developed with the cooperation of EPA Regional technical staff, and State, and local governmental personnel.

Copies of the publications may be obtained, for a minimum fee, through the U. S. Government Printing Office, Washington, D.C. or the National Technical Information Service, at Springfield, Virginia. Order forms are included for each of these sources.

Questions relating to the availability of these documents should be directed to the appropriate EPA Regional offices. A listing of mailing addresses for each office is included as an appendix. Inquires may also be submitted to the Municipal Operations and Training Division, (WH-596), United States Environmental Protection Agency, 401 "M" Street, Southwest, Washington, D.C. 20460.

"ASPECTS OF STATE-WIDE EMERGENCY RESPONSE PROGRAMS  
FOR MUNICIPAL WASTEWATER TREATMENT FACILITIES"

This document provides information to assist in the development of State emergency programs in responding to spills of raw or inadequately treated municipal wastewater. It emphasizes the legal aspects of spill reporting, the definition of a reportable spill and State-wide aspects of emergency response planning.

Preliminary steps in this work included a review of existing and proposed Federal statutes and current State water pollution control laws and regulations. Over 55 State and interstate agencies were asked to provide information on existing or future water pollution contingency plans. Over 200 wastewater treatment facilities were asked to provide information on emergency actions.

Each State response plan must be, of course, modified to the individual situation.

"A PLANNED MAINTENANCE MANAGEMENT SYSTEM  
FOR MUNICIPAL WASTEWATER TREATMENT PLANTS"

This information was developed and successfully demonstrated as a Planned Maintenance Management System (PMMS) at the 18-mgd Lower Potomac Wastewater Treatment Plant of Fairfax County, Virginia. It outlines a model maintenance management program for wastewater treatment plants throughout the United States. It provides for the specific maintenance needs of each item of plant equipment and reduces the maintenance of complex equipment to simple procedures. For each procedure the system details the methods, materials, tools, and personnel required; schedules the task; and provides for data recording and feedback.

During the 12-month demonstration, the system caused a steady downward trend in the frequency of malfunctions in various mechanical equipment. In many cases the detection of danger signs led to corrective action which prevented breakdowns.

This report describes the system in technical detail; thoroughly describes the installation of the system, including acceptance by the mechanics and coordination with plant operations; and outlines an application of the system to other wastewater treatment facilities.

"PROCESS CONTROL MANUAL FOR  
AEROBIC BIOLOGICAL WASTEWATER  
TREATMENT FACILITIES"

This document will provide an on-the-job reference for operators of activated sludge and trickling filter wastewater treatment plants. It will also assist operators in establishing process control techniques and optimizing the performance of these two aerobic biological treatment systems.

major divisions, includes: The  
Trickling Filter Process and Appendices.  
The following sections: Troubleshooting;  
Laboratory Control. These sections  
on operating and controlling aerobic biological  
sections are presented in sufficient  
detail to be used independently.

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## OPERATIONS MANUAL

### "ANAEROBIC SLUDGE DIGESTION"

Comments were solicited from treatment plant operators throughout the country on the operation, control and trouble-shooting of anaerobic sludge digesters and included in this document. Major contributions are also included from scientists and engineers.

Case histories of operational experiences and problem-solving form a section of the publication which will be useful to plant operators, designers and engineers who are interested in digester operation and theory.

The subject of anaerobic digester operation in municipal wastewater treatment plants is presented by covering the area of troubleshooting, general operation, safety, start-up of units, basic theory, sampling and laboratory testing, and other subjects relevant to day-to-day operations. The manual is intended for plant operators who have anaerobic digesters as part of their total treatment process. The document is structured so that each section is complete within itself and indexed for quick reference.

"CONSIDERATIONS FOR PREPARATION  
OF  
OPERATION AND MAINTENANCE MANUALS"

This document provides considerations for the preparation of complete and adequate municipal wastewater treatment plant operation and maintenance (O&M) manuals. Proper utilization of these guidelines will assist the user in complying with the eligibility requirements of EPA's Construction Grant Program.

