

State of Oregon

Department of Environmental Quality Guidelines

Guidelines for Writing Sewage Treatment Plant O&M Manuals

GENERAL

An operations and maintenance manual should aid understanding in situations where time may be critical. For example:

1. To present information in the most accessible manner possible, include less narrative and more drawings, schematics, tables, schedules, and checklists. An operator looking for a specific piece of information should not have to read an essay to find it.
2. Avoid boilerplate language in favor of information that is specific to the treatment plant. A manual should be complete and thorough, but not too bulky. All of the manufacturers' literature should be bound separately.

FORMAT

Use labelled tabs to separate various sections of the manual, and bind it in a 3-ring binder to accommodate future revisions. Provide both cover and spine labels.

CONTENTS

1. **Table of Contents.** This should correspond to the tabs, in case the tabs get torn out, and to save time in reference.
2. **Introduction and Use of Manual.** Provide a narrative on the background and history on the facility. The level of description in DEQ's approval letter for the project is a minimum. The engineer should be able to do better.
3. **General Description.** Include plan-view diagrams of the plant and outfall, along with influent sewer manholes, pump stations, force mains, and any piped diversions, overflow dams, or bypass weirs. Show locations of power drops, main breakers, gas meters, backflow preventers, fuel tanks, chemical storage, and other such auxiliary equipment as may concern firemen responding to an alarm. Include complete design data here in tabular form. The design data may normally be photo-copied directly from the approved plans, which should include a complete listing as a reference.
4. **Diagrams.** Include a sufficient number of instrumentation diagrams to illustrate all electrical controls and circuits, and also all mechanical controls. The diagrams should illustrate the control, operation, and relationship of the various unit processes. Include a hydraulic profile of the plant, from influent pumps to the end of the outfall. Do not omit auxiliary devices such as meters, seal water, compressors, and so on. Manufacturer's standard diagrams are seldom sufficient. The engineer will normally have to develop various customized operational drawings for each unit process and equipment item. Complex piping arrangements will require an isometric. Valves, equipment, switches, gates, and controls should be numbered or tagged to further clarify all instructions.

5. Operation and Control of Unit Processes. Describe each unit process and equipment item in detail. Provide instructions for startup, shutdown, operation under various conditions, and control. Provide a troubleshooting guide for each electrical and mechanical feature of the plant. Often manufacturers have developed general guides, which can be adapted to a particular process. This section should also include pump curves showing actual impeller trim and motor HP installed. Provide a tabulation of all control and alarm setpoints and elevations. Normally this can be copied from schedules in the plans or specifications.

Either this section or an appendix should also include forms for recording startup conditions. Forms may be developed by the engineer or adapted from the manufacturer's standard forms. The shutoff head, discharge head, and suction head of pumping equipment should be measured and recorded to create a basis for maintenance and also to estimate the actual pumping rate. A copy of the engineer's theoretical system-head design curve should be included in this section, with actual measured operating points entered at the time of start-up.

Initial vibration levels should also be measured, diagrammed, and recorded for all major items of rotary equipment such as blowers, pumps, and mixers. Power draws for each one at startup should be measured and recorded, including normal and shutoff, for future reference.

6. Operation and Control of Other Mechanical Systems. Such systems may include alarms, telemetry, emergency power and fuel transfer systems, landscaping irrigation, chemical feeders, HVAC, seal water, level controls, flowmeters, samplers, and so on. Provide information on how these systems work, and their operation and maintenance requirements. Supplement with appropriate diagrams as necessary. Any of these may be sufficiently complex to warrant a separate section in the manual.

7. Utilities. Include or reference a plan that shows how the plant is served with water, gas, electricity, phone, etc. The map should show the location of isolation valves, access points and other pertinent features. Describe the standby power system in detail. Provide explicit procedures to be followed on loss of utility power and conversion to standby power, and vice-versa. Develop a complete list of all non-maintained contacts that will have to be manually re-set on each occurrence. Describe the phasing of any start-ups controlled by time-delay relays. Provide instructions on which equipment to re-set and start up first. Tabulate whether various equipment items may be considered non-critical, describe which start-ups must be staggered, and provide instructions accordingly.

