

GUIDELINES FOR THE PREPARATION OF WASTEWATER TREATMENT FACILITY OPERATION AND MAINTENANCE (O & M) MANUALS

I. INTRODUCTION

The operation and maintenance (O & M) manual is a very valuable tool in the operation and maintenance of every wastewater treatment facility. The operation and maintenance manual serves three main functions; first, as a text to be used during start-up training by the consultant; second, to provide technical information about the plant and its equipment and controls, and provide plant staff with guidance regarding the operation of equipment and systems including startup, shutdown, and normal/alternative operations; and third, to provide assistance to the operating staff in continuing standard operating procedures after startup.

Past studies have shown O & M manuals often to be inadequate for operating personnel, a common problem being practicality and inadequacy for use by operating personnel. If these manuals are to benefit treatment facility operation, they must be written for use as a practical tool by the treatment plant operators. Remember, the O & M manual should contain useful information pertinent to the day-to-day operation of the treatment facilities.

II. O & M MANUAL DEFINITIONS

The O & M manual is referred to as either the O & M Manual or the Amended O & M Manual.

O & M MANUAL - No more than 90 percent (90%) of the SRF loan may be paid unless the loan recipient has submitted a complete O & M Manual and the manual has been reviewed by Construction Grants and Loans (CGL). The manual will be reviewed for content and completeness and if found to be satisfactory will be approved. The manual must be complete enough to be used as a textbook for the operators during start-up training. If the O & M Manual is approved at this point include a statement in the approval letter suggesting the incorporation of plant specific information learned during the first year of operations.

AMENDED O & M MANUAL - The amended O & M manual must be submitted at least 30 days prior to the completion of performance certification (eleven months after initiation of operation). The amended manual is an updated manual that includes revisions based on experience gained from actual operation of the plant plus other issues brought up in the comment letter (re: CGL's O&M review). Only the revisions need be submitted (not the entire manual). A suggestion would be to submit revisions on colored pages different from the final manual. The amended manual must be prepared by a cooperative effort between the consultant and the treatment facility operating staff. It is suggested that the amended material be reviewed by the Chief Operator or Plant Superintendent and that the signature of this person be affixed on the first page of the manual.

III. O & M MANUAL CONTENT

These guidelines present a suggested format for O & M manual preparation. Consultants are encouraged to improve upon these guidelines to accommodate unique treatment plant requirements. It is not the intent of these guidelines to restrict or stifle initiative. Formats which differ from these guidelines will be accepted, however, the entire content as presented in these guidelines must still be provided. The O & M manual should not be written in this format just to satisfy C G & L's review. The overlying reason for writing the O & M manual must be to provide O & M instructions to the plant operator(s).

It is suggested that the O & M manual be bound in a 3-ring binder along with tabs for each section (and in some cases each subsection) to facilitate access and/or revisions at a later date. Operator input is required in the development of the revised O & M manual as this will make the manual more useable to the operator and easier to upgrade. For example, the operators may have certain procedures, records, lab forms, etc. that they prefer which should then be incorporated in the final manual. Many parts of the O & M manual may, in fact, be prepared by the operations staff. For example, when the operators implement their maintenance programs as per the O & M manual instructions, they would be in a good position to also develop the table summarizing the maintenance schedule of all equipment for the revised final manual.

The manual should be complete enough to be used as a textbook for start-up training and plant start-up including suggested operational criteria to be used as a guideline in attaining optimum treatment efficiency. The manual should include design operating parameters such as unit efficiencies, operating criteria, suggested

design or process control test ranges, etc. The operational areas should be a series of simplified instructions for plant personnel to follow. The amended manual should include recommended operational values and modes of operation based on actual plant operation and data obtained during the one-year start-up and performance certification period.

Format recommendation is as follows:

CHAPTER I: INTRODUCTION

General description of manual purpose, organization, and use.

Tabular design summary of each unit and the overall treatment facility including plant and unit influent/effluent design data, number of units, size(s), average design loading and peak design loading, design performance data (average and peak efficiencies), etc. (state location in O & M manual).

Include a copy of the current NPDES permit (state location in O&M manual), or draft permit and copy of application for final permit and any appeals of draft permit limits. For non-dischargers (e.g. - spray irrigation, groundwater recharge, collect and transport, etc.), a copy of the State Operating Permit is required. Also list any other regulatory permits associated with the plant such as air pollution stack discharge permits for sludge incinerators or land application site permits for sludge disposal.

CHAPTER II: OPERATION AND CONTROL OF WASTEWATER TREATMENT

It is not the intent of this manual to discuss detailed theory. Rather than this, other pertinent reference manuals should be purchased and referenced. Suggested manuals include those published by the Water Environment Federation (WEF) on design and operation. This chapter should be a discussion of the operation of the treatment plant and its integrated control. Information which should be part of this chapter includes:

- a. **Operation** - including start-up, normal operation (design condition), alternate modes of operation, seasonal operation, bypass operation, shutdown and draining procedures. Normal operation discussion should include initial operation parameters and a systematic approach to attaining these parameters with a detailed step-by-step procedure for making adjustments and receiving feedback through the use of control tests and physical measurements. Operator application of concepts and testing for the purpose of process control must be emphasized. Potential problems and how to avoid them should be a part of the process control discussion. This section should

also include valve positions (fully open, partially open, fully closed) for each mode of operation, when to use the unit or alternative mode(s) of operation, flow rates, sludge concentrations, expected results or efficiencies, operation during industrial shock loads, I/I, etc.