Some of the information included was extracted from the appendix of the "Federal Guidelines for Design, Operation and Maintenance of Wastewater Treatment Facilities", (1970). Material gathered from individuals experienced in the preparation of plant O&M manuals and data compiled from existing O&M manuals are also included in this work.

The document contains separate sections on each major topic recommended for inclusion in an O&M manual, as well as detailed discussions on the type of information which should be included. A suggested manual outline is presented for treatment plants; another for pumping stations and pipelines. The guidelines are not intended to present a rigid format; each manual must be suited to the case at hand.



"EMERGENCY PLANNING FOR  
MUNICIPAL WASTEWATER TREATMENT FACILITIES"

This manual is designed to assist those responsible for developing comprehensive emergency operating procedures and systems for wastewater treatment facilities. It is a supporting document for treatment plant staffs to use in explaining to local governing bodies the need for additional funds to remedy malfunctioning units at their plants. The document is also useful for municipal department heads and staff for use in developing plans suited to the peculiarities of their plants. It is useful for regulatory agencies in evaluating the emergency operation program sections of O&M manuals. Consulting engineers may use it as a guide for writing the emergency operating portion of an O&M manual for any municipal treatment system.

The document was also prepared to provide guidance to ensure each plant's discharge of pollutants does not exceed the effluent limitations written into the facility's discharge permit.

"ESTIMATING LABORATORY  
NEEDS FOR MUNICIPAL WASTE-  
WATER TREATMENT  
FACILITIES"

Because treatment processes and combinations of processes vary widely, laboratory needs must be specifically tailored to each installation. This manual provides data to make possible the rough estimation of laboratory needs for municipal wastewater treatment plants. Criteria for physical facilities, staffing, and laboratory services are included. Considerations for sampling and testing needs are presented for individual processes, and include the minimum and the best testing requirements. The testing programs are designed to meet the needs of each process.

Guidelines for equipment and supplies are divided into six categories: Major Equipment; Miscellaneous Equipment; Expendable Supplies; Glass and Plasticware; Test Kits; and Chemicals. The guidelines for Major Equipment and Chemicals are based on testing requirements, while the others are usually general and indicate items needed at any laboratory.

Estimates for staffing needs are given as the annual base man-hours for laboratories serving the several types of treatment facilities, and include methods for adjusting the number of man-hours for local conditions. The manual describes two ways of optimizing laboratory services: regional laboratories serving several facilities, and local laboratories serving both water and wastewater facilities.

"ESTIMATING STAFFING FOR  
MUNICIPAL WASTEWATER TREATMENT FACILITIES"

This manual, intended for use by consulting engineers, plant management personnel, State regulatory agencies and EPA, describes a four-step method for preparing staffing estimates for sewage treatment plants. It covers plants with capacities of from 0.5 to 25 million gallons per day (mgd) of sewage, using primary, secondary and advanced treatment processes. The four-steps are to:

1. Develop from a Table of Adjustment for Local Conditions, factors for increasing or decreasing staffing needs relative to those for an "average" plant.

2. Develop the staffing for such an "average" plant from a number of curves that show annual manhour needs for:

a. Supervisory, clerical, laboratory and yard work on the basis of plant design capacity.

b. Operation and maintenance work on the basis of both plant design capacity and types of process units or steps.

In addition, develop from a table the operation and maintenance manhour needs for certain types of non-continuous processes on the basis of the time that the equipment for these processes is in operation.

3. Increase or decrease the annual manhour staffing for these six types of work by using the factors taken from the Table of Adjustment for Local Conditions.

4. Break down this staffing by type of work into specific jobs.

Staffing estimates prepared according to this manual should not be used as rigid requirements. The final decision on the staff required for a particular plant should be made by a person experienced with similar plants in a like area. Ultimately, a plant staffing requirement must be a matter of judgment.

"MAINTENANCE MANAGEMENT  
SYSTEMS FOR MUNICIPAL WASTE-  
WATER FACILITIES"

The basic information furnished in this document was gathered from individuals experienced in maintenance management systems at various-sized facilities. Existing systems were reviewed at different municipalities, the private sector and defense establishments.