8. Safety Requirements. The manual should make reference to hazards and safe practices throughout. There should also be a separate section in the manual on safety. As a minimum, the safety section should include information on specific hazards with electrical switchgear and confined spaces at the plant, and should refer to the safety training program and standard safety procedures handbook followed by the operating utility.

9. Emergencies. This is a separate section listing emergency phone numbers, including the DEQ Regional Office to be called to report any sewage overflow or other problem. Describe or reference procedures for chlorine leaks and neighborhood evacuation, fires, power and phone outages, and so on.

10. Maintenance of Equipment Provide schedules that list periodic maintenance requirements for the various pieces of equipment. Include record-keeping forms as necessary. List all equipment suppliers and service reps telephones. The engineer must normally extract these items from the manufacturer's O&M information provided with each item of equipment. Plant

maintenance staff should particularly review any engineer's draft of this section before it is finalized.

11. Storeroom and Spare Parts Inventory. Include a list of critical replacement parts that may have long delivery times associated with them. Normally the manufacturers of various equipment in the station can make helpful recommendations. Indicate where the spares are to be stored. Computerized maintenance software programs help keep track of spares, supplies, and lubricants. A suitable program should normally be purchased, installed, and referenced in this section.

12. Manufacturer's O&M Literature. In the manual, only provide a list of manufacturers/suppliers and phone contacts for ordering equipment and spare parts. Cut-sheets and other manufacturer's literature should be contained in separate binders. Do not send them to DEQ for review.

13. Operator and Management Responsibility. Include operator certification requirements, plant staffing requirements, and a breakdown of workhours estimated to operate and maintain the facility. Include or reference information on continuing education for operators, such as short courses and operator training schools available. The operator certification rules (OAR 340-49) should be appended for reference.

14. O&M Budget Requirements. Provide estimated budget costs for operating and maintaining the plant. The estimate should contain a breakdown by major category such as staffing and benefits, training, power, laboratory, parts, supplies, repairs, chemicals, sludge hauling and disposal costs, grit and screenings disposal, and so on.

15. Sample Collection, Laboratory Analysis and Reporting. Provide a schedule indicating when and where samples should be taken, a map that shows sampling locations, and information on sampling protocols. This section should reference the NPDES permit as necessary. Provide one complete set of all worksheets/reporting forms including Daily Monitoring Reports (DMR). Normally the engineer must develop a custom DMR form for each plant, often covering at least two 11" x 17" pages. Explain the rationale for tests, which ones to do (e.g. total not free chlorine residual), and how to do them.

16. Sludge Disposal and Analysis. This section should provide or reference the information necessary for the operator to insure safe and proper handling and disposal of sludges. Briefly summarize and reference the approved sludge management plan and sludge disposal records. Describe the operation, maintenance, and control of sludge storage and disposal equipment, tanks, ponds, spreaders, sprayers, and so on. Provide one copy of sludge disposal log forms. Provide a list of approved sites and contacts, along with a vicinity map for locations.

17. Effluent Reuse. Briefly summarize and include a copy of the irrigation reuse plan. Manuals should contain whatever additional information the operator may require to comply with this plan.

18. Permit Requirements. Include a copy of the a copy of the current NPDES permit in an appendix, along with any current compliance orders.

19. Additional Technical Information. Relevant publications on treatment plant O&M should be referenced or included where appropriate (e.g., DEQ and EPA publications on lagoon O&M).

20. As-Built Drawings. One complete set of as-built record drawings should be kept on file at the treatment plant. One set of reproducible drawings should also be obtained from the design engineer and stored in a permanent archive. Reproducibles should be on mylar or vellum or other material that will not deteriorate quickly. Sepias do not last, and should not be accepted for this purpose. A diskette of the O&M manual should be considered, as an aid to future revisions or expansions of the manual.

SUBMITTALS

Submit complete draft O&M manuals for review by DEQ and the plant operations staff well in advance of scheduled start-up (at least 90 days). Sewage treatment utilities are not authorized to accept or use treatment works without an approved manual, per OAR 340-52. For that reason, late submittal of the draft manual may delay plant start-up.

Manuals are expected to be maintained current through updating a master copy of the manual kept at the plantsite. This expectation also applies to DEQ's file copy of the manual. Utilities should submit copies of insert pages reflecting all physical and procedural changes to DEQ.

INQUIRIES

Inquiries about these guidelines should be directed to DEQ regional water-quality plan review engineers.

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