- b. **Controls** - such as flow controls (flow to the unit, recirculation, air, or sludge), electrical controls and manual controls, alarms, etc.
- c. **Unit or related equipment diagram(s) or schematic(s) including valve location(s).**

CHAPTER III: OPERATION AND CONTROL OF SLUDGE HANDLING

This chapter should be a discussion of how sludge handling and disposal is integrated into the overall treatment and disposal scheme. Information which should be part of this chapter includes:

- a. Operation including start-up, normal operation (design condition, alternate modes of operation, bypass operation, draining procedures. Each discussion should include valve positions, flow rates, sludge concentrations, expected results or efficiencies, use of laboratory tests for control, etc.
- b. Controls such as flow controls (flow to unit, sludge flows, air rates, etc.), electrical controls and manual controls.
- c. Unit diagram including valve locations.
- d. Potential operational problems and methods of avoiding them.

In addition, the sludge handling chapter must contain a copy of the present sludge management plan and adequate information to instruct the operator how to update a sludge management plan. Items which must be addressed in the O & M manual include:

How to obtain a letter of approval for newly proposed landspreading sites.

The Tennessee requirements and limitations when landspreading sludge (i.e., slopes, separation distances, ponding potential, etc.)

Compliance with EPA regulations per 40 CFR 503 (include a copy of the 40 CFR 503 regulations in an appendix; obtainable from the Division of Water Pollution Control).

CHAPTER IV: PERSONNEL

Outline manpower requirements and recommended qualifications of each position such as training, experience, skills and license requirements. The amended manual should include any recommended staffing changes, training needs, etc. based on the first year of actual operation.

Discuss pertinent aspects of operator certification as they apply to this facility, including both wastewater and waste disposal (land application of sludge) certification requirements.

CHAPTER V: PROCESS CONTROL AND LABORATORY TESTING

In the past, O & M manuals have been quite inadequate in the area of applying laboratory testing to process control. One suggested method of presenting this information is to review sampling points, sample preservation, and laboratory quality control and discuss the laboratory results as they apply to the overall operation of the treatment process.

Discuss specific testing requirements (control testing NPDES requirements, etc.).

Discuss proper sampling procedures.

Give instruction for conducting tests or taking physical measurements including interpretation of test results or measurements (i.e. expected range, what high or low values may indicate, etc.) for each application of the test and how the operator should apply the test results to process control. When discussing test procedures, do not reprint "Standard Methods" but reference when applicable. Give instructions in the O & M manual for only those tests not found in "Standard Methods" or other approved manuals. Outline quality control program for NPDES and control tests conducted on-site. (Criteria for a quality control program is available from EPA CERL Publications).

Sample laboratory worksheets (filled in).

CHAPTER VI: RECORDS

Discuss and provide copies of the records used for daily operations, equipment, costs, personnel, laboratory, etc. that will be of use to the operations staff.

Discuss and provide examples of the sludge disposal periodic report form.

CHAPTER VII: MAINTENANCE

The general discussion should be complete in the manual including the instructions on developing and operating a suggested maintenance program. Using this chapter, the operating staff should be able to implement and utilize a maintenance program including a system to schedule, conduct and record all maintenance. Through start-up services, the maintenance program outlined in the O & M manual is implemented by the operations staff with assistance from the consultant. The amended manual should include a table developed during start-up summarizing the maintenance schedule of all equipment on a weekly, monthly, etc., basis.

Discuss basic features of maintenance program and management system to include:

- a. maintenance (or work order) procedures;
- b. equipment maintenance record system (including equipment and spare parts inventory) with instructions in starting and carrying out such a record system;
- c. scheduling of maintenance activities and maintaining appropriate records;
- d. method of developing maintenance cost and budgeting system; and
- e. summary of maintenance schedule of all equipment on a weekly, monthly, etc. basis including the type of lubricant, (to be in the amended manual).

CHAPTER VIII: SAFETY

General safety discussion including hazards of sewers, mechanical equipment, explosion, bacterial infections, chlorine, oxygen deficiencies, laboratory, electrical, etc.: A copy of the Chlorine Safety Manual from the Chlorine Institute should be included in an appendix or its location at the plant site included in this chapter. Other emergency situations such as fires, flooding, earthquakes, etc. should also be considered for discussion.

General discussion and use of safety equipment including recommended training and re-training schedules.

Safety relating to the specific areas and equipment in the treatment facility.

Discussion and copy of confined space regulation(s) [29 CFR 1910.146, effective 15 April 1993], including a table of permit-required and non-permit-required confined spaces in the plant and collection system.

CHAPTER IX: APPENDICES

The appendices should be listed in the Table of Contents and tabbed for easy referencing and include the following information:

- a. Schematics
- b. Valve indices/schedule
- c. Equipment list/schedule (including HVAC)
- d. Utilities: rates, capacities of supply lines, etc.
- e. Sample forms
- f. NPDES permit
- g. List of manufacturers manuals: The manuals need not be included in the O & M manual, but a list must be provided referencing their location in another manual or filing system.
- h. Copy of completed state reporting forms (Discharge Monitoring Report and Monthly Operating Report) and instruction booklets (or their location(s) at the plant site).
- i. Copy of sludge regulations - 40 CFR 503, disposal site approval form, sewage sludge disposal periodic report form.
- j. Copy of confined space regulations - 29 CFR 1910.146.
- k. List the location of and appropriate contents of the reference library. It should include a copy of the Chlorine Institute's Chlorine Safety Manual, the latest edition of Standard Methods for the Analysis of Water and Wastewater, and EPA Laboratory Certification and Quality Control Procedures.

IV. SUBMITTING AN O & M MANUAL

One copy of the O & M manual must be submitted to CGL for review. Only amended pages need be submitted in answer to comments or for subsequent reviews of manuals submitted during the same project. The reviewer will need to find the proper spot to insert the revised or amended pages in order to complete the O & M. The manual may be returned to the SRF Loan Recipient by mail or in person at the one year certification inspection.