The manual includes recommendations covering each of the basic elements required to develop an effective maintenance management system. These recommendations may be tailored to specific equipment and plant types. The procedures are comprehensive and will aid the development of effective systems.

## OPERATIONS MANUAL

### "PACKAGE TREATMENT PLANTS"

Package treatment plants were originally designed to serve areas that could not be easily connected to an existing sewage treatment plant. Such areas include the subdivisions that began springing up in the fifties and commercial establishments such as restaurants, motels and parks. More recently, package plants have increased to a size that can serve small municipalities. Many were sold with the idea that plants would operate themselves and, therefore, could be turned on and forgotten. However, to meet today's more demanding pollution discharge regulations, these plants require daily attention by a knowledgeable and conscientious operator. In addition, the new operator needs time to familiarize himself with the plant. This manual is designed to give the operator an increased knowledge of the basics and aid in effective operation of a package treatment plant.

The manual is also directed to the plant owner and the design engineer. The owner is either the actual purchaser of the plant if privately owned, or the individual or group responsible for making policy decisions concerning the treatment plant; such as a city council. The owner is responsible for adding to the treatment plant when needed, controlling sewer construction practices in the service area, keeping supplies at the plant and supervising the operator. Most importantly, the owner is ultimately, legally and administratively responsible for the performance of the treatment plant. The manual contains detailed descriptions of the duties and responsibilities of the owner.

For the engineer, the purposes of this manual are two-fold. It provides additional information that can be used wholly or in part with an O&M manual written for a specific plant. In addition, it can aid the consulting engineer in the selection of a plant by pointing out design problems found in some package plants.

## "STABILIZATION PONDS--OPERATIONS MANUAL"

Stabilization ponds were first used for wastewater treatment in the midwest for remote communities. They have since been used extensively in various parts of the country. In addition to domestic uses, ponds are now treating various types of industrial wastes--including vegetable, oil refineries, slaughter houses, dairies, and rendering plants.

This manual is intended to serve several functions:

- A. Supplement the specific operation and maintenance manual prepared for municipal ponds.
- B. Provide basic information on pond theory and features the entry-level operator should know.
- C. Provide tips on operation and maintenance for experienced operators based on information from various parts of the nation.
- D. Outline troubleshooting tips for handling various problems common to ponds.

The manual is divided into six major divisions:

- I. The Basics
- II. Control Information
- III. Operation and Maintenance for Ponds
- IV. Troubleshooting for Ponds
- V. Safety
- VI. Appendices

## "START-UP OF MUNICIPAL WASTEWATER TREATMENT FACILITIES"

The manual is a guide for establishing the initial guidelines for the operation of a new municipal wastewater treatment plant, a new addition to an existing plant or a change in the mode of a plants's operation.

Information is provided on preparing for actual treatment plant start-up, including: staffing, developing standard operating procedures; establishing procedures when construction is continued during start-up; dry and wetrun testing of equipment; on-site operator training; and safety training.

Start-up procedures are described for some of the more common pretreatment and primary treatment units. Methods are also provided for specific secondary treatment processes of activated sludge, trickling filters, stabilization ponds and aerated lagoons, as well as sludge handling units and the anaerobic digestion process.

"PROCEDURES FOR EVALUATING  
THE PERFORMANCE OF  
WASTEWATER TREATMENT PLANTS"

This manual establishes a procedure for the evaluation of the performance of wastewater treatment plants. It furnishes the information necessary to identify and classify various types of treatment plants. Details of the processes commonly utilized are included, and the identity and description of ordinary problems are provided. Information is also provided as to the type of laboratory tests which should be performed, along with other evaluation techniques. Corrective measures are listed in order of their effectiveness.



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Municipal Wastewater Treatment Facilities," (055-001-01077-0)  
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\_\_\_\_\_ copies of "A Planned Maintenance Management System for  
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_____	copies of "Considerations for Preparation of Operation & Maintenance Manuals," (PB227096/AS)	7.50	2.25	\$_____
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